DOE/RL-2014-13
Revision 0

Integrated Remedial Design Report/ Remedial Action Work Plan for the 300 Area (300-FF-1, 300-FF-2 & 300-FF-5 Operable Units)

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
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

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Title Integrated Remedial Design Report/Remedial Action Work Plan for the 300 Area (300-FF-1, 300-FF-2 & 300-FF-5 Operable Units)

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Terms

ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CHPRC	CH2M HILL Plateau Remediation Company
COC	contaminant of concern
CUL	cleanup level
D4	decommissioning, deactivation, decontamination, and demolition
DCE	*cis*-1,2-dichloroethylene
DOE	U.S. Department of Energy
DWS	drinking water standard
EAA	enhanced attenuation area
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FFTF	Fast Flux Test Facility
FS	feasibility study
HASP	health and safety plan
HHE	human health and the environment
IC	institutional control
MNA	monitored natural attenuation
NCP	National Contingency Plan (40 CFR 300, “National Oil and Hazardous Substances Pollution Contingency Plan”)
NPL	“National Priorities List” (40 CFR 300, Appendix B)
O&M	operations and maintenance
OU	operable unit
PRZ	periodically rewetted zone
QA	quality assurance
RA	remedial action

RAO	remedial action objective
RCRA	*Resource Conservation and Recovery Act of 1976*
RDR	remedial design report
RI	remedial investigation
RL	DOE Richland Operations Office
ROD	record of decision
RTD	remove, treat (as required), and dispose
RWP	radiological work permit
SAP	sampling and analysis plan
TCE	trichloroethene
TPA	Tri-Party Agreement
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TSD	treatment, storage, and disposal
VOC	volatile organic chemical
WP	work plan

1 Introduction

The U.S. Department of Energy (DOE) Hanford Site is a 1,517 km^2 (586 mi^2) federal facility located in south-central Washington State; the 300 Area is in the southeastern portion of the Hanford Site along the Columbia River (Figure 1-1). For administrative purposes, the Hanford Site was divided into four National Priority List (NPL) sites (40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," hereafter referred to as the "National Contingency Plan [NCP], Appendix B) under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) in 1989, one of which is the 300 Area. In anticipation of the NPL (40 CFR 300, Appendix B) listing, DOE, the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology) entered into the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989a), hereinafter called the Tri-Party Agreement (TPA), in May 1989, which established a procedural framework and schedule for developing, implementing, and monitoring CERCLA response actions and *Resource Conservation and Recovery Act of 1976* (RCRA) compliance and permitting on the Hanford Site.

The 300 Area (CERCLA site identification number WA2890090077) encompasses approximately 105 km^2 (40 mi^2) in the southeast portion of Hanford Site in Benton County. The 300 Area contains three operable units (OUs) including two source (soil) OUs (300-FF-1 and 300-FF-2), and one groundwater OU (300-FF-5) (Figure 1-1). The 300-FF-5 OU encompasses groundwater contamination from 300 Area sources and does not include groundwater contamination from sources other than the 300 Area. Contaminated buildings are being removed in accordance with CERCLA Action Memoranda and are not included in the OU as described in the 300 Area Record of Decision (ROD) Amendment. This Integrated Remedial Design Report (RDR)/Remedial Action (RA) Work Plan (WP) addresses all three OUs.

The DOE Richland Operations Office (RL) is the lead agency responsible to perform the RAs, and the EPA is the lead regulatory agency as identified in Section 5.6 and Appendix C of the TPA (Ecology et al., 1989a). In accordance with the TPA (Ecology et al., 1989a), Article XIV, Paragraph 54, DOE developed and proposed RAs for the 300 Area OUs through previous investigations and remedial decisions. The 300 Area remedial investigation (RI)/feasibility study (FS) report (DOE/RL-2010-99, *Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units*), and corresponding addendum (DOE/RL-2010-99-ADD1, *Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units, Addendum*) were the basis for the Proposed Plan (DOE/RL-2011-47, *Proposed Plan for Remediation of the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units*). A 30-day public comment period for the Proposed Plan (DOE/RL-2011-47) occurred from July 17 through August 16, 2013.

Hanford Site 300 Area Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1 (EPA and DOE, 2013), hereinafter called the 300 Area ROD/ROD Amendment, was signed by EPA and DOE on November 25, 2013. The selected remedies were chosen in accordance with CERCLA, as amended by the *Superfund Amendments and Reauthorization Act of 1986*, the TPA (Ecology et al., 1989a), and, to the extent practicable, the NCP (40 CFR 300). The selected remedies for the three OUs include a combination of no further action; remove, treat (as required), and dispose (RTD); pipeline void filling; surface barriers; enhanced attenuation using uranium sequestration; monitored natural attenuation (MNA); and institutional controls (ICs) to address the organic, inorganic, and radionuclide contaminants of concern (COCs). RAs for the three OUs will minimize the release or threat of release of hazardous substances that pose a risk to human health and the environment (HHE). Completion of the RAs will protect personnel and provide an end state consistent with the 300 Area ROD/ROD Amendment (EPA and DOE, 2013). The interim action remedy for the 300-FF-5 OU selected in 1996 and the interim action remedy for the 300-FF-2 OU that was selected in 2001 are replaced with

this final action remedy. The final remedy for the 300-FF-1 OU selected in 1996 is amended for additional RA of uranium below a subset of the 300-FF-1 OU waste sites.

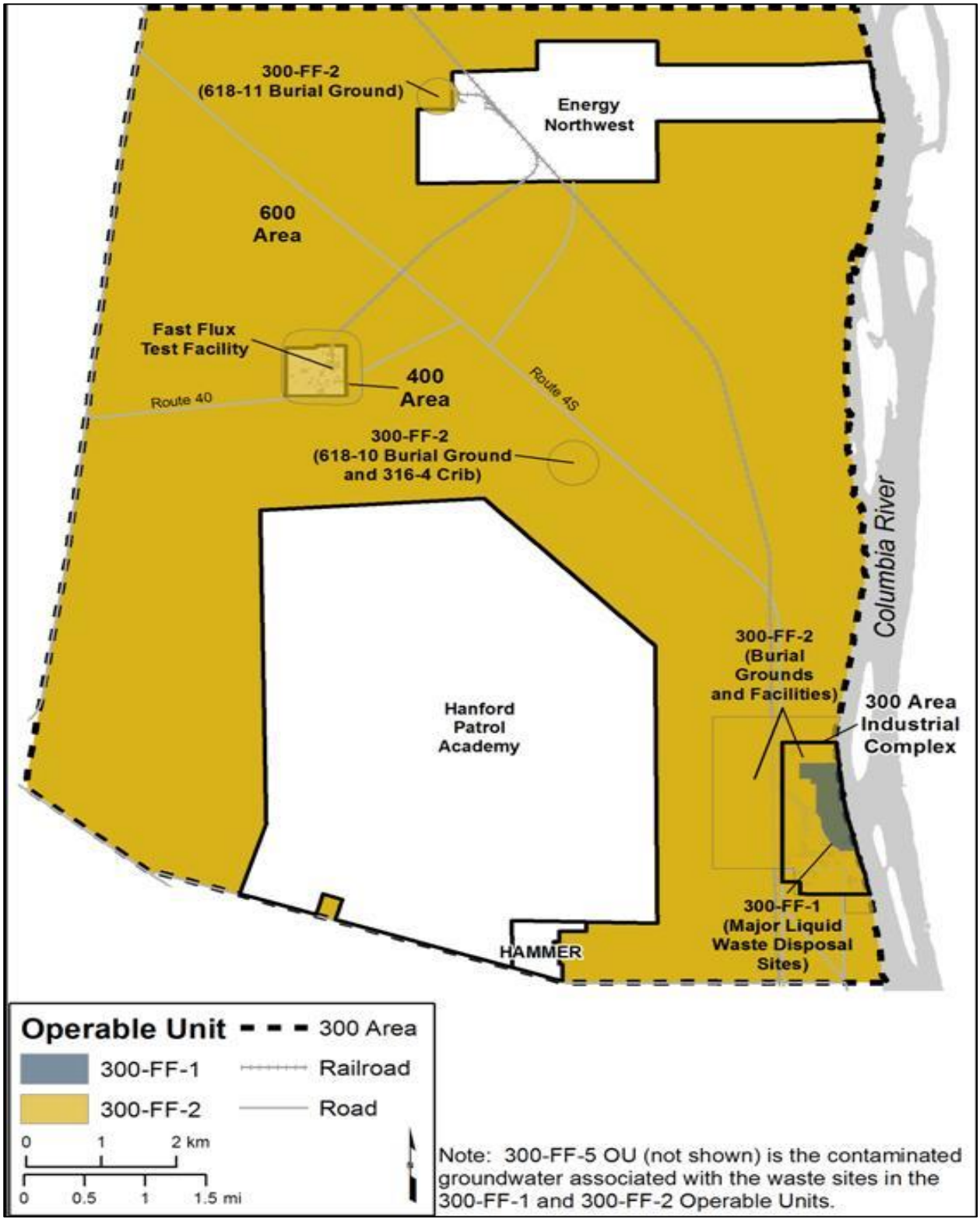


Figure 1-1. 300-FF-1 and 300-FF-2 Operable Units

This Integrated RDR/RAWP supports implementation of the 300 Area ROD/ROD Amendment (EPA and DOE, 2013). This document is written in three parts:

1. An integrated RDR/RAWP that contains common information to support remedy implementation
2. An addendum containing information specific to waste site/soil specific remedies for the 300-FF-2 OU
3. An addendum containing information specific to groundwater specific remedies for the 300-FF-5 OU and uranium sequestration elements implemented at the 300-FF-1 and 300-FF-2 OUs

This Integrated RDR/RAWP establishes the general size, scope, and character of the RA project and identifies the technical requirements of the RAs that are common to each of the three OU remedies. It also identifies what information is further detailed in the soil or groundwater remedy-specific addendum. Each addendum describes additional implementing documents as indicated on Figure 1-2. The scope for the two addenda have been split for ease of implementation, based on the services provided by the two remediation contractors, and do not align directly with the OUs. The two addenda include the following scope:

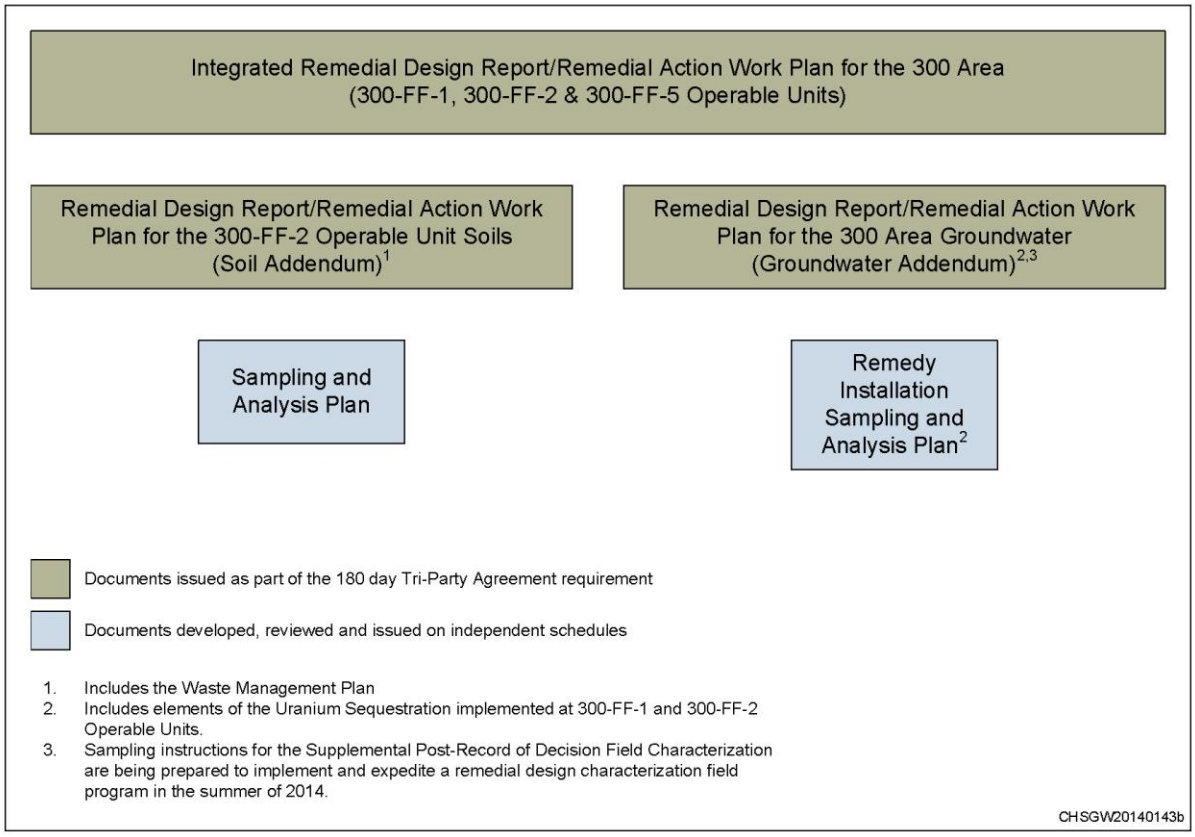
- RDR/RAWP for 300-FF-2 OU Soils (herein referred to as the Soil Addendum): The Soil Addendum describes the work elements, performance measurements, construction management and oversight, and schedule specific to the RTD, pipeline void filling and temporary surface barriers for waste sites associated with the 300-FF-2 OU.
- RDR/RAWP for 300 Area Groundwater (herein referred to as the Groundwater Addendum): The Groundwater Addendum describes the work elements, construction management and oversight, and schedule specific to uranium sequestration in the vadose zone, periodically rewetted zone (PRZ), and top of the aquifer below the 300-FF-1 and 300-FF-2 OUs, uranium sequestration in the top of aquifer at the 300-FF-5 OU, and MNA at the 300-FF-5 OU. Uranium sequestration actions at the 300-FF-1 and 300-FF-2 OUs are intended to reduce uranium mobility in the vadose zone and PRZ, thereby minimizing the source of uranium to groundwater. These actions are completed in support of the groundwater remedy for the 300-FF-5 OU, and are thereby included in the Groundwater Addendum.

The Integrated RDR/RAWP, Soil Addendum, and Groundwater Addendum serve as the RDR.

1.1 Purpose

This Integrated RDR/RAWP, along with the Soil and Groundwater Addenda, describes how the site remedies will be designed, installed, and operated to meet the remedial action objectives (RAO) identified in the 300 Area ROD/ROD Amendment (EPA and DOE, 2013).

The Integrated RDR/RAWP and Soil and Groundwater Addenda are being submitted in accordance with the 300 Area ROD/ROD Amendment (EPA and DOE, 2013) and Section 11.6 of the TPA Action Plan (Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*), which states: “Within 180 days of the last ROD signature, … or an alternative period designated in the ROD …, an RD/RA work plan including schedule, along with a milestone change package, shall be submitted for lead regulatory agency review and approval….”



Source: TPA (Ecology et al., 1989a, *Hanford Federal Facility Agreement and Consent Order*).

Figure 1-2. 300 Area ROD/ROD Amendment Implementation Document Structure

1.2 Scope

This Integrated RDR/RAWP and Soil and Groundwater Addenda provide the plan and schedule for design, construction, and monitoring activities necessary for successful implementation of the RA selected in the 300 Area ROD/ROD Amendment. The selected remedies for the three OUs are described in Table 1-1.

RTD will be used to remove contaminated soil, structures, and debris from waste sites via excavation; treat as necessary to meet disposal facility requirements, protect workers and prevent unacceptable environmental releases; and dispose of the waste. Temporary surface barriers, such as asphalt and void filling in pipelines, will be used to reduce mobility of contaminants associated with waste sites affected by long-term retained facilities until RTD can be performed.

Uranium sequestration will be used in the deep vadose zone and PRZ to reduce the mobility of uranium that is the primary source of contamination in groundwater. Uranium sequestration will also be used at the top of the aquifer to sequester uranium that may be mobilized during the deep vadose zone and PRZ treatment process. MNA will be used for nitrate, tritium, trichloroethene (TCE), and *cis*-1,2-dichloroethylene (DCE) in groundwater. Uranium and other contaminants in the groundwater will be monitored until cleanup levels (CUL) are met.

Table 1-1. Major Components of the Selected Remedy

300-FF-1 OU	300-FF-2 OU	300-FF-5 OU
Enhanced attenuation of uranium source mass using sequestration by phosphate application in the vadose zone and PRZ, and enhanced attenuation of uranium using sequestration by phosphate application at the top of aquifer. [c]	RTD at waste sites[b]	MNA for nitrate, tritium, TCE, and DCE in groundwater.[c]
	Temporary surface barriers and pipeline void filling[b]	Groundwater monitoring for nitrate, tritium, TCE, DCE, uranium, gross alpha, and nitrate in groundwater.[c]
	Enhanced attenuation of uranium source mass using sequestration by phosphate application in the vadose zone and PRZ, and enhanced attenuation of uranium using sequestration by phosphate application at the top of aquifer.[c]	Enhanced attenuation of uranium using sequestration by phosphate application at the top of aquifer.[c]
	ICs[a, b]	ICs[a]

a. Details are described in this Integrated RDR/RAWP.

b. Details are described in the Soil Addendum.

c. Details are described in the Groundwater Addendum.

DCE = *cis*-1,2-dichloroethylene

IC = institutional control

MNA = monitored natural attenuation

OU = operable unit

PRZ = periodically rewetted zone

TCE = trichloroethene

ICs are required before, during, and after the active phase of RA to protect HHE. ICs are used to control access to residual contamination in soil and groundwater above standards for unrestricted use and unrestricted exposure.

