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Revision 5

200 West Pump and Treat Operations and Maintenance Plan

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

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Executive Summary

This operations and maintenance (O&M) plan outlines the activities necessary to operate, maintain, and monitor the performance of the 200 West pump and treat (P&T), from startup of operations through decommissioning of the system. The 200 West P&T is a major component of the remedial actions selected for cleanup of the 200-ZP-1 and 200-UP-1 Groundwater Operable Units (OUs), the 200-DV-1 OU perched water, extracted groundwater from treatability testing at the 200-BP-5 OU, and leachate collected at the Environmental Restoration Disposal Facility (ERDF), all located on the Central Plateau of the Hanford Site.

The remedy selected in the *Record of Decision Hanford 200 Area 200-ZP-1 Superfund Site, Benton County, Washington*[1] (hereafter referred to as the record of decision [ROD]) includes a groundwater P&T system, monitored natural attenuation (MNA), flow-path control, and institutional controls (ICs). These remedy components are combined to meet the objective of achieving established groundwater cleanup levels for all contaminants of concern (COCs) in the 200-ZP-1 OU within 125 years. The COCs identified for the 200-ZP-1 OU are carbon tetrachloride, total chromium (trivalent and hexavalent), nitrate, trichloroethene, iodine-129, technetium-99, and tritium.

The 200-UP-1 remedy selected in *Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit*[2] (hereafter referred to as the 200-UP-1 OU interim Record of Decision [ROD]) is a combination of groundwater extraction and treatment using P&T, MNA, hydraulic containment of the iodine-129 plume, an iodine-129 treatment technology evaluation, remedy performance monitoring, and ICs. The COCs identified for the 200-UP-1 OU are carbon tetrachloride, total chromium (trivalent and hexavalent), nitrate, trichloroethene, iodine-129, technetium-99, tritium, and uranium.

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[1] EPA, Ecology, and DOE, 2008, *Record of Decision, Hanford 200 Area, 200-ZP-1 Superfund Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.

[2] EPA, Ecology, and DOE, 2012, *Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.

The 200-DV-1 Action Memorandum, *Action Memorandum for 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction*[3], documents the selected alternative for remediating perched water in the 200-DV-1 OU. The non-time critical removal action alternative extracts perched water from the 200-DV-1 OU and transfers the water by truck or pipeline to the 200 West P&T for treatment. This removal action is designed to recover as much perched water as practical while awaiting issuance of the 200-DV-1 ROD. The COCs identified for the 200-DV-1 perched water are total chromium (trivalent and hexavalent), nitrate, technetium-99, tritium, and uranium.

The 200-BP-5 treatability testing described in *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit*[4] provides the approach for evaluating the groundwater pumping rate that can be achieved within and extending from the B Complex. The overall objective of the treatability test is to determine whether a sufficient groundwater pumping rate can be sustained, as a measure of the effectiveness of a pump-and-treat alternative, to provide hydraulic containment, and reduce the mass of COCs within and extending from the B Complex. The COCs identified for the 200-BP-5 treatability test water are cyanide, iodine-129, nitrate, technetium-99, and uranium.

Treatment and disposal of ERDF leachate is described in the 1999 amended ERDF ROD, *U. S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site - 200 Area, Benton County, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary*[5], as being performed at ETF and TEDF. The 2015 *Explanation of Significant Differences for the U.S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site – 200 Area, Benton County, Washington*[6] (hereafter referred to as the Explanation of Significant Differences [ESD]), allows for the onsite 200 West P&T to be used as an option for the treatment of ERDF leachate. With the installation of a uranium IX system at the 200 West P&T, leachate generated at ERDF

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[3] DOE/RL-2014-34, 2014, *Action Memorandum for 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

[4] DOE/RL-2010-74, 2015, *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

[5] EPA, 1999, *U. S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site - 200 Area, Benton County, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

[6] EPA, 2015, *Explanation of Significant Differences for the U.S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site – 200 Area, Benton County, Washington.* U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

could be pumped or trucked to the 200 West P&T for treatment and disposal. The leachate has been delisted and, therefore, contains no listed waste concerns.

The 200-ZP-1, 200-UP-1, 200-BP-5, 200-DV-1, and ERDF leachate COCs in contaminated water from each of these streams will be acceptable for treatment at the 200 West P&T based on calculations performed in preparation for the new waste streams[7],[8]. Mass removal will primarily be accomplished by operation of the 200 West P&T, which is designed to capture and treat contaminated groundwater and reduce the mass of COCs from each operable unit. Treated groundwater will be reinjected into the aquifer to attain flow-path control.

This O&M plan addresses the activities required to operate, maintain, and monitor the 200 West P&T to ensure that these objectives are met. Implementation and oversight of the remedy's IC provisions are performed in accordance with *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions and RCRA Corrective Actions*.[9]

This document discusses the operational philosophy for the P&T system, as well as the programs and procedures in place for preventative, routine, and corrective maintenance. These measures ensure that the system will perform as intended and operates safely and efficiently.

Short- and long-term performance monitoring will be conducted to ensure the system is performing in accordance with the objectives of the RODs. This plan outlines how monitoring will be conducted and the periodic reporting that will document system performance and monitoring results. This periodic reporting includes 5-year reviews under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*.[10]

After the remedial action objectives for all waste streams being treated at the 200 West P&T have been attained, the 200 West P&T will be shut down and permanently taken out of service through the decontamination and decommissioning process. This O&M plan

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[7] DOE/RL-2013-37, 2014, *Engineering Evaluation/Cost Analysis for Perched Water Pumping/Pore Water Extraction*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

[8] SGW-57790, 2015, *Characterization Data for New Waste Streams (200-UP-1, ERDF Leachate, 200-BP-5 and Perched Water) for the 200 West Pump-and-Treat Facility*, Rev. 2, CH2M Hill Plateau Remediation Company, Richland, Washington.

[9] DOE/RL-2001-41, 2014, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions and RCRA Corrective Actions*, Rev. 7, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

[10] *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002.

provides a summary of the documents that will likely be developed to guide both interim and final decontamination and decommissioning activities.

Safe operation of the 200 West P&T is an overarching goal that affects all activities associated with O&M of the system. This plan provides an overview of the health and safety plan that addresses safe operation of the P&T system, including key hazards that may be encountered during O&M of the system and procedures for mitigating those hazards.

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Terms

ALARA	as low as reasonably achievable
AMP	air monitoring plan
ARAR	applicable or relevant and appropriate requirement
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CHPRC	CH2M HILL Plateau Remediation Company
CLARC	Cleanup Levels and Risk Calculations
CM	compliance matrix
COC	contaminant of concern
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DWS	drinking water standard
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FBR	fluidized bed reactor
GAC	granular activated carbon
gpm	gallons per minute
HAB	Hanford Advisory Board
HASP	health and safety plan
HCP EIS	*Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*
HEIS	Hanford Environmental Information System
IC	institutional control
IX	ion exchange
MCL	maximum contaminant level
MNA	monitored natural attenuation
MTCA	"Model Toxics Control Act—Cleanup" (WAC 173-340)
NA	not available
NCP	National Contingency Plan

O&M	operations and maintenance
OU	operable unit
P&T	pump and treat
PMP	performance monitoring plan
QA	quality assurance
QAPP	quality assurance program plan
RAO	remedial action objective
RL	DOE Richland Operations Office
ROD	Record of Decision
SAP	sampling and analysis plan
Tri-Parties	U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology
USGS	U.S. Geological Survey
VPGAC	vapor-phase granular activated carbon
WMP	waste management plan

1 Introduction

The 200 West pump and treat (P&T) is a major component of the final remedial action selected in the *Record of Decision, Hanford 200 Area 200-ZP-1 Superfund Site, Benton County, Washington* (EPA et al., 2008), hereafter referred to as the Record of Decision (ROD) and in the 200-UP-1 remedy selected in the *Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit* (EPA et al., 2012), hereafter referred to as the interim ROD. Additionally, the 200 West P&T is the selected alternative in the non-time critical removal action of the 200-DV-1 OU perched water as described in *Action Memorandum for the 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction* (DOE/RL-2014-34, 2014) and for the treatment of contaminated water from the 200-BP-5 treatability testing described in *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit* (DOE/RL-2010-74, 2015). The treatment and disposal of leachate from ERDF will also be conducted at the 200 West P&T as described in the 2015 *Explanation of Significant Differences for the U.S. Department of Energy Environmental Restoration Disposal Facility Hanford Site – 200 Area Benton County, WA* (EPA, 2015), hereafter referred to as the Explanation of Significant Differences (ESD). This operations and maintenance (O&M) plan outlines the activities necessary to operate, maintain, and monitor performance of the 200 West P&T from operations through decommissioning. The scope of this plan includes O&M, performance monitoring and reporting, 5-year remedy reviews, health and safety, and quality assurance (QA).

The O&M plan was prepared by the U.S. Department of Energy (DOE), Richland Operations Office (RL) in accordance with the following:

- 40 CFR 300.435(f), "National Oil and Hazardous Substances Pollution Contingency Plan," "Remedial Design/Remedial Action, Operation and Maintenance" (hereafter referred to as the National Contingency Plan [NCP])
- DOE/RL-2008-78, *200 West Area 200-ZP-1 Pump-and-Treat Remedial Design/Remedial Action Work Plan*
- DOE/RL-2013-07, *200-UP-1 Groundwater Operable Unit Remedial Design/Remedial Action Work Plan*
- EPA 540-F-01-004, *Operation and Maintenance in the Superfund Program*

This O&M plan presents information based on the current system design. This plan is not intended to be updated or revised each time a minor change to the constructed facility is made or each time a facility operational procedure is modified. Instead, this plan will be updated or revised when relevant or substantive changes are made to the operating system or its supporting primary documents. It is assumed that the O&M plan will be updated periodically to allow for incorporation of minor changes to the plan's primary supporting documents as the remedy moves through its lifecycle. Supporting documents include the compliance matrix (CM; Appendix A), waste management plan (WMP; Appendix B), the air monitoring plan (AMP; Appendix C), and the sampling and analysis plan (SAP; Appendix D) for the 200 West P&T.

1.1 Purpose of This Plan

Maintaining an adequate and functioning O&M program throughout a remedy's lifecycle is critical for successful implementation and ultimate achievement of the remedial action objectives (RAOs). The O&M measures described in this plan are designed to provide guidance on implementation of the requirements necessary for maintaining the remedy to ensure protection of human health and the environment. This O&M plan serves as an administrative document that describes how O&M of the remedy will be conducted.

Although a majority of this O&M plan addresses the activities necessary for the long-term O&M of the 200 West P&T, requirements for O&M of the other remedy components are also described, including site-specific inspection, sampling and analysis, and routine reporting. Institutional controls (ICs) for the Hanford Site are already in place, as described in the *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions and RCRA Corrective Actions* (DOE/RL-2001-41), hereafter called the Sitewide IC Plan. Therefore, inspection and annual reporting on ICs for the 200-ZP-1 Operable Unit (OU) and for the 200-UP-1 OU will be performed in accordance with the Sitewide IC Plan (DOE/RL-2001-41).

This O&M plan contains the following information:

- **Chapter 1 – Introduction:** Presents a detailed description of the various components comprising the selected remedies.
- **Chapter 2 – Organization, Operations, and Optimization:** Describes the organizational structure supporting operations of the 200 West P&T, the O&M program, and process optimization activities conducted to ensure that RAOs for the P&T system are achieved.
- **Chapter 3 – Operations and Maintenance:** Describes the 200 West P&T routine and nonroutine O&M activities conducted to ensure that the P&T system achieves its operational up-time goal.
- **Chapter 4 – Monitoring:** Summarizes routine sampling and analysis of the groundwater treatment plant's influent and effluent conducted to ensure that applicable or relevant and appropriate requirements (ARARs) are met. This chapter also summarizes the sampling and analysis conducted within the OU groundwater monitoring well network to track remedial action progress. Sampling within the groundwater treatment plant to assess the performance of individual treatment processes is not addressed in this O&M plan but will be covered in operational procedures.
- **Chapter 5 – Periodic Reporting and Closure:** Describes the periodic reports that will be prepared to summarize remedial action progress and the approach that may be used to transition the remedies from active P&T operations to natural attenuation, implementation of ICs, and eventual closure once RAOs have been met for all OUs sending contaminated water to the 200 West P&T.
- **Chapter 6 – Decontamination and Decommissioning:** Summarizes the process that will be used for decontamination and decommissioning (D&D) of P&T system equipment once a determination has been made that the equipment is no longer required.
- **Chapter 7 – Safety, Health, and Quality:** Summarizes health and safety practices and other measures used to ensure overall safety during implementation of the selected remedies.
- **Chapter 8 – References:** Provides a list of references cited in this plan.

This O&M plan provides additional information on the scope of routine activities to be conducted in conjunction with implementation of the selected remedy. The appendices included with this plan provide supporting documentation, as follows:

- **Appendix A:** Provides the CM for the 200 West P&T. Summarizes the approach used to ensure that the fully implemented remedies comply with the ARARs identified in Appendix A of the 200-ZP-1 ROD, in Chapters 10 and 13 in the 200-UP-1 ROD, in Chapter 5 of the 200-DV-1 Perched Water Action Memorandum, and in Chapter 8 of the 200-BP-5 Treatability Test Plan.

- **Appendix B:** Provides the WMP for the 200 West P&T. Describes the management of the various waste streams associated with implementation of the selected remedies and routine operation of the P&T system.
- **Appendix C:** Provides the AMP for the 200 West P&T. Describes the evaluation performed to assess potential atmospheric air effects associated with groundwater treatment operations and the sampling and analysis conducted to ensure that air discharges comply with ARARs.
- **Appendix D:** Provides the SAP for the 200 West P&T. Describes the sampling and analysis conducted to characterize the treatment plant's influent, effluent, and associated waste streams.

Figure 1-1 identifies notable regulatory decisions, documentation, and events in regard to the 200 West P&T.

1.2 Statement of Remedy Goals

The following RAOs are specified in the ROD (EPA et al., 2008) for the 200-ZP-1 Groundwater OU:

- **RAO #1:** Return 200-ZP-1 OU groundwater to beneficial use (restore groundwater to achieve domestic drinking water levels) by achieving cleanup levels (provided in Table 11 of the ROD). This objective is to be achieved within the entire 200-ZP-1 OU groundwater plumes. The estimated time frame to achieve cleanup levels is within 150 years.[11]
- **RAO #2:** Apply ICs to prevent the use of groundwater until the cleanup levels (provided in Table 11 of the ROD) have been achieved. Within the entire OU groundwater plumes, ICs must be maintained and enforced until cleanup levels are achieved, which is estimated to be within 150 years.[11]
- **RAO #3:** Protect the Columbia River and its ecological resources from degradation and unacceptable impact caused by contaminants originating from the 200-ZP-1 OU. This final objective is applicable to the entire 200-ZP-1 OU groundwater plumes. Protection of the Columbia River from impact caused by 200-ZP-1 OU contaminants must last until cleanup levels are achieved, which is estimated to be within 150 years.[11]

The final cleanup levels for 200-ZP-1 OU groundwater contaminants of concern (COCs) following implementation of the selected remedy are identified in the ROD and are listed in Table 1-1. The cleanup levels were developed using federal drinking water maximum contaminant levels (MCLs); the criteria and equations provided in WAC 173-340-720(4)(b)(iii)(A) and (B), and WAC 173-340-720(7)(b) ("Model Toxics Control Act—Cleanup," "Groundwater Cleanup Standards"); and the federal and state drinking water standards (DWSs) for radionuclides.

The following RAOs are specified in the interim ROD (EPA et al., 2012) for the 200-UP-1 Groundwater OU and are based on restoring the 200-UP-1 OU groundwater as a potential future drinking water source. The NCP (40 CFR 300) establishes an expectation to return useable ground waters to their beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances of the site (40 CFR 300.430[a][1][iii][F], "Remedial Investigation/Feasibility Study and Selection of Remedy"). The U.S. Environmental Protection Agency (EPA) generally defers

[11] The RAOs identify that the estimated time frame to achieve cleanup is within 150 years. The expected outcome of the selected remedy is that 200-ZP-1 OU groundwater will be returned to a level that supports future use as a potential domestic drinking water supply in 125 years (EPA et al., 2008).

to the state definitions of groundwater classification provided under *Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites* (EPA/540/G-88/003).

- **RAO #1:** Return 200-UP-1 OU groundwater to beneficial use as a potential drinking water source by achieving cleanup levels (provided in Table 14 of the interim ROD).
- **RAO #2:** Prevent human exposure to contaminated 200-UP-1 OU groundwater that exceeds acceptable risk levels for drinking water. To prevent the use of groundwater until the cleanup levels (provided in Table 14 of the interim ROD) have been achieved, ICs will be applied.

The following RAOs are specified in the Action Memorandum for the 200-DV-1 OU perched water (DOE/RL-2014-34, 2014):

- Apply ICs to protect human receptors from exposure to contaminants that exceed the MCLs in the underlying aquifer
- Control sources of groundwater contamination
- Remove contaminant mass from perched water and support final remedial options for both the 200-DV-1 OU and the 200-BP-5 Groundwater OU

The human health protection described in the first RAO in the Engineering Evaluation/Cost Analysis (DOE/RL-2013-37, *Engineering Evaluation/Cost Analysis for Perched Water Pumping/Pore Water Extraction*) is provided for by the use of ICs (DOE/RL-2001-41). DOE/RL-2001-41 describes how the ICs are applied across the Hanford Site. For this removal action, ICs associated with denial of public access and drilling of groundwater wells would apply.

The removal action controls sources of groundwater contamination and removes contaminant mass from the perched water by pumping the contaminated water from the perched layer and treating it at the 200 West P&T to below MCLs to meet injection criteria.

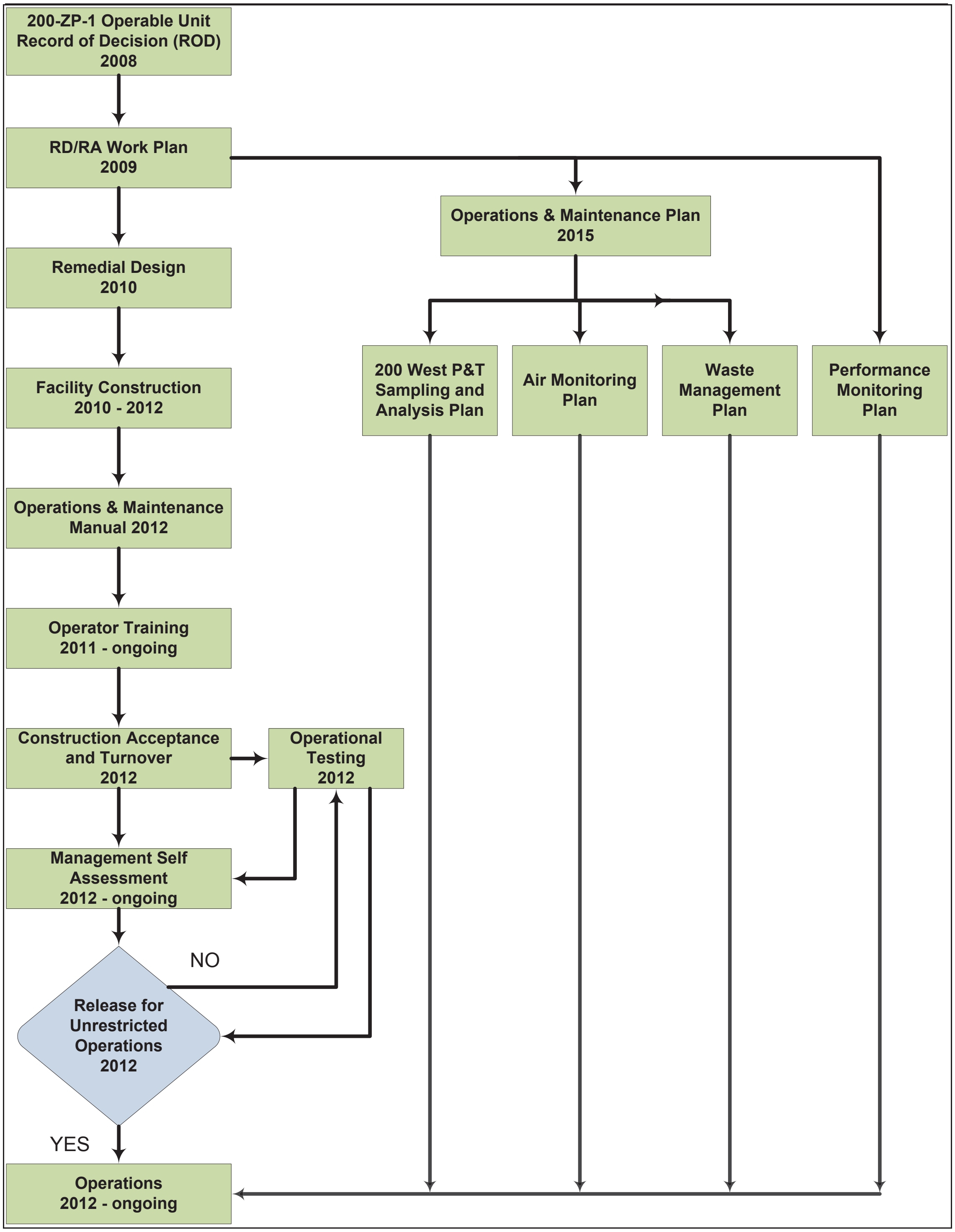

Figure 1-1. Notable 200 West P&T Regulatory Decisions, Documentation, and Events

Table 1-1 Cleanup Levels for the 200-ZP-1 and 200-UP-1 Groundwater OUs

COC	Units	Final Cleanup Level	Cleanup Level Basis
Carbon tetrachloride	µg/L	3.4[a,b]	MTCA Method B
Chromium (total)	µg/L	100	Federal/state MCL
Hexavalent chromium	µg/L	48[c]	MTCA Method B
Nitrate-nitrogen	µg/L	10,000[d]	Federal/state MCL
Nitrate-nitrate	µg/L	45,000[d]	
Trichloroethene[e]	µg/L	1[a,b]	MTCA Method B
Iodine-129	pCi/L	1	Federal MCL
Technetium-99	pCi/L	900	Federal MCL
Tritium	pCi/L	20,000	Federal MCL
Uranium[f]	µg/L	30	Federal MCL

a. The WAC 173-340, "Model Toxics Control Act—Cleanup" (MTCA) Method B cleanup levels for carbon tetrachloride and trichloroethene are from the Washington State Department of Ecology's Cleanup Levels and Risk Calculations (CLARC) table, current as of September 25, 2008 (Ecology, 2008).

b. DOE will clean up COCs for the 200-ZP-1 and 200-UP-1 OUs subject to MTCA (WAC 173-340) (carbon tetrachloride and trichloroethene), so the excess lifetime cancer risk does not exceed 1×10^{-5} at the conclusion of the remedy.

c. There is no MCL specific to hexavalent chromium.

d. Nitrate may be expressed as nitrogen (N) or as total nitrate (NO_3). The MCL for nitrate-N is 10,000 µg/L, and the same concentration expressed as nitrate as NO_3 is 45,000 µg/L.

e. Trichloroethene is another name for trichloroethylene, the COC identified in the *Record of Decision, Hanford 200 Area, 200-ZP-1 Superfund Site, Benton County, Washington* (EPA et al., 2008). Trichloroethene is a COC in 200-ZP-1 OU only.

f. Uranium is a COC in 200-UP-1 OU only.

COC = contaminant of concern
DOE = U.S. Department of Energy
MCL = maximum contaminant level
OU = operable unit

1.3 Remedy Description

The DOE 200 Areas National Priorities List site, commonly referred to as the Central Plateau, encompasses approximately 190 km^2 (75 mi^2) within the 1,517 km^2 (586 mi^2) area of the Hanford Site (Figure 1-2) located in south-central Washington State. The *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) site identification number for the 200 Areas is WA 1890090078. The 200-ZP-1, 200-UP-1, and 200-BP-5 Groundwater OUs are three of four groundwater OUs located on the Central Plateau. Each groundwater OU has its own plan of study and enforceable schedule, and each OU will eventually have its own ROD and cleanup action as needed. Before any additional CERCLA-related contaminated water is sent to the 200 West P&T for treatment, the appropriate calculations must be made to ensure that the facility can effectively treat the contaminated water to meet cleanup levels identified in each applicable ROD.

The selected remedy for both the 200-ZP-1 and 200-UP-1 Groundwater OUs combines P&T, MNA, flow-path control, and ICs to meet the objective of achieving cleanup levels for all COCs in 125 years, with the exception of iodine-129 in the 200-UP-1 OU (Table 1-1). Additionally, with the installation of the uranium ion exchange system, treatment of contaminated water from ERDF leachate, 200-DV-1, and 200-BP-5 is possible at the 200 West P&T. The effectiveness of the P&T system will diminish over time as COC concentrations are reduced, whereas the effectiveness of natural attenuation is relatively constant. As a result, natural attenuation will eventually become the dominant mechanism for continued reduction of COC concentrations specific to the 200-ZP-1 and 200-UP-1 OUs. The effectiveness of the remedy is further enhanced by controlling the direction and rate of groundwater flow throughout the 200-ZP-1 and 200-UP-1 OUs using strategically placed extraction and injection wells for flow-path control. The ICs provide protection from exposure to groundwater contamination for both site workers and potential future users of groundwater until the remedy is complete (see Section 1.3.2.4).