Contaminated groundwater that migrates into the 300 Area from other areas, including offsite and from the 200 Area, is not part of 300-FF-5 OU and is not addressed by the 300 Area ROD/ROD Amendment (EPA and DOE, 2013) or by this Integrated RDR/RAWP. Major facilities exist in the 300 Area that are not within the scope of this Integrated RDR/RAWP. Some of the facilities and utilities that support the continuing mission of Pacific Northwest National Laboratory in the 300 Area Industrial Complex are expected to be retained through at least 2027 (Figure 1-3). Industrial activities and contamination in the 300 Area, that are not part of the OUs being addressed by this Integrated RDR/RAWP, include the following:

- Hanford Patrol Training Academy including the firing ranges (active facility)
- Fast Flux Test Facility (FFTF) reactor and associated structures (now inactive)
- Energy Northwest and Bonneville Power Administration facilities (active facility)
- Volpentest Hazardous Materials Management and Emergency Response (HAMMER) Training and Education Facility (active facility)

- Groundwater contamination emanating from the 200 Area (addressed in the 200-PO-1 OU) and nitrate from other than 300 Area sources
- Various buildings (facilities are addressed under a separate action memorandum and an associated RAWP)

Several CERCLA and RCRA decisions made for the 300 Area are described in the 300 Area ROD/ROD Amendment (EPA and DOE, 2013). For the facilities that are not clean-closed and where activities are ongoing in the 300 Area, RA activities will be coordinated. Coordination and communication between project teams will occur with the decommissioning, deactivation, decontamination, and demolition (D4) activities; permitted RCRA treatment, storage, and disposal (TSD) facilities; and the closure activities associated with the 324 Building.

The following five action memoranda apply to Building D4 in the 300 Area:

- *331-A Virology Laboratory Building Action Memorandum* (DOE and EPA, 2000)
- *Action Memorandum #1 for the 300 Area Facilities* (DOE and EPA, 2005)
- *Action Memorandum #2 for the 300 Area Facilities* (DOE and EPA, 2006a)
- *Action Memorandum #3 for the 300 Area Facilities* (DOE and EPA, 2006b)
- Action Memorandum for General Hanford Site Decommissioning Activities (DOE/RL-2010-22)

Two RCRA TSD units are currently permitted to operate in the 300 Area: the 325 Hazardous Waste Treatment Units (325 HWTU) and the 400 Area Waste Management Unit (400 40). Closure of these TSD units will occur in accordance with the Hanford Facility Dangerous Waste Permit.

The Radiochemical Engineering Cells, High-Level Vault, Low-Level Vault, and associated areas within the 324 Building are planned to be closed under *324 Building Radiochemical Engineering Cells, High-Level Vault, Low-Level Vault, and Associated Area Closure Plan* (DOE/RL-96-73, Rev.3 2005), and coordinated with CERCLA Action Memorandum #2 for the 324 Building.

1.3 Site Description and Background

The 300 Area encompasses approximately 105 km^2 (40 mi^2) adjacent to the Columbia River in the southern portion of the Hanford Site. The 300 Area includes the 300 Area Industrial Complex (major liquid waste disposal sites and solid waste burial grounds), waste sites associated with FFTF (400 Area), and the 600 Area waste sites (618-11 Burial Ground, 618-10 Burial Ground/316-4 Crib, and waste sites near the east of the 300 Area Industrial Complex) (Figure 1-1). The 400 Area is located approximately 8 km (5 mi) northwest of the 300 Area Industrial Complex and about 6 km (4 mi) west of the Columbia River.

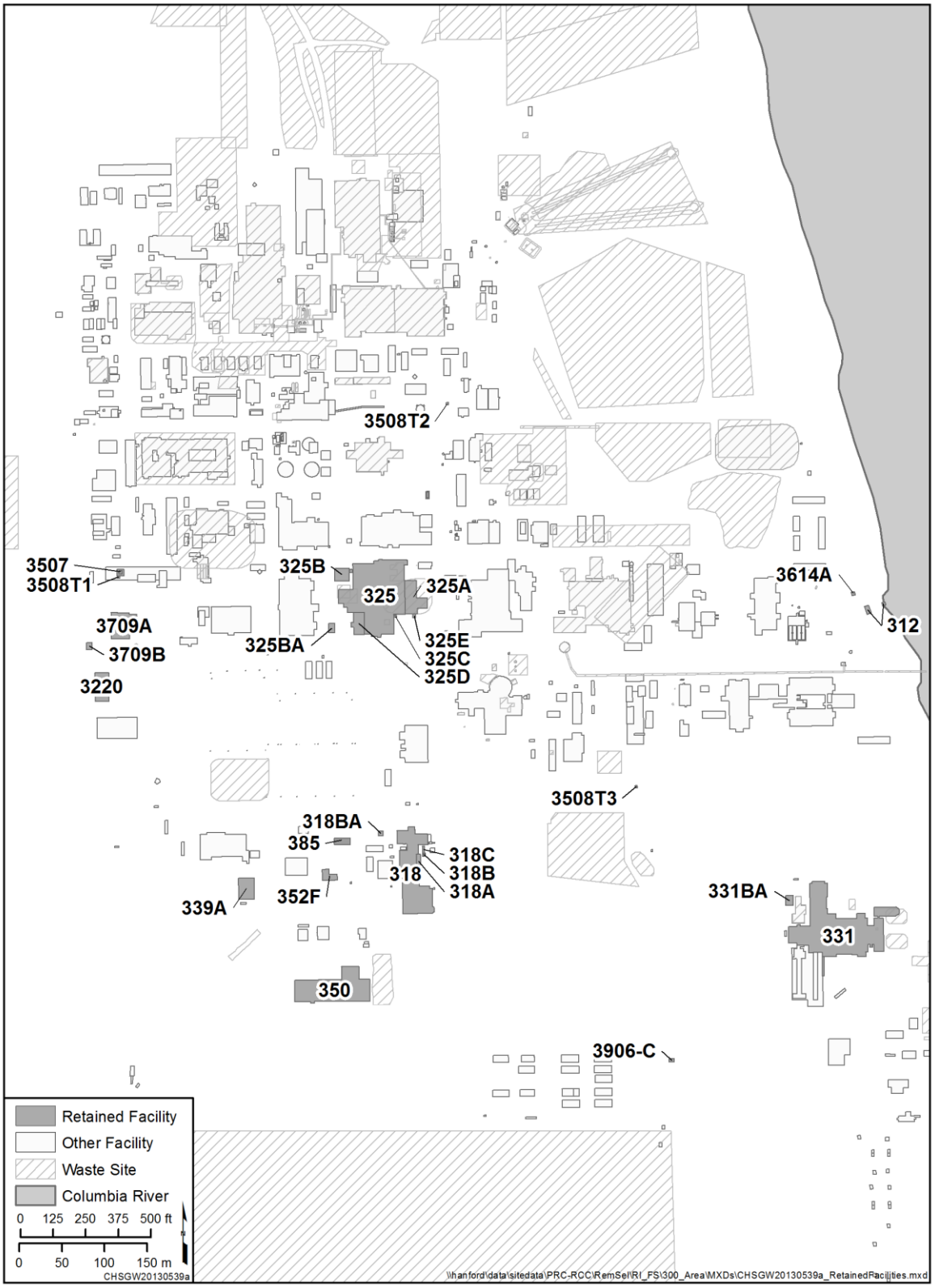


Figure 1-3. Long-Term Retained Facilities in the 300 Area Industrial Complex

Operations in the 300 Area Industrial Complex (Figure 1-1) began in 1943. The complex includes the buildings, facilities, and process units where the majority of uranium fuel production and research and development activities took place. The 300-FF-1 OU contains the major liquid waste disposal sites within the 300 Area Industrial Complex where large volumes of liquid waste containing uranium were discharged, including the former South Process Pond (316-1), North Process Pond (316-2), and 300 Area Process Trenches (316-5). The 300-FF-2 OU contains waste sites within and near the 300 Area Industrial Complex, 400 Area, and 618-10 and 618-11 Burial Grounds. Contaminant releases identified at waste sites resulted in several groundwater contaminant plumes that lie within the 300-FF-5 OU.

The following subsections briefly describe the site setting and the nature and extent of contamination within the 300 Area. Additional information describing the Hanford Site and the 300 Area OUs is provided in the 300 Area RI/FS (DOE/RL-2010-99 and DOE/RL-2010-99 Addendum) and 300 Area ROD/ROD Amendment (EPA and DOE, 2013).

1.3.1 Physical Setting

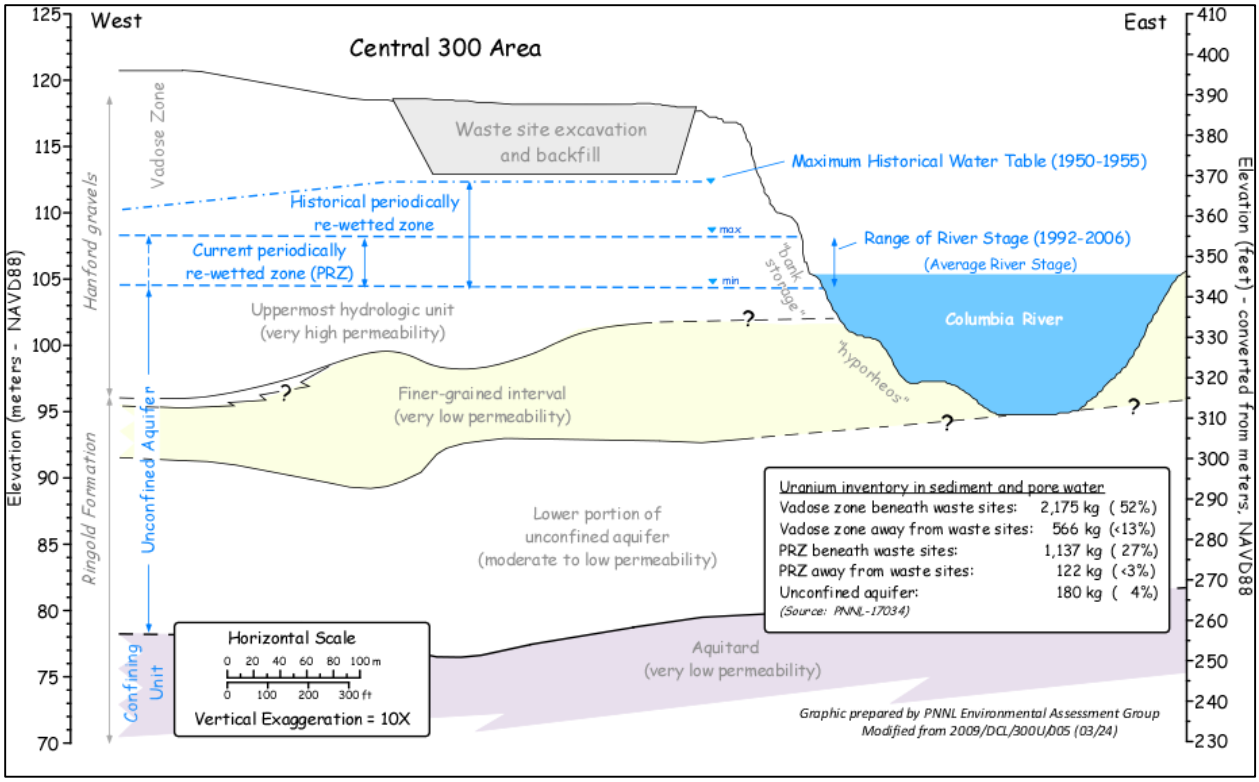
The ground surface in the 300 Area Industrial Complex is flat, except for a steep slope on the eastern edge down to the Columbia River which is the only surface water feature in the area. For the rest of the 300 Area, surface elevations change from approximately 137 m (449 ft) above mean sea level at the inland 618-11 Burial Ground to approximately 115 m (377 ft) at the 300 Area Industrial Complex.

The vadose zone is comprised of backfill materials and unconsolidated gravels and sand of the Hanford formation. In the 300 Area Industrial Complex, the average thickness of the vadose zone is 10 m (33 ft), while the thicknesses of the vadose zone at the 618-10 Burial Ground, 618-11 Burial Ground, and 400 Area are 21 m (68 ft), 19 m (63 ft), and 31 m (125 ft), respectively. However, the vadose zone thickness varies with the seasonal stages of the Columbia River and distance inland from the river. Rising groundwater elevations resulting from higher Columbia River stages seasonally saturate deeper portions of the vadose zone, while lower river stages result in falling groundwater elevations that de-water these same deeper portions of the vadose zone. These fluctuating groundwater elevations create the PRZ shown in Figure 1-4. The unconfined aquifer occurs in the highly permeable gravel-dominated Hanford formation and in the underlying, less permeable sands and gravels of the Ringold Formation (Figure 1-5). The Ringold Formation lower mud unit is a confining layer (i.e. the aquitard at the base of the unconfined aquifer) and is characterized by very low permeability fine-grained sediment. This hydrologic unit prevents further downward movement of groundwater contamination to the deeper aquifers. The thickness of the unconfined aquifer along the Columbia River shoreline is about 25 m (80 ft).

Groundwater in the unconfined aquifer discharges to the Columbia River via upwelling through the riverbed and riverbank seeps. The flux from the unconfined aquifer is very low, compared to the flow of the river. Because the river stage regularly fluctuates up and down, flow beneath the shoreline oscillates back and forth, with river water intruding into the unconfined aquifer and mixing with groundwater at times. When the river stage drops quickly to a low elevation, riverbank seeps appear.

Groundwater flow velocities beneath the 300 Area in the Hanford Formation portion of the aquifer are rapid, with rates up to 18 m/d (59 ft/d) having been observed. However, the hydraulic gradients change direction in response to river stage, which fluctuates on seasonal and multiyear cycles. Consequently, groundwater flow is not always directed toward the river.

In general, regional groundwater flow converges from the northwest, west, and southwest, inducing an east-southeast flow direction in the 300 Area. During periods of extended high river stage (March through June), water flows from the river into the aquifer. The rise and fall of the river stage creates a dynamic zone of interaction between groundwater and river water (Figure 1-4) affecting groundwater flow patterns, contaminant transport rates (e.g., uranium in groundwater), groundwater geochemistry, contaminant concentrations, and contaminant attenuation rates.



Source: PNNL-17034, *Uranium Contamination in the Subsurface Beneath the 300 Area, Hanford Site, Washington*.

Figure 1-4. Principal Subsurface Features with PRZ and Uranium Inventory Estimates

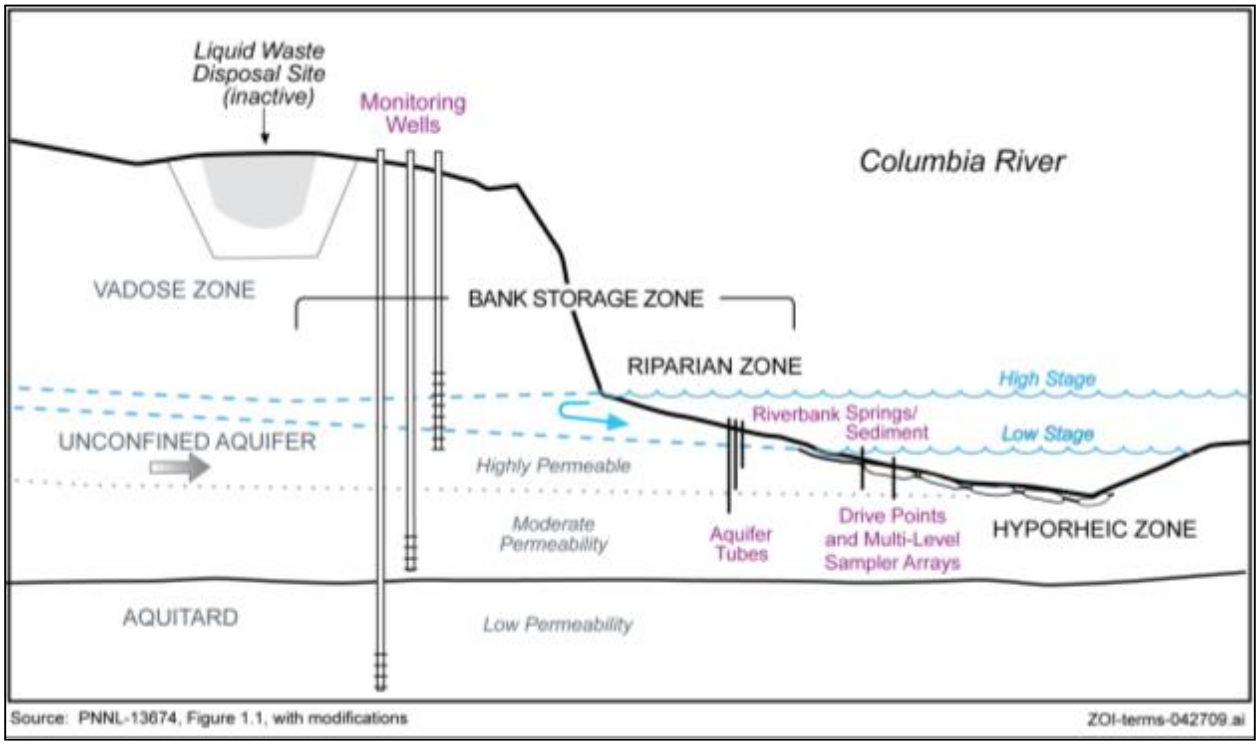


Figure 1-5. Conceptual Site Model of Hyporheic Zone

1.3.2 Nature and Extent of Contamination

DOE performed RIs and limited field investigations beginning in the early 1990s for the 300-FF-1, 300-FF-2, and 300-FF-5 OUs to characterize the nature and extent of contamination in the vadose zone and groundwater. The nature and extent of waste site and groundwater contamination are summarized in the following subsections. A thorough evaluation of nature and extent for the 300 Area is presented in the RI/FS (DOE/RL-2010-99 and DOE/RL-2010-99 Addendum).

1.3.2.1 Waste Site Contamination

300-FF-1 OU waste sites received liquid waste containing nitrate, uranium and other metals, organics, and radionuclides. 300-FF-2 OU waste sites also received contaminated liquid waste and/or solid waste. Most of the mobile contaminants, such as nitrate, have migrated through the vadose zone to groundwater. Primary contaminants in solid waste disposed in burial grounds were uranium and other metals, plutonium (primarily in the 618-2 Burial Ground, 618-10 Burial Ground, and 618-11 Burial Ground), tritium and other fission products, and nitrate. The solid wastes were buried up to 8 m (25 ft) below ground.

Many of the 300-FF-2 OU waste sites resulted from chemical and radionuclide releases under and around 300 Area buildings. Buildings are or will be addressed by CERCLA Action Memoranda, but waste sites resulting from building releases are in the 300-FF-2 OU. Many 300 Area buildings contained structural materials such as asbestos, mercury, lead, and polychlorinated biphenyls that are in waste sites. However, most of the contamination resulted from facility processes, primarily laboratory and uranium fuel rod production wastes.

Most of the uranium disposed in the 300 Area has been exhumed and disposed in the Environmental Restoration Disposal Facility (ERDF). Residual uranium in the deep vadose zone is associated with the South Process Pond (316-1); North Process Pond (316-2); 300 Area Process Trenches (316-5) in 300-FF-1; 618-1, 618-2, and 618-3 Burial Grounds; and 307 Process Trenches (316-3) in the 300-FF-2 OU.

The PRZ, contaminated by releases from these waste sites, serves as the primary contributor of uranium to groundwater. When groundwater rises into the PRZ, it mobilizes residual uranium contamination. This mobilized uranium moves vertically and laterally with the groundwater, and some is redeposited near the original location when the groundwater elevations fall. In addition to river water fluctuations, small amounts of precipitation periodically percolate down through the vadose zone, which can further move uranium contamination to the PRZ and groundwater. This periodic input of mobile uranium to the groundwater results in a persistent uranium plume and continued discharge of relatively low uranium concentrations to the river until the source of uranium is depleted. Measurements were made to characterize the uranium inventories in the 300 Area Industrial Complex. The residual uranium inventories, as documented in 2008, are presented in Figure 1-6 (PNNL-17034, *Uranium Contamination in the Subsurface Beneath the 300 Area, Hanford Site, Washington*).

Soil sampling in the southwestern portion of the North Process Pond (316-2), near the former effluent inlet, and in the southern portion of the 300 Area Process Trenches (316-5) identified elevated uranium concentrations in the vadose zone and PRZ. Uranium concentrations increase in groundwater at these locations when the water table rises during high river stage, indicating that these locations constitute sources of ongoing groundwater contamination. Soil sampling at the 307 Process Trenches (316-3) and 307 Retention Basins identified uranium concentrations in the vadose zone under the central and eastern portions of the 307 Process Trenches and on the eastern side of the 307 Retention Basin.

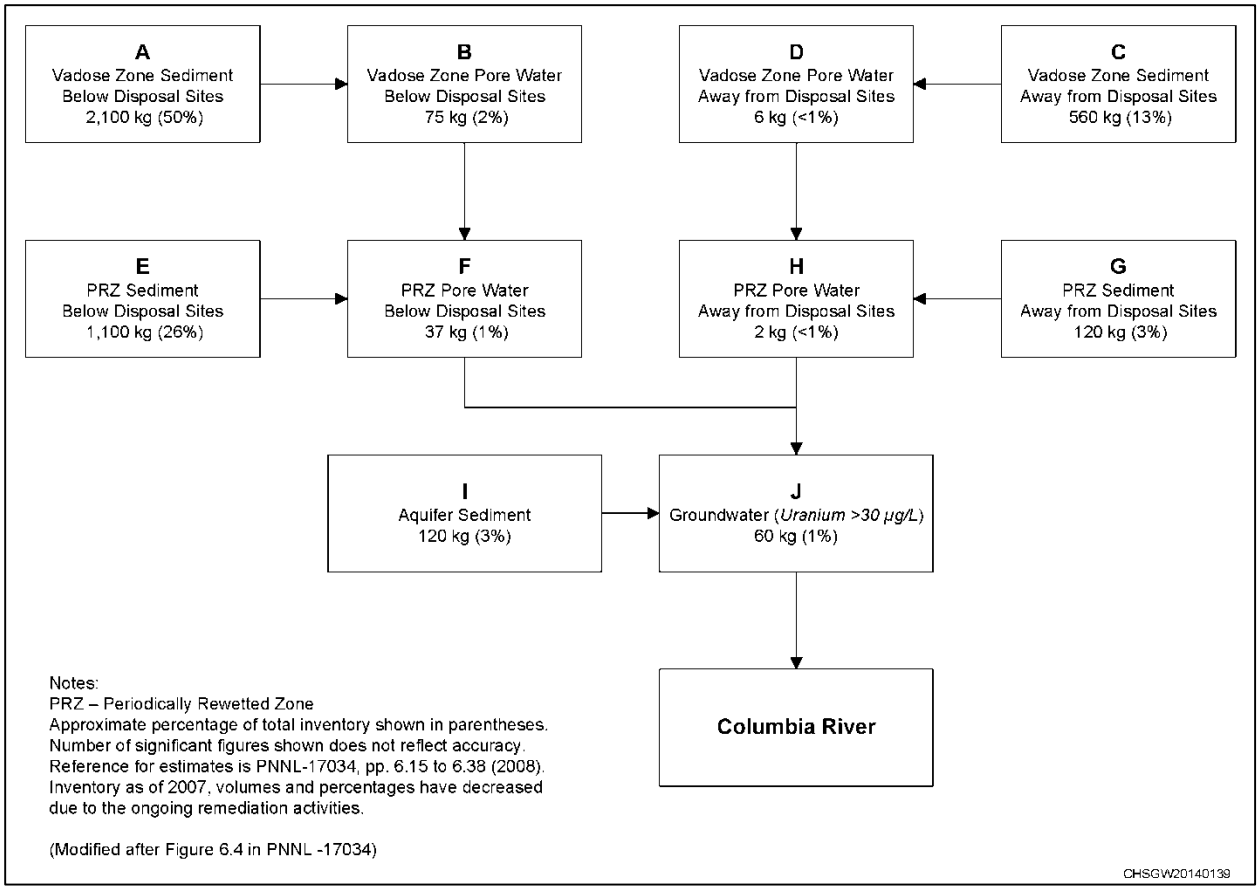


Figure 1-6. Estimated Residual Uranium Inventory and Exchange Paths Among Subsurface Compartments

In addition to the seven sites listed, the following burial grounds have contributed to uranium in groundwater:

- At the 618-7 Burial Ground, a new area of uranium contamination in groundwater developed in 2008 as a result of infiltration of dust-control water during implementation of the interim RA. Uranium concentrations at nearby downgradient wells subsequently decreased. However, during the unusually high water table conditions in 2011, the uranium concentration temporarily increased because of the presence of mobile uranium in the lower portion of the vadose zone at this location. The 618-7 Burial Ground received solid waste containing uranium from fuel fabrication processes.
- The 618-10 Burial Ground and adjacent 316-4 Crib are the sources of uranium detected in groundwater at the 618-10 Burial Ground site. Uranium concentrations in nearby downgradient wells increased in 2004 and again in 2012 following application of dust-control water during implementation of the interim RA. The 316-4 Crib received liquid waste containing uranium.

The 618-10 and the 618-11 Burial Grounds contain a broad spectrum of low-level radioactive waste including fission products and byproduct waste (thorium and uranium), as well as waste with transuranic constituents. The 618-11 Burial Ground was the source of nitrate and of the tritium gas that interacted with vadose zone moisture and eventually entered groundwater.

Investigation of the soils beneath the 324 Building indicates that cesium-137 contamination extends at least 1.5 m (5 ft) below the building floor (4.0 m [13 ft] below grade) and strontium-90 contamination extends at least 9.1 m (30 ft) below grade, which is approximately 7.6 m (25 ft) above average groundwater levels. The contamination was discovered during D4 activities at the building in 2009, but likely resulted from a 1986 unplanned release of liquid within the B-Cell. A portion of the spill is believed to have left the cell through a leak in the floor, creating waste site 300-296.

1.3.2.2 Groundwater Contamination

Groundwater contaminants that exceed federal or state drinking water standards (DWSs) in the 300-FF-5 OU are uranium, gross alpha, tritium, nitrate, TCE, and DCE. Groundwater contaminants do not exceed federal or state ecological protection standards near the river or where groundwater discharges into the river.

The groundwater contamination observed resulted from activities that occurred in the past, especially during the peak nuclear fuels and plutonium production years of the 1950s and 1960s. High volume waste effluents resulting from fabrication of nuclear fuel assemblies were sent to ponds and trenches for infiltration into the soil column and formed groundwater mounds beneath the 300-FF-1 OU disposal sites. Effluents were typically acidic, which promoted movement through the vadose zone, and contained significant quantities of uranium and other metals, such as copper. Volatile organic chemicals (VOCs) such as TCE were used and present in the effluent.

Other chemicals and radionuclides resulting from fuels processing research were also disposed to ponds and trenches, but in lesser volumes. Solid wastes from 300 Area Industrial Complex activities were buried at locations within the complex, or sent to outlying burial grounds.

Contaminants retained in the vadose zone at most of the disposal facilities, including solid waste burial grounds, has been removed and disposed via interim RAs. Contamination currently observed in the soils and groundwater beneath the 300 Area is residual amounts that persist for a variety of reasons. Attenuation of these contaminants is dependent on contaminant properties and continues to occur by natural processes along environmental pathways away from the source locations. Contamination that has entered the groundwater ultimately discharges to the Columbia River via upwelling through the riverbed and occasionally through riverbank seeps. Mobile contaminants, including volatile organic solvents such as TCE and DCE, migrated with the flow of liquid, while less mobile contaminants such as uranium migrated at slower rates. The mounds dissipated after discharge ceased, with a portion of the contaminants dispersed inland.

Contaminants can remain in the vadose zone following active liquid waste discharge as dissolved fractions within pore water or sorbed to soil until sufficient moisture is available for transport. Uranium is present in the lower vadose zone. The form uranium takes in solution is influenced by alkalinity which, in turn, affects uranium mobility. Uranium tends to sorb to aquifer matrix mineral surfaces and be less mobile when alkalinity in the aquifer is lowered. Columbia River water is low in alkalinity. At high river levels, river water infiltrates inland and portions of the lower vadose zone become periodically rewetted (the PRZ) by a mix of groundwater and river water that is lower in alkalinity than pure groundwater. As a result, uranium in this zone of mixed river water/groundwater is sorbed to a large degree on the mineral surfaces. The combination of uranium sorption and dilution results in diminished uranium concentrations in the river water/groundwater mixing zone during high river stage.

Further inland from the river water/groundwater mixing zone, the river stage creates an interruption of the natural groundwater gradient towards the river, causing groundwater levels to rise into the PRZ. In these inland areas, the relatively high-alkalinity groundwater comes in contact with uranium in the PRZ

(in the form of both entrained vadose zone pore water and mineral-sorbed forms). Under these conditions, the uranium takes the form of a negative ion carbonate complex, which has less tendency to sorb. The overall effect is that, in the inland areas, uranium concentrations rise in groundwater as the water table rises during high river stages (Figure 1-5).

The uranium plume in groundwater that exceeds the 30 µg/L DWS covers approximately 0.5 km^2 (0.2 mi^2) in the 300 Area Industrial Complex. There are much smaller uranium groundwater plumes downgradient of the 618-7 and 618-10 Burial Grounds. The volume of the main uranium plume is approximately 1,000,000 m^3 (35 million ft^3) with a dissolved uranium mass of approximately 60 kg (132 lb). The extent of Columbia River shoreline, where the uranium concentrations exceed the DWS during low river stage, is approximately 1,200 m (3,400 ft) in length. Figures 1-7 and 1-8 present the groundwater uranium plumes for winter (low river stage) and summer (high river stage) seasons in 2012.

Tritium in groundwater that exceeds the 20,000 pCi/L DWS occurs in five wells downgradient from the 618-11 Burial Ground. Tritium concentrations from the 618-11 Burial Ground (Figure 1-9) do not, and are not predicted to, affect the Columbia River above the DWS.

Nitrate concentrations exceed the DWS at four wells downgradient from the 618-11 Burial Ground. The extent of the nitrate plume is similar to the extent of the tritium plume (Figure 1-9).

Nitrate in the 300 Area Industrial Complex exceeds the 45 mg/L DWS in areas where groundwater has been affected by off-site activities. Elevated nitrate concentrations are detected in the southern portion of the 300 Area and result from the migration onsite of nitrate-contaminated groundwater from sources to the southwest. Nitrate from off-site is not part of 300-FF-5 OU.

VOCs that exceed the DWS in 300 Area groundwater are TCE and DCE. For the unconfined aquifer, only two samples collected during the past five years exceeded the DWS of 5 µg/L for TCE (the risk-based MTCA CUL for TCE is 4 µg/L). There have been no TCE detections from the wells that monitor the 300 Area confined aquifer.

DCE has been detected consistently at concentrations exceeding the DWS of 70 µg/L at a well located near the southern boundary of the former North Process Pond (316-2). The well monitors groundwater near the bottom of the unconfined aquifer in sandy gravel sediment of relatively low permeability. The origin for DCE is attributed to degradation of TCE historically disposed to the Process Trenches and/or North Process Pond. In 2011, DCE was also detected above the DWS at a new RI well located approximately 80 m (262 ft) further downgradient and screened at mid-depth in the unconfined aquifer.

TCE and DCE contamination exceeding DWSs occurs in fine-grained sediment with less capacity to yield or transmit groundwater. The greatly restricted hydraulic flow in these fine-grained sediments has contained the VOCs since their disposal decades ago, and has minimized migration of VOCs into the more transmissive portions of the aquifer. Concentrations of these VOCs are not above DWSs in this more transmissive portion of the aquifer. Natural attenuation through biodegradation is evident in historical monitoring results from well 399-1-16B, where TCE has degraded to DCE. Over the past 20 years, TCE concentrations from this well have decreased to below the DWS whereas DCE concentrations have remained fairly stable. DCE can then further degrade anaerobically to vinyl chloride, which then degrades either anaerobically or aerobically to CO_2. DCE can also degrade directly to CO_2 under aerobic conditions. The absence of vinyl chloride in downgradient wells indicates that these contaminants are degrading aerobically. The limited areal extent of VOCs in groundwater shows that these natural attenuation processes are preventing the persistence and significant migration of VOCs.