Actual and threatened releases of hazardous substances from the 200-DV-1 OU perched water to the 200-BP-5 groundwater OU aquifer and their migration present an imminent and substantial endangerment to public health or welfare or the environment. Contamination of the groundwater justified the use of the NTCRA and CERCLA removal action authority in accordance with the NCP (40 CFR 300.415(b)(2), "Removal Action") to protect public health, welfare, and the environment.

The objective of the 200-DV-1 perched water removal action is to extract perched water from the 200-DV-1 OU and transfer the water by truck or pipeline to the 200 West P&T, where it is treated and injected into the aquifer below the 200 West Area. Completion of the action will remove uranium, technetium-99, nitrate, total chromium, hexavalent chromium, and tritium (all at concentrations above maximum contaminant levels) from the perched water and will be protective of human health and the environment. This removal action is designed to recover as much perched water as practical while awaiting issuance of the 200-DV-1 OU ROD.

The objective of the 200-BP-5 treatability test is to determine whether a sufficient groundwater pumping rate can be sustained, as a measure of the effectiveness of a pump-and-treat alternative to provide hydraulic containment and reduce the mass of the technetium-99 and uranium plumes near the B Tank Farm Complex. The results of the testing will be used to determine if the hydrogeologic conditions are amenable to a pump-and-treat alternative for containment and cleanup of these plumes in the final remedy.

1.3.1 Pump-and-Treat System Description

The 200 West P&T is designed to capture and treat contaminated groundwater to reduce the mass of carbon tetrachloride, total chromium (trivalent and hexavalent), cyanide, nitrate, trichloroethene, iodine-129, technetium-99, and uranium. Following treatment, the water is reinjected into the aquifer to serve as a recharge source and to promote flow-path control (Figure 1-3). The 200 West P&T facility is located south of T Plant in the 200 West Area (Figure 1-4). The 90 percent design was presented in *200 West Area Groundwater Pump-and-Treat Remedial Design Report* (DOE/RL-2010-13), and the system was constructed in calendar years 2010 and 2011.

Currently, the radiological treatment facility is designed to treat up to 1,135 L/min (300 gallons per minute [gpm]) for uranium through the uranium ion exchange system and 2,270 L/min (600 gpm) for technetium-99 through the technetium-99 ion exchange system. Treated water is then blended with the untreated water coming into the central facility.

The central facility can treat up to 9,464 L/min (2,500 gpm) of extracted groundwater using two parallel treatment trains. The extraction and injection well network from all OUs includes approximately

30 extraction wells and 27 injection wells. The number and location of these wells were dependent on site-specific conditions. Figure 1-5 provides the layout of the injection wells, extraction wells, and conveyance piping in the 200 West and 200 East Areas.

The design of the central facility included the ability to add a third treatment train (also in parallel) within the existing facility footprint and infrastructure, increasing the design flow rate to 14,195 L/min (3,750 gpm). The need for additional treatment capacity will be based on the treatment capacity required for 200-ZP-1 OU, 200-UP-1, and 200-BP-5 groundwater remedies.

The groundwater treatment approach involves multiple treatment steps to remove the various COCs (Table 1-1). The relationship between each unit process and the targeted COCs is presented in Table 1-2. Additional information on each treatment step is provided in the following subsections.

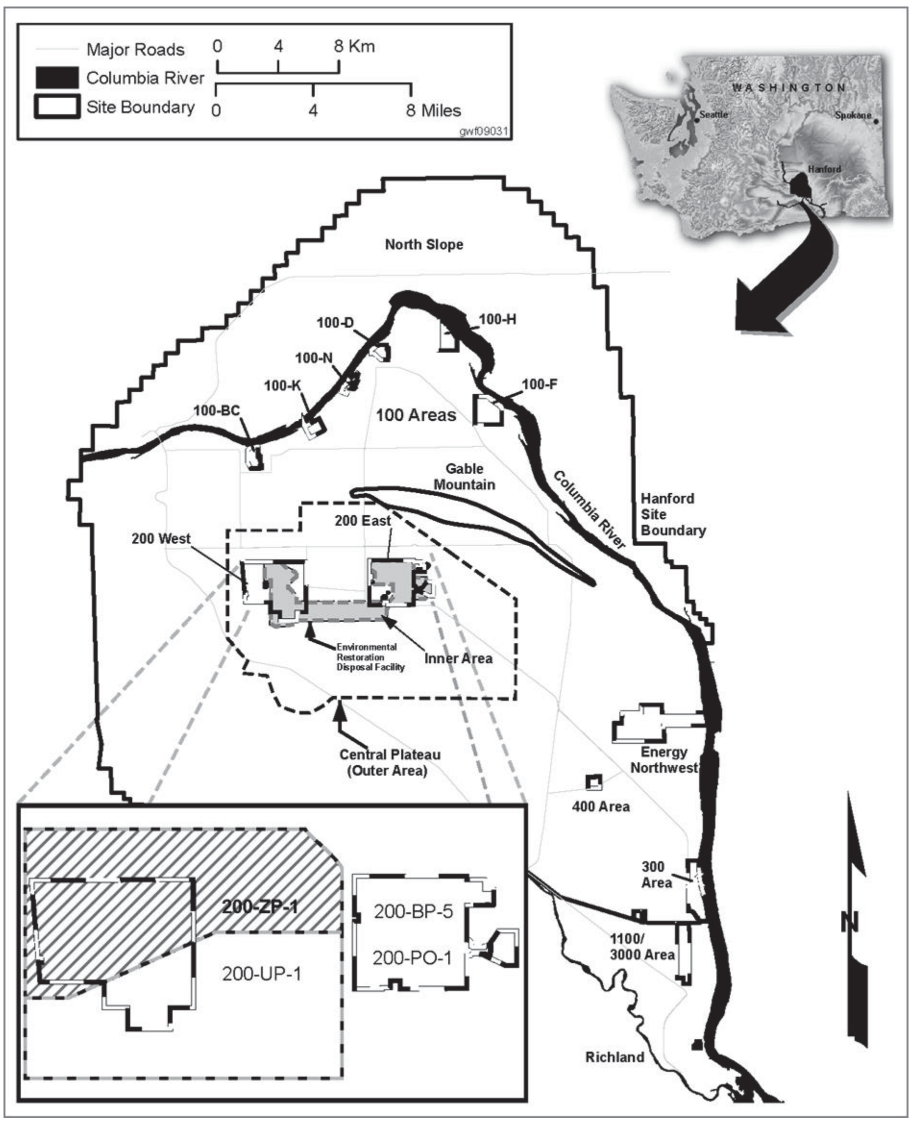

Figure 1-2. Hanford Site Map Showing Central Plateau Groundwater OUs

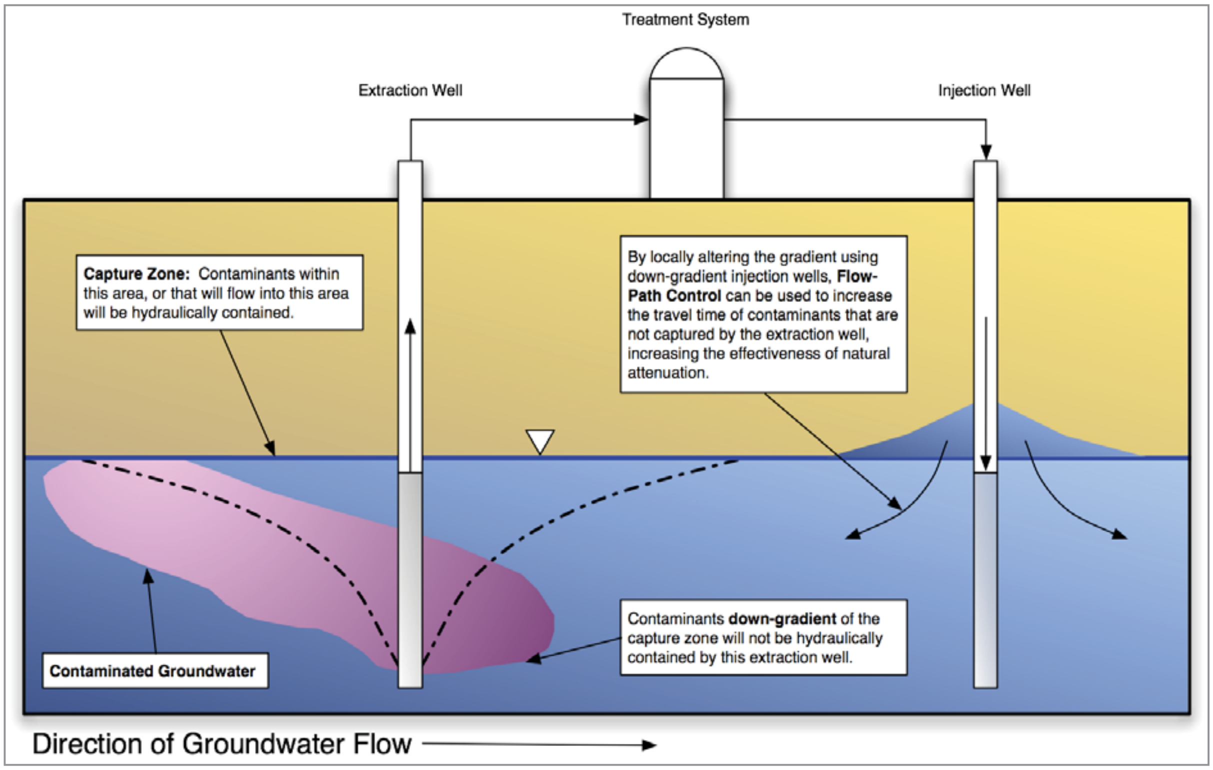

Figure 1-3. Conceptual Summary of the 200 West P&T

1.3.1.1 Uranium Ion-Exchange System

The 200 West P&T system design considered the need for treatment of other constituents (e.g., uranium) that may be captured by the 200 West and East Area extraction wells and from the leachate collected at ERDF. From 2014 to 2016, the 200 West P&T was expanded to provide the necessary treatment capability for uranium-contaminated groundwater from the 200-UP-1, 200-BP-5, and 200-DV-1OUs and from leachate collected at ERDF. The focus of the new extraction systems is cleanup of the uranium and technetium-99 plumes. Associated higher levels of nitrate will also be extracted locally, as well as carbon tetrachloride that has migrated into 200-UP-1 from the 200-ZP-1 OU. The 200-UP-1 system is expected to require approximately two extraction wells operating at an approximate average flow rate of 568 L/min (150 gpm) for 25 years based on current contamination conditions. With the installation of a uranium IX system at the 200 West P&T, treatability test water from 200-BP-5 and the leachate collected at ERDF can be trucked or piped to the 200 West P&T for treatment and disposal. Additionally, with uranium treatment, 200 West P&T is the selected alternative in the non-time critical removal action of the 200-DV-1 OU perched water, which contains high concentrations of uranium, technetium-99 and nitrate.

Influent groundwater to the uranium ion-exchange (IX) system is first filtered to remove fine particulate matter. The groundwater then flows to the uranium IX vessels (Figure 1-6) to remove uranium to less than 30 μg/L before being transferred to the technetium-99 IX vessels (Figure 1-7). Prior to the uranium IX resin reaching its loading limit, the resin will be removed from the vessel by sluicing it with treated water from the resin column into a carbon tetrachloride stripping tank (Figure 1-8), where the resin will be fully submerged with treated water. The tank will be heated and air will be bubbled through the resin bed to mix the bed and strip off carbon tetrachloride. The stripping water will be pumped to the equalization tank at the central treatment facility for treatment. The vapor emissions from the carbon tetrachloride stripping tank will be treated with vapor-phase granular activated carbon (VPGAC).

The resin in the strip tank will be sluiced with treated water to a container to allow drainage (Figure 1-9). The drained water will be collected and pumped back into the feed tank (Figure 1-6). The dewatered resin will be transported for placement at ERDF. The spent resin will be profiled to verify that Environmental Restoration Disposal Facility (ERDF) limits for technetium-99, iodine-129, uranium, and carbon tetrachloride are met. If these limits cannot be met, stabilization of the resin may be required.

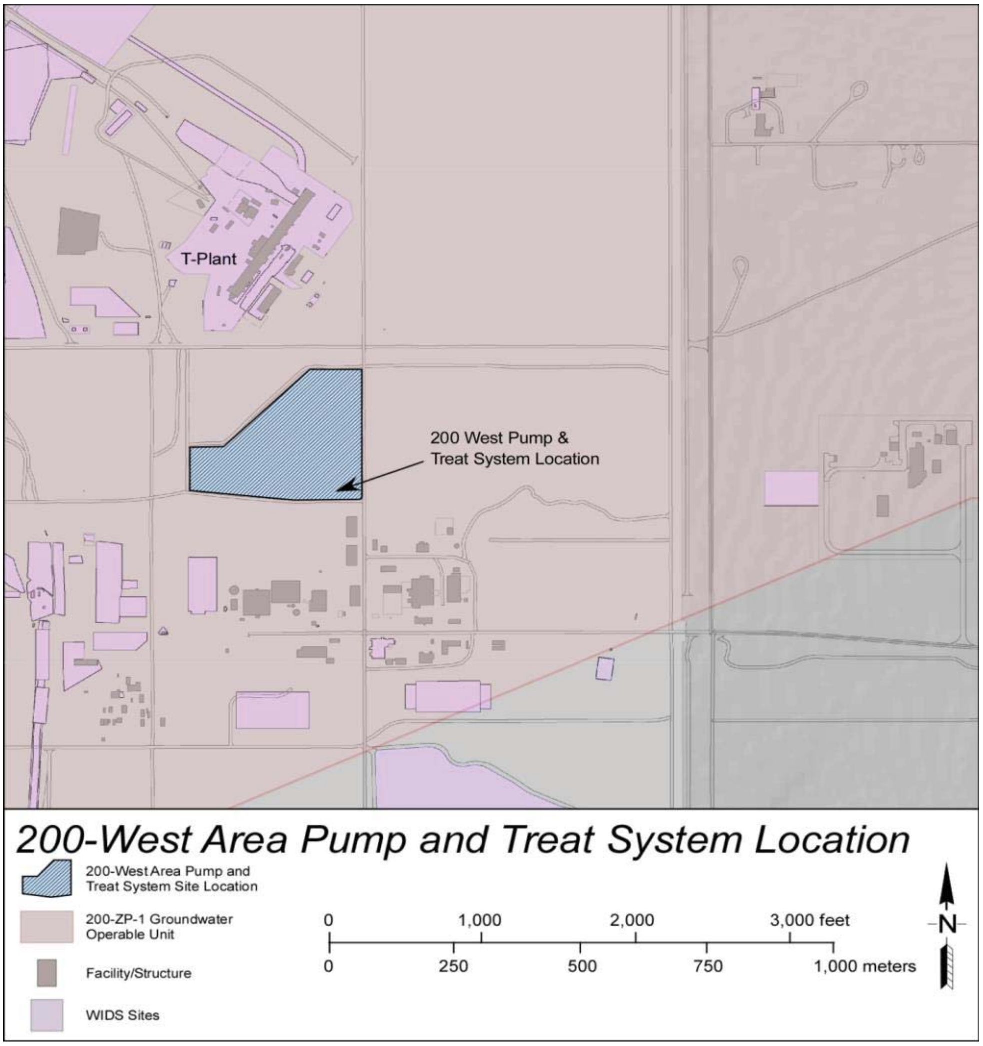

Figure 1-4. 200 West P&T Location

1.3.1.2 Technetium-99 Ion Exchange System

Contaminated water from 200-DV-1 OU perched water, 200-BP-5 OU treatability testing, ERDF leachate, and selected wells in the 200-ZP-1 and 200-UP-1 OUs (after separate pre-treatment for uranium) is pre-treated to reduce technetium-99 to less than 900 pCi/L (Figure 1-7). Influent groundwater is first filtered to remove fine particulate matter. The groundwater then flows to the technetium-99 IX vessels before passing through a final set of filters and ultimately being transferred to the central treatment facility.

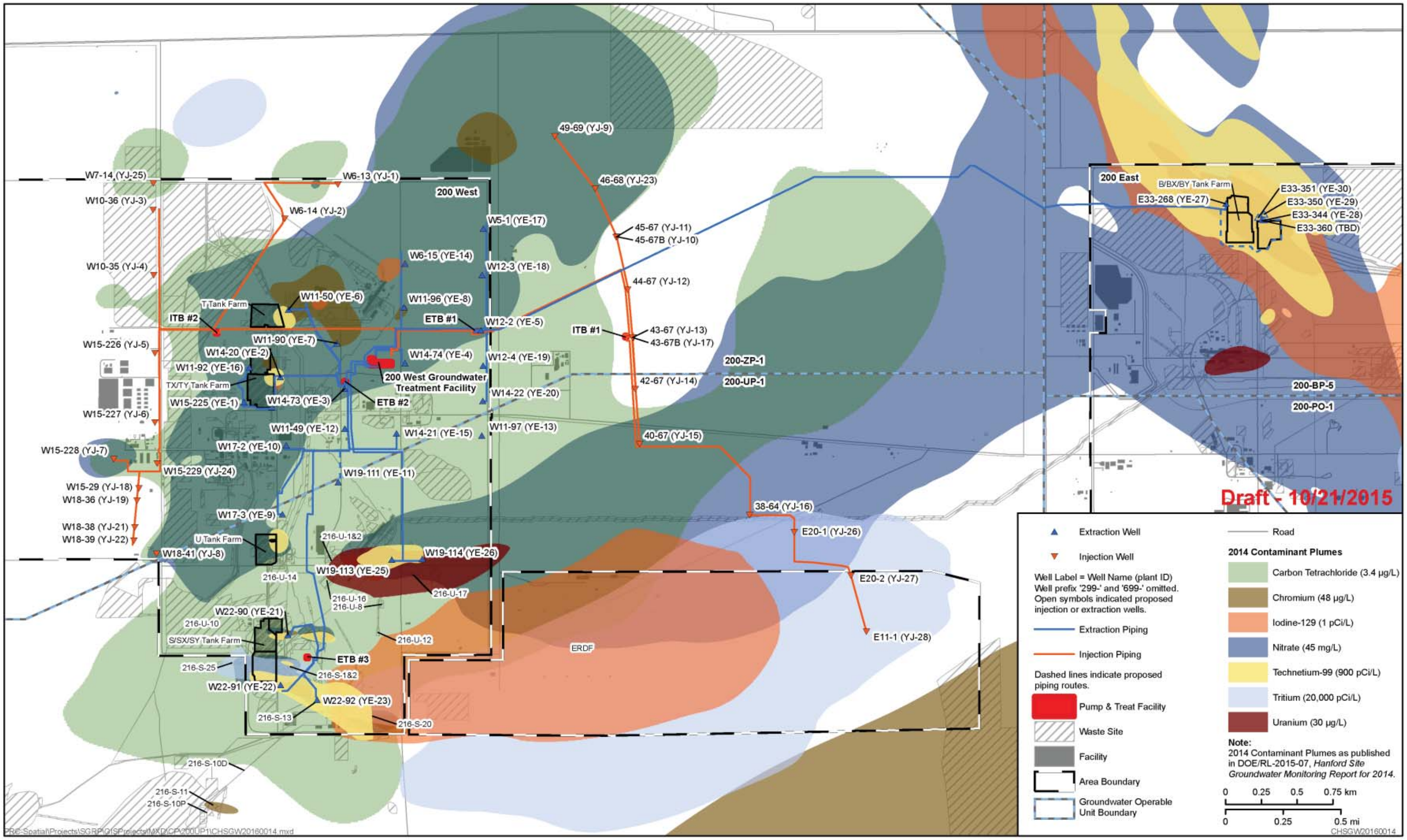

Figure 1-5. Contaminant Plumes and Extraction and Injection Well Locations with Conveyance Pipe Routing for the 200 West P&T

Table 1-2. 200 West P&T Unit Process Descriptions

Unit Process	Process Benefit	Targeted Parameter
Ion exchange	Removal of technetium-99, iodine-129, and uranium	Technetium-99 Iodine-129 Uranium[a]
Anoxic/anaerobic Biodegradation (fluidized bed reactor)	Removal of nitrate, carbon tetrachloride, cyanide, and trichloroethene, and conversion of hexavalent chromium to trivalent form	Nitrate Carbon tetrachloride Cyanide Trichloroethene Hexavalent chromium
Aerobic biodegradation	Degradation/removal of residual organic carbon substrate	Biochemical oxygen demand
Membrane filtration	Removal of particles, biomass, and precipitated trivalent chromium	Trivalent chromium Turbidity and biochemical oxygen demand
Air stripping	Removal of volatile organic compounds carbon tetrachloride and trichloroethene	Carbon tetrachloride Trichloroethene
Sludge thickening	Thicken biological solids for dewatering process	Solids content
Sludge dewatering	Reduce water content to allow for landfill disposal	Water content
Treated water chemistry adjustment	Provide treated water stability	pH and alkalinity

a. Uranium treatment is required for groundwater from the 200-UP-1 OU and 200-BP-5 OU.

Prior to the IX resin reaching its loading limit, the resin will be removed from the vessel by sluicing it with treated water from the resin column into a carbon tetrachloride stripping tank (Figure 1-8), where the resin will be fully submerged with treated water. The tank will be heated and air will be bubbled through the resin bed to mix the bed and strip off carbon tetrachloride. The stripping water will be pumped to the equalization tank at the central treatment facility for treatment. The vapor emissions from the carbon tetrachloride stripping tank will be treated with VPGAC.

The resin in the strip tank will be sluiced with treated water to a container to allow drainage (Figure 1-9). The drained water will be collected and pumped back into the feed tank (Figure 1-6). The dewatered resin will be transported for placement at the ERDF. The spent resin will be profiled to verify that the ERDF limits for technetium-99, iodine-129, uranium, and carbon tetrachloride are met. If these limits cannot be met, stabilization of the resin may be required.