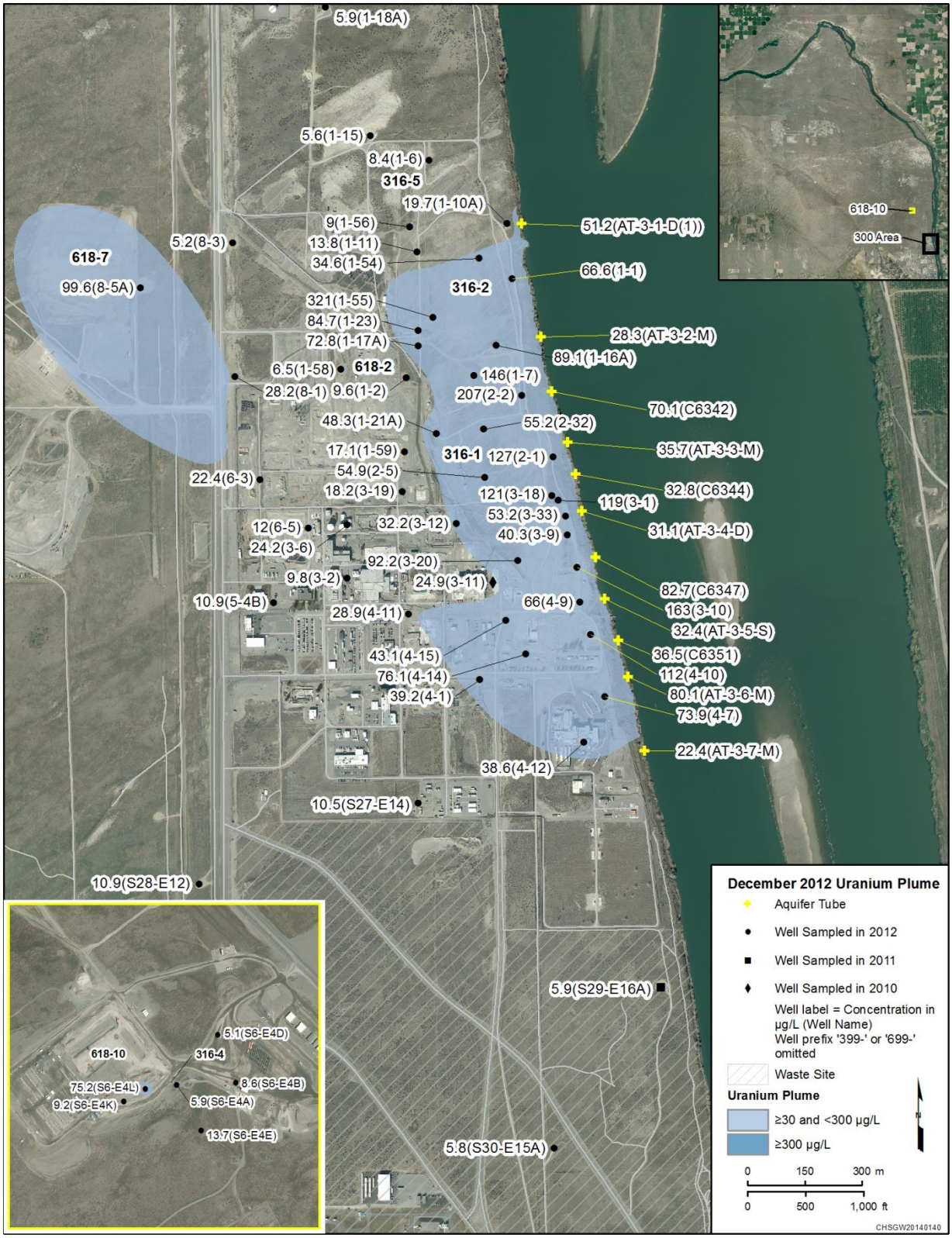


Figure 1-7. Uranium Plume in Groundwater, Winter 2012

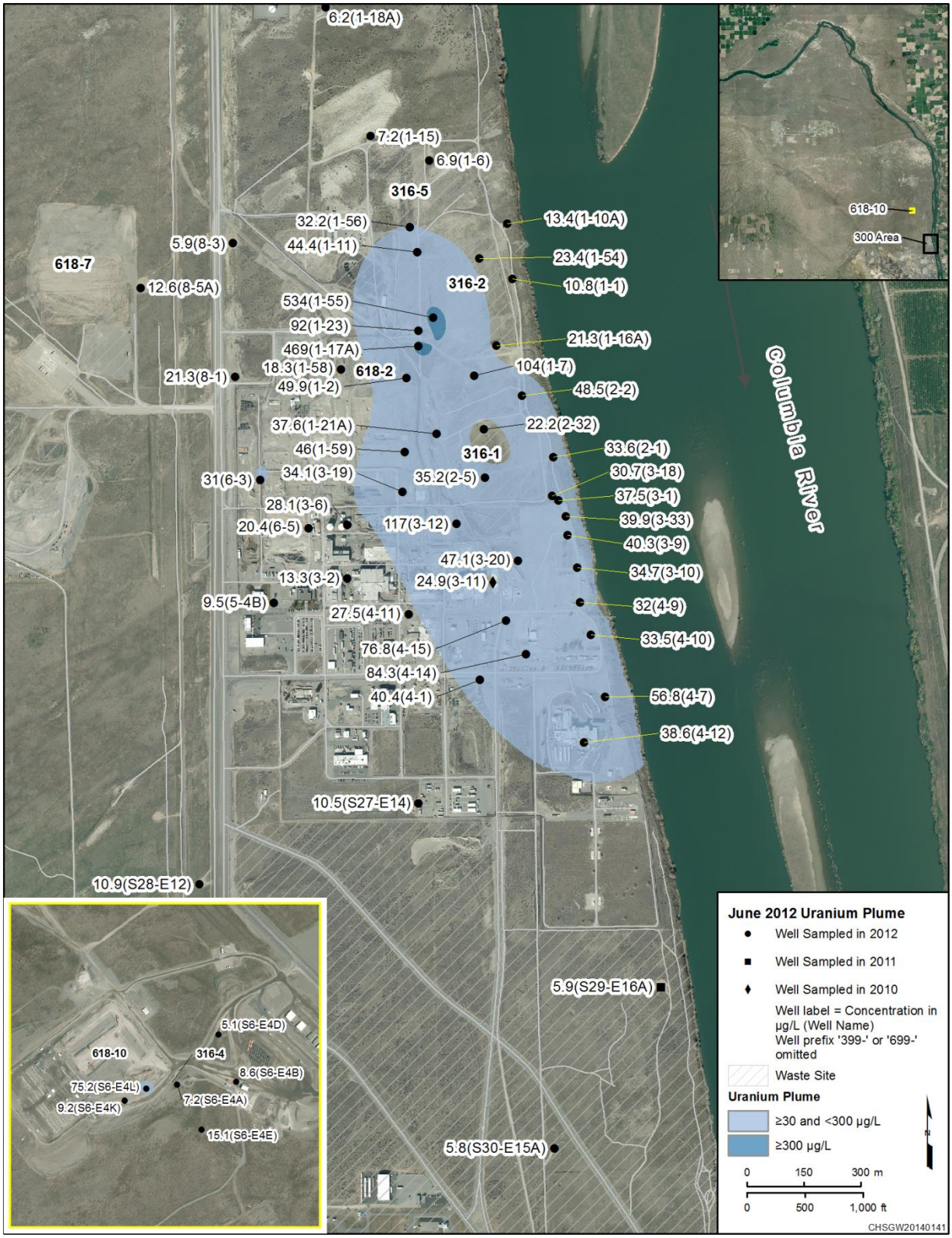


Figure 1-8. Uranium Plume in Groundwater, Summer 2012

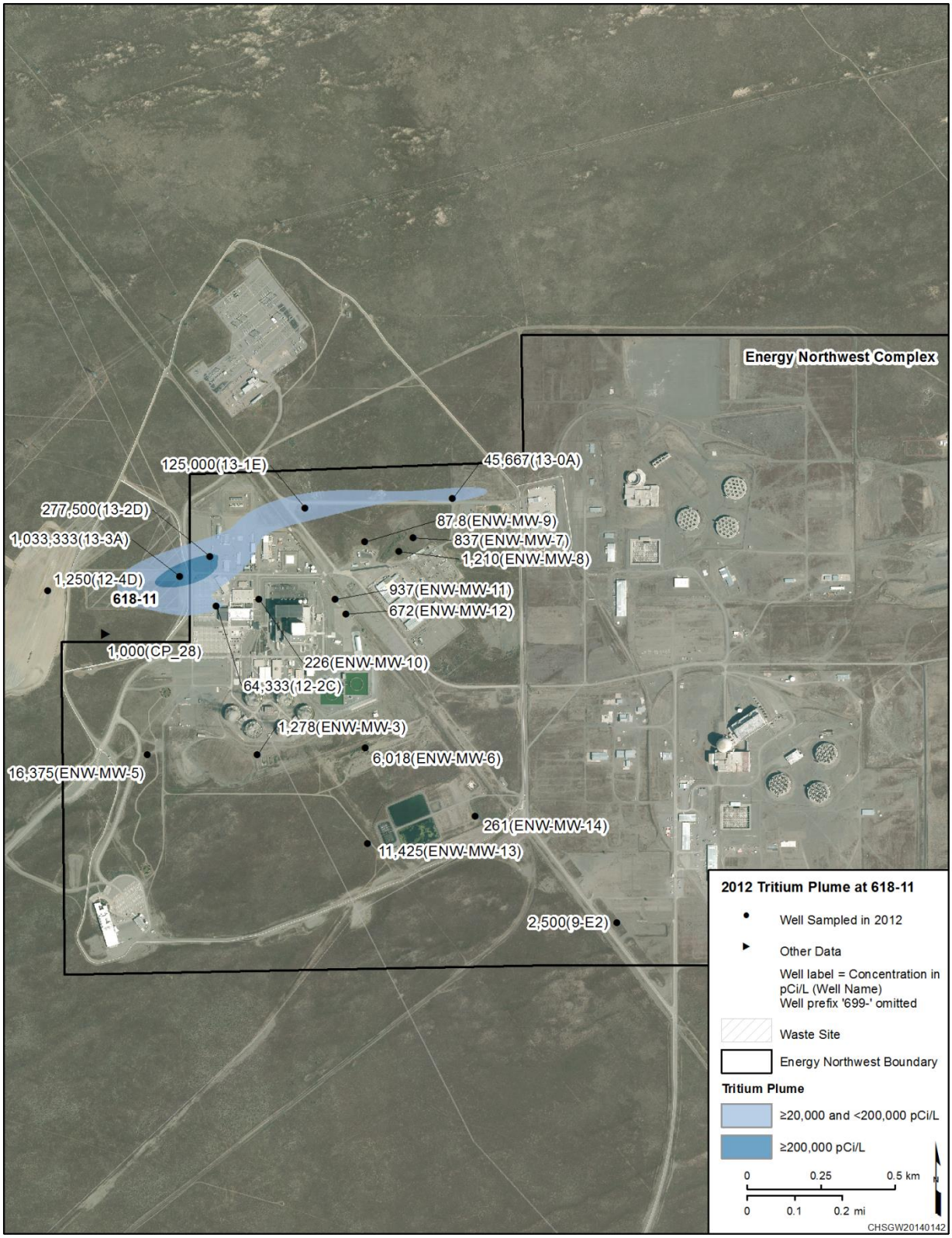


Figure 1-9. Tritium Plume from 618-11 Burial Ground (2012)

2 Basis for Remedial Action

The risk assessment in the 300 Area RI/FS (DOE/RL-2010-99 and DOE/RL-2010-99 Addendum) reported risks to HHE at the 300 Area that are the basis for RA. Waste sites that have not been remediated were determined to pose an unacceptable risk to HHE from direct exposure and some are potential sources for groundwater contamination. Based on the results of the groundwater risk evaluation, concentrations of uranium, TCE, and DCE, tritium and nitrate are present at levels in the groundwater that provide a basis for RA. Gross alpha is also a groundwater COC based on comparison to DWSs.

The 300 Area ROD/ROD Amendment (EPA and DOE, 2013) states that the selected response action is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants or contaminants into the environment. Such a release or the threat of release may present an imminent and substantial endangerment to public health, welfare or the environment.

2.1 Selected Remedy

The selected remedies presented in the 300 Area ROD/ROD Amendment (EPA and DOE, 2013) may be modified and refined as a result of the remedial design and construction process. Any changes to the remedies described in the 300 Area ROD/ROD Amendment (EPA and DOE, 2013) will be documented using a technical memorandum in the administrative record, Change Notices to the RDR/RAWP, an Explanation of Significant Differences, or a ROD amendment, as appropriate.

An overview of the basis for the selected RA for each OU is summarized in the following paragraphs as presented in the 300 Area ROD/ROD Amendment (EPA and DOE, 2013). The details of the design and any refinements are described in the Soil and Groundwater Addenda.

2.1.1 RTD at Waste Sites for 300-FF-2 OU

Contaminated soil, structures, debris, and pipelines with concentrations above the CULs will be removed from the waste sites, treated as necessary to meet disposal facility requirements, and disposed at ERDF, which is considered onsite, or another facility approved by EPA. If disposed at ERDF, wastes from the 300 Area waste sites will meet Environmental Restoration Disposal Facility Waste Acceptance Criteria, WCH-191 Rev. 3 which prohibits disposal of spent nuclear fuel, transuranic and high level wastes. Treatment may be conducted in advance of removal as necessary to control worker exposure and minimize airborne releases (e.g., for highly radioactive materials, including principal threat waste).

2.1.2 Temporary Surface Barriers and Pipeline Void Filling for 300-FF-2 OU

For waste sites that exceed CULs that are adjacent to the 300 Area facilities and utilities that will remain in operation through at least 2027 (long-term retained facilities), temporary surface caps will be installed and maintained to reduce infiltration and contaminant flux to groundwater. Surface caps will be constructed of asphalt or other similar impervious materials, and may contain other materials to decrease permeability and increase durability, such as high-density polyethylene and soil cover. In addition, pipelines with uranium and/or mercury contamination that exceeds CULs for groundwater and river protection that are inaccessible for the RTD remedy because of their close proximity to long-term facilities will be void filled to the maximum extent practicable as to immobilize radionuclides (and elemental mercury in waste site 300 RRLWS) in pipelines for groundwater protection. When the long-term facilities are no longer in use and are removed, the waste sites and pipelines will be remediated as described in the RTD discussion. The long-term retained facilities are shown on Figure 1-3. Additional descriptions of the locations and methods for temporary surface barriers and pipeline void filling are provided in the Soil Addendum.

2.1.3 Enhanced Attenuation of Uranium Common Elements for 300-FF-2 OU

Enhanced attenuation of uranium will be implemented by treatment with phosphate to promote sequestration of uranium. The specific treatment area and design are described in the Groundwater Addendum.

Uranium sequestration by phosphate application will be implemented to promote immobilization of the uranium source mass in the vadose zone and PRZ in the area of highest uranium contamination (Figure 2-1). The groundwater plume in this area results from three 300-FF-1 OU sites (316-1, 316-2, and 316-5) and four 300-FF-2 OU waste sites (316-3, 618-1, 618-2, and 618-3.) The enhanced attenuation treatment area is approximately 1 ha (3 ac) and includes injection of phosphate at the top of the aquifer to sequester uranium that may be mobilized during the vadose zone and PRZ treatment process.

2.1.4 Enhanced Attenuation of Uranium for 300-FF-5 OU

Uranium sequestration phosphate solutions will be delivered to the top of the aquifer through injection wells to limit the lateral mobility of untreated uranium that may be mobilized from the vadose zone during surface infiltration and injection into the PRZ. Design details are presented in the Groundwater Addendum.

The estimated time to achieve the groundwater CUL for uranium is expected to range between 22 and 28 years, which is based on the 90th percentile of modeled uranium concentrations in groundwater after sequestration with phosphate in vadose zone and PRZ (300-FF-2 OU) and top of the aquifer (300-FF-5 OU). There is significant uncertainty in the estimated time to achieve the uranium CUL, due to complex interactions of the contamination in the vadose zone, PRZ and groundwater with the dynamic groundwater levels controlled by seasonal changes in the elevation of the river water. The maximum time to achieve the groundwater CUL for uranium may be as high as 56 to greater than 180 years, based on the maximum modeled groundwater concentrations.

2.1.5 MNA of Groundwater for 300-FF-5 OU

MNA is a remedial strategy that monitors natural attenuation processes until CULs are met. Natural attenuation relies on natural processes within the aquifer to achieve reductions in the toxicity, mobility, volume, concentration, and/or bioavailability of contaminants. These natural processes include physical, chemical, and biological transformations that occur without human intervention. Contaminants in 300-FF-5 OU groundwater that will be managed through MNA are nitrate and tritium downgradient from the 618-11 Burial Ground and TCE and DCE at the 300 Area Industrial Complex.

Natural attenuation of nitrate and tritium from the 618-11 Burial Ground will occur through a combination of dispersion during transport and natural radiological decay for tritium. Computer modeling predicts that the tritium concentrations will decrease to below the CUL by 2031. The waste within the 618-11 Burial Ground will be removed by RTD.

MNA is used for TCE and DCE in groundwater from the 300 Area Industrial Complex. Natural attenuation will occur primarily through physical attenuation (diffusion and dispersion) and biodegradation.

MNA includes monitoring to ensure the effectiveness of natural attenuation to meet CULs. Monitoring as a component of MNA as well as the remaining monitoring requirements for 300-FF-5 OU is integrated into a Performance Monitoring Plan that will be submitted as a separate plan that is part of the Remedy Implementation SAP.