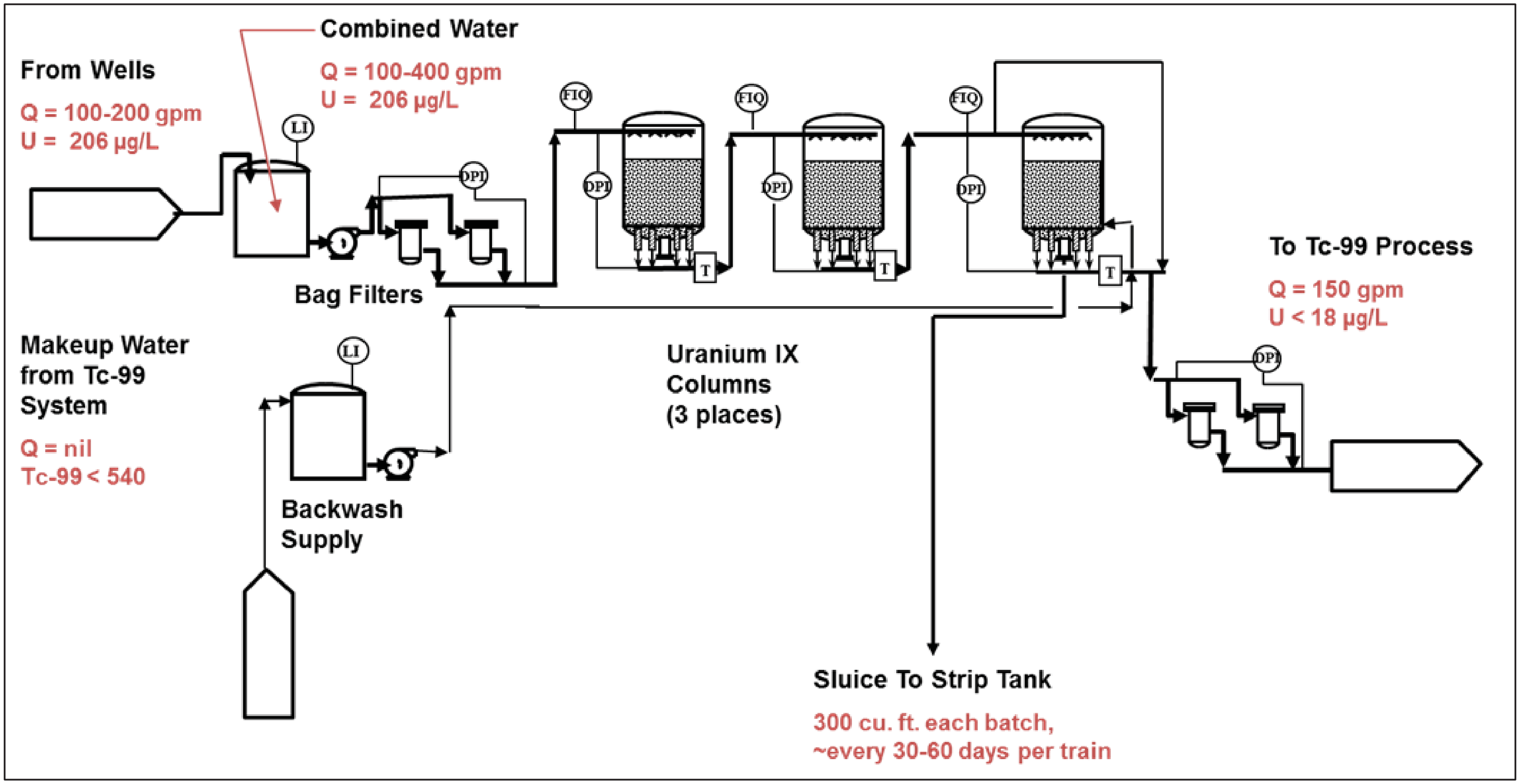

Figure 1-6. Uranium IX Process Schematic

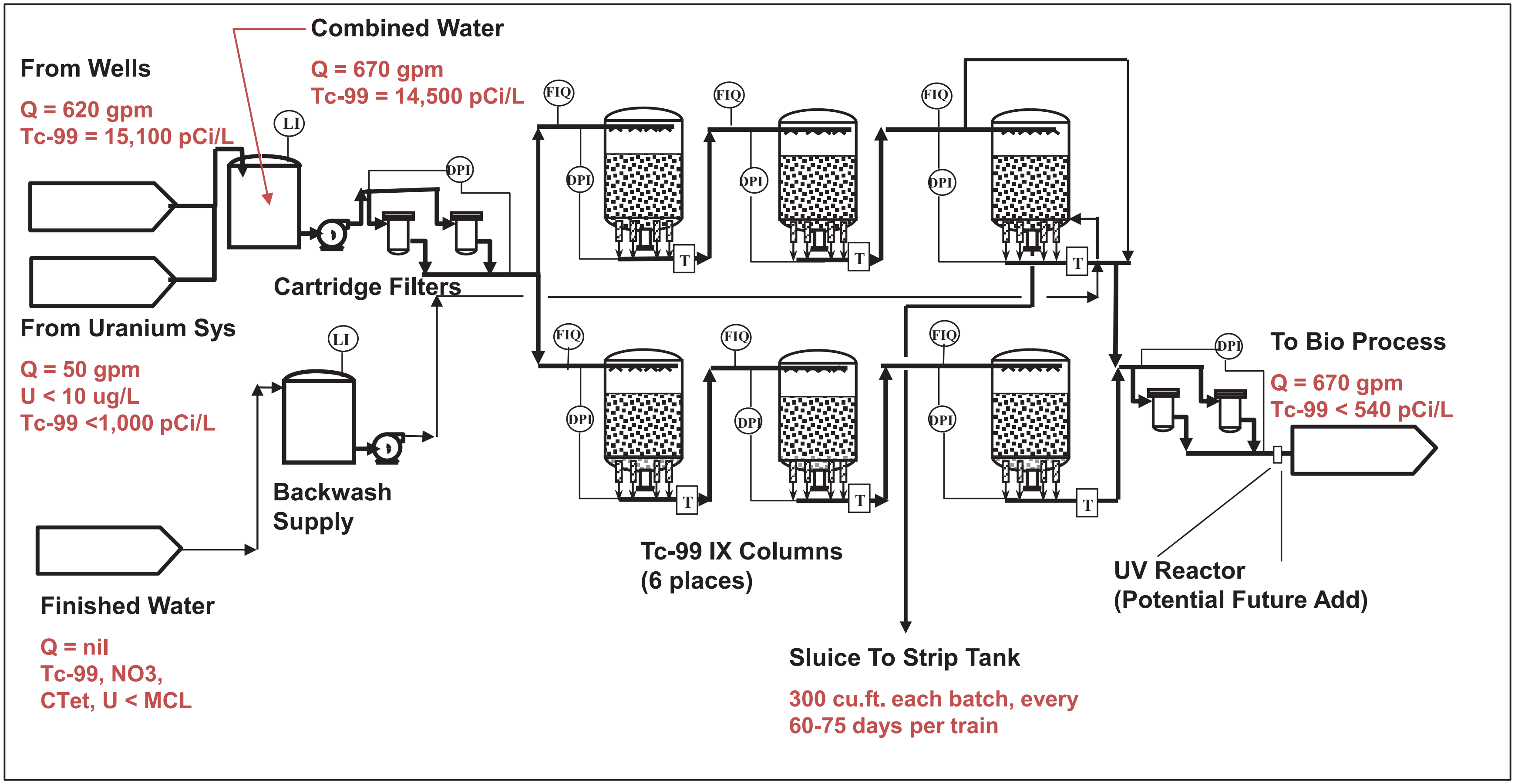

Figure 1-7. Technetium-99 IX Process Schematic

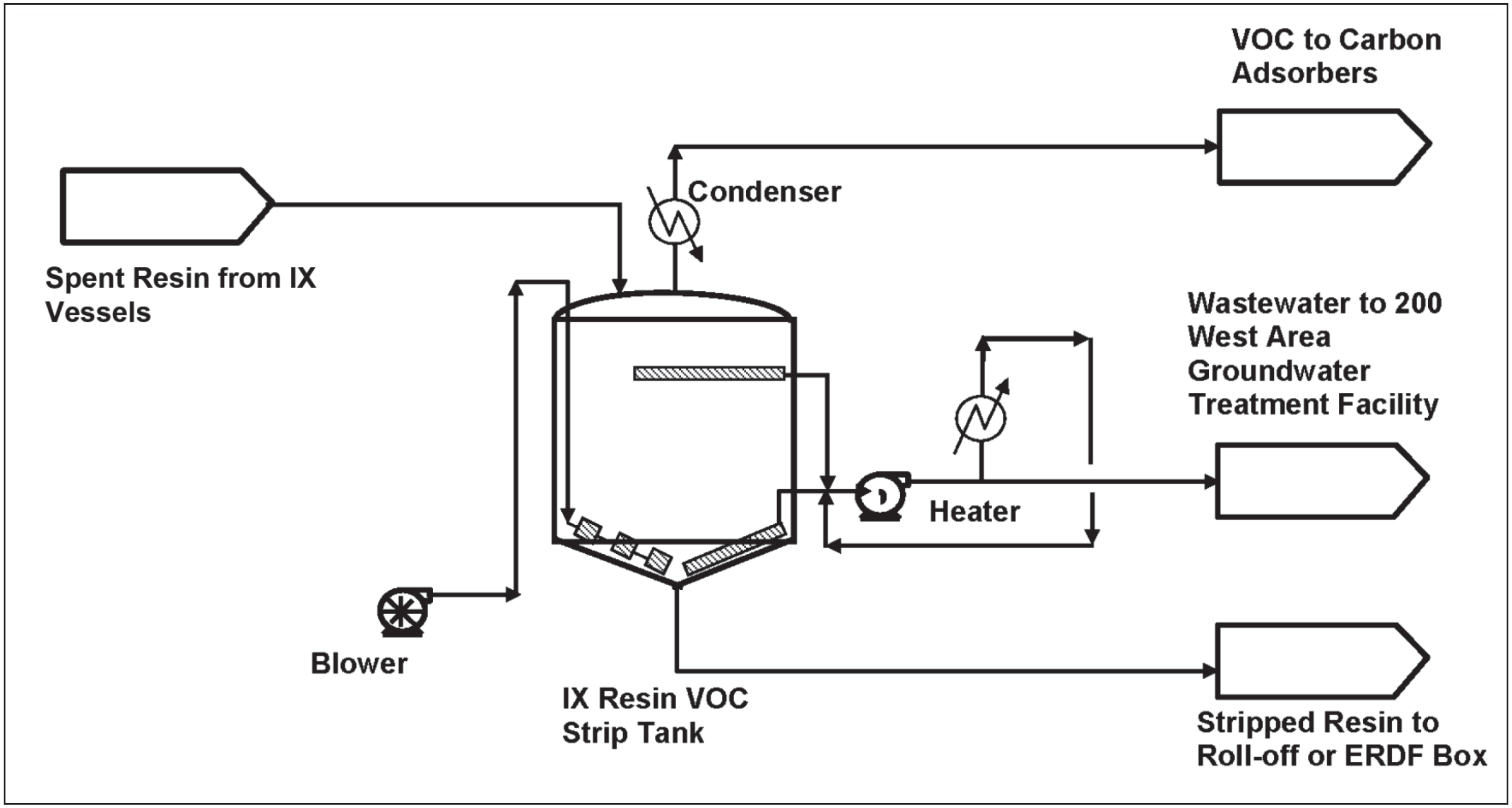

Figure 1-8. Technetium-99 and Uranium IX Resin Strip Tank Schematic

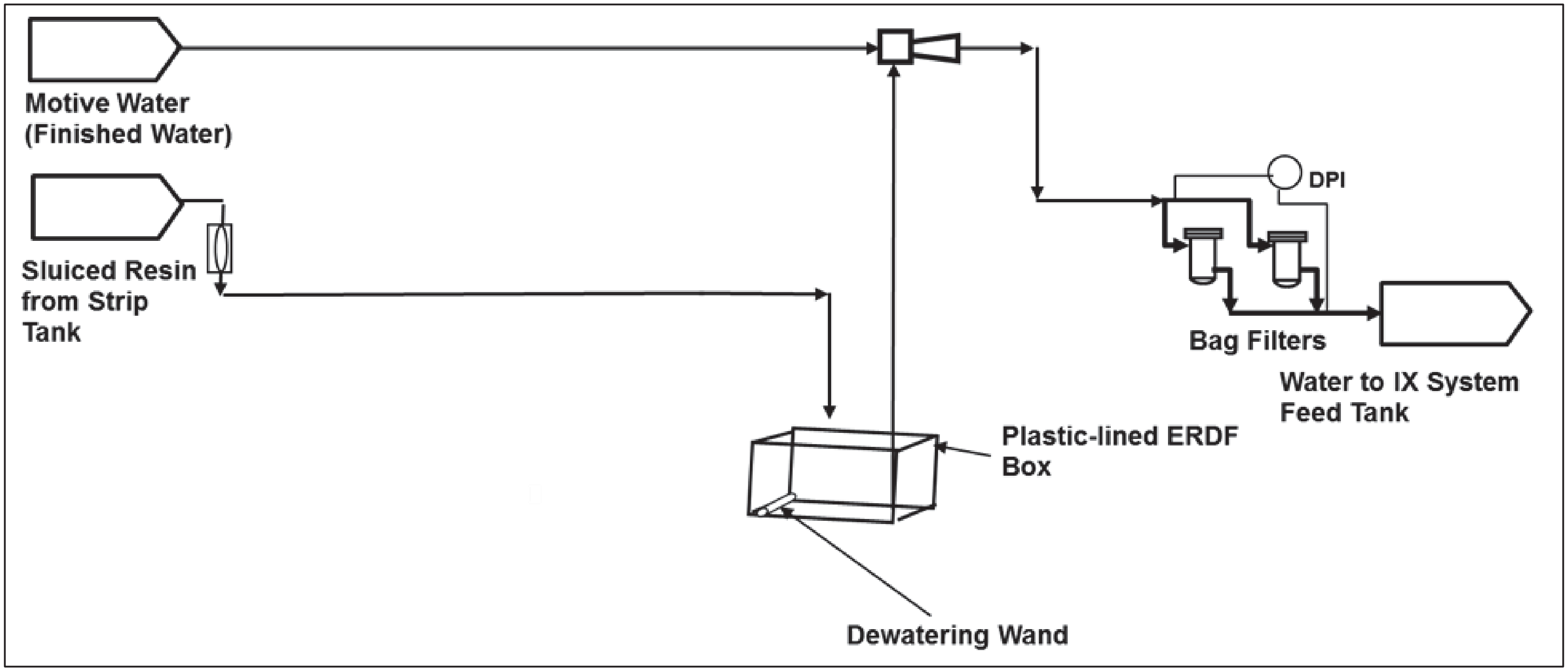

Figure 1-9. Technetium-99 and Uranium IX Resin Dewatering Schematic

1.3.1.3 200 West Pump and Treat

The treatment processes for carbon tetrachloride and nitrate removal at the 200 West P&T are configured in two parallel, 4,732 L/min (1,250 gpm) treatment trains to accommodate flow rates up to 9,464 L/min (2,500 gpm). The treatment facility infrastructure is designed to accommodate a third treatment train, if required, to increase the total treatment capacity to 14,195 L/min (3,750 gpm).

Following treatment for uranium and technetium-99, water from the technetium-99 IX system flows to the central treatment facility where it is blended in an equalization tank (Figure 1-10) with extracted groundwater conveyed through transfer pumps serving several extraction wells or directly to the facility from individual extraction wells. Water is pumped from the equalization tank to a recycle tank and then into the bottom of the fluidized bed reactor (FBR), creating upflow to suspend the granular activated carbon (GAC) bed media to which microorganisms attach and grow. Within the FBR, nitrate is converted to nitrogen gas (denitrification) and carbon tetrachloride is degraded by the microorganisms under anoxic conditions (i.e., in the absence of dissolved oxygen).

An organic carbon substrate and phosphorus are added to the FBR to serve as the electron donor and to provide nutrients to promote microbial growth. As the microbes grow on the GAC, the fluidized bed height expands, and excess biomass is removed by shear forces resulting from normal flow through the FBR. Additional excess biomass is removed with a biomass separator and flows out with the effluent.

The effluent from the FBR flows by gravity to aerobic membrane tanks (Figure 1-11) for removal of residual carbon substrate through aerobic biodegradation and removal of total suspended solids, including biomass generated in the FBR. The membrane tanks have aeration capacity to provide sufficient oxygen for maintaining the aerobic biological process to reduce the residual carbon substrate. The membrane tanks have an aeration zone followed by a membrane zone with submerged membranes for filtration. The aeration zone is maintained by a blower that diffuses air into the tank. A second blower for the membrane zone provides air scouring to remove accumulated organic debris from the membrane surface to maintain its water permeability. The aeration and air-scouring processes also strip off carbon tetrachloride. Vapor emissions are collected for treatment with VPGAC.

The membrane zone contains multiple modules of vertically strung membrane fibers. Water is filtered by applying a slight vacuum to the end of each fiber, which draws the water through the tiny pores into the fibers. The filters remove solids that are retained in the tank concentrate. A portion of the concentrate is recycled to the first compartment of the membrane tank to maintain the biomass concentration necessary to reduce biochemical oxygen demand.

Solids from the membrane tanks are pumped to rotary drum thickeners (Figure 1-12). Thickened sludge leaving the rotary drum thickeners is sent to aeration tanks. As the solids concentration in the aeration tanks decreases, less flow is bypassed around the thickeners; conversely, as the solids concentration in the tank increases, more flow is bypassed around the thickening process. Polymer is added upstream of the rotary drum thickeners to thicken the solids, as necessary. The aeration tanks also provide further digestion of biomass and maintain aerobic conditions for odor control.

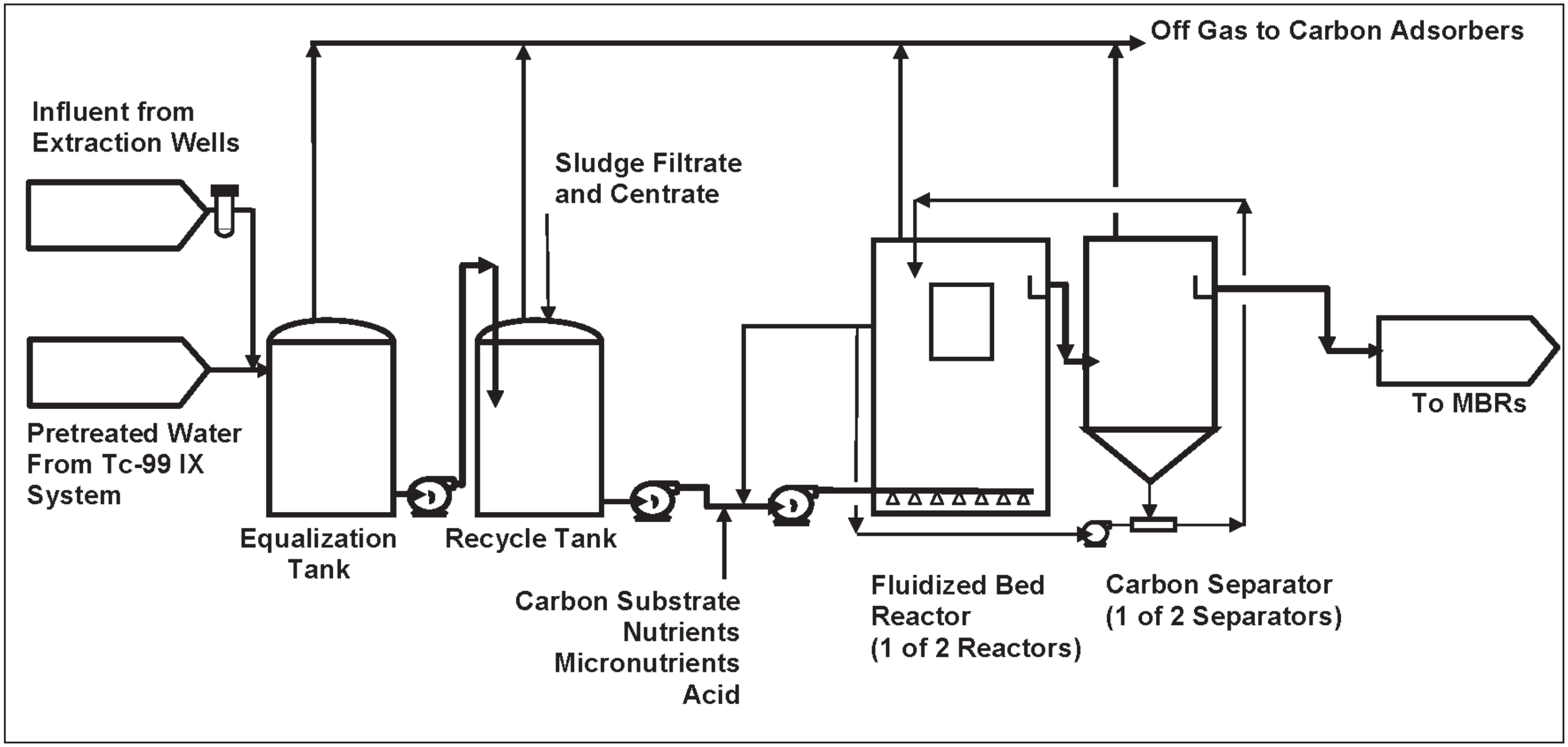

Figure 1-10. Biological Process – Anoxic FBR Schematic

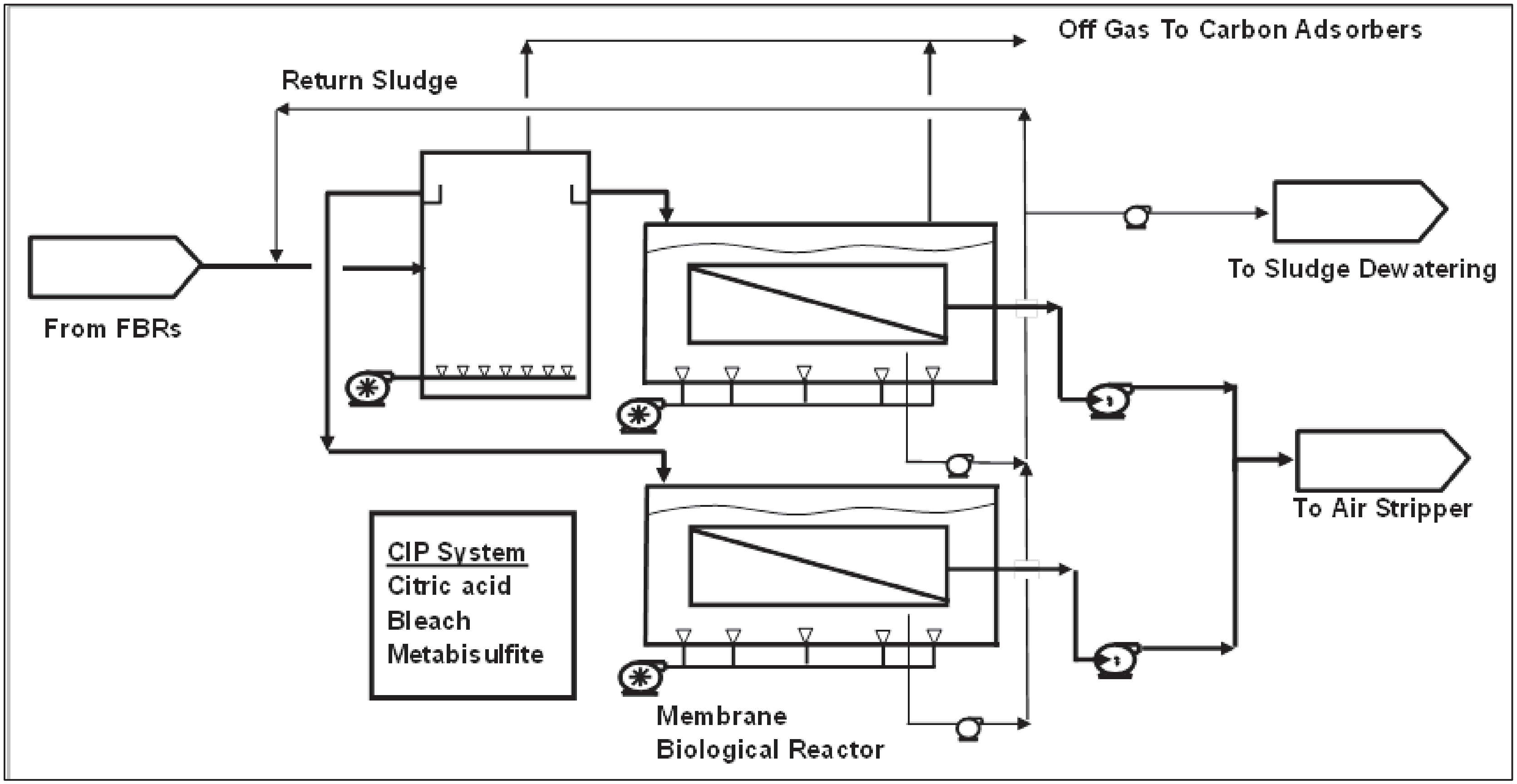

Figure 1-11. Biological Process – Membrane Bioreactor Schematic

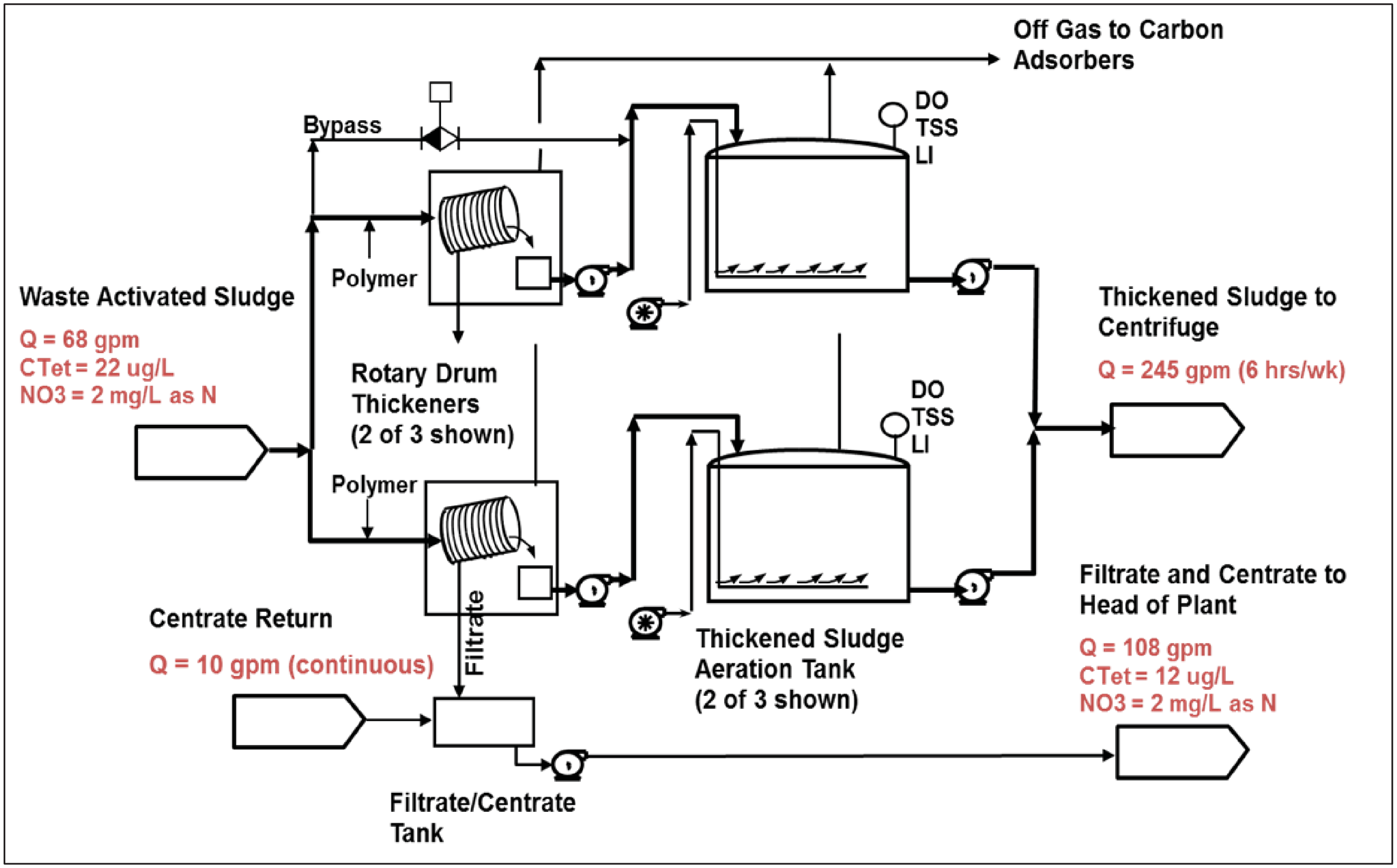

Figure 1-12. Solids Handling System – Thickeners and Thickened Sludge Aeration Tank Schematic

The thickened solids are then pumped from the sludge holding tank to centrifuges for dewatering (Figure 1-13). Polymer is added upstream of the centrifuges to aid in solids dewatering. A screw conveyor is used to move the dewatered sludge from the centrifuge to a lime stabilization system where a mechanical mixer (e.g., pug mill) mixes lime with the thickened sludge. This controls free water to meet ERDF disposal criteria and prevents further decomposition and generation of objectionable gasses and odors. Once the lime is added, the conditioned sludge is transferred by screw conveyor into ERDF containers for disposal. The filtrate from the rotary drum thickeners and centrate from the centrifuges are piped to a collection tank and then to the recycle tank located upstream of the FBR.