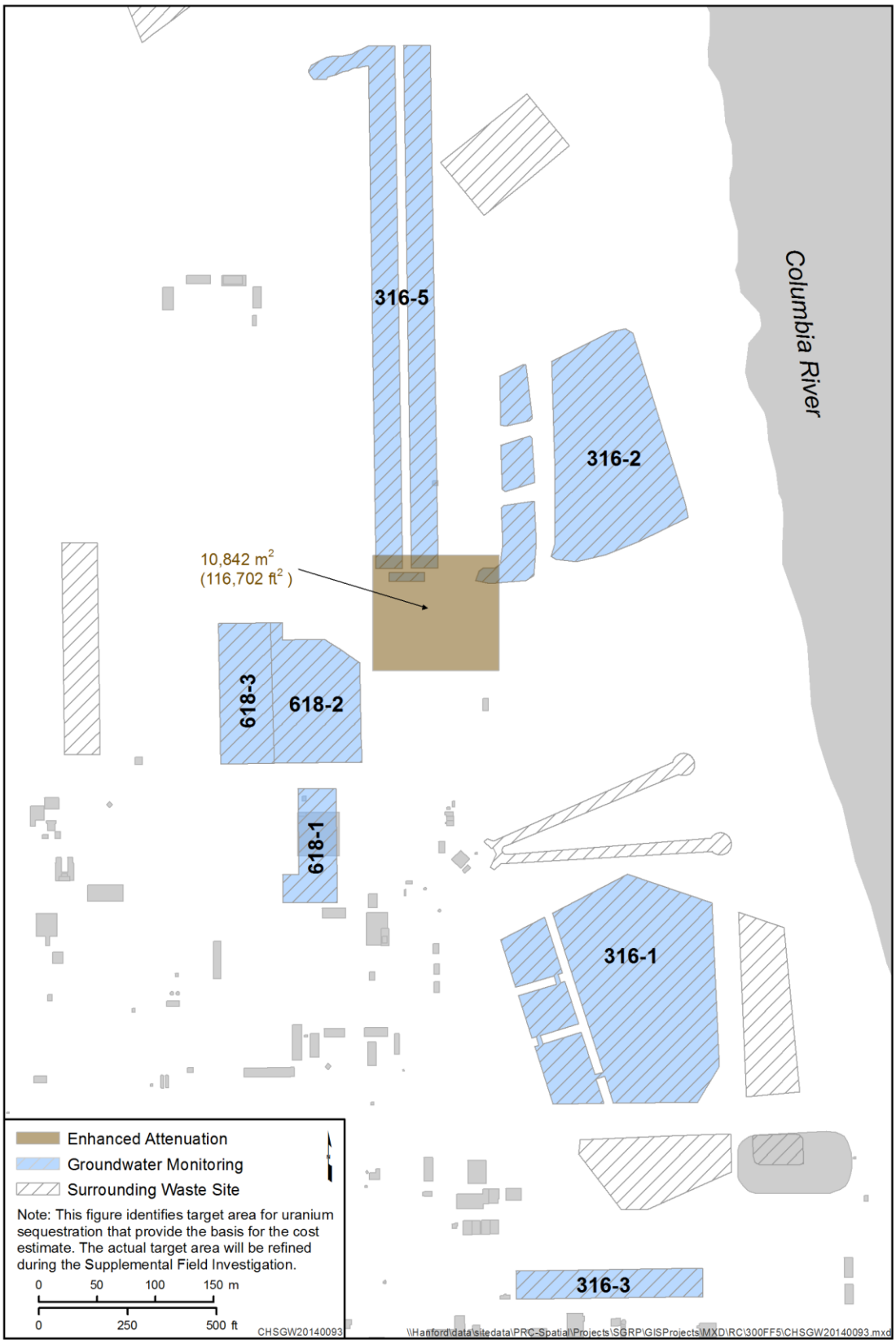


Figure 2-1. Enhanced Attenuation Treatment Area

2.1.6 Groundwater Monitoring for 300-FF-5 OU

Groundwater monitoring, included as a required MNA component, will be described in the Performance Monitoring Plan that is part of the Remedy Implementation SAP. Sampling will be sufficient to document changes in contaminant plumes for all groundwater COCs. As part of monitoring the lateral extent of plumes, groundwater will be monitored in the near vicinity of the Columbia River throughout the 300 Area Industrial Complex and both north and south of that area to ensure lateral extent of the plumes are defined. Because several of the 300-FF-5 OU groundwater COCs are also contaminants in the 200-PO-1 OU that move through the 300 Area, monitoring of 300-FF-5 OU COC plumes will include lateral extent sufficient to distinguish contamination that is part of the 300-FF-5 OU versus the 200-PO-1 OU. Monitoring will continue until COCs have attained the CULs and EPA approves termination of the monitoring. Considered in the evaluation will be processes that can affect concentrations such as river fluctuations, waste site activities, and land use activities. Groundwater monitoring will be performed to evaluate the effectiveness of the selected 300-FF-5 OU remedy to achieve CULs as described in the Performance Monitoring Plan that is part of the Remedy Implementation SAP. The monitoring will be for groundwater COCs (uranium, gross alpha, nitrate, TCE, and DCE at the 300 Area Industrial Complex; uranium and gross alpha downgradient from the 618-7 Burial Ground; and tritium and nitrate downgradient from the 618-11 Burial Ground).

2.1.7 Institutional Controls Common Elements for 300-FF-1, 300-FF-2, and 300-FF-5 OUs

ICs are required before, during, and after the active phase of RA implementation where ICs are needed to protect HHE. ICs are used to control access to residual contamination in soil and groundwater above standards for unrestricted use and unrestricted exposure. DOE shall be responsible for implementing, maintaining, reporting on, and enforcing ICs. Although DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, DOE shall retain ultimate responsibility for remedy integrity and ICs. In the event that land is transferred out of federal ownership, deed restrictions (proprietary controls such as easements and covenants) are required that are legally enforceable against subsequent property owners.

The current implementation, maintenance, and periodic inspection requirements for ICs at the Hanford Site are described in approved work plans and in DOE/RL-2001-41, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions*, hereinafter called the Sitewide IC Plan, that was prepared by DOE and approved by EPA and Ecology in 2002. No later than 180 days after the ROD is signed, DOE shall update the Sitewide IC Plan (DOE/RL-2001-41) to include ICs required by this ROD and specify the implementation and maintenance actions that will be taken, including periodic inspections. The revised Sitewide IC Plan (DOE/RL-2001-41) shall be submitted to EPA and Ecology for review and approval as a TPA (Ecology et al., 1989a) primary document. DOE shall comply with the Sitewide IC Plan (DOE/RL-2001-41) as updated and approved by EPA and Ecology.

The following IC performance objectives are required to be met as part of this RA. Land-use controls will be maintained until CULs are achieved and the concentrations of hazardous substances are at such levels to allow for unrestricted use and EPA authorizes the removal of restrictions. ICs to be implemented by DOE are the following:

- In the event that land is transferred out of federal ownership, deed restrictions (proprietary controls such as easements and covenants) are required that are legally enforceable against subsequent property owners in accordance with Section 120(h) of CERCLA.
- In the event of any unauthorized access (e.g. trespassing), DOE shall report such incidents to the Benton County Sheriff's Office for investigation and evaluation of possible prosecution.

- Activities that would disrupt or lessen the performance of any component of the remedies are prohibited. DOE shall notify EPA and Ecology immediately upon discovery of any activity inconsistent with the specific ICs.
- DOE shall report on the effectiveness of ICs for 300-FF-2 OU and 300-FF-5 OU in an annual report, or on an alternative reporting frequency specified by EPA. This report will typically be provided in the form of an update on IC effectiveness presented at the September 300 Area Unit Manager's Meeting. Such reporting may be for 300-FF-2 OU and 300-FF-5 OU alone or may be part of the Hanford Sitewide IC plan (DOE/RL-2001-41).

Measures that are necessary to ensure continuation of ICs shall be taken before any lease or transfer of any land in subject to ICs. DOE will provide notice to Ecology and EPA at least 6 months before any transfer or sale of land subject to ICs so that the lead regulatory agency can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective ICs. If it is not possible for DOE to notify Ecology and EPA at least 6 months before any transfer or sale, DOE will notify Ecology and EPA as soon as possible, but no later than 60 days before the transfer or sale of any property subject to ICs. In addition to the land transfer notice and discussion provisions, DOE further agrees to provide Ecology and EPA with similar notice, within the same time frames, as to federal-to-federal transfer of property. DOE shall provide a copy of the executed deed or transfer assembly to Ecology and EPA.

2.1.8 Institutional Controls Unique Elements for 300-FF-2 OU Waste Sites

The following IC performance objectives are required to be met as part of this RA for 300-FF-2 OU. Land-use controls will be maintained until CULs are achieved and the concentrations of hazardous substances allow for unrestricted use and EPA authorizes the removal of restrictions. The following ICs are to be implemented by DOE:

- Exposure to contamination deeper than 4.6 m (15 ft) below ground surface (bgs) is not anticipated. Where contamination at depth exceeds the residential or industrial use CULs attained for the waste site, ICs are required to ensure future activities do not bring this contamination to the surface or otherwise result in exposure to contaminant concentrations that exceed the CULs that were attained at the waste site.
- DOE will prevent the development and use of property that does not meet residential use CULs at the 300 Area Industrial Complex and 618-11 (Figure 2-2) for other than industrial uses, including use of property for residential housing, elementary and secondary schools, childcare facilities, and playgrounds.
- Signage and access control to unremediated waste sites with contamination above CULs will be provided as described in the Soil Addendum.
- DOE shall employ and maintain an excavation permit program for protection of human health against unacceptable exposure, and protection of environmental and cultural resources.
- Enhanced recharge over or near waste sites with soil concentration at any depth that exceeds irrigation-based groundwater and surface water protection CULs will be prevented until the CULs are achieved. Enhanced recharge controls are no irrigation or landscape watering, controlling drainage from low permeability areas including paved parking lots or buildings, and preventing bare gravel or bare sand covers over waste sites in the 300 Area Industrial Complex and 618-11 that exceed groundwater and surface water protection CULs.

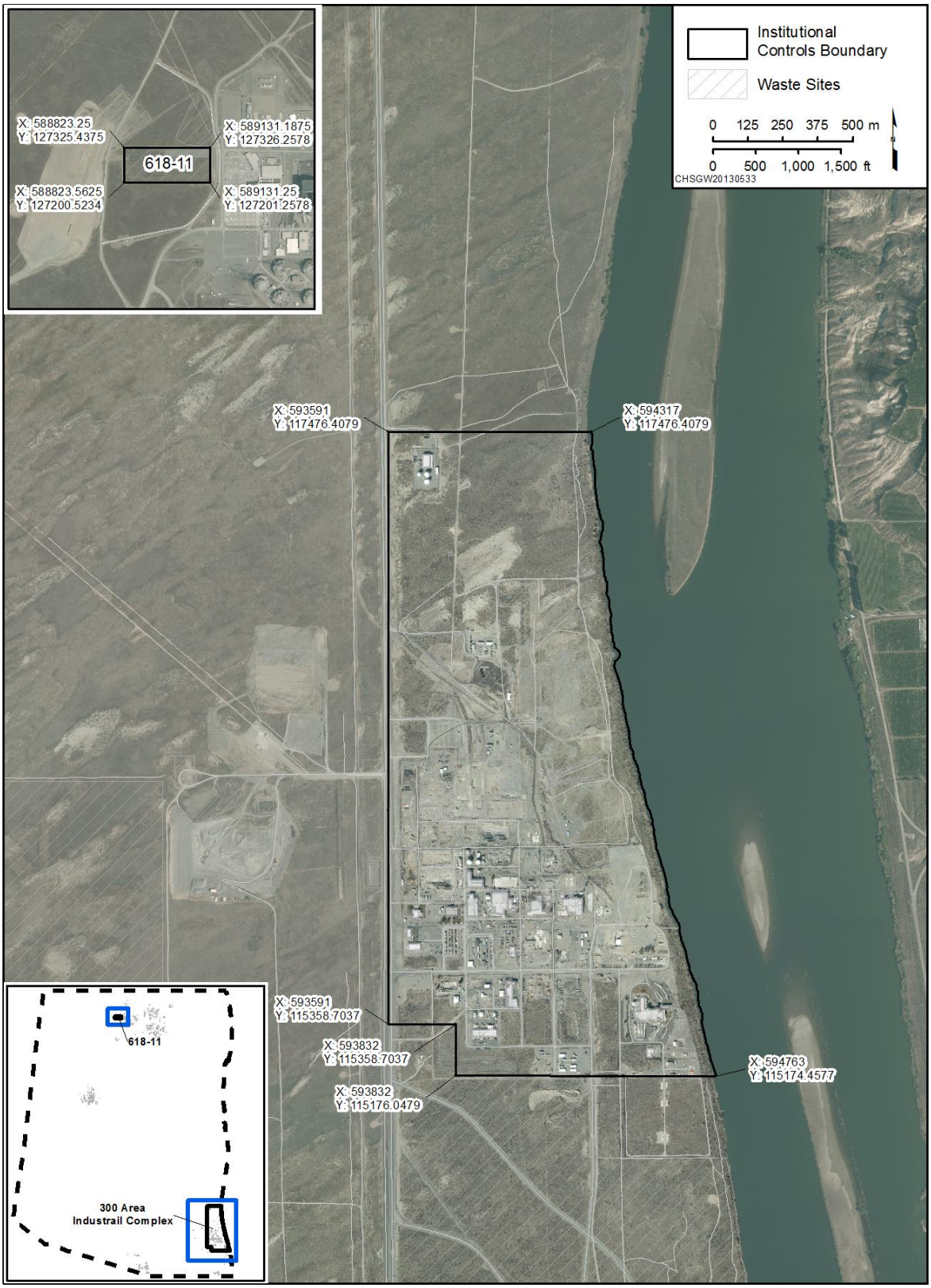


Figure 2-2. 300-FF-2 OU Industrial Use Areas Subject to Industrial Use ICs

2.1.9 Institutional Controls Unique Elements for 300-FF-5 OU Groundwater

The following IC performance objectives are required to be met as part of this RA for 300-FF-5 OU. Land-use controls will be maintained until CULs are achieved and the concentrations of hazardous substances are at such levels to allow for unrestricted use and EPA authorizes the removal of restrictions. ICs to be implemented by DOE to support achievement of the RAOs include administrative controls that limit 300-FF-5 OU groundwater access and use in a manner that is protective of human health where groundwater is above CULs.

2.1.10 Description of the Amended Remedy for 300-FF-1 OU

The ROD for 300-FF-1 OU was amended to require enhanced attenuation with sequestration for uranium using phosphate at select 300-FF-1 OU waste sites. Phosphate will be applied to the vadose zone and PRZ using a combination of surface infiltration and injection into the deep vadose zone and PRZ near the southern portion of waste site 316-5. Uranium sequestration also occurs at the top of the aquifer below the vadose zone and PRZ treatment zone to limit the mobility of any uranium potentially mobilized during surface infiltration and PRZ injection into the vadose zone and PRZ. Details of the uranium sequestration for the 300-FF-1 OU waste sites are included in the Groundwater Addendum.

2.2 Remedial Action Objectives

RAOs are site-specific objectives that define the extent of cleanup necessary to achieve the specific level of remediation at the site. RAOs for the 300-FF-1 OU ROD Amendment address uranium contamination in the vadose zone and PRZ that provides the greatest contribution of contamination to the uranium groundwater plume and also reflect the potential use of 300-FF-5 OU groundwater as a drinking water source. The RAOs for the 300-FF-1 OU ROD Amendment are RAO 2 and RAO 7. The RAOs for the 300-FF-2 OU ROD are RAOs 2 through 6. The RAOs for the 300-FF-5 OU ROD are RAOs 1 and 7.

The RAOs identified in the 300 Area ROD/ROD Amendment are summarized in Table 2-1, followed by the specific sections of the Integrated RDR/RAWP, Soil Addendum, or Groundwater Addendum that describe the actions that address the RAO.

Table 2-1. Remedial Action Objectives

RAO	Integrated RDR/RAWP	Soil Addendum	Groundwater Addendum
RAO 1. Prevent human exposure to groundwater containing COC concentrations above CULs.	Sections 2.1.3, 2.1.4, 2.1.5, 2.1.6, 2.1.7, and 2.1.9		Sections 3 and 4
RAO 2. Prevent COCs migrating and/or leaching through soil that will result in groundwater concentrations above CULs for protection of groundwater, and of surface water concentrations above CULs for the protection of surface water at locations where groundwater discharges to surface water.	Sections 2.1.1 and 2.1.2	Sections 3 and 4	
RAO 3. Prevent human exposure to the upper 4.6 m (15 ft) of soil, structures, and debris contaminated with COCs at concentrations above residential scenario-based CULs in areas outside both the 300 Area Industrial Complex and waste site 618-11 (adjacent to Energy Northwest).	Sections 2.1.1, 2.1.2, 2.1.7, and 2.1.8	Sections 3 and 4	

Table 2-1. Remedial Action Objectives

RAO	Integrated RDR/RAWP	Soil Addendum	Groundwater Addendum
RAO 4. Prevent human exposure to the upper 4.6 m (15 ft) of soil, structures, and debris contaminated with COCs at concentrations above CULs for industrial use in the 300 Area Industrial Complex and waste site 618-11 (adjacent to Energy Northwest).	Sections 2.1.1, 2.1.2, 2.1.7, and 2.1.8	Sections 3 and 4	
RAO 5. Manage direct exposure to contaminated soils deeper than 4.6 m (15 ft) to prevent an unacceptable risk to HHE**.**	Sections 2.1.1, 2.1.2, 2.1.7, and 2.1.8	Sections 3 and 4	
RAO 6. Prevent ecological receptors from direct exposure to the upper 4.6 m (15 ft) of soil, structures, and debris contaminated with COCs at concentrations above CULs.	Sections 2.1.1, 2.1.2, 2.1.7, and 2.1.8	Sections 3 and 4	
RAO 7. Restore groundwater impacted by Hanford Site releases to CULs which include DWSs, within a timeframe that is reasonable given the particular circumstances of the site.	Sections 2.1.3, 2.1.4, 2.1.5, 2.1.6, and 2.1.7		Sections 3 and 4

These RAOs address the risks identified in the RI/FS, are protective of HHE, and are compatible with the RAOs in the previous RODs for these OUs.

2.3 Cleanup Levels

CULs for the 300-FF-2 OU were developed based on direct human contact as well as groundwater and surface water protection. Soil CULs for the protection of groundwater and surface water are based on site-specific data for the 300 Area, current federal DWSs, and risk-based concentrations that are more stringent than DWS for TCE and DCE using a WAC 173-340, “Model Toxics Control Act—Cleanup,” calculation method plus EPA-approved toxicity information. The soil CULs are provided in the Soil Addendum. CULs developed for 300-FF-5 OU groundwater are presented in the Groundwater Addendum.

2.4 Performance Monitoring

A Performance Monitoring Plan will be developed to assess the responses of the groundwater plumes to the remedy over time. The Performance Monitoring Plan will be submitted as a separate document as part of the Remedy Implementation SAP. It will address both the MNA and groundwater monitoring remedy components.

2.5 Applicable or Relevant and Appropriate Requirement Compliance

Applicable or relevant and appropriate requirements (ARAR) are determined based on analysis of which requirements are applicable or relevant and appropriate to the distinctive set of circumstances and actions at a specific site. The NCP (40 CFR 300, Appendix B) requires that ARARs be attained or appropriately waived during implementation and at completion of the RA. No ARAR waivers are authorized as part of the ROD for 300-FF-2 and 300-FF-5 OUs and ROD amendment for 300-FF-1 OU. A summary of federal and state ARARs is attached as Appendix A.

3 Remedial Design Approach

This chapter is intended to provide general RD information and a description of RA activities necessary to support implementation of the selected remedy. As described in Section 1 (Table 1-1), design details specific to waste site remedies (RTD, surface barriers, and void fill grouting) are described in the Soil Addendum. Design details for enhanced attenuation of uranium using sequestration in the vadose zone, PRZ, and top of the aquifer; MNA; and groundwater monitoring are presented in the Groundwater Addendum. ICs for soil and groundwater are described in Section 2.1.