The treated water from the membranes is pumped to an air stripper (Figure 1-14) to remove the remaining carbon tetrachloride and other volatile organic compounds. The air stripper effluent is then pumped to an effluent tank. Acid is added upstream of the effluent tank through an in-line static mixer to adjust pH.

Off-gas from the stripper, influent equalization tank, strip tanks (technetium-99 and uranium), FBRs, membrane tanks, sludge holding tanks, rotary drum thickeners, and centrifuges is combined and treated by VPGAC. To avoid buildup of radionuclides in the VPGAC, air streams to the VPGAC system are pre-treated by a demister to minimize liquid carryover.

The air stripper tower is piped so this treatment step can occur before the FBR in the event that the degradation of the carbon tetrachloride in the FBR is less than anticipated. Process monitoring conducted during operations is used to determine the optimum configuration of the air stripper.

1.3.2 Other Remedy Components

This subsection describes the components of the groundwater remedy that augment the P&T system.

1.3.2.1 Monitored Natural Attenuation

In addition to P&T, the final and interim CERCLA remedies for the 200-ZP-1 and 200-UP-1 OUs include natural attenuation processes for reducing COC concentrations to the cleanup levels. Natural attenuation will eventually become the dominant mechanism for continued reduction of COC concentrations as the effectiveness of the P&T system decreases over time. Because there is no viable treatment technology for removing tritium from the groundwater in the P&T system, the short half-life of tritium will allow natural attenuation to reduce its concentration to meet cleanup levels.

For the remaining portion of the carbon tetrachloride and nitrate (as well as tritium) not captured by the P&T component, natural attenuation processes will be used to reduce concentrations to cleanup levels.

Natural attenuation processes include biotic and abiotic degradation, dispersion, sorption, and, for tritium, natural radioactive decay. Monitoring conducted under this O&M plan for the 200-ZP-1 OU will be used to evaluate the effectiveness of the P&T and natural attenuation processes, as described in Chapters 3 and 4. Fate and transport analyses conducted as part of the *Feasibility Study Report for the 200-ZP-1 Groundwater Operable Unit* (DOE/RL-2007-28) indicate that the time frame necessary to reduce the remaining COC concentrations to acceptable levels through MNA will be approximately 100 years. For the 200-UP-1 OU, a separate PMP (*Performance Monitoring Plan for the 200-UP-1 Groundwater Operable Unit Remedial Action* [DOE/RL-2015-14]) was prepared to define remedy performance monitoring requirements for the aquifer including MNA.

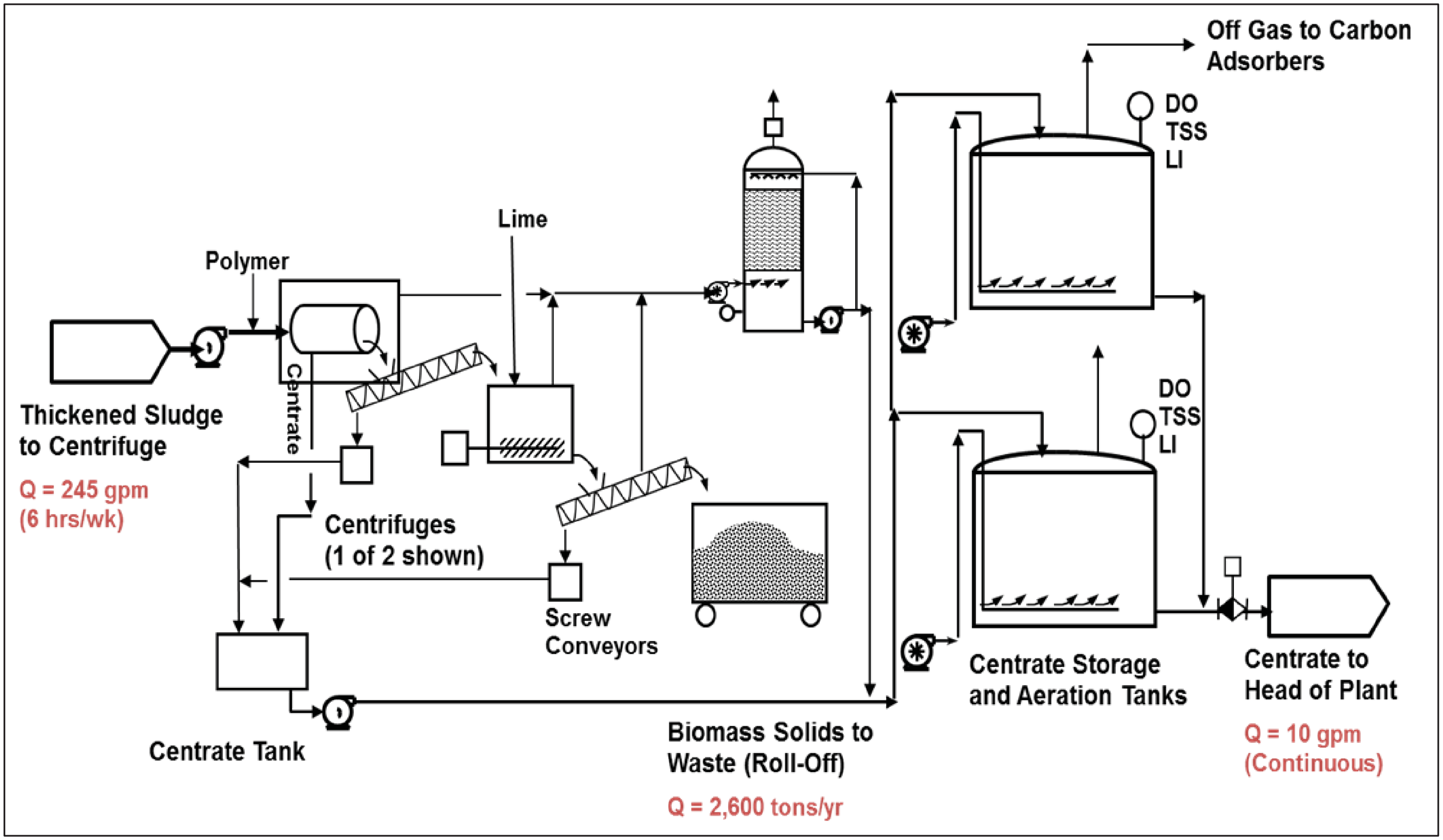

Figure 1-13. Solids Handling System – Centrifuge Dewatering and Lime Treatment Schematic

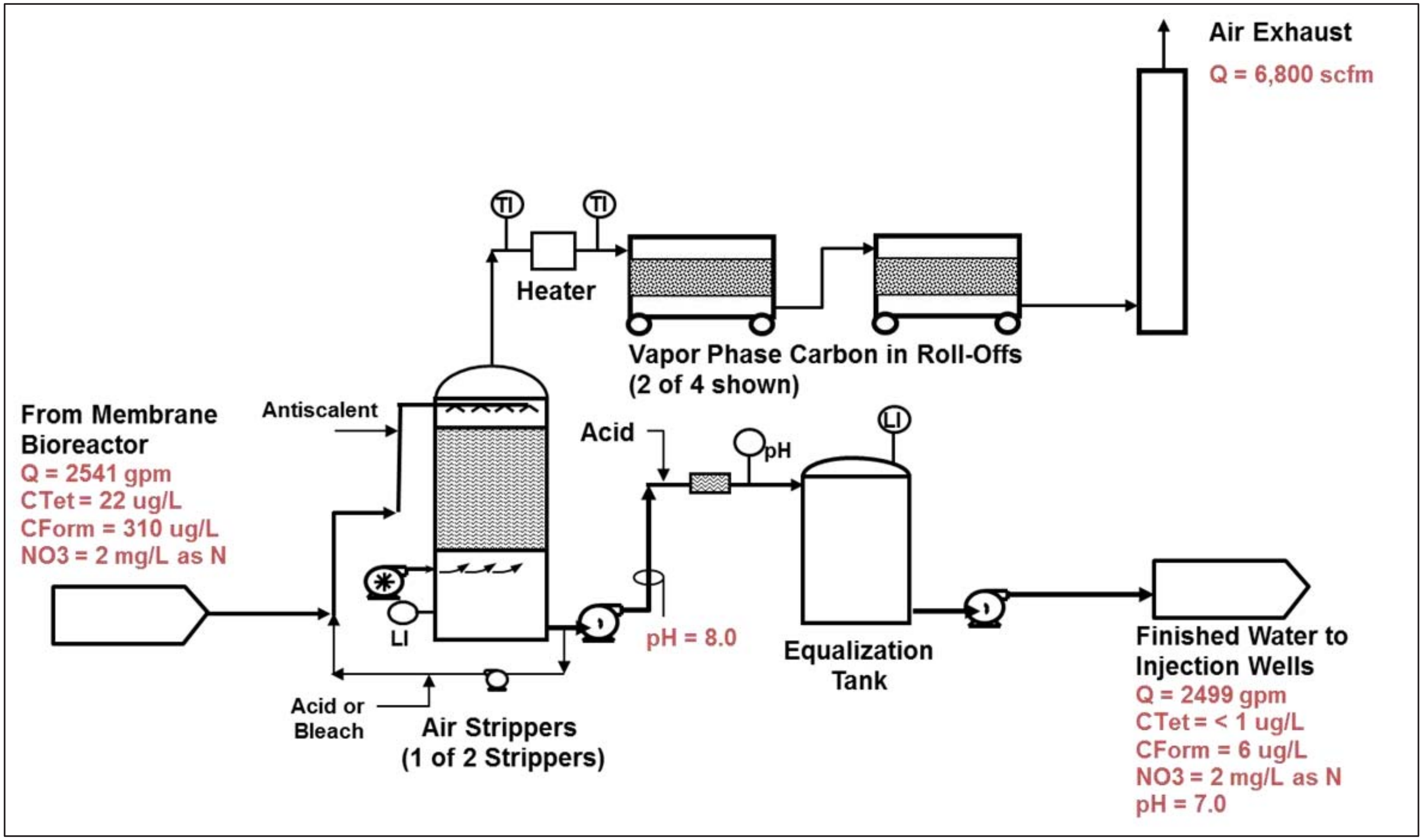

Figure 1-14. Air Stripper System Schematic

1.3.2.2 Flow-Path Control

The flow-path control component consists of injecting treated water from all of the OUs into the aquifer upgradient and downgradient of the groundwater contaminant plumes in 200-ZP-1 OU and downgradient of the 200-UP-1 iodine-129 plume. Injecting water at these locations contains the contaminant plumes and, as a result, maintains the higher concentration areas within the extraction well capture zone and also increases the time available for natural attenuation processes to reduce contaminant concentrations not captured by the extraction wells.

Flow-path control minimizes the potential for groundwater in the northern portion of the aquifer to flow northward through Gable Mountain Gap toward the Columbia River. The injection wells are located to redirect groundwater flow to the east, which provides the longest flow path to the river (about 26 km [16 mi]). Monitoring data collected under this O&M plan will be assessed to determine the effectiveness of flow-path control, as described in Chapters 3 and 4.

1.3.2.3 Hydraulic Containment of Iodine-129

Hydraulic containment is the selected remedy for the 200-UP-1 OU iodine-129 plume. Hydraulic containment is performed using injection wells placed at the leading edge of the iodine-129 plume (Figure 1-5). Treated water from the 200 West P&T is pumped to the injection wells. It is estimated that three injection wells with a flow rate of 189 L/min (50 gpm) per well (568 L/min [150 gpm] total) will be needed to hydraulically control the plume.

1.3.2.4 Institutional Controls

The 200-ZP-1 OU ROD, the 200-UP-1 interim ROD, and the 200-DV-1 action memorandum require ICs for groundwater until cleanup levels are met. A description of these controls and their implementation is provided in the Sitewide IC Plan (DOE/RL-2001-41). The following specific controls are required by the 200-ZP-1 OU ROD (EPA et al., 2008), the 200-UP-1 OU interim ROD (EPA et al., 2012), and the 200-DV-1 OU action memorandum (DOE/RL-2014-34, 2014):

- No intrusive work shall be allowed in the 200-ZP-1, 200-UP-1, or 200-DV-1 OUs unless the EPA has approved the plan for such work and that plan is followed.
- DOE shall prohibit well drilling in the 200-ZP-1, 200-UP-1, or 200-DV-1 OUs, except for monitoring, characterization, or remediation wells authorized in EPA-approved documents.
- Groundwater use in the 200-ZP-1, 200-UP-1, or 200-DV-1 OUs is prohibited, except for limited research purposes, monitoring, and treatment authorized in EPA-approved documents. The Sitewide IC Plan (DOE/RL-2001-41) contains the ICs and implementing details prohibiting well drilling and groundwater use in the 200-ZP-1 OU, 200-UP-1, and 200-DV-1 OU, as defined in each respective ROD.
- DOE shall post and maintain warning signs along pipelines conveying untreated groundwater that caution site visitors and workers of potential hazards from 200-ZP-1, 200-UP-1, and 200-DV-1 OU groundwater.
- In the event of any unauthorized access to the site (e.g., trespassing), DOE shall report such incidents to the Benton County Sheriff's Office for investigation and will consider administrative debarment of the trespasser, as well as prosecution in state or federal court, as deemed appropriate.
- Activities that would disrupt or lessen the performance of the P&T, MNA, and flow-path control components of the remedy are to be prohibited.

- DOE shall prohibit activities that would damage the P&T, MNA, and flow-path control components (e.g., extraction wells, injection wells, piping, treatment plant, and monitoring wells).
- DOE shall report on the effectiveness of ICs for the 200-ZP-1, 200-UP-1, and 200-DV-1 OU remedies in an annual report, or on an alternative reporting frequency specified by EPA. Such reporting may be for these OUs alone or may be part of a Hanford Sitewide annual report.
- DOE will prevent the development and use of property above the 200-ZP-1, 200-UP-1, and 200-DV-1 OUs for residential housing, elementary and secondary schools, childcare facilities, and playgrounds.
- Land-use controls will be maintained until cleanup levels are achieved and the concentrations of hazardous substances in groundwater are at such levels to allow for unrestricted use and exposure, and EPA authorizes the removal of restrictions.

Most of the land within the 200-ZP-1, 200-UP-1, and 200-DV-1 OUs has been designated by DOE, through the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (HCP EIS) (DOE/EIS-0222-F), for industrial exclusive use for the foreseeable future. Because this area contains facilities that will have long-term responsibility for disposal or storage of hazardous substances, the possibility that this property could qualify for transfer of title out of the federal government is remote, especially in light of the exacting requirements of CERCLA Section 120(h) for transfers of contaminated federal land. Because the 200 Areas were principally withdrawn from the public domain, if the land ever became surplus to the needs of DOE, federal law requires that it be turned over to the Bureau of Land Management. Nevertheless, as a general policy to ensure continuity of ICs that have been selected as part of remedial actions at the Hanford Site, DOE has made the following commitments to EPA Region 10:

- DOE will provide notice to EPA at least 6 months prior to transfer or sale of the land within the 200-ZP-1, 200-UP-1, and 200-DV-1 OUs so EPA 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 EPA at least 6 months prior to transfer or sale, then DOE will notify EPA as soon as possible, but no later than 60 days prior to the transfer or sale of property subject to ICs.
- In addition to the land transfer notice and discussion provisions above, DOE further agrees to provide 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 EPA.

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2 Organization, Operations, and Optimization

This chapter describes the 200 West P&T project organization, O&M program, and the system optimization process.

2.1 Project Organization

Figure 2-1 provides the organizational structure supporting the 200 West P&T. Management responsibilities and inter-relationships are described in the following subsections.

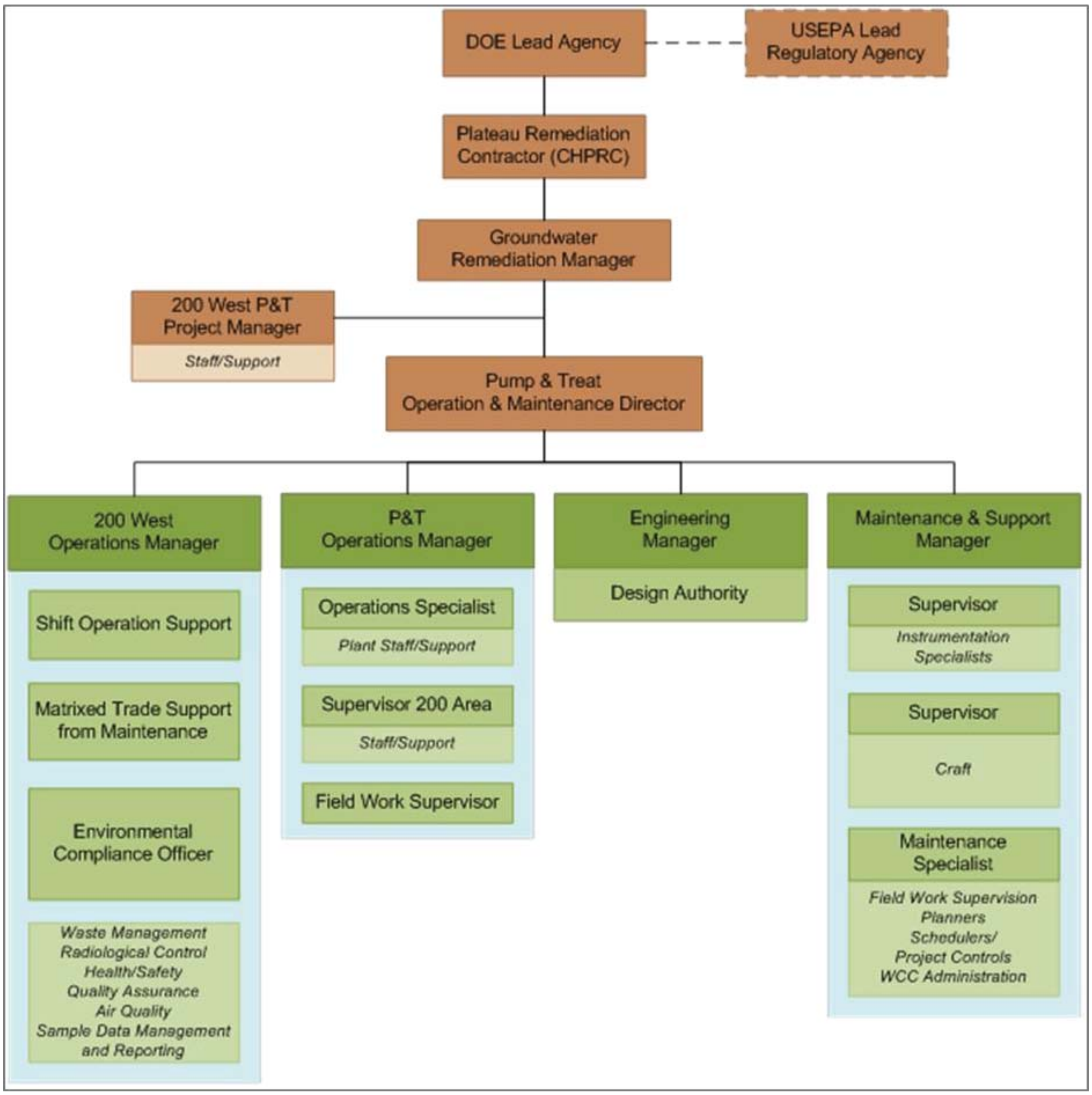

Figure 2-1. Organization Chart for 200 West P&T O&M

2.1.1 Regulatory Lead

The lead regulatory agency (LRA) is responsible for regulatory oversight of cleanup projects and activities. The LRA has SAP approval authority for the OUs they manage. The LRA works with the U.S. Department of Energy-Richland Operations Office (DOE-RL) to resolve concerns over the work described in this SAP in accordance with the TPA (Ecology et al., 1989a).

2.1.2 DOE-RL Project Manager

The DOE-RL Project Manager is responsible for monitoring the contractor's performance of activities under CERCLA, RCRA, *Atomic Energy Act of 1954*, and TPA (Ecology et al., 1989a) for the Hanford Site; obtaining LRA approval of the SAP; authorizing field sampling activities; approving the SAP; and functioning as primary interface with regulators.

2.1.3 DOE-RL Technical Lead

The DOE-RL Technical Lead is responsible for providing day-to-day oversight of the contractor's work scope performance; working with the contractor and the regulatory agencies to identify and resolve technical issues; and providing technical input to the DOE-RL Project Manager.

2.1.4 Groundwater Remediation Manager

The groundwater remediation manager provides oversight for activities and coordinates with RL, EPA, and CH2M HILL Plateau Remediation Company (CHPRC) management. In addition, support is provided to the 200 West P&T project manager to ensure that work is performed safely and cost effectively.

2.1.5 200 West P&T Project Manager

The project manager is responsible for the budget and schedule for the 200 West P&T, direct management of documents and requirements, and subcontracted tasks. The 200 West P&T project manager coordinates with and reports to RL and CHPRC management on 200 West P&T activities.

2.1.6 Operations/Maintenance Director

The operations/maintenance director is responsible and accountable for the O&M of the P&T system. Responsibilities include ensuring that appropriate operations support functions (e.g., radiological protection and safety) are available to support operations activities, and for verifying that O&M procedures have been prepared, approved, and implemented.

2.1.7 200 West P&T Operations Manager

The 200 West P&T operations manager assists with startup and development of operational guides, and performs training and performance evaluations for the 200 West P&T facility. Additional responsibilities include the following: implementing operator and operations management training programs, evaluating and directing the process of the treatment plant, analyzing operational process control procedure and making recommendations to the project manager, maintaining accurate operational records and preparing reports as required by the project manager, monitoring the records, and reviewing all plant operating records.

2.1.8 Chief Engineer

The chief engineer has overall management responsibility for the practice of engineering within CHPRC's Soil and Groundwater Remediation Project. The chief engineer is responsible for the assignment and approval of qualifications for the design authorities.

2.1.9 Maintenance Manager

The maintenance manager supervises all preventive and corrective maintenance of 200 West P&T facilities; plans, schedules, and directs maintenance of a variety of specialized mechanical and electrical equipment, including buildings, structures, and grounds; assigns, coordinates, and supervises personnel and materials required for the maintenance and repair of facilities; and estimates cost and time for all aspects of maintenance, repair, and construction work.

2.1.10 Maintenance Supervisors

Maintenance supervisors are responsible for preparing and executing facility maintenance-related work activities. As part of work planning, the maintenance supervisor conducts pre-work reviews, automated job hazard analyses, and walkdowns with the work team; ensures that all work documents are technically accurate, current, and have been approved and released for work performance; coordinates with other organizations to fully support the field work activities and ensures that craft personnel are adequately trained and qualified; implements planned and unplanned maintenance in accordance with facility operational priorities; and conducts post-job reviews and technical work document closure upon completion of the field activities.

2.1.11 Environmental Compliance Officer

The environmental compliance officer provides technical oversight, direction, and acceptance of project and subcontracted environmental work; develops appropriate mitigation measures to minimize adverse environmental impacts; reviews plans, protocols, and technical documents to ensure that environmental requirements have been addressed; identifies environmental issues that affect operations and develops cost-effective solutions; and responds to environmental and regulatory issues or concerns raised by RL or the lead regulatory agency or both. The environmental compliance officer also oversees project implementation for compliance with applicable internal and external environmental requirements.

2.1.12 Design Authority

The design authority is responsible and accountable for review and approval of the functional design criteria and for final acceptability of a structure, system, or component. The design authority also identifies applicable regulatory and safety requirements. The design authority's responsibilities related to operations include reviewing and approving functional design criteria, design changes, construction submittals, and requests for information; performing engineering inspections for design compliance; and reviewing and approving procedures.

2.1.13 Quality Assurance Engineer

The QA engineer is matrixed to the 200 West P&T project manager and is responsible for addressing QA issues on the project. Responsibilities include overseeing implementation of project QA requirements, reviewing project documents (including DQO summary reports, QAPjPs, and SAPs); reviewing data validation reports from third-party validation contractors, as appropriate, and participating in QA assessments.

2.1.14 Health and Safety

The Health and Safety organization is responsible for coordinating industrial safety and health support within the project, as carried out through the health and safety program, job hazard analyses, and other pertinent federal regulations or internal primary-contractor work requirements. In addition, the Health and Safety organization assists project personnel in complying with applicable health and safety standards and requirements. The Health and Safety organization coordinates with Radiological Engineering to determine personal protective equipment requirements.

2.1.15 Radiological Engineering

The Radiological Engineering lead is responsible for radiological and health physics support within the project. Specific responsibilities include conducting as low as reasonably achievable (ALARA) reviews, performing exposure and release modeling, and optimizing radiological controls for all work planning. In addition, the Radiological Engineering lead identifies radiological hazards and implements appropriate controls to maintain worker exposures ALARA (e.g., requiring personal protective equipment). The Radiological Engineering lead also interfaces with the project Health and Safety contact, and plans and directs radiological control technician support for all activities.

2.1.16 Analytical Laboratories

The analytical laboratories analyze samples in accordance with established methods and provide data packages and explanations of results to support data validation. The laboratories must meet site-specific QA requirements and must have an approved QA plan in place. The contract laboratories must be on the Mission Support Alliance Evaluated Suppliers List and be accredited by Ecology for the analyses performed for the Soil and Groundwater Remediation Project.

2.1.17 Sample Management and Reporting

Sample Management and Reporting is responsible for interfacing between the OU Technical Lead, the Field Sampling Operations (FSO), the Well Maintenance Organization, and the analytical laboratories. Sample Management and Reporting coordinates the laboratory analytical work and ensures that the laboratories conform to Hanford Site internal laboratory QA requirements (or their equivalent), as approved by DOE and EPA. Sample Management and Reporting receives analytical data from the laboratories, enters the data into the Hanford Environmental Information System (HEIS) database, and arranges for data validation. Sample Management and Reporting is responsible for informing the project manager of any issues reported by the analytical laboratories. In addition, Sample Management and Reporting is responsible for monitoring the entire sample and data process, and informing the 200-ZP-1 OU Project Manager or Technical Lead or both of any issues reported by the analytical laboratory.

2.1.18 Waste Management Lead

The Waste Management lead communicates policies and procedures, and ensures project compliance for waste storage, transportation, disposal, and tracking in a safe and cost-effective manner. Other responsibilities include identifying waste management sampling and characterization requirements to ensure regulatory compliance; and interpreting data to determine waste designations, profiles, and other documents to confirm compliance with waste acceptance criteria.

2.1.19 Field Sampling Organization

The Field Sampling Organization (FSO) is responsible for planning, coordinating, and conducting field sampling activities. The FWS directs the NCOs (samplers) and ensures they are appropriately trained and available; reviews the SAP for field sample collection concerns, analytical requirements, and special sampling requirements; and ensures the sampling design is understood by the NCOs and can be performed as specified by performing mock-ups and holding practice sessions with field personnel.

The NCOs collect all salient samples in accordance with sampling documentation, complete field logbook entries, chain-of-custody forms, shipping paperwork, and ensure delivery of the samples to the analytical laboratory.

The FWS acts as a technical interface between the OU Project Manager and the field crew supervisors (such as the Drilling Buyer's Technical Representative [BTR], and Geologist-BTR) and ensures technical aspects of the field work are met. In consultation with the OU Project Manager and SMR, the FWS resolves issues arising from translation of technical requirements to field operations and coordinates resolution of sampling issues

2.1.20 Well Maintenance

The Well Maintenance Manager is responsible for well maintenance activities and coordinating with the OU Technical Lead to identify field constraints that could affect groundwater sampling.

2.2 Operations and Maintenance Program

The O&M program adopted for the 200 West P&T was based on the O&M programs developed for existing P&T systems in the 100 and 200 Areas (e.g., 200-ZP-1 interim P&T system). This O&M program relies on an automated electronic information management platform for creating, storing, and updating the components of the O&M program on the Hanford local area network. The O&M program information specific to the 200 West P&T was uploaded into the electronic platform after the remedial design report was finalized and vendor information submittals were received during construction. The electronic information residing in this platform references the location of any supporting information not contained within the system (e.g., hardcopy vendor submittal information). The information contained within the electronic platform addresses the following topics, as appropriate:

- System description, including an overview of system equipment and treatment processes
- Operating parameters and procedures for the facility, including each of the critical unit processes (e.g., biological systems and air stripping)
- Vendor equipment specifications (e.g., fundamental technical information concerning each unit's process step, construction materials, and pump curves)
- System O&M information, including equipment manufacturer and vendor-supplied O&M manuals (specific to individual system components or equipment)
- Preventive and corrective maintenance information for monitoring system equipment and process operations
- Standard operating procedures addressing system and component repairs
- Master equipment and spare parts list
- System transient condition response actions and procedures
- Emergency response plan
- Warranty data and information
- Training procedures
- Process liquid stream sampling and reporting requirements

The operator training necessary to operate and maintain the P&T system includes required health and safety training and specialized training by equipment vendors or design personnel. A training plan was issued and included in the O&M program.

2.3 Operations and Process Optimization

System performance assessment is conducted during operations to monitor P&T system operations to ensure that each system is operating in accordance with the approved specifications, and is operational and functional. Data collected during this assessment include the following:

- Process monitoring data
- Performance monitoring data
- Air monitoring data
- Waste management data
- Preventative and corrective maintenance data

The data collected during operations are used for process optimization. Figure 2-2 provides an overview of O&M and monitoring inputs for process optimization. Process optimization is ongoing and relies on remedy performance monitoring data. The data are evaluated to make decisions on the scope of the future modifications and expansion to the 200 West P&T.

Performance monitoring, air monitoring, and waste management data are provided to EPA in a quarterly briefing presentation and are summarized in the performance monitoring report (described in Section 5.1 of this O&M plan).

Figure 2-2 also shows the decision process that is used to determine whether RAOs are being achieved, and whether system expansion or modification is necessary. If it is determined that RAOs are not achievable, even with additional system expansion or modification, a demonstration of technical impracticability and modification of RAOs may be necessary.

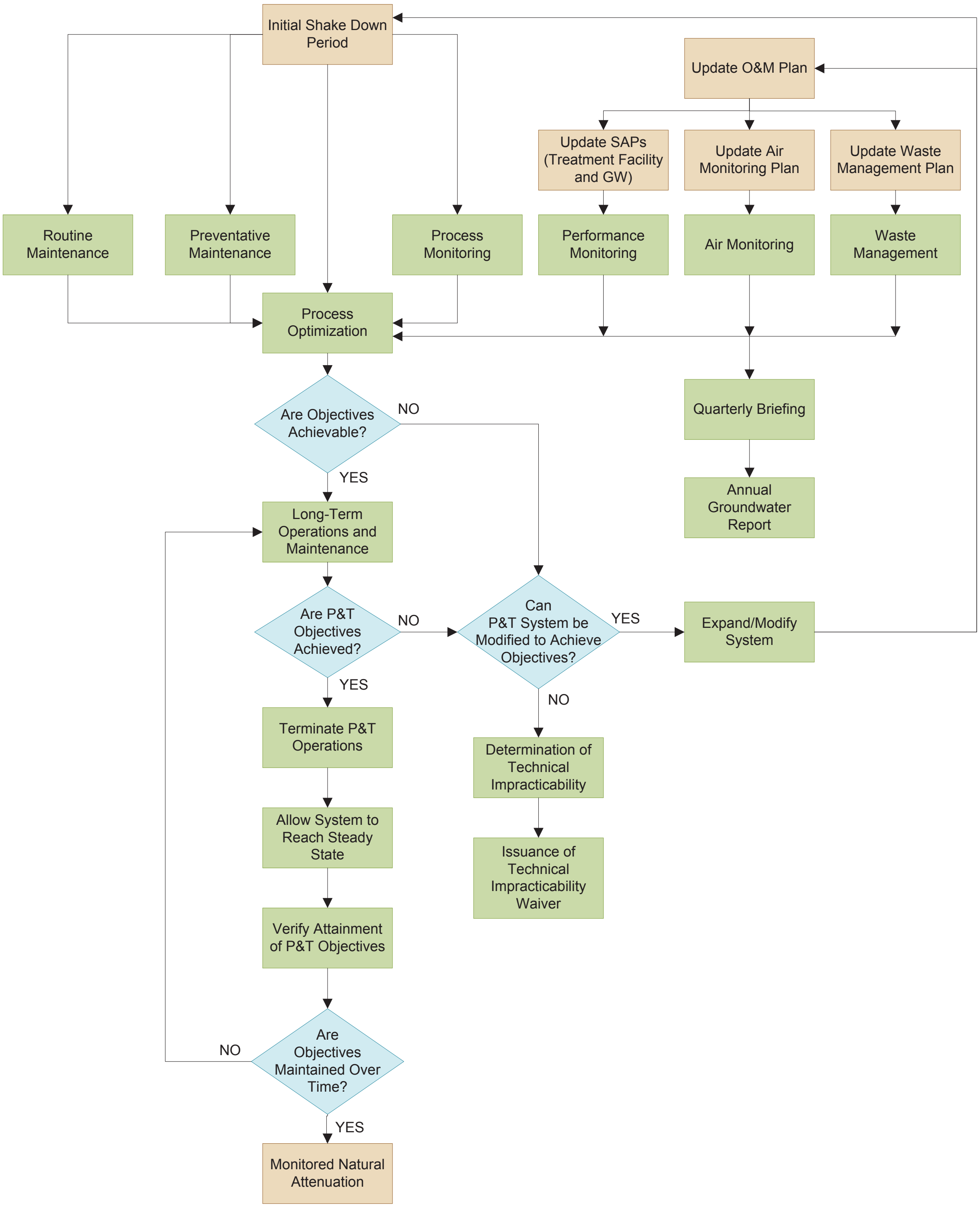

Figure 2-2. System Optimization, Modification, and Long-Term Operation

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3 Operations and Maintenance

This chapter presents information associated with routine and nonroutine O&M of the 200 West P&T and other remedy components requiring O&M. An effective O&M program is essential for successful completion of 200-ZP-1 and 200-UP-1 OU remedial actions. A thorough and well-implemented preventative maintenance program ensures that equipment is properly maintained and provides for early detection of problems.

3.1 Pump-and-Treat System Operational Criteria

Routine operation of the 200 West P&T consists of drawing groundwater from a network of extraction wells, pre-treating a portion of the flow to remove uranium and technetium-99, combining the post-treated stream with the balance of flow, and conveying the blended stream to the central treatment facility for the removal of COCs and other constituents. Following treatment, the treated water is returned to the aquifer through a series of injection wells.

The treatment system has the capacity to treat 9,464 L/min (2,500 gpm). Operational up-times are expected to average 80 percent. The operational up-time is calculated using a 12-month rolling average.

3.2 Routine and Preventative Operations and Maintenance

Routine and preventative maintenance of P&T system components is performed in accordance with engineering evaluations and approved procedures. An overall preventative maintenance schedule was developed for equipment (e.g., extraction well pumps, transfer pumps, and blowers) using the information provided in these procedures and according to manufacturer and vendor guidelines. The schedule is incorporated into the O&M program.

Routine and preventative maintenance activities are documented in accordance with work control procedures, and the work packages are maintained in project records. A general summary of maintenance activities is provided in the annual report.

3.3 Transient Conditions

During routine P&T system operation, instances may occur where periodic sampling or other information identifies the presence of COCs in the final effluent stream at concentrations above the ROD cleanup levels, or where the influent stream contains a new contaminant (not identified in the ROD) at concentrations greater than a federal or state drinking water MCL or other protective level. In these instances, confirmation sampling may be performed and individual treatment processes may be evaluated to assess treatment efficiency. During such events, the P&T system will continue to operate at the previous flow rate or the throughput rate may be reduced.

If the presence of a transient condition is confirmed, the event will be documented in the operating record, along with the following information:

- Concentration of COCs detected that exceeded ROD cleanup levels, or the concentration of new contaminants that exceeded MCLs or other protective concentrations
- Location(s) and date(s) sampled
- Concentrations of COCs or new contaminants detected during previous sampling events
- Corrective actions taken

Significant transient conditions will be discussed with the regulatory agencies at the periodic briefings and will be summarized in the annual report.

3.4 Corrective Maintenance

Corrective maintenance consists primarily of unplanned repairs or replacement of system components after components have failed. Typical examples include worn-out pumps, leaky pipe joints, and failed electronic components. If a failure occurs, the system will be evaluated to determine if there is an alternative operating configuration, the possible cause of the problem, and what actions should be taken to correct the problem. Corrective maintenance activities will then be performed in accordance with approved maintenance procedures or the manufacturer’s recommended procedures, or both.

Corrective maintenance activities will be documented in the job control system, and a summary of these activities will be provided in the annual report. Depending on the scope of corrective maintenance activities, the routine and preventative maintenance schedule may be reviewed and modified.

3.5 Operations and Maintenance Practices, Inspection, and Training

Routine inspection and maintenance activities are necessary to ensure the long-term integrity and success of the remedy. This section summarizes typical inspection and maintenance needs for the proper care and efficient operation of each remedy component, with primary emphasis on the 200 West P&T. Equipment-specific inspection forms and a preventative maintenance schedule will be developed using information contained in the manufacturer and vendor-supplied manuals. The forms will be incorporated into the O&M program.

Anticipated repair, replacement, and rehabilitation are also discussed in this section. Repair includes those activities of a routine nature that maintain the remedy in a well-kept condition. Replacement covers those activities performed when a worn-out component, or portion thereof, is replaced. Rehabilitation refers to a set of activities performed as necessary to bring deteriorated equipment back to its original condition. Repair, replacement, and rehabilitation actions are expected to conform to the original as-built plans and specifications.

The majority of the inspection and maintenance work will be performed using work packages developed from manufacturer recommendations or approved procedures or both. The following subsections summarize several of the key activities associated with the 200 West P&T inspection and maintenance program.

3.5.1 Personnel Training Program

Operations personnel will undergo classroom and on-the-job training. This training will cover facility startup, facility shutdown, operation adjustments, and other topics to be determined. The training will enable the operators to experience a number of routine and nonroutine events prior to actual hands-on contact with operations and equipment.

In addition to operator training, operations personnel undergo other Hanford Site training as required. The 200 West P&T operations manager will periodically review the training records of active O&M personnel to determine if additional or refresher training is required.

3.5.2 Hazard Communication Program

CHPRC maintains a hazard communication program to inform employees of hazards that may be encountered in the work place. The scope of this training is covered under an existing operating procedure in accordance with the 29 CFR 1910.120, "Occupational Safety and Health Standards," "Hazardous Waste Operations and Emergency Response."

3.5.3 Routine Procedures

A number of approved routine procedures were developed for inclusion in the O&M program to provide operators with the information necessary to perform typical day-to-day activities, such as the following:

- Housekeeping inspections
- Conveyance piping inspections
- Waste storage area inspections
- Instrument calibrations
- Inspections of facility equipment and machinery, and routine adjustments
- Inspections of tanks, secondary containment devices, and sumps

3.5.4 Treatment Facility Operation Procedures

Treatment system startup and shutdown are described in operations procedures. These procedures provide the necessary information and direction to properly start up, operate, and shut down the radionuclide pre-treatment facilities and the central treatment facility. These procedures include the operational steps needed to place the system into a normal operating lineup and place the system in service. These procedures also include the steps for performing a routine system shutdown. In addition, the following operating procedures may be prepared as individual activities, as determined by operations for inclusion in the O&M program:

- IX resin changeout
- VPGAC changeout for regeneration
- FBR and membrane bioreactor operations
- Filter changeout
- Changeout of chemical tank and bulk chemical storage

3.5.5 Treatment Process Monitoring

Sampling of influent and effluent from individual treatment processes is conducted to assess performance and changeout requirements (IX resin and VPGAC), and to ensure optimum FBR, membrane aeration tank, and air stripper performance under one or more operating procedures. These procedures were developed based on information supplied in the equipment manufacturers' manuals and by experience gained during startup operations.

3.5.6 Waste Handling Procedures

All waste streams associated with operation and decommissioning of the 200 Area P&T are managed in accordance with the WMP (Appendix B).

3.5.7 Safety Equipment Procedures

Approved operating procedures were developed to address the use and maintenance of safety equipment within the radionuclide pre-treatment facility and the central treatment facility.

3.5.8 Emergency Equipment Inspection and Maintenance Procedures

Approved operating procedures were developed to address the use, inspection, and maintenance of portable fire extinguishers, emergency lights, tank alarms, spill cleanup, and other protection systems.

3.5.9 Emergency Response Procedures

Approved operating procedures were developed to address the steps to be taken when an emergency indicator is triggered or an abnormal condition occurs. These procedures include the operational steps for determining the cause of an emergency, isolating it, and shutting down the system (if necessary) so influent or effluent will not be discharged from the containment system.

3.6 Inspection Requirement

The following subsections describe typical inspections for the 200 West P&T.

3.6.1 Extraction and Injection Well Inspection and Rehabilitation

Extraction and injection wellhead piping and fittings and aboveground conveyance piping are visually inspected periodically to detect leaks. The inspection findings are documented in a paper or electronic format that is maintained in the work control system.

Extraction and injection well performance often declines over time, resulting in lower throughput. Reduction in extraction well production or injection well capacity (if it occurs) can be corrected using routine well development and rehabilitation procedures (DOE/RL-2010-78, *200 West Area Groundwater Pump-and-Treat Facility Extraction and Injection Well Maintenance Plan*). The 200 West P&T O&M plan shall allow for addition of sodium hypochlorite or other chemical(s) for the purpose of preventing bio-fouling in the injection wells and other treatment system components, as desired.

To assess the need for well maintenance, extraction well pumping and injection rates are correlated with water-level measurements at each well to detect changes that could potentially affect well performance. Steadily declining pumping water levels at extraction wells or steadily increasing water levels at injection wells may indicate the need for well maintenance. An extraction and injection well monitoring and maintenance plan was developed to support 200 West P&T operations (DOE/RL-2010-78). Extraction and injection well maintenance and rehabilitation are discussed in the annual performance monitoring report.

3.6.2 Monitoring Well Inspections

The physical condition of monitoring wells is documented in field logbooks during each sampling event. Conditions requiring maintenance or repair are noted and communicated to the 200 West P&T operations manager.

3.6.3 Conveyance Piping Inspection

A majority of the conveyance piping between the extraction wellheads and the treatment building is located aboveground. During operations, flow monitoring for early leak detection is used. Flow-meter measurements are taken between the wellhead and the transfer station and between the transfer station and the 200 West P&T. If a difference of ±5 percent occurs between flow at the facility or transfer building or both and at the wellhead, an alarm will be triggered. The well pump and pipeline will then automatically shut down, and the potential leak will be inspected.

A majority of the conveyance piping between the injection wellheads and the treatment building is also located aboveground. During operations, flow monitoring is used in the same manner as the extraction conveyance piping for the piping that conveys treated groundwater to the western injection wells in the vicinity of the 200 West Area burial grounds. This supports the nuclear safety basis requirements for the burial grounds. Since groundwater treated at the 200 West P&T is regarded to no longer contain the F001 through F005 listed waste codes (TPA-CN-525, *Change Notice for Modifying Approved Documents/Workplans in Accordance with the Tri-Party Agreement Action Plan, Section 9.0, Documentation and Records: DOE/RL-2009-124, 200 West Area Pump-and-Treat Facility Operations and Maintenance Plan*), flow monitoring is not needed for the conveyance piping for the eastern injection wells located near the Hanford meteorological tower. However, visual inspections for leaks occur during normal-shift operator rounds.

3.6.4 General Inspections

Daily (i.e., normal work days, currently Monday through Thursday) observations and inspections are performed as specified in facility procedures. Facility component inspections (e.g., tank inspections, fence and posting observations, and site physical conditions) are also performed. Routine inspections are performed for support systems such as decontamination equipment, spill kits, eye washes, safety showers, and fire extinguishers. Inspections of nonroutine activities (e.g., groundwater monitoring, sampling, or short-term tests) are completed as indicated in the individual plans controlling those activities.

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4 Monitoring

As described in the final 200-ZP-1 and interim 200-UP-1 RODs and summarized in Chapter 1, the selected remedies combine P&T, MNA, flow-path control, and ICs to achieve the RAOs. This chapter describes the monitoring program implemented to assess performance of the 200-ZP-1 Groundwater OU remedy. The sampling design presented in this chapter is based on the evaluations and groundwater monitoring activities presented in the *Performance Monitoring Plan for the 200-ZP-1 Groundwater Operable Unit Remedial Action* (DOE/RL-2009-115). For the 200-UP-1 OU, a separate PMP was prepared to define remedy performance monitoring requirements (DOE/RL-2015-14).

Monitoring data will be collected over the lifecycle of the remedy to evaluate its performance and optimize effectiveness. Groundwater quality and groundwater elevation data are collected and evaluated to determine progress toward the specific performance monitoring goals shown in Table 4-1. The monitoring locations, monitoring period and frequency, parameters measured, and data uses are summarized in Table 4-2. Performance monitoring consists of short- and long-term monitoring tasks during various periods of the remedial action. Reviews of hydraulic and contaminant monitoring networks occur periodically, and individual wells are added or removed, as appropriate. Evaluations of monitoring frequencies and parameters also occur periodically for each location and are revised as appropriate. Any changes made to monitoring frequencies or parameters are made with DOE and EPA concurrence.

Table 4-1. 200-ZP-1 OU Performance Monitoring Goals and Data Requirements

Performance Monitoring Goals[a]	Data Requirements			
	Groundwater Sample Data from Monitoring Wells	Sample Data from Extraction Wells/ Treatment Plant Influent	Groundwater Elevations	Extraction/ Injection Well and System Flow Data[b]
1a. Determine if there are any new releases of COCs.	X			
1b. Determine if any new releases of COCs could impact the treatment process (the effectiveness of the remedy).	X	X		X
1c. Evaluate if any new releases are outside of the hydraulic capture zone of the P&T system.			X	
2. Determine if potentially toxic and/or mobile transformation products are being generated within OU groundwater.	X			
3. Determine if changes are occurring in environmental conditions (hydrogeological, geochemical, or microbial) that may reduce the efficacy of the P&T system, natural attenuation processes, and flow-path control actions.	X		X	

Table 4-1. 200-ZP-1 OU Performance Monitoring Goals and Data Requirements

Performance Monitoring Goals[a]	Data Requirements			
	Groundwater Sample Data from Monitoring Wells	Sample Data from Extraction Wells/ Treatment Plant Influent	Groundwater Elevations	Extraction/ Injection Well and System Flow Data[b]
4. Verify that contamination is not expanding downgradient, laterally, or vertically.	X		X	
5a. Verify and/or predict if the P&T system will remove at least 95 percent of the mass of COCs from 200-ZP-1 OU groundwater in 25 years or less.	X	X	X	X
5b. Determine if the current remedy design is predicted to achieve cleanup levels for all COCs within 125 years.	X	X	X	X
6. Determine if remediation has been successfully completed.	X	X	X	

a. From the *Record of Decision, Hanford 200 Area, 200-ZP-1 Superfund Site, Benton County, Washington* (EPA et al., 2008).

b. Extraction rate, injection rate, and flow volumes.

COC = contaminant of concern

OU = operable unit

P&T = pump and treat

4.1 Performance Monitoring

The performance monitoring program consists of water-level measurements and groundwater sampling using a monitoring and extraction well network. The following subsections briefly summarize the planned data collection associated with baseline monitoring, short-term monitoring (first through third years), and long-term monitoring (fourth to twenty-fifth years). Appendix D and DOE/RL-2009-115 provide details.

4.1.1 Baseline Monitoring

Baseline monitoring for the 200-ZP-1 OU was conducted in 2011 and 2012 and for the 200-UP-1 OU in 2014 and 2015 to characterize the initial groundwater flow field and COC distribution from a monitoring well network based on recommendations in DOE/RL-2009-115. Current and future data are compared with baseline conditions to evaluate changes resulting from pumping operations. The laboratory results from the 200-ZP-1 OU baseline monitoring showed that for certain analytes the data were consistently below the cleanup levels defined in the 200-ZP-1 ROD. As a result, contaminant-specific monitoring networks were defined for each isolated contaminant plume, which includes the first downgradient monitoring well from each plume.