3.1 Design Basis

Contaminant fate and transport modeling, laboratory-scale and field-scale treatability studies, and results of the risk assessment as documented in the 300 Area RI/FS (DOE/RL-2010-99 and DOE/RL-2010-99 Addendum) were used to identify areas needing remediation and for the basis for design for groundwater and soil RAs. The basis for design of specific soil and groundwater remedies is described in detail in the addenda.

3.2 Conceptual Design Summary

As discussed, conceptual design approaches and enhanced attenuation area (EAA) for the 300 Area remedies are presented in the Soil and Groundwater Addenda. A high-level summary of the remedy conceptual designs is presented below.

3.2.1 RTD

The RTD remedy component includes removal (by excavation) of contaminated soil and structures as necessary to meet soil CULs, treatment as necessary to meet disposal criteria, disposal at an appropriate facility, and backfill and restoration at the waste sites to control subsequent infiltration. No additional post-ROD field investigations are anticipated to support the RTD remedy. Actions to complete RTD are discussed further in the Soil Addendum.

3.2.2 Void Fill Grouting

Pipelines that are inaccessible for the RTD remedy because of their close proximity to long-term facilities will be void filled, as necessary, to immobilize uranium in pipelines for groundwater protection. Void filling involves injecting chemical extrusions or other mixtures to immobilize contaminants and to fill large voids that can act as transport pathways. Once solidified, the structure is then left in place until the final RA can be implemented. No additional post-ROD field investigations are anticipated to support the void fill grouting remedy. Actions to complete void fill grouting, including the composition of the mixture, mixing systems, and injection techniques are discussed further in the Soil Addendum.

3.2.3 Temporary Surface Barriers

For waste sites that exceed CULs that are adjacent to the 300 Area facilities and utilities that will remain in operation through at least 2027 (long-term facilities), temporary surface caps will be installed and maintained, as necessary, to reduce infiltration and contaminant flux to groundwater. No additional post-ROD field investigations are anticipated to support the temporary surface barrier remedy. Additional descriptions of the locations and methods for temporary surface barrier installations are provided in the Soil Addendum.

3.2.4 Enhanced Attenuation of Uranium

Enhanced attenuation of uranium will be implemented at the 300-FF-1, 300-FF-2, and 300-FF-5 OUs. Phosphate compounds will be applied using a staged approach to promote immobilization of uranium source mass in the vadose zone and PRZ in the area of highest uranium contamination.

The EAA, as presented in the 300 Area ROD/ROD Amendment, is illustrated in Figure 2-1. The treatment area is approximately 1 ha (3 ac). Application of phosphate will be completed using surface infiltration and injection well techniques. Near surface treatment will use surface infiltration with phosphate reagent-amended water. Wells will be used for injection of phosphate to a zone spanning across the PRZ and top of aquifer. Injection of phosphate into the top of aquifer will be performed to mitigate potential impacts to the aquifer from uranium that may be carried downward during phosphate application in the vadose zone and PRZ. This treatment zone will be in place during the surface application of phosphate and maintained for a short period afterwards to react with any uranium that leaches into groundwater as a result of the phosphate solution applied to the vadose zone and PRZ.

Phosphate injections will be performed when groundwater conditions are favorable. The timing of the application in the PRZ will be scheduled to maximize contact with the PRZ. Monitoring and verification sampling, including soil borings and monitoring wells, will be completed to monitor effectiveness and potential impacts to groundwater from phosphate delivery. Design details are presented in the Groundwater Addendum.

The specific reagent blends of phosphate will be designed to optimize desired treatment characteristics, depending on the delivery method and target media. The specific reagent blend is presented in the Groundwater Addendum.

Uranium concentration and leachability characterization will be conducted on vadose zone and PRZ core samples collected before and after phosphate treatment to quantify the vadose zone and PRZ treatment effectiveness and to refine the groundwater model. Groundwater monitoring will be conducted to assess changes in uranium concentrations and the lateral spread of phosphate.

Additional post-ROD field investigations will be implemented to support the design of uranium sequestration and are summarized in Section 3.3 and the Groundwater Addendum. The design for uranium sequestration, including the design basis and volumes of specific phosphate blends, surface infiltration design, injection well construction requirements, injection implementation, and performance monitoring is described Groundwater Addendum.

3.2.5 MNA of Groundwater

Contaminants in groundwater in 300-FF-5 OU that will be managed through MNA are nitrate and tritium downgradient from the 618-11 Burial Ground, and TCE, and DCE at the 300 Area Industrial Complex. MNA includes monitoring to ensure the effectiveness of natural attenuation to meet CULs.

No additional post-ROD field investigations will be implemented to support the design of MNA. A Performance Monitoring will be developed to assess the responses of the groundwater plume to the remedy over time. The Performance Monitoring Plan will be submitted as a separate document as part of the Remedy Implementation SAP. It will address both MNA and overall groundwater monitoring and will describe the groundwater monitoring locations, parameters, and frequency to support the MNA remedy.

3.2.6 Groundwater Monitoring

Groundwater monitoring will be completed to document changes in contaminant plumes for all groundwater COCs. Monitoring will continue until COCs have attained the CULs and are expected to continue to meet CULs and EPA approves termination of the monitoring. Sampling will include analyses

for uranium, gross alpha, nitrate, TCE, and DCE at the 300 Area Industrial Complex; uranium and gross alpha downgradient from the 618-7 Burial Ground; and tritium and nitrate downgradient from the 618-11 Burial Ground.

No additional post-ROD field investigations will be implemented to support the groundwater monitoring program. The Performance Monitoring Plan will be submitted as a separate document as part of the Remedy Implementation SAP. It will address both MNA and overall groundwater monitoring and will describe the groundwater monitoring locations, parameters, and sampling frequency.

3.3 Supplemental Design Tasks

The current uranium sequestration EAA is shown in Figure 2-1. A supplemental post-ROD field characterization task will be completed to refine the location of the EAA as described in the Groundwater Addendum.

3.4 Design Approach

The overall design approach for the 300 Area remedy relies on the use of supplemental post-ROD field characterization to refine the uranium sequestration EAA, a staged implementation approach to refine phosphate application methods and formulations, field instructions to guide completion of the RAs, and groundwater monitoring to assess progress with respect to RAOs. The methods and sampling designs summarized in Section 3.2 of this Integrated RDR/RAWP and the addenda represent the overall design and implementation approach that will be followed.

The Integrated RDR/RAWP, Soil Addendum, and Groundwater Addendum serve as the RDR. Additional refinements to the groundwater remedial design maybe made after completion of the supplemental field characterization and the Stage A implementation as described in the Groundwater Addendum. Analyses of data and recommended changes to the remedial design will be presented in the Supplemental Post-ROD Field Investigation Report and Stage A Delivery Performance Report. These reports will be discussed and agreed upon as part of the Unit Managers Meetings.

The remedial design for the groundwater monitoring and MNA will be provided in the Performance Monitoring Plan as part of the Remedy Implementation SAP. The Integrated RDR/RAWP and addenda will be submitted to the EPA for review as a primary document in accordance with the TPA (Ecology et al., 1989a), Section 9.2.1. Installation of the injection wells and monitoring wells required for the groundwater remedy implementation will be described in the Remedy Implementation SAP.

For the uranium sequestration remedy component, the following operations and maintenance (O&M) components will be described in Remedy Implementation SAP:

- Phosphate formulations
- Phosphate solution injection and infiltration rates
- O&M requirements for phosphate solution storage, distribution, and delivery systems
- Injection and infiltration schedule
- Monitoring plan for evaluating phosphate distribution during injection and infiltration

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4 Remedial Action Management and Approach

This chapter describes the work elements and management approach associated with implementation of the selected remedies that are common to all three OUs. The Soil and Groundwater Addenda include the elements that are specific to each.

4.1 Project Team

The term "project team" includes the individuals working to accomplish the RA. Accordingly, the project team includes RL; the lead regulatory agency; the 300 Area project manager, and the remediation contractors. Figure 4-1 shows the RDR/RA project organization. The roles and responsibilities for these team members are discussed in the addenda. The overall project team common to both remediation contractors is briefly discussed in the following paragraphs.

- Lead Agency (U.S. Department of Energy) – DOE is the lead agency under CERCLA (delegated by Executive Order 12580, *Superfund Implementation*, the primary authority under Sections 104 and 121) to conduct removal and RAs at DOE facilities. DOE is responsible for the remediation actions through the Hanford Site and, as such, has assigned remedial project managers to each main area and task involved with remediation activities. The lead agency is responsible for managing the assigned activities, which include scope, budget, schedule, quality, personnel, communication, risk/safety, contracts, and regulatory interface and works under EPA oversight in accordance with CERCLA Section 120, as implemented through the TPA (Ecology et al, 1989a). DOE obtains congressional funding for these activities.

- Lead Regulatory Agency (U.S. Environmental Protection Agency) – EPA is the lead regulatory agency for the CERCLA remediation activities within the 300 Area NPL (40 CFR 300, Appendix B) site, as described in the TPA (Ecology et al., 1989a). The lead regulatory agency is responsible for overseeing activities to verify that applicable regulatory requirements are met. Lead regulatory agency approval will be required on all TPA (Ecology et al., 1989a) primary documents (e.g., this Integrated RDR/RAWP and addenda).

- Remediation Contractors – The waste site remediation contractor will implement the RDR/RA of the waste sites including RTD and surface barriers. The RDR/RAWP elements specific to the RA management and approach are provided in the Soil Addendum.

The groundwater remediation contractor will implement the RDR/RA activities associated with the uranium sequestration for the vadose zone, PRZ, top of the aquifer, and MNA. The RDR/RAWP elements specific to the RA management and approach are provided in the Groundwater Addendum.

Contractors for Operations, Waste Management, Field Construction, Radiological Control, Engineering, Quality Assurance (QA), Health and Safety, Environmental Compliance, and Sample Management may be used for both soil and groundwater work and would report to the Remediation Contractors.

Facilities that are not clean-closed at the 324 Building or where D4 activities are taking place are not within the scope of this Integrated RDR/RAWP. Where needed, the Remediation Contractors will coordinate activities with the contractors to keep them informed of groundwater and waste site RAs near these sites.

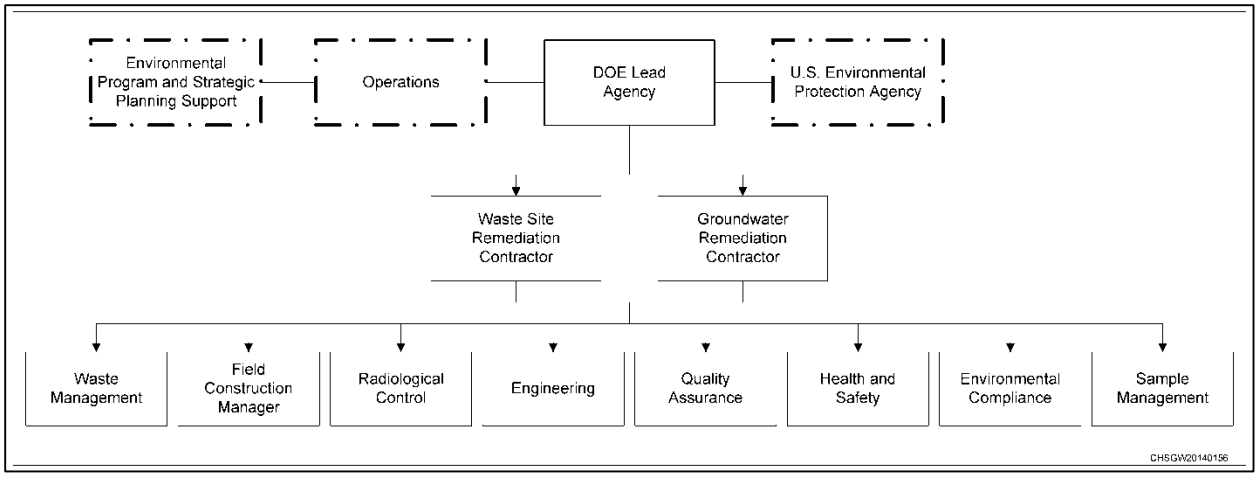

Figure 4-1. RDR/RA Project Organization

4.2 Change Management

Three types of changes in the RAs could affect compliance with the requirements in the 300 Area ROD/ROD Amendment:

- A fundamental change is a change that does not meet the requirements set forth in the 300 Area ROD/ROD Amendment or that incorporates remedial activities not defined in the scope of the ROD. These changes will be discussed with the lead agency to establish a path forward.
- A significant change generally involves a change to a component of a remedy that does not fundamentally alter the overall cleanup approach. All significant changes will be addressed in an explanation of significant difference.
- A minor change will not have a significant impact on the scope, performance, or cost of the remedy. Minor changes should be documented in the appropriate post-decision project file (for example, through interoffice memoranda or logbooks). Nonsignificant changes will not impact the requirements of the 300 Area ROD/ROD Amendment, nor will they impact the functional requirements.

Determining the significance of the change is the responsibility of DOE and the lead regulatory agency. The remediation or environmental manager is responsible for tracking all changes and obtaining appropriate reviews by contractor staff. The remediation or environmental manager will discuss the change with DOE, and DOE will then discuss the type of change that is necessary with the lead regulatory agency up to and including the TPA Action Plan (Ecology et al., 1989b), Sections 9.3 and 12.4 changes. Appropriate documentation will follow, in accordance with the requirements for that type of change.

4.3 Remedial Action Work Tasks

RA work tasks include procurement and construction, operational approach, and data use and interpretation. RA activities that are specific to the soil or groundwater RA are described in the Soil and Groundwater Addenda, respectively.

5 Environmental Management and Controls

This chapter describes the environmental management and controls associated with implementation of the 300 Area remedies.

5.1 Air Emissions

5.1.1 Radiological Air Emissions

The proposed remedial activities will be evaluated on a waste site-specific basis with respect to determining the potential-to-emit radionuclides from any point source or diffuse/fugitive source. Radiological air emissions associated with the RTD at waste sites for 300-FF-2 OU will be managed with treatment conducted as necessary in advance of removal to control worker exposure and minimize airborne releases. Additional information regarding evaluation and management of radiological emissions from waste site RA is presented in the Addendum for 300 Area Soil. Air monitoring requirements for waste site RTD are described further in the 300 Area Soil Addendum.

Radiological air emissions associated with deployment of the phosphate for uranium sequestration are not anticipated.

5.1.2 Nonradiological Air Emissions

To demonstrate compliance with the ARARs of WAC 173-400, “General Regulations for Air Pollution Sources,” and WAC 173-460, “Controls for New Sources of Toxic Air Pollutants,” fixatives and dust suppression methods will be used. No treatment requirements have been identified that would meet the substantive applicable requirements WAC 173-460.

Nonradiological air emissions associated with deployment of the phosphate for uranium sequestration are not anticipated.

5.2 Reporting Requirements for Non-Routine Releases

40 CFR 302, “Designation, Reportable Quantities, and Notification,” requires immediate notification to the National Response Center upon discovery of a release of a hazardous substance into the environment in excess of a reportable quantity in a 24-hour period. 40 CFR 355, “Emergency Planning and Notification,” requires immediate notification to the community emergency coordinator for the local emergency planning committee and to the State Emergency Response Commission for a release of a reportable quantity of an extremely hazardous substance or a CERCLA hazardous substance in a 24-hour period, except for releases exempted from reporting under 40 CFR 355.31, “What Types of Releases are Exempt from the Emergency Release Notification Requirements of this Subpart?”.

5.3 Waste Management

Waste management requirements for project waste streams, waste characterization, designation and disposal, waste generation management, management of waste containers, final disposal/storage, waste disposal records, waste transportation, waste treatment, and waste minimization and recycling are specific to the RTD and uranium sequestration activities. Activities associated with the waste management are included in the 300 Area Soil Addendum and Waste Management Plan for Groundwater.

5.4 Cultural/Ecological Resources

As of March 31, 2015, DOE has completed cultural resource reviews and made its determinations for one hundred twenty-five (125) waste sites covered by the ROD. DOE will complete cultural resource reviews, make its determinations, and provide notifications for the remaining waste sites and for any remaining subsurface and groundwater work prior to undertaking ground disturbing activities at those sites in accordance with the NHPA implementing regulations at 36 C.F.R. § 800.3 through § 800.6 using the HCRMP as guidance. Further procedures, including entering into Memoranda of Agreement ("MOAs") or other agreement documents, may be conducted for some activities but are not required.

5.5 Safety and Health Program

A health and safety plan (HASP) addresses routine job site hazards and physical hazards and specifies general controls and requirements for work activities. Access and work activities are controlled in accordance with approved work packages, as required by established internal work requirements and processes. The HASP includes the requirements for hazardous waste operations and/or construction activities, as specified in 29 CFR 1910.120, “Occupational Safety and Health Standards,” “Hazardous Waste Operations and Emergency Response.” Depending on the specific hazards present, one or more HASPs could be written for this RA. As part of work package development, a job or activity hazards analysis will be written to identify the hazards associated with specific tasks in addition to the HASP.

In addition to the HASP, in accordance with contractor-level procedures and programs, radiological work permits (RWPs) will be prepared, as needed, for work in areas with potential radiological hazards. The RWP extends the Radiological Protection Program to the specific work site or operation. All personnel assigned to the project and all work site visitors strictly shall adhere to the provisions identified in the HASP and RWP. Before work and before each activity begins, a pre-job briefing will be held with the involved workers. This briefing will include reviews of the hazards that could be encountered and the associated requirements. Throughout an activity, daily briefings also could be held, as well as special briefings before major evolutions.

5.6 Emergency Response

During construction and operations, emergency response for project activities will be covered by the project-specific HASP, and related health and safety procedures and work instructions. The HASP, health and safety procedures, and work instructions contain primary emergency response actions for site personnel, area alarms, implementation of the emergency action plan, and emergency equipment at each task site, as well as emergency coordinators, emergency response procedures, and spill containment. A copy of the HASP will be kept in the construction field office. When emergencies arise that are beyond the limitations of the project-specific HASP, DOE-0223, *Emergency Plan Implementing Procedures*, will govern project staff response, as specified in the HASP.

5.7 Quality Assurance Program

Overall QA for the RDR/RAWP will be planned and implemented in accordance with 10 CFR 830, “Nuclear Safety Management,” Subpart A, “Quality Assurance Requirements;” EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5); EPA/240/R-02/009, *Guidance for Quality Assurance Project Plans* (EPA QA/G-5); and EPA/240/B-05/001, *Guidance on Quality Assurance for Environmental Technology Design, Construction and Operation* (EPA QA/G-11). The QA activities will use a graded approach based on the potential impact to the environment, safety, health, reliability, and continuity of operations. QA for the soil and groundwater remedy implementation will be discussed in the Remedy Implementation SAP and will comply with the following requirements:

- DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Documents*
- DOE O 414.1D, *Quality Assurance*

All SAPs and groundwater monitoring plans prepared to support the 300 Area RA will contain a QA project plan, which establishes the quality requirements for environmental data collection, including planning, implementation, and assessment of sampling, field measurements, and laboratory analysis.

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6 Remedial Action Completion

This chapter describes how the effectiveness of the remedies will be evaluated for RA completion. Performance standards were established for 300-FF-5 OU groundwater and 300-FF-2 soil, structures, and debris. Performance standards for groundwater are CULs that are based on the DWS for uranium, tritium, nitrate, and gross alpha, and risk-based standards that are more stringent than respective DWS for TCE and DCE. Performance standards selected for 300-FF-2 soil, structures, and debris within the top 4.6 m (15 ft) bgs are protective of industrial uses of the 300 Area Industrial Complex and the 618-11 Burial Ground, and residential use for the remaining areas. Soil, structures, and debris performance standards for industrial use CULs protect an adult worker but not children. At industrial use CULs areas, land use controls are required to prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities, and playgrounds. CULs for 300-FF-2 soil at all depths are also based on protection of groundwater and surface water.

Additional details for remedy completion are provided in the 300 Area Soil and Groundwater Addenda, including the CULs.

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7 Cost and Schedule

This chapter describes cost and schedule as associated with implementation of the 300 Area remedies.

7.1 Cost Summary

Cost estimates for remediation of remaining 300-FF-2 OU waste sites were prepared as part of the 300 Area RI/FS (DOE/RL-2010-99) and subsequently carried forward into the 300 Area ROD (EPA and DOE, 2013). The estimates were prepared with an accuracy of -30 to +50 percent to support evaluation of remedial alternatives and selection of a remedy. Cost estimates are updated based on design work. In accordance with CERCLA requirements, an ESD will be pursued by the Tri-Parties if remediation costs change significantly from those identified in the ROD.

Costs for the 300-FF-5 uranium sequestration and groundwater monitoring were updated based on the design presented in the Groundwater Addendum and are estimated at $23,585,000, with an accuracy of -30 to +50 percent and include 25 years of O&M.

The estimate for 150 years of ICs is estimated at $39,803,000 for both the waste sites and groundwater.

7.2 Schedule

Milestone schedules for implementation of the remedies are presented in the 300 Area Soil and Groundwater Addenda. Remove, treat, and dispose and interim stabilization at the majority of 300 Area waste sites are planned to be completed by March 2017. Remediation of other outlying waste sites, including RTD at 618-10, is planned to be completed by March 2020. Unique considerations at the 618-11 and 300-296 waste sites require later completion dates, and continued use of the long-term retained facilities will preclude remediation of underlying and associated waste sites until after 2027. Implementation for the 300 Area groundwater remedy is scheduled for completion in 2016.

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WAC 173-400, "General Regulations for Air Pollution Sources," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-400.

WAC 173-460, "Controls for New Sources of Toxic Air Pollutants," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-460.

WCH-191, Environmental Restoration Disposal Facility Waste Acceptance Criteria, current revision, Washington Closure, Hanford, Richland, Washington.

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Appendix A

Applicable or Relevant and Appropriate Requirements

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A Introduction

Only the substantive requirements of the listed applicable or relevant and appropriate requirements (ARAR) are included in Table A-1. This record of decision (ROD) amendment for the 300-FF-1 Operable Unit (OU) does not remove any of the ARARs established in the 300-FF-1 ROD. ARARs have been added, where specified, in the application column of Table A-1. New 300-FF-1 ARARs only apply to the limited part of the amended 300-FF-1 ROD, which is uranium as an impact to groundwater.