Table 4-2 Monitoring Locations, Monitoring Period and Frequency, Parameters, and Data Uses for 200-ZP-1 OU Performance Monitoring

Data	Location[a]	Baseline	Short-Term Operations and Optimization[b]	Long-Term Operations and Monitoring[c]	Post-P&T	Frequency[d]	Parameters[d]	Data Use
Groundwater elevations	Hydraulic monitoring network	X				Once.	Manual or automatic measurement of groundwater levels.	Constructing groundwater elevation contour maps for determining groundwater elevations, flow directions, and gradients before system startup.
	Hydraulic monitoring network		X	X		Annually to semicontinuously.	Combination of manual and automatic measurement of groundwater levels.	Monitoring sustainability of extraction rates and rebalancing flow rates. Constructing contour maps for evaluating groundwater flow directions and hydraulic gradients, and hydraulic capture and flow control.
	Hydraulic monitoring network				X	At least every 5 years.	Combination of manual and automatic measurement of groundwater levels.	Evaluating flow directions and hydraulic gradients.
Groundwater monitoring (contaminants, biogeochemical, and field screening)	Contaminant-specific[e] monitoring network Networks to be evaluated annually		X	X		Annually. Evaluate reduction in frequency at some wells from annually to biennially.	COCs and other contaminants (Table 4-3). Biogeochemical and field screening (Table 4-4). To be reviewed periodically for reductions in analytes.	Constructing three-dimensional contaminant plume shells, evaluating concentration trends, evaluating plume boundaries, evaluating plume capture, evaluating natural attenuation, determining if there are any new releases or transformation products, and predicting and confirming progress toward performance goals.
	Contaminant[e] monitoring network (to be evaluated)				X	At least every 5 years. To be evaluated.	Selected COCs and other contaminants (Table 4-3). Biogeochemical and field screening (Table 4-4).	Evaluating progress toward monitored natural attenuation performance goals.
Influent monitoring (contaminants)	Extraction wells	X				Once.	All contaminants in Table 4-3.	Determining groundwater contaminant distribution at system startup.
	Extraction wells		X[a]	X[a]		Quarterly during initial P&T operation. Possible reduction to semiannual or annual after contaminant plume stabilizes. Reviewed periodically for reduction in analytes.	All contaminants in Table 4-3.	Calibrating COC plume shells, calculating mass removing and optimizing mass removal performance for each well, and monitoring for new COCs.
	Combined treatment plant influent		X			Monthly.	Table 4-3.	Calculating contaminant mass removal.
Flow rates and volumes	Extraction wells, injection wells, and combined treatment plant influent		X	X		Semicontinuously.	Automatic measurements of instantaneous flow and totalized flow rates.	Monitoring sustainability of extraction and injection rates, rebalancing flow rates, calculating COC mass removal. Input to groundwater model and plume shell calibration. Evaluating flow control.

a. Hydraulic and contaminant monitoring networks are defined in DOE/RL-2009-115 and are reviewed periodically and individual wells added or dropped, as appropriate, with concurrence of the regulatory agency. Influent and effluent monitoring are described in Appendix D.

b. During initial P&T operations (2012-2015).

c. After contaminant concentrations and system operations have stabilized.

d. Monitoring frequencies and parameters are periodically evaluated and revised as appropriate for each location.

e. Contaminant-specific monitoring network refers to a monitoring well network defining the contaminant plume for each contaminant of concern; the contaminant monitoring network includes monitoring wells across the 200 West area including all contaminants of concern.

COC = contaminant of concern

P&T = pump and treat

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A single round of groundwater elevation data was collected from the monitoring well network in 2012 to provide a baseline set of hydraulic data used to evaluate groundwater flow directions and gradients (horizontal and vertical) in the 200 West Area prior to P&T system startup. The 200-ZP-1 interim action P&T system was active until May 2, 2012 when it was shutdown to transition to the 200 West P&T. The hydraulic monitoring well network (Figure 4-1) includes a network of monitoring wells screened at depth intervals within the aquifer that cover elevations ranging from the basalt bedrock to the water table surface. A few of the monitoring wells are located in close proximity to several of the extraction wells. The monitoring wells cover a spatial area that exceeds the boundaries of the COC plumes (except nitrate) and the influence of the P&T system. A majority of the measurements are collected manually but are supplemented with data obtained from wells equipped with transducers and data loggers. The data from the baseline event were used to construct groundwater elevation contour maps for determining groundwater elevations, flow directions, and gradients prior to system startup.

During the baseline sampling event, groundwater samples were collected from the monitoring well network (Figure 4-2) and analyzed for COCs, other potential contaminants listed in Table 4-3, and the biogeochemical and field screening parameters listed in Table 4-4.

Baseline samples were also collected from the groundwater extraction wells during the well installation and development process and from the combined treatment plant influent. The samples were analyzed for the contaminants listed in Table 4-3.

4.1.2 Short-Term Performance Monitoring

Performance monitoring is conducted during P&T operations to obtain data used to evaluate progress, assess aquifer and COC plume response to pumping, and optimize extraction and injection well pumping rates for system performance. Short-term performance monitoring refers to the first 3 years of operation (2012 through 2015).

While the P&T system is operating, groundwater elevation data are collected from the hydraulic monitoring well network on an annual basis. Additional wells will be equipped with transducers or existing transducer locations will be shifted as needed. Water-level data are used to monitor the sustainability of extraction rates and the need to rebalance flow rates to optimize capture zone boundaries. Water-level data are also used to construct groundwater elevation contour maps for evaluating groundwater flow directions, hydraulic gradients, and hydraulic capture and flow control.

Flow rates are measured in each extraction and injection well and for the combined treatment plant influent using in-line flow meters on a semicontinuous basis. This information is recorded by the programmable logic controller and is extracted as needed for use in optimizing flow rates and calculating COC mass removed. Results are also used as input parameters to the numerical groundwater flow and plume shell models described in the 200-ZP-1 and 200-UP-1 OU PMPs (DOE/RL-2009-115 and DOE/RL-2015-14).

Groundwater samples will be collected from the monitoring well network annually (Figure 4-2) until determined through concurrence from EPA and RL. The samples are analyzed for COCs and other potential contaminants listed in Table 4-3 and the biogeochemical and field screening parameters listed in Table 4-4. The monitoring plan is evaluated annually to determine if wells should be dropped from or added to the network, or if any monitoring frequency changes are warranted. Results are used to construct three-dimensional contaminant plume shells; evaluate concentration trends, plume boundaries, and plume capture; and determine if there are any new releases or occurrences of COC transformation products. The concentration trends and plume models are used to confirm and predict progress toward performance goals. Monitoring results will be communicated to EPA in quarterly briefings and documented in the annual P&T report and CERCLA 5-year review.

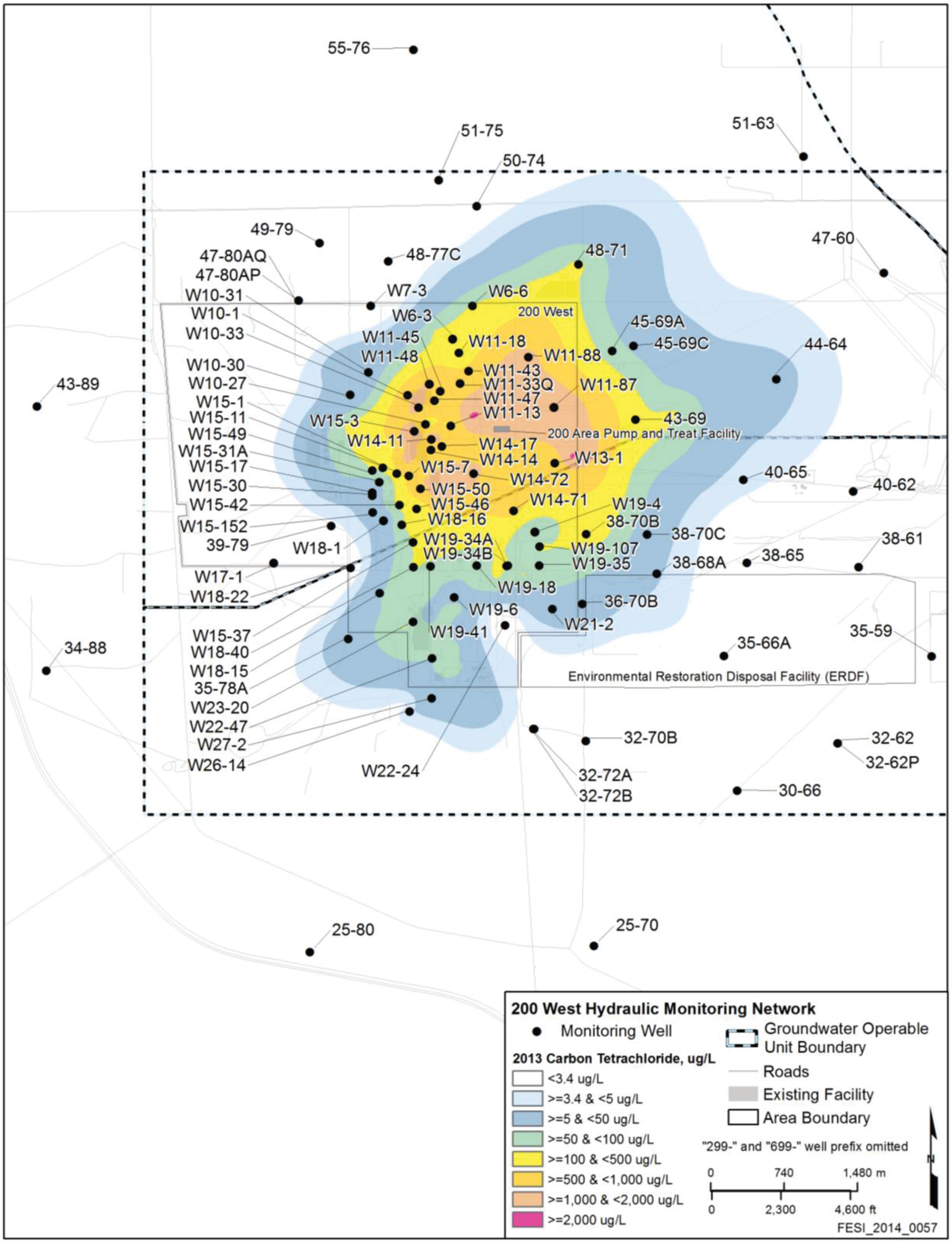

Figure 4-1. Hydraulic Monitoring Well Network

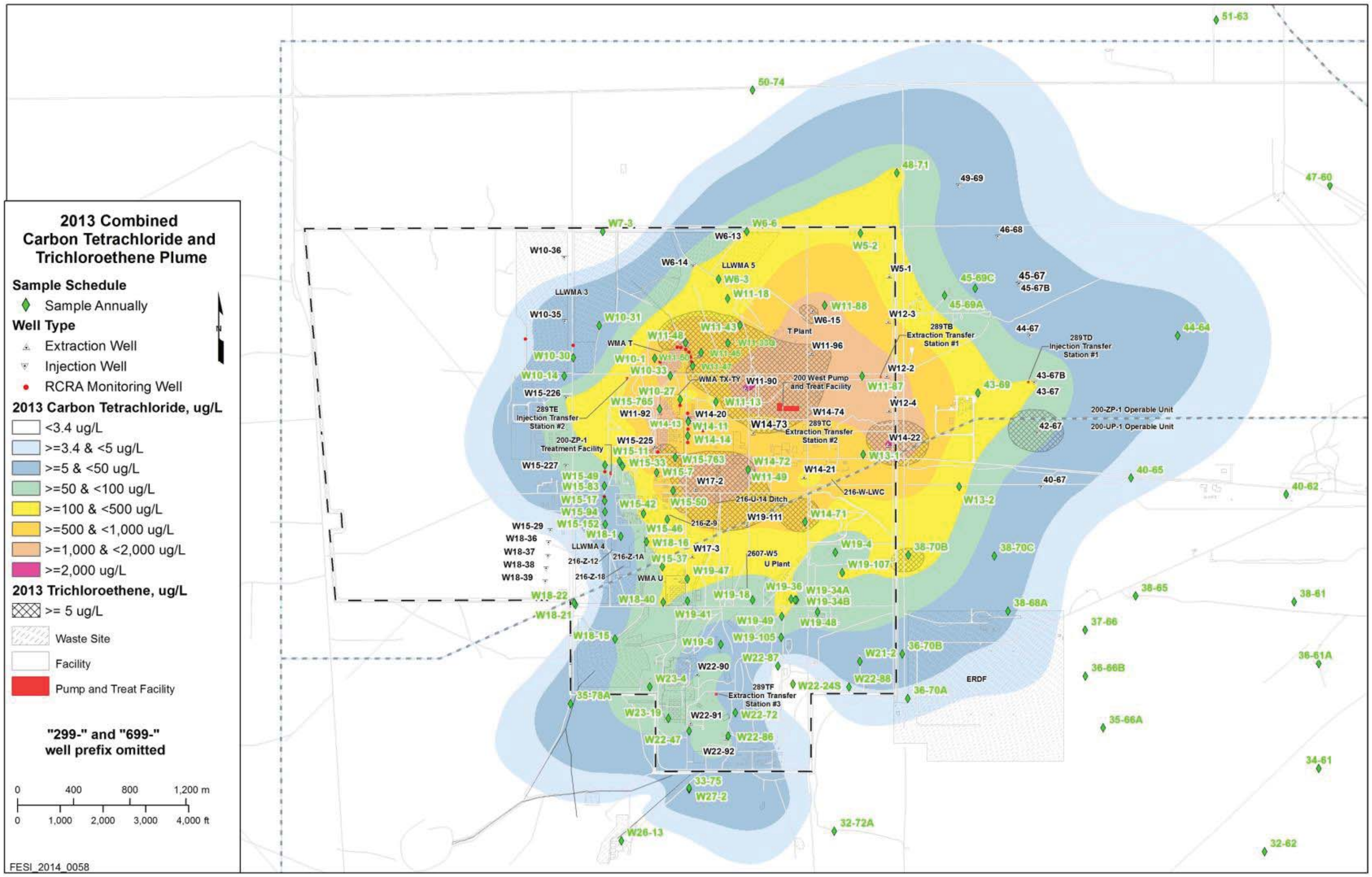

Figure 4-2. Contaminant Monitoring Well Network

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Table 4-3. Contaminant Monitoring Constituents

Constituent	Acceptable Detection Limit	Units	Data Use
COCs			
Carbon tetrachloride	3.4[a]	µg/L	Delineate carbon tetrachloride plume
Chromium (total)	100	µg/L	Delineate chromium plume
Hexavalent chromium	48	µg/L	Delineate chromium plume
Nitrate as nitrogen (as nitrate)	10,000[b] (45,000)	µg/L	Delineate nitrate plume
Trichloroethene	1[a]	µg/L	Delineate trichloroethene plume
Iodine-129	1	pCi/L	Delineate iodine-129 plume
Technetium-99	900	pCi/L	Delineate technetium-99 plume
Tritium	20,000	pCi/L	Delineate tritium plume
Uranium (from 200-UP-1 OU)	30[b]	µg/L	Delineate uranium plume
Other Potential Contaminants			
Chloride	1,000	µg/L	Evaluate chlorinated solvent natural attenuation
Chloroform	70[b]	µg/L	Evaluate carbon tetrachloride natural attenuation
Chloromethane	NA[c]	NA	Evaluate carbon tetrachloride natural attenuation
cis-1,2-Dichloroethene	70[b]	µg/L	Evaluate carbon tetrachloride natural attenuation
Dichloromethane	5[b]	µg/L	Evaluate carbon tetrachloride natural attenuation
Nitrite as N (as nitrite)	1,000[b] (3,300)	µg/L	Evaluate nitrite natural attenuation
Vinyl chloride	2[b]	µg/L	Evaluate carbon tetrachloride natural attenuation

a. DOE will clean up COCs for the 200-ZP-1 OU subject to WAC 173-340, "Model Toxics Control Act—Cleanup" (carbon tetrachloride and trichloroethene), so the excess lifetime cancer risk does not exceed 1×10^{-5} at the conclusion of the remedy.

b. Federal drinking water standard.

c. No federal drinking water standard has been promulgated for this constituent.

COC = contaminant of concern

DOE = U.S. Department of Energy

NA = not available

OU = operable unit

4.1.3 Long-Term Performance Monitoring

The following subsections summarize the requirements for long-term performance monitoring of P&T system operations and post-P&T MNA.

4.1.3.1 Long-Term Operations and Monitoring During Pump-and-Treat

Long-term P&T system monitoring includes collecting groundwater elevation data, measuring flow rates, monitoring groundwater, and monitoring P&T influent and effluent.

Water levels are measured annually. Results are used to confirm continued hydraulic capture and flow control.

Flow rates are measured in each extraction well and injection well and for the treatment facility influent using in-line flow meters on a semicontinuous basis. Results are used to adjust (increase, decrease, or shut down) extraction and injection well flow rates to optimize flow patterns and to calculate the COC mass removed. Additionally, results are used as input parameters to the groundwater and plume shell models.

Table 4-4. Biogeochemical and Field Screening Monitoring Parameters

Constituent	Preferred Method	Units	Data Use
Biogeochemical Parameters			
Total organic carbon	EPA 415.1*	mg/L	Evaluate natural attenuation
Total dissolved solids	EPA 160.1*	mg/L	Evaluate natural attenuation, identify new releases
Sulfate	EPA 300.0A*	mg/L	Evaluate natural attenuation
Sulfide	EPA 9215*	mg/L	Evaluate natural attenuation
Iron	EPA 6010B*, 200.8, 6020, or equivalent	µg/L	Evaluate natural attenuation
Manganese	EPA 6010B*, 200.8, 6020, or equivalent	µg/L	Evaluate natural attenuation
Alkalinity	EPA 310.1*	mg/L as CO_3	Evaluate natural attenuation
Carbonate content (bicarbonate and carbonate)	EPA 310.1*	mg/L as CO_3 and HCO_3	Evaluate natural attenuation
Field Screening Parameters			
Temperature	Hach HQ40d or equivalent	°C	Evaluate well purge for sampling
pH	Hach HQ40d or equivalent	pH unit	Evaluate well purge for sampling
Specific conductance	EPA 1201.1*	mS/cm	Evaluate well purge for sampling
Turbidity	Hach 2100P turbidimeter HQ40d or equivalent	NTU	Evaluate well purge for sampling
Dissolved oxygen	Hach HQ40d or equivalent	mg/L	Evaluate natural attenuation
Reduction-oxidation potential	USGS, *National Field Manual for the Collection of Water-Quality Data*	mV	Evaluate natural attenuation

* SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B.*

NTU = nephelometric turbidity unit

USGS = U.S. Geological Survey

Groundwater samples are collected from the monitoring well network annually or once every 5 years in preparation for the CERCLA 5-year review. The monitoring program will be evaluated prior to initiating long-term operations to adjust monitoring locations and frequencies. Samples are analyzed for COCs and other potential contaminants listed in Table 4-3 and for the biogeochemical and field screening parameters listed in Table 4-4. The results are used to construct three-dimensional contaminant plume shells; evaluate concentration trends, plume boundaries, and plume capture; and determine if there are any new releases or transformation products. The concentration trends and plume models are used to confirm and predict progress toward performance goals. Modeling will also be used to optimize flow rates to maximize mass recovery of contamination.

Monitoring results from the 200 West P&T will be communicated in quarterly briefings to EPA and documented in the annual P&T report and CERCLA 5-year review.

4.1.3.2 Long-Term Operations and Monitoring After Pump-and-Treat

After the P&T system is shut down, natural attenuation of remaining contamination will continue. Monitoring is required during this period to evaluate the progress of natural attentuation and to determine when cleanup levels are achieved.

The frequency of hydraulic monitoring in the monitoring wells will be evaluated based on how rapidly the water table stabilizes after shutdown of the P&T system. At a minimum, a synoptic set of hydraulic monitoring data will be collected from the hydraulic monitoring well network every 5 years in accordance with the 5-year review requirement described in the RODs. Results will be used to evaluate groundwater flow patterns, hydraulic gradients, and COC plume migration.

Groundwater samples will be collected from the monitoring well network at least every 5 years. The monitoring plan will be re-evaluated at the completion of long-term P&T operations to determine monitoring locations and frequencies. The samples will be analyzed for COCs, other potential contaminants listed in Table 4-3, and the biogeochemical and field screening parameters listed in Table 4-4. Concentration trends and plume models will be used to confirm and predict progress toward natural attenuation performance goals. Monitoring results will be communicated and documented in the CERCLA 5-year review.

4.2 Compliance Matrix

The CM is presented in Appendix A. The purpose of the CM is to consolidate the 200-ZP-1, 200-UP-1 OU, 200-DV-1 OU, and 200-BP-5 OU compliance requirements such as federal and state ARARs and other conditions established in each ROD or other regulatory document, and in the remedial action/remedial design work plans (DOE/RL-2008-78; DOE/RL-2013-07).

The CM assembles, in one location, a comprehensive summary of compliance requirements for the selected remedies, including air and groundwater monitoring obligations and associated reporting requirements. The overarching objective of the CM is to provide the 200 West P&T project team (particularly the 200 Area P&T operations manager, the environmental compliance officer, and the waste management representative) with the means to track the status of remedy requirements. This capability will confirm that compliance performance is satisfactory and will avoid, or rapidly correct, potential noncompliance issues. The CM does not replicate specific project methodologies and procedures used to meet required actions (e.g., the PMP or AMP), but rather provides the most expedient means for a reviewer to locate where this reference information can be obtained. As a practical reference, the CM is formatted into tables with 200-ZP-1, 200-UP-1, 200-DV-1, and 200-BP-5 OU requirements that address the remedies' RAOs and ARARs. The tables cite a particular requirement, the source and location of the requirement (i.e., ROD or approved remedial design/remedial action work plan), a brief description of the requirement, whether the requirement has been achieved, or the location or both where compliance procedures and methods for meeting the requirement are documented.

The CM is a dynamic tool that should be updated to document the status of the required reduction of COCs throughout the 200-ZP-1, 200-UP-1, 200-DV-1, and 200-BP-5 OUs in the specific time periods approved by each decision document.

4.3 Air Emissions

The AMP, provided in Appendix C, is required because contaminated water from the 200-ZP-1, 200-UP-1, 200-DV-1, and 200-BP-5 OUs, and from ERDF leachate is treated in an aboveground facility with the potential to emit hazardous air pollutants. As required, the P&T system reduces the mass of COCs and other contaminants or treatment byproducts. The treatment system consists of IX for removal of radionuclides (technetium-99 and uranium); an anoxic FBR for removal of nitrate, metals, and carbon tetrachloride; an aerobic membrane bioreactor for the removal of residual carbon substrate, total suspended solids, biomass, and carbon tetrachloride; and an air stripper to remove remaining carbon tetrachloride. Off-gas from the stripper, FBR, membrane bioreactor, and biomass sludge thickener is commingled and treated with VPGAC prior to discharge via powered exhaust. A scrubber is used to remove any ammonia associated with biomass sludge. Compliance with Washington State requirements for radiological and air toxic emissions has been demonstrated by the calculations and modeling described in the AMP. Abatement controls and environmental monitoring for air toxic and radiological constituents are described in Sections C3 and C4 of the AMP, respectively.

4.4 Waste Management

The WMP, provided in Appendix B, is required because waste from the extraction and treatment of contaminated water from the 200-ZP-1, 200-UP-1, 200-DV-1, and 200-BP-5 OUs and from leachate collected at ERDF is generated and needs to be managed consistently with the substantive requirements of federal and state regulations identified as ARARs, in accordance with CERCLA Section 121. Throughout the conduct of this P&T remedial action, every effort will be made to minimize waste generation. All 200-ZP-1, 200-UP-1, 200-DV-1, 200-BP-5, and ERDF investigation-derived and remediation waste is managed in accordance with the WMP. The WMP establishes the requirements for the management and disposal of the remediation waste generated from the 200 West P&T and the investigation-derived waste generated from the groundwater investigation and monitoring activities at the 200-ZP-1, 200-UP-1, 200-DV-1, and 200-BP-5 OUs, and from leachate collected at ERDF.

In addition to the waste generated from P&T operations, the WMP also includes the requirements for management and disposal of investigation-derived waste generated from the installation, monitoring, sampling, maintenance, and decommissioning of wells in accordance with “Environmental Restoration Program Strategy for Management of Investigation-Derived Waste” (Ecology et al., 1999).

4.5 Cultural/Ecological Resources

Managing the cultural and biological resources of the Hanford Site is an essential component of RL resource trust responsibilities. Effective cultural and biological resource management is accomplished by implementing a program to ensure that all DOE facilities and programs comply with existing cultural resources and biological executive orders, laws, and regulations. DOE’s Hanford Cultural and Historic Resources Program conducts resource reviews on the Hanford Site before any project is initiated that involves disturbances to the land. If 200-ZP-1 and 200-UP-1 OU P&T activities extend to areas beyond those previously surveyed, Hanford Site Form RL-665, “Request for Cultural and/or Ecological Resources Review for the Hanford Site,” will be prepared and submitted. This review will establish compliance monitoring requirements, as appropriate, consistent with the Hanford Cultural and Historic Resources Program. Remedial activities will be coordinated to comply with any restrictions identified by the review with regard to endangered species, critical habitat, migratory birds, and cultural and archaeological resources.

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5 Periodic Reporting and Closure

This chapter describes periodic reporting for the 200 West P&T while the system is in operation, as well as final remedial action closure reporting once the 200-ZP-1 and 200-UP-1 OU RAOs have been met. A brief description of the CERCLA 5-year review process is also presented. The reports discussed in this chapter may be prepared as individual project-specific reports, or they may be combined into area-specific (i.e., Central Plateau annual report) or Hanford Sitewide reports.

5.1 Periodic System Operations and Remedy Performance Report

The water-level and groundwater quality monitoring data to be collected (described in Chapter 4) are evaluated and reported on an annual basis. The data evaluation and reporting frequency may change in the future as aquifer and plume response to pumping are better understood. A performance monitoring report, which is applicable for the early years of P&T system operation, would include information on P&T operations (e.g., average flow rates, contaminant monitoring results from the system and from the hydraulic monitoring well network, and mass removal), progress toward meeting remedial goals, and conclusions.