The application column of the table identifies if the ARARs apply to the selected remedy for 300-FF-2, 300-FF-5 and/or the 300-FF-1 ROD amendment.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"Maximum Contaminant Levels for Organic Contaminants" (40 CFR 141.50(b) and 141.61)	Establishes MCLs and non-zero MCLGs for drinking water. The standards are designed to protect human health from adverse effects of organic contaminants in drinking water.	These levels regulate the concentrations of contaminants in public drinking water supplies and are considered relevant and appropriate for groundwater and for surface water used potentially for drinking water. Although 300-FF-5 groundwater is not currently used for drinking water, it is a potential drinking water source and discharges into the Columbia River which is used for drinking water.	300-FF-5. To be met through MNA and source control measures.
"Maximum Contaminant Levels for Inorganic Contaminants" (40 CFR 141.51(b) and 141.62)	Establishes MCLs and non-zero MCLGs for drinking water. The standards are designed to protect human health from adverse effects of inorganic contaminants in drinking water.	These levels regulate the concentrations of contaminants in public drinking water supplies and are considered relevant and appropriate for groundwater and for surface water used potentially for drinking water. Although 300-FF-5 groundwater is not currently used for drinking water, it is a potential drinking water source and discharges into the Columbia River which is used for drinking water.	300-FF-5. To be met through enhanced attenuation, MNA, and source control measures.
"Maximum Contaminant Levels for Radionuclides" (40 CFR 141.66)	Establishes MCLs for drinking water. The standards are designed to protect human health from adverse effects of radionuclide contaminants in drinking water.	These levels regulate the concentrations of contaminants in public drinking water supplies and are considered relevant and appropriate for groundwater and for surface water used potentially for drinking water. Although 300-FF-5 groundwater is not currently used for drinking water, it is a potential drinking water source and discharges into the Columbia River which is used for drinking water.	300-FF-5. To be met through enhanced attenuation, MNA, and source control measures.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"UIC Well Classification Including Allowed and Prohibited Wells" (WAC 173-218-040)	Establishes the criteria and standards for an underground injection control program.	Wells and borings are used to monitor groundwater; characterize the vadose zone, PRZ, and groundwater; and phosphate injection.	300-FF-1, 300-FF-2, and 300-FF-5. The selected remedies and ROD amendment will comply for injection wells and borings used for enhanced attenuation.
"Decommissioning of UIC Well" (WAC 173-218-120)	Identifies the requirements for decommissioning of UIC wells.	Wells and borings are used for phosphate injection.	300-FF-1, 300-FF-2, and 300-FF-5. The selected remedies and ROD amendment will comply for UIC wells used for enhanced attenuation.
"Potable Groundwater Defined" (WAC 173-340-720(2)) "Groundwater Cleanup Standards" (WAC 173-340-720(4)(b)(i-iii) (A)&(B) "Adjustments to Cleanup Levels" (WAC 173-340-720(7)) "Points of Compliance" (WAC 173-340-720(8)) "Compliance Monitoring" (WAC 173-340-720(9)(b-f))	Groundwater shall be classified as potable unless exclusion criteria are met. These groundwater cleanup requirements are ARARs where they are more stringent than federal MCL ARARs. Adjustments to CULs are made in accordance with WAC 173-340-720(7). Points of compliance are established throughout 300-FF-5. Groundwater sample analysis shall be conducted on unfiltered samples unless a filtered sample is shown to be more representative.	Groundwater in 300-FF-5 contains contaminants that require remediation. Although 300-FF-5 groundwater is not currently used for drinking water, it is a potential drinking water source and discharges into the Columbia River which is used for drinking water.	300-FF-5. The groundwater CULs for chemicals are calculated using Method B equations (720-1 and 720-2) for non-carcinogens and carcinogens, respectively. The selected remedy will comply with the standards using MNA and source control measures, with the 300-FF-5 points of compliance throughout the 300-FF-5 aquifer.
"How Shall Each Water Well Be Planned and Constructed?" (WAC 173-160-161)	Water wells must not be a conduit for contamination and be constructed to yield the necessary quantity of water.	Water wells may be used to obtain water for remedial actions such as dust suppression. Monitoring wells in WAC 173-160-410(7) for 300-FF-5 are not water wells.	300-FF-2. The selected remedies will comply by constructing water wells that meet these standards.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"What Are the Requirements for the Location of the Well Site and Access to the Well?" (WAC 173-160-171)	Identifies the requirements for locating a well to protect groundwater from contamination and to provide for future well access.	Wells and borings are used to monitor groundwater; characterize the vadose zone, PRZ, and groundwater; and for injection of phosphate.	300-FF-1, 300-FF-2, and 300-FF-5. The selected remedies will comply by building wells that meet these standards.
"What Are the Requirements for Preserving the Natural Barriers to Ground Water Movement Between Aquifers?" (WAC 173-160-181)	Identifies the requirements so that water wells do not provide a pathway for vertical movement of water and contamination within and between aquifers.	Water wells may be used to obtain water for remedial actions such as dust suppression.	300-FF-2. The selected remedies will comply by building water wells that meet these standards.
"What Are the Minimum Standards for Resource Protection Wells and Geotechnical Soil Borings?" (WAC 173-160-400)	Identifies the minimum standards for resource protection wells and geotechnical soil borings.	Wells and borings are used to monitor groundwater; characterize the vadose zone, PRZ, and groundwater; and for injection of phosphate.	300-FF-1, 300-FF-2, and 300-FF-5. The selected remedies will comply by building wells that meet these standards.
"What Are the General Construction Requirements for Resource Protection Wells?" (WAC 173-160-420)	Identifies the general construction requirements for resource protection wells.	Wells and borings are used to monitor groundwater; characterize the vadose zone, PRZ, and groundwater; and for injection of phosphate.	300-FF-1, 300-FF-2, and 300-FF-5. The selected remedies will comply by building wells that meet these standards.
"What Are the Minimum Casing Standards?" (WAC 173-160-430)	Identifies the minimum casing standards.	Wells and borings are used to monitor groundwater; characterize the vadose zone, PRZ, and groundwater; and for injection of phosphate. Water wells may be used to obtain water for remedial actions such as dust suppression.	300-FF-1, 300-FF-2, and 300-FF-5. The selected remedies will comply by building wells that meet these standards.
"What Are the Equipment Cleaning Standards?" (WAC 173-160-440)	Identifies the equipment cleaning standards for construction and maintenance of wells.	Wells and borings are used to monitor groundwater; characterize the vadose zone, PRZ, and groundwater; and for injection of phosphate. Water wells may be used to obtain water for remedial actions such as dust suppression.	300-FF-1, 300-FF-2, and 300-FF-5. The selected remedies will comply by building, using, and managing wells that meet these standards.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"What Are the Well Sealing Requirements?" (WAC 173-160-450)	Identifies the well sealing requirements for resource protection wells.	Wells and borings are used to monitor groundwater; characterize the vadose zone, PRZ, and groundwater; and for injection of phosphate.	300-FF-1, 300-FF-2, and 300-FF-5. The selected remedies will comply by building wells that meet these standards.
"What Is the Decommissioning Process for Resource Protection Wells and borings?" (WAC 173-160-460)	Identifies the decommissioning process for resource protection wells and borings.	Wells and borings are used to monitor groundwater; characterize the vadose zone, PRZ, and groundwater; and for injection of phosphate.	300-FF-1, 300-FF-2, and 300-FF-5. The selected remedies will comply by decommissioning wells to meet these standards.
"Toxics Criteria for Those States Not Complying with Clean Water Act" (40 CFR 131.36(b)(1) as applied to Washington, 40 CFR 131.36(d)(14))	Establishes the numeric water quality criteria for priority toxic pollutants for the protection of human health and aquatic organisms which supersede criteria adopted by the state, except where the state criteria are more stringent than the federal criteria.	Groundwater from 300-FF-5 that discharges into the Columbia River contains priority toxic pollutants that require remediation to meet toxics criteria standards.	300-FF-5. These standards apply where groundwater discharges to the river. The selected remedies will comply through MNA, infiltration control, and source control measures.
"Toxic Substances" (WAC 173-201A-240(6))	Establishes the water quality standards for surface waters of the State of Washington. Risk-based criteria for carcinogenic substances shall be selected such that the upper-bound excess cancer risk is less than 1×10^{-6} for individual contaminants.	Groundwater discharges to the Columbia River contains contaminants that require remediation.	300-FF-5. These standards apply where groundwater discharges to the river. The selected remedies will comply through MNA, infiltration control, and source control measures.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"Unrestricted Land Use Soil Cleanup Standards" (WAC 173-340-740(3) "Unrestricted Land Use Soil Cleanup Standards, Adjustment to Cleanup Levels" (WAC 173-340-740(5)) "Unrestricted Land Use Soil Cleanup Standards, Point of Compliance" (WAC 173-340-740(6)) "Unrestricted Land Use Soil Cleanup Standards, Compliance Monitoring" (WAC 173-340-740(7))	Requires that soil CULs result in no significant adverse effects on terrestrial ecological receptors. Requires human health protection from both groundwater and direct soil contact. Total excess cancer risk may not exceed 1×10^{-5} or a non-cancer hazard index of 1 for chemical contaminants. Soil points of compliance are throughout the site. Soil CULs apply to the less than 2mm size fraction of dry samples, or also larger size fractions if they could be crushed.	Soil contains contaminants in areas other than those identified as industrial use areas that require remediation.	300-FF-2. The selected remedies will comply through RTD of contaminants that exceed the standards.
"Soil Cleanup Standards for Industrial Properties" (WAC 173-340-745(5)) "Soil Cleanup Standards for Industrial Properties, Adjustments" (WAC 173-340-745(6))	Rules set standards for degree of cleanup required by a remedial action where industrial land use represents the reasonable maximum exposure under both current and future site use conditions. Total excess cancer risk may not exceed 1×10^{-5} or a non-cancer hazard index of 1 for chemical contaminants.	Soil contains contaminants in industrial use areas that require remediation.	300-FF-2. The selected remedies will comply through RTD of contaminants that exceed the standards.
"Institutional Controls. Restrictive Covenants" (WAC 173-340-440(9))	Limit or prohibit activities that may interfere with the integrity of an interim action or cleanup action or that may result in exposure to hazardous substances at a site.	ICs are required for soil and groundwater that do not meet requirements for unrestricted use and unrestricted exposure.	300-FF-2 and 300-FF-5. The selected remedies include ICs that will meet the standard.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"General Standards for Maximum Emissions" (WAC 173-400-040)	Defines the methods of control to be employed to minimize the release of air contaminants associated with fugitive emissions resulting from materials handling, construction, demolition, or other operations. Emissions are to be minimized through application of reasonably available control technology. All sources and emission units are required to meet the general emission standards unless a specific source standard is available. General standards apply to visible emissions, particulate fallout, fugitive emissions, odors, emissions detrimental to health and property, sulfur dioxide, and fugitive dust.	Soil remedial action at 300-FF-2 provides the potential for emissions subject to these standards because hazardous contaminants include regulated hazardous air pollutants.	300-FF-2. Remedial actions that have the potential to release hazardous air emissions will meet standards.
"Emission Standards for Sources Emitting Hazardous Air Pollutants" (WAC 173-400-075(1, 3, 6)	Establishes emission standards, testing, monitoring and analytical methods for hazardous air pollutants.	300-FF-2 waste sites contain hazardous contaminants that can become airborne.	300-FF-2. Actions performed at 300-FF-2 that have the potential to emit visible, particulate, fugitive, and hazardous air emissions and odors will meet standards.
"New sources in attainment or unclassifiable areas" (WAC 173-400-113)	New sources or modifications comply with identified standards.	Remediation of 300-FF-2 waste sites may involve a new source or modification to an existing source.	300-FF-2. Remedial actions will be designed and performed in compliance with the standard.
"Emission Standards for Sources Emitting Hazardous Air Pollutants" (WAC 173-400-075)	Establishes national emission standards for hazardous air pollutants.	Soil hazardous contaminants detected at 300-FF-2 include regulated hazardous air pollutants.	300-FF-2. Remedial actions at 300-FF-2 will be designed and performed in compliance with the standard.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
Controls for New Sources of Toxic Air Pollutants. "Control Technology Requirements" (WAC 173-460-060) "Ambient Impact Requirement" (WAC 173-460-070) "Table of ASIL, SQER and de Minimis Emission Values" (WAC 173-460-150)	Shall not establish, operate, or cause to be established or operated any new or modified toxic air pollutant source that is likely to increase TAP emissions without installing and operating BACT. Nonprocess fugitive emissions activities are exempt for the requirement to apply BACT. Requires compliance with the limits air pollutants include carcinogens and non-carcinogens listed in "Table of ASIL, SQER and de Minimis Emission Values" (WAC 173-460-150).	Hazardous contaminants detected in soil and/or 300-FF-5 groundwater include constituents that would constitute toxic air pollutants if released to the air.	300-FF-2. Remediation activities with the potential to emit hazardous air emissions identified in this standard will comply.
"Ambient Standard" (WAC 173-480-040)	Requires that emissions of radionuclides in the air shall not cause a maximum effective dose equivalent of more than 10 mrem/year to the whole body to any member of the public. Per "Applicability" (WAC 173-480-020), the ambient standard applies to the entire state. Measurements may be made at all points up to property lines of point, area, and fugitive emission sources.	300-FF-2 contains radioactive soil, structures, and debris that could be emitted to ambient air.	300-FF-2. Investigative and remediation activities (e.g., RTD, demolition, ventilation, and vacuuming/exhaust) that have the potential to emit radionuclides above maximum acceptable levels will be controlled to meet standards.
"General Standards for Maximum Permissible Emissions" (WAC 173-480-050(1))	At a minimum, all emission units shall make every reasonable effort to maintain radioactive materials in effluents to unrestricted areas ALARA. Control equipment of facilities operating under ALARA shall be defined as reasonably available control technology and as low as reasonably achievable control technology.	The potential for fugitive and diffuse emissions because of demolition and excavation and related activities will require efforts to minimize those emissions.	300-FF-2. Investigative and remediation activities (e.g., excavation, RTD, demolition, ventilation, and vacuuming/exhaust) that have the potential to emit radionuclides to residential areas will meet standards.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"Emission Monitoring and Compliance Procedures" (WAC 173-480-070(2))	Compliance is determined by calculating the dose to members of the public at the point of maximum annual air concentration in an unrestricted area where any member of the public may be.	Hazardous contaminants detected in residual structures and waste, soil, and groundwater in 300-FF-2 include radionuclides that could be emitted to unrestricted areas during remedial actions.	300-FF-2. Investigative and remediation activities (e.g., RTD, demolition, ventilation, and vacuuming/exhaust) that have the potential to emit radionuclides to unrestricted areas will meet standards.
"Emission Standards for New and Modified Emission Units" (WAC 173-480-060)	Requires that construction, installation, or establishment of new air emission control units use best available radionuclide control technology.	Hazardous contaminants detected in residual structures and waste, soil, and groundwater in the 300-FF-2 include radionuclides that could be emitted from air emission control units during remedial actions.	300-FF-2. Investigative and remediation activities (e.g., RTD, demolition, ventilation, and vacuuming/exhaust) that require air pollution control measures and/or equipment and have the potential to emit radionuclides to the ambient air will meet standards.
"National Standards Adopted by Reference for Sources of Radionuclide Emissions" (WAC 246-247-035(1)(a)(i) [adopts by reference 40 CFR 61.05, "Prohibited Activities"])	Identifies prohibition of any owner, or operator of any stationary source subject to a national emission standard for hazardous air pollutants from constructing or operating the new or existing source in violation of any such standard.	Investigation and remedial actions in 300-FF-2 have the potential to emit hazardous air pollutants.	300-FF-2. Investigation and remedial actions that require air pollution control measures and/or equipment and have the potential to emit radionuclides to the ambient air will meet this standard.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"National Standards Adopted by Reference for Sources of Radionuclide Emissions" (WAC 246-247-035(1)(a)(i) and (ii) Adopts by reference "General Provisions" (40 CFR 61, Subpart A) "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities" (40 CFR 61, Subpart H)	Requires the owner or operator of each stationary source of hazardous air pollutants subject to a national emission standard for a hazardous air pollutant to determine compliance with numerical emission limits in accordance with emission tests established in NESHAP, "Emission Tests and Waiver of Emission Tests" (40 CFR 61.13) or as otherwise specified in an individual subpart. Compliance with design, equipment, work practice or operational standards shall be determined as specified in the individual subpart. Also, maintain and operate the source, including associated equipment for air pollution control, in a manner consistent with good air pollution control practice for minimizing emissions.	Investigation and remedial actions in 300-FF-2 have the potential to emit hazardous air pollutants.	300-FF-2. Investigative and remedial actions involve stationary sources that provide a potential to emit regulated hazardous air pollutants (e.g., vapor extraction systems, decontamination stations, deactivation, demolition or waste removal, or storage activities). Associated design, equipment, work practice, or air emissions controls will be maintained and operated and compliance determined to meet this standard.
"Radiation Protection, Air Emissions. General Standards" (WAC 246-247-040(3) and (4))	Requires that ALARA-based control technology Best Available Controls (ALARACT) be used to control emissions depending on whether there is new construction or there is an existing emission unit, and whether there is a significant modification of an emission unit.	Hazardous contaminants that would be subject to radionuclide air emission standards and resultant requirements have the potential to be detected in and emitted from, structures, debris, soil, and remediation equipment during remedial actions.	300-FF-2. Investigative and remedial actions will use BARCT or ALARACT to meet this standard.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"Monitoring, Testing and Quality Assurance" (WAC 246-247-075)	Establishes the monitoring, testing, and quality assurance requirements for radioactive air emissions. Requires that the emissions from nonpoint and fugitive sources of airborne radioactive material be measured.	Hazardous contaminants that would be subject to radionuclide air emission standards and resultant requirements have the potential to be detected in and emitted from, structures, debris, soil, and remediation equipment during remedial actions.	300-FF-2. Monitoring, testing and quality assurance requirements will be defined and followed to meet this standard.
"National Emission Standards for Hazardous Air Pollutants" (40 CFR 61, Subparts A, C, E, H, I, M, Q, and V)	Emission standards and activity requirements for hazardous air pollutants including emission control requirements.	Hazardous contaminants are in the soil, structures, and debris to be remediated, which could be released to the air. In particular, air exhaust units, vacuums and guzzlers, other remediation equipment, and open air excavation have relatively high potential for air releases.	300-FF-2. Investigative and remedial activities will be conducted to meet standards.
40 CFR 61.140, "Applicability" 40 CFR 61.14, "Standard for Demolition and Renovation"	Defines regulated asbestos containing material ACM and regulated removal and handling requirements. Specifies requirements for demolition of regulated sources having the potential to emit asbestos, including the requirement that no visible emissions are allowed during demolition, handling, packaging, and transport of ACM.	Encountering ACM on pipelines or buried asbestos within the 300-FF-2 Area is possible during the remediation activities.	300-FF-2. Site investigation and demolition remediation activities and associated handling, packaging, transportation, and disposal of ACM will meet standards.
40 CFR 61.150, "Standard for Waste Disposal for Manufacturing, Fabricating, Demolition, Renovation and Spraying Operations"	Identifies the requirements for the removal and disposal of asbestos from demolition and renovation activities.	Pipelines, other debris, and soil contain ACM.	300-FF-2. Site investigation and demolition remediation activities and associated handling, packaging, transportation, and disposal of ACM will meet standards. Disposal will meet standards for the disposal facility.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
Toxic Substances Control Act of 1976, as amended (15 USC 2605, et seq.); "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions" (40 CFR 761)	Establishes the prohibitions of, and requirements for, the manufacturing, processing, distribution in commerce, use, disposal, storage, and marking of PCBs and PCB items.	Remediation waste resulting from 300-FF-2 remedial actions will contain PCBs subject to the standards for disposal, storage, and marking of PCBs and PCB items.	300-FF-2. Disposal, storage, and marking of PCBs and PCB waste will meet standards.
"Applicability" (40 CFR 761.50(b)1, 2, 3 and 7 and (c))	Identifies PCB disposal, storage, and cleanup requirements for PCB remediation waste and PCB/radioactive wastes at concentrations greater than 50 parts per million.	Remediation is expected to generate PCB and PCB/radioactive waste.	300-FF-2. Management and disposal of remediation waste with PCBs will meet standards.
"Disposal Requirements" (40 CFR 761.60(a), (b), and (c))	Establishes requirements applicable to the disposal of PCB liquids, PCB articles, and PCB containers.	PCB liquids, articles, and/or containers may be encountered and/or generated during the remedial actions for the 300-FF-2 Area.	300-FF-2. Standards will be met for PCB liquids, articles, and debris handling, storage, and disposal.
"PCB Remediation Waste" (40 CFR 761.61)	Provides cleanup and disposal options for PCB remediation waste based on the concentration at which the PCBs are found.	PCB remediation wastes may be encountered and/or generated during the remedial actions for the 300-FF-2 Area.	300-FF-2. Standards will be met for PCB remediation wastes.
"Dangerous Waste Regulations. Identifying Solid Waste" (WAC 173-303-016) "Dangerous Waste Regulations. Recycling Processes Involving Solid Waste" (WAC 173-303-017)	Identifies those materials that are and are not solid wastes and identifies those materials that are and are not solid wastes when recycled.	Solid wastes will be generated during 300-FF-2 remedial actions which will be subject to solid waste and dangerous waste designation requirements.	300-FF-2. Standards will be met for investigative and remediation activities.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"Designation of Dangerous Waste" (WAC 173-303-070)	Establishes the method for determining if a solid waste is a dangerous waste (or an extremely hazardous waste).	Dangerous/hazardous waste will be generated during 300-FF-2 Area remedial actions.	300-FF-2. Standards will be met for investigative and remediation (including waste treatment) activities that generate wastes (e.g., drums, barrels, tanks, containers, bulk wastes, debris, and contaminated soil).
"Requirements for Universal Waste" (WAC 173-303-077)	Identifies certain batteries, mercury-containing equipment, and lamps as exempt from regulation under WAC 173-303-140 and WAC 173-303-170 through 173-303-9906 (excluding WAC 173-303-960). These wastes are subject to regulation under WAC 173-303-573, "Land Disposal Restrictions" (WAC 173-303-140) and WAC 173-303-170 through 173-303-9907 (excluding WAC 173-303-960, "Special Powers and Authorities of the Department"). These wastes are subject to regulation under "Standards for Universal Waste Management" (WAC 173-303-573).	Waste sites in 300-FF-2 contain wastes listed in this section.	300-FF-2. Remediation activities will meet standards for universal wastes.
"Recycled, Reclaimed, and Recovered Wastes" (WAC 173-303-120(3) and (5))	Defines the requirements for recycling materials that are solid and dangerous waste. Specifically, WAC 173-303-120(3) provides for the management of certain recyclable materials, including spent refrigerants, antifreeze, and lead acid batteries. WAC 173-303-120(5) provides for the recycling of used oil.	Wastes that can be recycled, reclaimed, or recovered have the potential to be generated during 300-FF-2 Area remedial actions.	300-FF-2. Recycling of wastes subject to these requirements will be done in a manner that satisfies standards.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"Land Disposal Restrictions" (WAC 173-303-140)	Establishes treatment requirements and disposal prohibitions for land disposal of dangerous waste and incorporates by reference the federal land disposal restrictions (40 CFR 268).	Remediation may generate waste subject to land disposal restrictions.	300-FF-2. Disposal of wastes subject to these requirements will be treated as required and disposed in a manner that satisfies standards.
"Requirements for Generators of Dangerous Waste" (WAC 173-303-170)	Establishes the requirements for dangerous waste generators which include the substantive provisions of "Accumulating Dangerous Waste On-Site" (WAC 173-303-200) by reference.	300-FF-2 investigation and remedial actions may generate dangerous wastes.	300-FF-2. Investigation and remediation wastes (contaminated soil and groundwater, personnel protective gear, treatment chemicals) may be dangerous waste, and will be managed in accord with these requirements.
"Requirements for Closure of Dangerous Waste Disposal Units" (WAC 173-303-610)	Establishes requirements for closing units that have treated, stored, or disposed of dangerous waste.	The 300-FF-2 OU includes units or areas where materials were disposed that would designate as dangerous waste.	300-FF-2. Closure requirements will be satisfied in implementing the selected remedial action where they are applicable or both relevant and appropriate.
"Use and Management of Containers" (WAC 173-303-630)	Establishes requirements for dangerous waste facilities that store containers of dangerous waste.	Remedial actions may generate dangerous waste in containers that are subject to this standard.	300-FF-2. Investigation and remedial actions that produce containers of dangerous waste will be managed to meet standards.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"Owner Responsibilities for Solid Waste" (WAC 173-350-025) "Performance Standards" (WAC 173-350-040) "On-Site Storage, Collection and Transportation Standards" (WAC 173-350-300) "Remedial Action" (WAC 173-350-900)	Establishes minimum functional performance standards for the proper handling and disposal of solid waste other than specified regulated dangerous waste, PCB waste, and radioactive waste. Provides requirements for the proper handling of such solid waste materials originating from residences, commercial, agricultural and industrial operations, and other sources, and identifies those functions necessary to ensure effective solid waste handling programs at both the state and local level.	Covered solid waste will be generated during implementation of remedial actions.	300-FF-2. Investigative and remedial actions that generate covered solid waste will meet standards.
"Protection of Historic Properties" (36 CFR 800)	Requires federal agencies to consider the impacts of their undertaking on cultural properties through identification and evaluation. Potential project adverse effects are to be avoided or mitigated. Need to take actions as necessary to minimize harm to any National Historic Landmarks.	Cultural and historic sites have been identified within 300-FF-2.	300-FF-2. Historical and cultural reviews have been done to identify cultural and historic sites. Additional reviews will be done at investigation and remedial action areas where existing reviews aren't sufficient. For any discoveries appropriate actions will be taken to meet standards.
"National Historic Landmarks Program" (36 CFR 65)	These regulations set forth the criteria for establishing national significance. Requires that federal agencies shall, to the extent possible, undertake such planning and actions as may be necessary to minimize harm to landmarks.	Cultural and historic sites have been identified within 300-FF-2.	300-FF-2. Investigation and remedial actions shall comply with this standard.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"Native American Graves Protection and Repatriation Regulations" (43 CFR 10) *Native American Graves Protection and Repatriation Act of 1990* (25 USC 3001, et seq.)	Establishes federal agency responsibility for discovery, protection, and appropriate disposition of human remains, associated and unassociated funerary objects, sacred objects, and items of cultural patrimony.	Native American archaeological, cultural, and historic sites have been identified within the 300-FF-2. Native American remains and associated objects have the potential to be present.	300-FF-2. Investigations and remedial activities will be conducted to identify, protect, and provide for appropriate disposition of covered human remains, objects, and items.
National Historic Preservation Act of 1966 (16 USC 470, et seq.)	Establishes a program for preservation of additional historic properties and other purposes.	Historical properties may be located near 300-FF-2 waste sites or the lands used during remediation of the waste sites.	300-FF-2. Investigations and remedial activities will include identification and preservation of historic properties in accord with this standard.
Archeological and Historic Preservation Act of 1974 (16 USC 469a-1 through 469a-2(d)	Requires that federal projects do not cause the loss of archaeological or historic data. This act mandates preservation of the data; it does not require protection of the actual waste site or facility.	Archaeological and historic sites have been identified within 300-FF-2.	300-FF-2. In the event that investigation and remediation activities may cause irreparable loss to significant scientific, prehistoric, or archeological data, the data will be preserved.
Endangered Species Act of 1973, as Amended (16 USC §§ 1531-1544, specifically Sections 7 and 9(a). 50 CFR 17 (listings, prohibitions) 50 CFR 402, 50 CFR 222-224 (endangered and threatened marine species), 50 CFR 226.212 (critical habitat for Northwest salmon and steelhead)	Prohibits actions by federal agencies that are likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of habitat critical to them. Also prohibits taking of any endangered species.	300-FF-5 groundwater discharges into the Hanford Reach of the Columbia River which contains the Upper Columbia River spring-run Chinook salmon and endangered steelhead. The spring-run Chinook salmon do not spawn in the Hanford Reach but use it as a migration corridor. Steelhead spawning has been observed in the Hanford Reach. The bull trout is listed as a threatened species but is not considered a resident species and is rarely observed in the Hanford Reach.	300-FF-5. Remediation actions and investigation activities will be managed to avoid jeopardy and/or adversely affect a listed species or critical habitat.

Table A-1. Applicable or Relevant and Appropriate Requirements

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
Migratory Bird Treaty Act of 1918 (16 USC 703-712) 50 CFR 10 and 50 CFR 21	Protects all migratory bird species and prevents "take" of protected migratory birds, their young, or their eggs." Federal agencies are required to avoid or minimize impacts to migratory bird resources, restore or enhance their habitat and prevent or abate its detrimental alteration.	Migratory birds use 300-FF-2.	300-FF-2. Remedial actions will require mitigation measures to deter nesting by migratory birds on, around, or within remedial action sites and methods to identify and protect occupied bird nests.
Bald and Golden Eagle Protection Act, 16 USC § 668, 50 CFR 22	Protect eagle habitats to maintain eagle populations so the species is not classified as threatened, endangered, or sensitive in Washington State.	Bald eagles nest, feed, and overwinter along the shores of the Columbia River.	300-FF-2. Remedial actions will be performed to protect bald eagle habitat.

ACM = asbestos-containing material
ALARA = as low as reasonably achievable
ALARACT = as low as reasonably achievable control technology
BACT (BARCT) = best available (radionuclide) control technology
CFR = *Code of Federal Regulations*
CUL = cleanup level
MCL = maximum contaminant level (drinking water standard)
MCLG = maximum contaminant level goal
MNA = monitored natural attenuation
NESHAP = National Emission Standards for Hazardous Air Pollutants
PCB = polychlorinated biphenyl
PRZ = periodically rewetted zone
ROD = record of decision
RTD = remove, treat, and dispose
USC = United States Code
WAC = *Washington Administrative Code*

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