5.2 CERCLA Five-Year Review

In accordance with the NCP (40 CFR 300.430[f][4][ii]), DOE and EPA have agreed to conduct 5-year reviews for the 200 Areas because the selected remedies will not achieve levels that allow for unlimited use and unrestricted exposure within 5 years. Reviews will begin within 5 years after initiation of the remedial actions, at the time of the next periodic Hanford Site consolidated 5-year review, and will be conducted every 5 years until cleanup levels established in each ROD are attained. The reviews will be conducted pursuant to CERCLA Section 121(c) and as provided in *Comprehensive Five-Year Review Guidance* (EPA 540-R-01-007).

5.3 Closure Report

This section describes the final remedial action closure report and provides a brief summary of typical report content.

The remedy implementation process includes a remedial action phase, which involves construction and successful operation of the 200 West P&T.

During operations, routine O&M activities are required to maintain the remedy's effectiveness and integrity. The O&M phase is completed when the groundwater cleanup goals specified in the ROD are achieved. For the 200-ZP-1 OU, the O&M phase will include operation of the 200 West P&T and then MNA following P&T system shutdown.

A final remedial action report is prepared to document the cleanup activities that occurred and compliance with ROD requirements.

The final remedial action report will be prepared using the format provided in *Close Out Procedures for National Priorities List Sites* (EPA 540-R-98-016). The final remedial action report includes the following suggested primary sections:

- Chapter 1, Introduction
- Chapter 2, Summary of Site Conditions
- Chapter 3, Demonstration of Cleanup Activity Quality Assurance/Quality Control
- Chapter 4, Monitoring Results

- Chapter 5, Performance Standards and Construction Quality Control
- Chapter 6, Summary of Operation and Maintenance
- Chapter 7, Summary of Remediation Costs
- Chapter 8, Protectiveness
- Chapter 9, Five-Year Review
- Chapter 10, References

Additional information on the final remedial action reports is provided in EPA 540-R-98-016.

5.4 Records Management

The following records are associated with O&M of the 200 West P&T:

- Operating logs
- Field logbooks and laboratory reports
- Operating costs
- Emergency and transient condition events
- P&T system maintenance

6 Decontamination and Decommissioning

This chapter specifies the plans that will be in place to address D&D of the P&T system after the RAOs have been attained. Anticipated future land use after completion of P&T system D&D is also discussed.

Decontamination is a process whereby contaminants that have accumulated on or in equipment, tools, or treatment systems are removed or neutralized so they no longer present a hazard to human health or the environment. Decontamination efforts associated with 200 West P&T have been grouped into two activities: (1) activities that are interim (i.e., involved with day-to-day operations), and (2) activities that are associated with the final shutdown and decommissioning of the facility.

Decommissioning is the process of removing a facility that is no longer needed from service and removing and/or disposing equipment and materials in a manner that protects worker and public health and the environment. Under authority delegated by Executive Order 12580, *Superfund Implementation*, DOE is responsible for evaluating whether conditions at sites under DOE's jurisdiction pose a significant threat of release of hazardous substances, as defined by CERCLA. If a significant threat of release is identified, DOE is authorized to conduct removal action, remedial action, and any other response measures consistent with the NCP (40 CFR 300).

In accordance with *Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)* (DOE and EPA, 1995), decommissioning activities at facilities located on DOE sites will be conducted as non-time-critical removal actions under CERCLA, unless circumstances at the facility make it inappropriate. DOE will conduct a removal site evaluation, as directed by the NCP (40 CFR 300), to assess site conditions and determine whether a release or substantial threat of release exists at the facility. At any facility for which DOE conducts a removal site evaluation, DOE will consult with EPA and provide EPA with, as requested, information necessary for EPA to review such evaluation. At any facility where DOE determines that a release or substantial threat of release has not occurred, DOE will consult with EPA and provide any information necessary for EPA to evaluate such determination. Further guidance on decommissioning of DOE facilities is provided by DOE G 430.1-4, *Decommissioning Implementation Guide*.

6.1 Interim Decontamination and Decommissioning

Detailed procedures for decontamination of equipment and other miscellaneous items will be developed as part of an interim D&D plan. Decontamination of the tanks, containers, and equipment associated with the 200 West P&T involves removing and disposing wastes present in containers, and decontaminating the interiors of tanks, containers, and associated ancillary equipment that were in contact with waste, as necessary. Decontamination and disposal of equipment and miscellaneous items will be conducted in accordance with the procedures and criteria of the decontamination plan including, as appropriate, the requirements of WAC 173-303-070, "Dangerous Waste Regulations," "Designation of Dangerous Waste," and 40 CFR 268.45, "Land Disposal Restrictions," "Treatment Standards for Hazardous Debris," as adopted in entirety by WAC 173-303-140, "Dangerous Waste Regulations," "Land Disposal Restrictions."

Disposal of waste streams from D&D is discussed in the WMP (Appendix B). In general, spent decontamination water and other liquid waste streams generated during the decontamination process that are compatible with the 200 West P&T will be reintroduced into the P&T system for treatment. Those waste streams that are not compatible with 200 West P&T and all decontamination fluids (i.e., water and/or nonhazardous cleaning solutions) generated from cleaning equipment, tools, and materials will be contained and transported to the Purgewater Storage and Treatment Facility or the Effluent Treatment

Facility if waste acceptance criteria can be met. If the waste acceptance criteria cannot be met, pre-treatment may be necessary, or another suitable disposal facility may be identified, as authorized by EPA.

6.2 Final Decontamination and Decommissioning

Final D&D of the 200 West P&T will be addressed after DOE, EPA, and the Washington State Department of Ecology (Ecology) (i.e., the Tri-Parties) determine that active remediation is complete or the treatment system is no longer required. The D&D requirements will be addressed in a future D&D plan, which will be developed and submitted near the end of the active remediation time frame. This will likely occur at least 25 years after startup of the P&T system. Final D&D of the 200 West P&T will be performed in accordance with ARARs and applicable guidance.

Decontamination of the P&T system is expected to include the following activities:

- Remove and dispose liquids from tanks, piping, and process equipment.
- Remove and dispose IX and other resins, filters, and media.
- Remove and dispose all waste solids.
- Drain transfer piping and dispose the liquid.
- Winterize buildings and leave the facility for evaluation of further use at a later date. Periodic inspections of the buildings will be necessary for long-term care.

Once a determination is made that no further use of the 200 West P&T is required, decommissioning is expected to include the following activities:

- Remove and dispose conveyance and process piping.
- Salvage equipment and materials that can be used elsewhere on the Hanford Site.
- Demolish building, tanks, and structures.
- Perform site restoration.

Extraction and injection wells will be evaluated for use as groundwater monitoring wells (sampling and water levels). Those wells not retained for monitoring purposes will be decommissioned in accordance with WAC 173-160-381, “Minimum Standards for Construction and Maintenance of Wells,” “What Are the Standards for Decommissioning a Well?”

The site will be returned to its pre-operational condition to the extent feasible considering cost and intended future use (see Section 6.3). The wells that are used in conjunction with the 200 West P&T will continue to be used for groundwater monitoring. If a well is no longer needed, it will be decommissioned in accordance with WAC 173-160-381. Waste materials generated as part of D&D activities will be managed and disposed as addressed in the WMP (Appendix B).

6.3 Future Land and Groundwater Use

This section describes the anticipated future land, groundwater, and surface water uses applicable to the both the 200-ZP-1 and 200-UP-1 OUs. The following sections summarize the anticipated uses presented in each ROD.

6.3.1 Anticipated Future Land Use

The reasonably anticipated future land use for the core zone of the Central Plateau is industrial (DOE worker) for at least 50 years and then industrial (DOE or non-DOE worker) thereafter. DOE has worked for several years with cooperating agencies to define land-use goals for the Hanford Site. The cooperating agencies and stakeholders included the National Park Service, Tribal Nations, the states of Washington and Oregon, local county and city governments, economic and business development interests, environmental groups, and agricultural interests.

The Future for Hanford: Uses and Cleanup, The Final Report of the Hanford Future Site Uses Working Group (Drummond, 1992) was an early product of the efforts to develop land-use assumptions. The report recognized that the Central Plateau would be used to some degree for waste management activities for the foreseeable future. Following the report, DOE issued the HCP EIS (DOE/EIS-0222-F) and the associated HCP EIS ROD (64 FR 61615, "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement [HCP EIS]") in 1999. The HCP EIS (DOE/EIS-0222-F) analyzes the potential environmental impacts of alternative land-use plans for the Hanford Site and considers the land-use implication of ongoing and proposed activities. Under the preferred land-use alternative selected in the HCP EIS ROD (64 FR 61615), the Central Plateau was designated for industrial exclusive use, defined as areas suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes, as well as related activities.

Subsequent to the HCP EIS (DOE/EIS-0222-F), the Hanford Advisory Board (HAB) issued "Consensus Advice #132: Exposure Scenarios Task Force on the 200 Area" (02-HAB-0006). The HAB acknowledged that some waste would remain in the core zone of the Central Plateau when cleanup is complete. The goal identified in the HAB report is for the core zone to be as small as possible and not to include contaminated areas outside the Central Plateau's fenced areas. The HAB further stated that waste within the core zone should be stored and managed to make it inaccessible to inadvertent intruding humans and biota, and that DOE should maximize the potential for any beneficial use of the accessible areas of the core zone. The HAB advised that risk scenarios for waste management areas of the core zone should include a reasonable maximum exposure to a worker/day user and to an intruder.

In response to 02-HAB-0006, and for the purposes of 200-ZP-1 and 200-UP-1 OU remedial actions, the Tri-Parties agreed to assume the following reasonably anticipated future land use: continuing industrial land use for at least 50 years, including ongoing active waste treatment, storage, and/or new disposal (especially in the ERDF) of hazardous, dangerous, radioactive, and nonradioactive wastes. Following that period, the area above the 200-ZP-1 and 200-UP-1 OUs is anticipated to continue in industrial use. Starting at least 100 years after active waste management (roughly 150 years from present), the potential for inadvertent intrusion into subsurface waste may increase because the majority of the present Hanford Site will have been opened to nonindustrial uses and less-restrictive public access, and knowledge of residual hazards within the remaining controlled access area may not be as widely held among the public as at present. As long as residual contamination remains above levels that allow for unrestricted use, ICs will continue to be required.

6.3.2 Potential Future Ground and Surface Water Uses

The NCP (40 CFR 300) establishes the following national expectation for cleanup of groundwater at CERCLA sites: "EPA expects to return useable ground waters to their beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances of the site" (40 CFR 300.430). EPA generally defers to state agency definitions of useable groundwater provided under the various comprehensive state groundwater protection programs administered by the states across the country.

Based on physical yield and natural water quality, the state of Washington, through its groundwater protection program, has determined that the aquifer setting for the 200-ZP-1 and 200-UP-1 OUs meets the *Washington Administrative Code* definition for potable groundwater and for beneficial use, and it has been recognized by the state as a potential source of domestic drinking water. For the next 150 years, as long as the anticipated land use remains industrial, it is unlikely that 200-ZP-1 or 200-UP-1 OU groundwater will be used as a drinking water source because drinking water is provided from a central water treatment facility.

Current uses of the Columbia River are anticipated to continue in the future. Given the local hydrogeology at the 200-ZP-1 and 200-UP-1 OUs, the remedial actions for groundwater at both the 200-ZP-1 and 200-UP-1 OUs will also protect the Columbia River and its ecological resources from degradation and unacceptable impact caused by contaminants originating from both of these OUs.

7 Health, Safety, and Quality

7.1 Health and Safety

The HASP (SGW-41472, *Soil and Groundwater Remediation Project Site Specific Health and Safety Plan [HASP]*) meets the requirements set forth in 29 CFR 1910.120. The HASP contains the applicable core functions and guiding principles of the Integrated Safety Management System. The HASP governs safe performance of routine facility O&M activities, including facility inspection and surveillance, equipment replacement, maintenance, housekeeping, and sampling. It also governs personnel safety training requirements, control of recognized health and safety hazards, use of personal protective equipment, facility access requirements, and contingencies (e.g., fire, spills, accidents, personnel injuries, and incident reporting).

The HASP is not a stand-alone document. It is supplemented by other procedures governing work control, conduct of operations, industrial safety, maintenance, and waste handling. Major elements of the HASP (SGW-41472) are summarized in the following subsections.

7.1.1 Visitor Requirements

Visitors to the site shall sign in (and out) at the site office and be briefed on the HASP (SGW-41472). Visitors are not allowed into control zones when the process system is breached unless the following training requirements are met:

- Monitoring and sampling protocols
- Site control measures
- Spill containment and control
- Decontaminations procedures
- Medical surveillance

7.1.2 Facility Upset Conditions

The HASP covers procedures and requirements for the following potential facility upset conditions:

- Minor and life threatening injuries
- Fire
- Chemical exposure
- Radiological exposure
- Area alarms

7.1.3 Hazard Control

Control of the following hazards that are likely present during O&M activities is a primary element of the HASP (SGW-41472):

- Confined spaces
- Bloodborne pathogens
- Biological hazards
- Compressed gases
- Chemical hazards
- Illumination
- Adverse weather
- Dust
- Excavations
- Portable ladders
- Scaffolding
- Manual lifting

- Heat and cold stress
- Radiological hazards
- Waste control
- Elevated work
- Electrical hazards
- Fire hazards
- Pinch points
- Hand tools
- Standing water
- Noise
- Powered industrial trucks (forklifts)
- Man lifts, cranes, and rigging
- Pressure systems
- Sanitation
- Vehicle parking
- Walking and work surfaces (slip/trip/fall)
- Motor vehicles

7.1.4 Facility Response Plan

The HASP (SGW-41472) includes a facility response plan which includes the following elements:

- Emergency response organization
- Emergency equipment (location descriptions and capabilities)
- Implementation procedures for the facility response plan
- Emergency response procedures
- Plan location and amendment procedures

7.2 Quality

Overall QA for the O&M plan will be implemented in accordance with the CHPRC QA program management plan and environmental quality assurance program plan (QAPP).

The environmental QAPP includes the overall structure, requirements, implementation methods, and responsibilities, which require that program and project plans be developed to ensure effective implementation of the QA requirements for CHPRC's environmental activities. The environmental QAPP is a management tool that documents the quality system for planning, implementing, documenting, and assessing the effectiveness of the environmental activities; *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989) implementation; data operations; and other environmental programs. The environmental QAPP includes the QAPP requirements for implementation of the Soil and Groundwater Remediation Project and the D&D Project.

These QA activities use a graded approach based on potential impacts to the environment, safety, health, reliability, and continuity of operations. The QA for sampling activities and performance monitoring is discussed in Appendix D of this O&M plan; in the 200-ZP-1 OU PMP (DOE/RL-2009-115); and in the 200-UP-1 OU PMP (DOE/RL-2015-14).

The SAPs prepared to support the 200 West P&T include a QAPP, which is used to support the sampling and characterization activities. Other specific activities include QA implementation, responsibilities and authority, document control, QA records, and audits.

8 References

02-HAB-0006, 2002, "Consensus Advice #132: Exposure Scenarios Task Force on the 200 Area" (letter to Todd Martin, Hanford Advisory Board, from Keith A. Klein, U.S. Department of Energy, Richland Operations Office; David R. Einan, U.S. Environmental Protection Agency; and Michael A. Wilson), Washington State Department of Ecology, Richland, Washington, July 11. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D7346962.

29 CFR 1910.120, "Occupational Safety and Health Standards," "Hazardous Waste Operations and Emergency Response," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=0cff01005f9529de9127ab4a8e355abd&node=29:5.1.1.1.8.8.33.14&rgn=div8.

40 CFR 268.45, "Land Disposal Restrictions," "Treatment Standards for Hazardous Debris," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=877d0a95450a18185e2bb887ded529c7&node=40:27.0.1.1.3.4.27.6&rgn=div8.

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=0cff01005f9529de9127ab4a8e355abd&node=40:28.0.1.1.1&rgn=div5.

40 CFR 300.430, "Remedial Investigation/Feasibility Study and Selection of Remedy."

40 CFR 300.435, "Remedial Design/Remedial Action, Operation and Maintenance."

64 FR 61615, "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS)," *Federal Register*, Vol. 64, No. 218, pp. 61615-61625, November 12, 1999. Available at: http://www.gpo.gov/fdsys/pkg/FR-1999-11-12/pdf/99-29325.pdf.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: http://epw.senate.gov/cercla.pdf.

DOE and EPA, 1995, *Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*, U.S. Department of Energy and U.S. Environmental Protection Agency, Washington, D.C. Available at: http://energy.gov/em/policy-decommissioning-department-energy-facilities-under-comprehensive.

DOE/EIS-0222-F, 1999, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, U.S. Department of Energy, Washington, D.C. Available at:
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D199158842.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D199158843.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D199158844.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D199158845.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D199158846.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D199158847.

DOE G 430.1-4, 1999, *Decommissioning Implementation Guide*, U.S. Department of Energy, Washington, D.C. Available at: https://www.directives.doe.gov/directives/0430.1-EGuide-4/at_download/file.

DOE/RL-2001-41, 2014, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions and RCRA Corrective Actions*, Rev. 7, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0085328.

DOE/RL-2007-28, 2008, *Feasibility Study Report for the 200-ZP-1 Groundwater Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0808050315. http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=00098828.

DOE/RL-2008-78, 2009, *200 West Area 200-ZP-1 Pump-and-Treat Remedial Design/Remedial Action Work Plan*, Rev. 0 REISSUE, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0096137.

DOE/RL-2009-115, 2014, *Performance Monitoring Plan for the 200-ZP-1 Groundwater Operable Unit Remedial Action*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=1411040775.

DOE/RL-2010-13, 2010, *200 West Area Groundwater Pump-and-Treat Remedial Design Report*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0084153.

DOE/RL-2010-74, 2015, *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0081243H.

DOE/RL-2010-78, 2010, *200 West Area Groundwater Pump-and-Treat Facility Extraction and Injection Well Maintenance Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0078754H.

DOE/RL-2013-07, 2013, *200-UP-1 Groundwater Operable Unit Remedial Design/Remedial Action Work Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0087671.

DOE/RL-2013-37, *Engineering Evaluation/Cost Analysis for Perched Water Pumping/Pore Water Extraction*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0086598.

DOE/RL-2014-34, 2014, *Action Memorandum for 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0082284H

DOE/RL-2015-14, *Performance Monitoring Plan for the 200-UP-1 Groundwater Operable Unit Remedial Action*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0080172H.

DOE/RL-2015-26, 2015, *Engineering Evaluation/Cost Analysis for the 200-BP-5 Operable Unit Groundwater Extraction*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=1506220854.

Drummond, M.E., 1992, *The Future for Hanford: Uses and Cleanup, The Final Report of the Hanford Future Site Uses Working Group*, prepared by the Hanford Future Site Uses Working Group for the U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D196123428.

Ecology, 2008, Cleanup Levels and Risk Calculations (CLARC) database, Washington State Department of Ecology, Olympia, Washington. Available at: https://fortress.wa.gov/ecy/clarc/.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.hanford.gov/?page=81.

Ecology, EPA, and DOE, 1999, "Environmental Restoration Program Strategy for Management of Investigation Derived Waste" (letter to Douglas R. Sherwood, U.S. Environmental Protection Agency, and Mike A. Wilson, State of Washington, Department of Ecology, from K. Michael Thompson and George H. Sanders), U.S. Department of Energy, Richland Operations Office, Richland, Washington, March 29. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=D199084884.

EPA, 1999, *U. S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site - 200 Area, Benton County, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 2015, *Explanation of Significant Differences for the U.S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site – 200 Area, Benton County, Washington,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0079657H.

EPA, Ecology, and DOE, 2008, *Record of Decision, Hanford 200 Area, 200-ZP-1 Superfund Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.epa.gov/superfund/sites/rods/fulltext/r2008100003103.pdf.

EPA, Ecology, and DOE, 2012, *Record of Decision for Interim Remedial Action ,Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0091413.

EPA/540/G-88/003, 1988, *Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites*, Interim Final, OSWER Directive 9283.1-2, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/superfund/policy/remedy/pdfs/540g-88003-s.pdf.

EPA 540-F-01-004, 2001, *Operation and Maintenance in the Superfund Program*, OSWER 9200.1-37FS, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C. Available at: http://epa.gov/superfund/policy/pdfs/sheet.pdf.

EPA 540-R-01-007, 2001, *Comprehensive Five-Year Review Guidance*, OSWER No. 9355.7-03B-P, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C. Available at: http://www.epa.gov/superfund/accomp/5year/guidance.pdf.

EPA 540-R-98-016, 2000, *Close Out Procedures for National Priorities List Sites*, OSWER No. 9320.2-09A-P, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/superfund/programs/npl_hrs/closeout/pdf/guidance.pdf.

Executive Order 12580, 1987, *Superfund Implementation*, Ronald W. Reagan, January 23. Available at: http://www.archives.gov/federal-register/codification/executive-order/12580.html.

SGW-41472, 2014, *Soil and Groundwater Remediation Project Site Specific Health and Safety Plan (HASP)*, Rev. 9, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0082379H.

SGW-57790, 2015, Characterization Data for New Waste Streams (200-UP-1, ERDF Leachate, 200-BP-5 and Perched Water) for the 200 West Pump-and-Treat Facility, Rev. 2, CH2M Hill Plateau Remediation Company, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0078453H.

SW-846, 2007, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*, as amended, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/epawaste/hazard/testmethods/sw846/online/index.htm.

TPA-CN-525, 2012, *Change Notice for Modifying Approved Documents/Workplans in Accordance with the Tri-Party Agreement Action Plan, Section 9.0, Documentation and Records: DOE/RL-2009-124, 200 West Area Pump-and-Treat Facility Operations and Maintenance Plan*, Rev. 1, dated June 4, U.S. Department of Energy, Richland Operations Office, and U.S. Environmental Protection Agency, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0092656.

USGS, variously dated, *National Field Manual for the Collection of Water-Quality Data*, Techniques of Water-Resources Investigations, Book 9, U.S. Department of the Interior, U.S. Geological Survey, Reston, Virginia. Available at: http://water.usgs.gov/owq/FieldManual/.

WAC 173-160-381, "Minimum Standards for Construction and Maintenance of Wells," "What Are the Standards for Decommissioning a Well?" *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/wac/default.aspx?cite=173-160.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code,* Olympia, Washington. Available at: http://apps.leg.wa.gov/wac/default.aspx?cite=173-303.

WAC 173-303-070, "Designation of Dangerous Waste."

WAC 173-303-140, "Land Disposal Restrictions."

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

WAC 173-340-720, "Groundwater Cleanup Standards."

Appendix A

Compliance Matrix for the 200 West Pump and Treat

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Terms

ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
ASIL	acceptable source impact levels
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC	contaminant of concern
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
ECR	ecological compliance review
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ESD	explanation of significant differences
IC	institutional control
IDW	investigation-derived waste
LDR	land disposal restriction
MCL	maximum contamination level
MCLG	maximum contamination level goal
MNA	monitored natural attenuation
NAPL	nonaqueous-phase liquid
NCP	National Contingency Plan
O&M	operations and maintenance
OU	operable unit
P&T	pump and treat
PMP	performance monitoring plan
PNNL	Pacific Northwest National Laboratory
RCRA	*Resource Conservation and Recovery Act of 1976*
RD/RA	remedial design/remedial action
RDR	remedial design report
ROD	Record of Decision

SQER	small quantity emissions rate
SWITS	Solid Waste Information and Tracking System
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
WPLIS	waste packaging and labeling instruction sheet

A1 Introduction and Purpose

This compliance matrix presents the requirements established for the 200-ZP-1 (Table A-1), 200-UP-1 (Tables A-2 and A-3), 200-DV-1 (Tables A-4, A-5, and A-6), and 200-BP-5 (Tables A-7 and A-8) Groundwater Operable Units (OU)s as applicable to the 200 West pump and treat (P&T). This is the final action selected in the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) Record of Decision (ROD) (*Record of Decision, Hanford 200 Area, 200-ZP-1 Superfund Site, Benton County, Washington* [EPA et al., 2008]) (hereafter referred to as the 200-ZP-1 ROD); the interim action selected in the *Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit* (EPA et al., 2012) (hereafter referred to as the 200-UP-1 interim ROD); the removal action selected in *Action Memorandum for 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction* (DOE/RL-2014-34, 2014); and treatment for treatability testing as described in *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit* (DOE/RL-2010-74, 2015).

The purpose of this compliance matrix is to consolidate the 200-ZP-1, 200-UP-1, 200-DV-1, and 200-BP-5 Groundwater OU compliance requirements, such as federal and Washington State applicable or relevant and appropriate requirements (ARARs) and other conditions included in each document cited above, with a cross reference of requirement locations listed in the "Source Documents" column of each table. It assembles, in one location, a comprehensive summary of compliance requirements for the selected remedies, including air and groundwater monitoring obligations and associated reporting requirements. The overarching objective of the compliance matrix is to provide the 200 West P&T operations team (particularly the operations manager, environmental compliance officer, and waste management lead) with the means to track the status of remedy requirements. This capability will ensure confirmation that compliance performance is satisfactory, and it will allow the operations team to avoid, or rapidly correct, potential noncompliance issues. The compliance matrix does not replicate project-specific methodologies and procedures used to meet required actions; rather, this matrix provides the most expedient means for a user to locate where this reference information can be obtained.

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Table A-1. 200 West P&T Compliance Matrix for the 200-ZP-1 Groundwater OU

Line #	Source Documents	Requirement	Compliance Methodology	Comments
1	200-ZP-1 ROD (Part I, 4.2), 200-ZP-1 ROD (Part II, 13.5)	The remedial action decisions for the source-control OUs are being made under the enforcement strategies and schedules contained in the Hanford Tri-Party Agreement and will consider the nature and characteristics of the principal threat materials found in the source-control OUs. The closure and cleanup decisions made for the RCRA-regulated units will also consider the nature and characteristics of the principal threat materials found in those units.	"There are no known contaminant source materials such as NAPLs in the 200-ZP-1-OU groundwater that would serve as a source of principal threat materials" (ROD, Section 11.0, p. 54).	No further action required for 200-ZP-1 OU.
2	200-ZP-1 ROD (Part I, 4.3.1), 200-ZP-1 ROD (Part II, 12.2.1), 200-ZP-1 ROD (Part II, 12.4)	The system will capture and treat contaminated groundwater to reduce the mass of carbon tetrachloride, total chromium (trivalent and hexavalent), nitrate, trichloroethene, iodine-129, and technetium-99, throughout the 200-ZP-1 OU by a minimum of 95 percent in 25 years.	Remedy design details are provided in the approved RD/RA work plan (DOE/RL-2008-78), the RDR (DOE/RL-2010-13), the PMP (DOE/RL-2009-115), and the O&M plan (DOE/RL-2009-124).	Contaminant treatment and monitoring procedures associated with the groundwater pump and treat system are provided in DOE/RL-2009-115, and in Appendix D of the O&M Plan ("200 West Pump and Treat Sampling and Analysis Plan"). Performance of the 200 West P&T will be communicated to EPA during quarterly briefings and summarized in the performance monitoring report.
3	200-ZP-1 ROD (Part I, 4.3.2), 200-ZP-1 ROD (Part II, 12.2.2), DOE/RL-2008-78 (2.1)	Monitoring locations, points of compliance and specifications will be developed as part of RD/RA documents to provide data on performance. Monitoring will provide the following: • Detect changes in environmental conditions (e.g., hydrogeologic, geochemical, microbiological, or other changes) that may reduce the efficacy of the pump and treat system, natural attenuation processes, and the flow path control actions. • Identify potentially toxic and/or mobile transformation products. • Verify that contamination is not expanding downgradient, laterally, or vertically subsequent to the period of time over which the P&T component has been functional. • Detect new releases of contaminants of concern to the environment that could impact the effectiveness of the remedy. • Verify attainment of remediation requirements. RD/RA documents will be reviewed and approved by EPA.	MNA design details are provided in the approved RD/RA work plan (DOE/RL-2008-78), the RDR (DOE/RL-2010-13), the PMP (DOE/RL-2009-115), and the O&M plan (DOE/RL-2009-124).	Natural attenuation monitoring and hydraulic control measures are described in the O&M plan and in the PMP (DOE/RL-2009-115). MNA performance will be summarized in the performance monitoring report.
4	200-ZP-1 ROD (Part I, 4.3.3), 200-ZP-1 ROD (Part II, 12.2.3), DOE/RL-2008-78 (2.1.3)	Groundwater modeling is required to locate extraction wells, estimate rates, and locate injection wells for flow-path control in accordance with RD/RA documents. Flow-path control shall be used as follows: • To slow natural eastward flow of most groundwater to keep COCs in the capture zone. • To minimize potential for groundwater in the northern portion of the aquifer to flow through Gable Cap to the Columbia River. RD/RA documents will be reviewed and approved by EPA.	Flow-path control details are provided in the approved RD/RA work plan (DOE/RL-2008-78), the RDR (DOE/RL-2010-13), the PMP (DOE/RL-2009-115), and the O&M plan (DOE/RL-2009-124).	Flow-path control monitoring methods are described in the PMP (DOE/RL-2009-115). Flow-path control performance will be summarized.

Table A-1. 200 West P&T Compliance Matrix for the 200-ZP-1 Groundwater OU

Line #	Source Documents	Requirement	Compliance Methodology	Comments
5	200-ZP-1 ROD (Part I, 4.3.4), 200-ZP-1 ROD (Part II, 12.2.4), DOE/RL-2008-78 (2.1.4)	200-ZP-1 OU groundwater use will be restricted through ICs and land-use controls until cleanup levels are achieved. No later than 180 days after the ROD is signed, DOE shall update DOE/RL-2001-41, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions and RCRA Corrective Actions*, to include ICs required by this ROD and specify the implementation and maintenance actions that will be taken, including periodic inspections. A land use control boundary map for the 200-ZP-1 OU is required. The ICs required of DOE through the completion of this 200-ZP-1 OU remedy are as follows: • Control access to prevent unacceptable exposure of humans to contaminants in groundwater. Visitors entering any site areas must be badged and escorted at all times. • Prohibit intrusive work unless approved in a plan by EPA. • Prohibit well drilling except for authorized wells. • Prohibit groundwater use except for authorized research purposes, monitoring, and treatment. • Post and maintain warning signs along pipelines conveying untreated groundwater that caution site visitors and workers of potential hazards. • Report any unauthorized access to the Site (e.g., trespassing) to Benton County Sheriff's Office for investigation and evaluation of possible prosecution. • Prohibit activities that disrupt or lessen the performance of the P&T, MNA, and flow-path control. • Prohibit activities that damage P&T, MNA, and flow-path control components (e.g., extraction, injection. monitoring wells, piping, or treatment plant). • Report on effectiveness of institutional controls in an annual report, or an alternative reporting frequency specified by EPA. Reporting may be for this OU alone or part of a Sitewide report. • Provide notice to EPA at least six months prior to any transfer or sale of any land subject to ICs (including federal to federal transfers). If not possible, then no later than 60 days prior to transfer or sale. In addition, provide a copy of executed deed or transfer assembly to EPA. • Prevent development and use of property for residential housing, elementary and secondary schools, childcare facilities and playgrounds. • Maintain ICs until cleanup levels are achieved. Concentrations of hazardous substances are at levels that allow unrestricted use and exposure, and EPA authorizes removal of ICs.	Implementation, maintenance, and periodic inspection requirements for ICs at the Hanford Site are described in DOE/RL-2001-41.	A land-use control map has been prepared and is included in the ROD as Figure 12. DOE/RL-2001-41 was revised March 3, 2009, to Rev. 3 to incorporate the ICs identified in 200-ZP-1 ROD.
6	200-ZP-1 ROD (Part I, 5.0)	Required at a minimum every 5 years if a remedy is selected that result in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure.	DOE and EPA have agreed to conduct 5-year reviews in accordance with 40 CFR 300.430[f][4][ii], until COCs are reduced below the cleanup levels established in this ROD.	Reviews begin 5 years after initiation of the remedial action (2012) to ensure that the selected remedy is protective of human health and the environment.

Table A-1. 200 West P&T Compliance Matrix for the 200-ZP-1 Groundwater OU

Line #	Source Documents	Requirement	Compliance Methodology	Comments
7	200-ZP-1 ROD (Part II, 12.1)	Treatment residuals generated as part of this action are expected to meet waste disposal criteria for onsite disposal in the ERDF. Waste that does not meet ERDF waste acceptance criteria will be sent offsite for treatment and disposal. Any offsite disposal will require a facility acceptability determination by EPA that the facility can receive CERCLA waste.	The 200-ZP-1 OU treatment residuals meeting the waste acceptance criteria will be disposed in ERDF. Waste that does not meet ERDF waste acceptance criteria will be evaluated for additional treatment at an onsite or offsite facility prior to ERDF disposal.	Treatment residual disposal/treatment will occur on an as-needed basis and will follow applicable waste management functions identified in the O&M plan, Appendix B ("Waste Management Plan for the 200 West Pump and Treat"). As described in Appendix B, the 200-ZP-1 IDW and remediation waste will be stored in the OU. CERCLA dangerous wastes and temporary storage areas for waste awaiting sampling and designation will be inspected weekly. Nondangerous waste storage areas will be inspected monthly or at the frequency defined in the waste control plan that was developed for IDW for the 200-ZP-1 OU. Accumulation, staging, storage, profiling, packaging, and labeling details for each waste are documented on the WPLIS. Disposal records are maintained in the Hanford Site SWITS database.
8	200-ZP-1 ROD (Part II, 12.3)	New information and data collected during the engineering design or implementation of the selected remedy.	Major changes will be documented in the form of a memorandum in the Administrative Record file, a CERCLA ESD, or a ROD amendment, as appropriate.	As necessary.
9	200-ZP-1 ROD (Part II, 13.2)	EPA OSWER Directive 9234.1-06, *Applicability of Land Disposal Restrictions to RCRA and CERCLA Ground Water Treatment Reinjection Superfund Management Review: Recommendation No. 26* (dated December 27, 1989), provides guidance on issues regarding whether LDRs apply to reinjection of groundwater.	This guidance states that EPA construes the provisions of RCRA Section 3020 to be applicable instead of LDR provisions contained in RCRA Sections 3004(f), (g), and (m), to reinjection of contaminated groundwater into an underground source of drinking water, which is part of a CERCLA response action.	Per the ROD, LDRs do not apply to reinjection of treated groundwater from the 200-ZP-1 Groundwater OU because this is a CERCLA action.
10	200-ZP-1 ROD (Part II, 13.2)	The NCP (40 CFR 300.430[f][5][ii][B] and [C]) require that a ROD describe the federal and state ARARs that the selected remedy will attain and any ARARs the remedy will not meet, the waiver invoked, and the justification for any waivers.	Appendix A of the ROD provides a definitive list of ARARs to be attained by the selected remedy, organized by federal requirements (Table A-1) and Washington State requirements (Table A-2). Table A-3 describes "to-be-considered" criteria that were used in developing the remedy. These ARARs are repeated in the RD/RA work plan (DOE/RL-2008-78, Appendix A, Table A-1).	See requirements which correspond to the tables listed for chemical-, location-, and action-specific requirements.
11	200-ZP-1 ROD (Part II, Table 11), ARAR (40 CFR 141.61), ARAR (40 CFR 141.62), ARAR (40 CFR 141.66), ARAR (WAC 173-340-720([4][b][iii][A] and [B]), ARAR (WAC 173-340-720[7][b])	The final cleanup levels identified in the ROD for 200-ZP-1 OU groundwater are federal and state drinking water MCLs and state groundwater cleanup standards (where more stringent than MCLs). • Carbon tetrachloride: 3.4 µg/L • Chromium (total): 100 µg/L • Chromium (hexavalent): 48 µg/L • Nitrate (as nitrate, N): 10,000 µg/L • Trichloroethene: 1 µg/L • Iodine-129: 1 pCi/L • Technetium-99: 900 pCi/L • Tritium: 20,000 pCi/L	Groundwater wells will be sampled to monitor the progress of remediating contaminated groundwater to achieve final cleanup levels. Monitoring will begin during the early stages of construction and will continue throughout treatment and closure to ensure that cleanup levels have been met. Following extraction, the COCs in groundwater (except tritium) will be treated to achieve cleanup levels. The treated groundwater will then be returned to the aquifer through injection wells. COC biological degradation products will be treated as part of the P&T and MNA components of the remedy.	MCL/MCLG measurements are described in Appendix D of the O&M plan, "200 West Pump and Treat Sampling and Analysis Plan"

Table A-1. 200 West P&T Compliance Matrix for the 200-ZP-1 Groundwater OU

Line #	Source Documents	Requirement	Compliance Methodology	Comments
12	ARAR (WAC 173-218-040), ARAR (*Interim Control of Hazardous Waste Injection,* 42 USC 6939b, et seq., Section 3020[b]), ARAR (WAC 173-218-120)	Establishes requirements to allow injection of groundwater that contains hazardous waste back into the aquifer during implementation of a CERCLA remedy. Injection wells used to return treated groundwater to an aquifer must meet the classification criteria of a Class IV well, and shall be abandoned following completion of the remedial action.	Extracted groundwater from the 200-ZP-1 OU will be treated to achieve cleanup levels before returning it to the aquifer through the injection wells. Treated effluent will be periodically tested prior to injection into the aquifer. Periodic testing (grab samples) will be used to demonstrate compliance. Treatment system may continue to operate if discharge concentrations are greater than cleanup levels. Injection wells will be decommissioned in accordance with the standards specified in the regulation.	Effluent measurements are described in the O&M plan, and, as appropriate, in Appendix D of the O&M plan, "200 West Pump and Treat Sampling and Analysis Plan"
13	ARAR (*Archeological and Historic Preservation Act of 1960*, 16 USC 469–469c-2, et seq.)	Requires that remedial actions at the 200-ZP-1 OU will not cause the loss of any archaeological or historic data. This act mandated preservation of data and does not require protection of the actual historical sites	In 1987 and 1988, a comprehensive archaeological resources review of the Central Plateau was conducted that included an examination of samples collected from undisturbed portions of the 200 West Area. The inventory reported no significant surface archaeological finds.	Cultural and ecological survey results and recommendations are listed in SGW-48726, *Mitigation Action Plan for the 200 West Area Groundwater Remediation Project* (Appendix B), and are maintained in the project files.
14	ARAR (*National Historic Preservation Act of 1966*, 16 USC 470, et seq., Section 106)	Requires federal agencies to consider the impacts of their undertaking on cultural properties through identification, evaluation, and mitigation processes.	In 1987 and 1988, a comprehensive archaeological resources review of the Central Plateau was conducted that included an examination of samples collected from undisturbed portions of the 200 West Area. The inventory reported no significant surface archaeological finds.	Cultural and ecological survey results and recommendations are listed in SGW-48726 (Appendix B) and are maintained in the project files.
15	ARAR (*Endangered Species Act of 1973*, 16 USC 1531[a], et seq.; and *Interagency Cooperation*, 16 USC 1536[c], et seq.)	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. Mitigation measures must be applied to actions that occur within critical habitats or surrounding buffer zones of listed species in order to protect the resource.	Results from previous surveys documented in ECR #2009-200-022 and ECR #2009-200-023, and DOE/EIS-0391, *Final Tank Closure and Waste Management EIS for the Hanford Site, Richland, Washington* (November 2012). Compliance procedures with EIS requirements are established in DOE/RL-95-11, *Ecological Compliance Assessment Management Plan* (Rev. 2, dated September 2006) and DOE/RL-96-32, *Hanford Site Biological Resources Management Plan* (dated 2001).	Evidence of listed species and/or their critical habitat requires a Request for Cultural and/or Ecological Resources Review (Hanford Form RL-665). Responsibility for conducting the ecological compliance review is assigned to the PNNL. Actions requiring an ecological compliance review include the following: (1) if the project occurs outside of a building, (2) if biota are present at the affected site, or (3) if an excavation permit is required for the action.
16	ARAR (*Native American Graves Protection and Repatriation Act of 1990*, 25 USC 3001, et seq.)	Establishes federal agency responsibility for discovery of human remains, associated and unassociated funerary objects, sacred objects, and items of cultural patrimony. Requires consultation with the Native American Tribes in the event of discovery.	Comprehensive archaeological resource surveys of the fenced portions of the 200 Areas indicate that minimal resources exist in project area (DOE/EIS-0391, *Final Tank Closure and Waste Management EIS for the Hanford Site, Richland, Washington*, dated November 2012). Compliance procedures with cultural and archaeological requirements are provided in DOE/RL-98-10, *Hanford Cultural Resources Management Plan*.	Expansion of 200-ZP-1 Groundwater OU remedial action activities to areas beyond those previously surveyed requires a Cultural Resource Review Request (Hanford Form RL-665) from PNNL.

Table A-1. 200 West P&T Compliance Matrix for the 200-ZP-1 Groundwater OU

Line #	Source Documents	Requirement	Compliance Methodology	Comments
17	ARARs: (WAC 173-160-161) (WAC 173-160-171) (WAC 173-160-181) (WAC 173-160-400) (WAC 173-160-420) (WAC 173-160-430) (WAC 173-160-440) (WAC 173-160-450) (WAC 173-160-460)	 Well planning and construction. Well location requirements. Preserving natural barriers between aquifers. Standards for resource protection wells and geotechnical borings. Construction requirements for resource protection wells. Minimum casing standards. Equipment cleaning standards. Well sealing requirements. Decommissioning for resource protection wells.	All monitoring, injection, and extraction wells completed for the 200-ZP-1 OU remediation activities will meet the substantive requirements of these regulations.	Well construction information is provided in the following documents: • *Hanford Site Well Management Plan* (DOE/RL-2003-13, Rev. 0, dated June 2003) • *Sampling and Analysis Plan for the First Set of Remedial Action Wells in the 200-ZP-1 Groundwater Operable Unit* (DOE/RL-2008-57, Rev. 0, dated December 2008)
18	ARAR (WAC 173-303-016)	Identifies those materials that are and are not solid wastes.	Waste materials generated from the 200-ZP-1 OU remedial action will be evaluated for solid waste properties in accordance with the substantive requirements of WAC 173-303-016.	The O&M plan, Appendix B ("Waste Management Plan for the 200 West Pump and Treat"), waste designation and corresponding waste profiles are completed by the Waste Management lead. The waste profiles are documented on the WPLIS.
19	ARAR (WAC 173-303-017)	Identifies materials that are and are not solid wastes when recycled.	IDW and remediation waste generated during the 200-ZP-1 OU remedial action that can be recycled will meet the substantive portion of these requirements.	The O&M plan, Appendix B ("Waste Management Plan for the 200 West Pump and Treat") waste designation and corresponding waste profiles are completed by the Waste Management lead. The waste profiles are documented on the WPLIS.
20	ARAR (WAC 173-303-070[3])	Establishes whether a solid waste is, or is not, a dangerous waste or an extremely hazardous waste.	Substantive requirements apply to IDW and remediation waste generated from 200-ZP-1 OU remedial activities. Media and treatment residuals generated from the 200-ZP-1 OU will be designated according to the procedures identified in WAC 173-303-070(3).	The O&M plan, Appendix B ("Waste Management Plan for the 200 West Pump and Treat) states that IDW and remediation waste that come into contact with 200-ZP-1 OU groundwater will be designated with a F001 through F005 RCRA-listed waste codes, at a minimum. Waste designation and corresponding waste profiles are completed by the Waste Management lead. The waste profiles are documented on the WPLIS.
21	ARAR (WAC 173-303-120[3] and [5])	These regulations define 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.	IDW and remediation waste generated from the 200-ZP-1 OU remedial action will be reviewed against the requirements for recyclable materials. If recyclable materials are generated, they will be managed according to the substantive requirements of WAC 173-303-120(3).	The O&M plan, Appendix B ("Waste Management Plan for the 200 West Pump and Treat") designation and corresponding waste profiles are completed by the Waste Management lead. The waste profiles are documented on the WPLIS.

Table A-1. 200 West P&T Compliance Matrix for the 200-ZP-1 Groundwater OU

Line #	Source Documents	Requirement	Compliance Methodology	Comments
22	ARAR (WAC 173-303-170), ARAR (WAC 173-303-200)	Establishes the requirements for dangerous waste generators. For purposes of this remedial action, WAC 173-303-170(3) includes the substantive provisions of WAC 173-303-200 by reference. WAC 173-303-200 further includes certain substantive standards from WAC 173-303-630 and -640 by reference. These requirements include the substantive portions of WAC 173-303-630 ("Use and Management of Containers") and WAC 173-303-640 ("Tank Systems"). Dangerous waste will be treated by the selected remedy; thus the substantive portions of WAC 173-303-640(4) ("Containment and Detection of Releases [from Tank Systems]") apply to key design and operational requirements. Secondary containment for new tank systems and ancillary equipment, which includes the collection piping, must be provided with secondary containment, except for aboveground piping that is visually inspected for leaks daily. A variance from daily inspections may be obtained per the requirements of WAC 173-303-640(4)(9) and as approved by Ecology.	IDW and remediation waste generation actions will meet the substantive requirements of WAC 173-303-170 and -200. Aboveground piping in the 200-ZP-1 OU without secondary containment will be visually inspected and recorded in accordance with these requirements, and approved variances.	TPA-CN-525 established the following: • Deleted the requirement for daily pipe walk downs with reliance on flow meter monitoring for pipeline leak detection. • Set inspection frequency for wellheads to be once per week. • Regard the treated groundwater to "no longer contain" F001 through F005 listed waste.
23	ARAR (WAC 173-303-64620[4])	Establishes requirements for corrective action for releases of dangerous wastes and dangerous constituents including releases from solid waste management units.	Corrective action requirements for the 200-ZP-1 OU will be completed under CERCLA authority. The selected remedy of this ROD meets the state of Washington requirements as an acceptable final remedy.	Washington's RCRA authorized *Hazardous Waste Management Act* and dangerous waste regulations give Ecology corrective action jurisdiction over the 200-ZP-1 OU concurrent with CERCLA. As stated in the ROD (Section 10.8, p. 53, "State Acceptance"), Ecology supports and accepts the 200-ZP-1 OU remedy under the Tri-Party Agreement and the CERCLA program as satisfying corrective action requirements.
24	ARAR (WAC 173-350-300), ARAR (WAC 173-304-190, WAC 173-304-200[2], WAC 173-304-460), ARAR (RCW 70.95)	Establishes requirements for the onsite storage of solid waste that is not radioactive or dangerous wastes. Establishes the requirements for managing temporary storage of solid waste in onsite containers and the collection and transportation of solid waste.	Solid waste generated from the 200-ZP-1 OU will be stored onsite and managed in leak-proof containers that meet the substantive requirements of this standard. IDW and remediation waste solid wastes stored in the 200-ZP-1 OU will meet the substantive requirements of this standard.	O&M plan, Appendix B ("Waste Management Plan for the 200 West Pump and Treat"). The 200-ZP-1 IDW and remediation waste solid wastes stored onsite will be managed to meet the requirements of this standard. Wastes destined for solid waste landfills shall also meet applicable requirements. Nondangerous waste storage areas will be inspected monthly or at the frequency defined in the waste control plan that was developed for IDW. O&M plan, Appendix B ("Waste Management Plan for the 200 West Pump and Treat"). Nondangerous solid wastes will be accumulated in safe and sanitary containers and will be inspected monthly or at the frequency defined in the waste control plan. Waste accumulation, staging, storage, profile, packaging, and labeling details for each waste is documented on the WPLIS.
25	ARAR (WAC 173-400-040), ARAR (WAC 173-400-113)	Requires all sources of air contaminants to meet emission standards for visible, particulate, fugitive, odors, and hazardous air emissions. Requires the use of reasonably available control technology. This state regulation is as (or more) stringent than the equivalent federal program requirement.	200-ZP-1 OU emission control equipment will meet the substantive requirements of these standards. The emission control equipment for radionuclides includes ion-exchange columns to remove technetium-99, iodine-129, and future removal of uranium. The DOE guide (DOE/RL-2006-29, *Calculating Potential to Emit Radionuclide Releases and Doses*) was used to calculate the unabated release potential for radiological constituents. Modeled results show that potential radionuclide emissions are determined to be from a minor source as described in WAC 246-247.	As described in O&M plan, Appendix C ("Air Monitoring Plan for the 200 West Pump and Treat") and Appendix D ("200 West Pump and Treat Sampling and Analysis Plan"), quarterly sampling for annual determination of compliance with SQERs and ASILs will be performed. Sample results will be documented in the performance monitoring report. Additional modeling to confirm compliance with ASILs will be completed if emissions exceed calculated/ modeled values.

Table A-1. 200 West P&T Compliance Matrix for the 200-ZP-1 Groundwater OU

Line #	Source Documents	Requirement	Compliance Methodology	Comments
26	ARAR (WAC 173-460-030 and -060), ARAR (WAC 173-460-070)	Requires that new sources of air emissions meet emission requirements. The owner/operator of a new toxic air pollutant source that is likely to increase toxic air pollutant emissions shall demonstrate that emissions from the source are sufficiently low to protect human health and safety from potential carcinogenic and/or other toxic effects.	200-ZP-1 OU emission control equipment to assure air toxics emission standards are not exceeded include the following: • Anaerobic fluidized bed bioreactor for removal of nitrate, metals, and carbon tetrachloride • Aerobic membrane bed reactor for removal of residual carbon substrate, total suspended solids, biomass, and carbon tetrachloride • Packed bed tower air stripper to remove remaining carbon tetrachloride and other volatile organic compounds • Off-gas from the air stripper, fluidized bed reactor, membrane bed reactor, and sludge thickener will be comingled and treated by granular activated carbon prior to discharge via powered exhaust • Biomass sludge will be treated with lime to reduce odors and ammonia; a scrubber will be used to remove ammonia	As described in O&M plan, Appendix C ("Air Monitoring Plan for the 200 West Pump and Treat") and Appendix D ("200 West Pump and Treat Sampling and Analysis Plan"), quarterly sampling will be performed for annual determination of compliance with SQERs and ASILs. Sample results will be documented in the performance monitoring report. Additional modeling to confirm compliance with ASILs would be completed if emissions exceed calculated/ modeled values.
27	ARAR (WAC 173-480-050[1]), ARAR (WAC 173-480-070[2])	Radionuclide emission control units are required to meet the emission standards identified in WAC 246-247 (as applicable). Requires 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 achievable control technology. Requires compliance with the public dose standard by calculating exposure (in curies) at maximum point of exposure and compare to public dose standard.	200-ZP-1 OU emission control equipment to ensure that radiation emission standards are not exceeded includes ion-exchange columns to remove technetium-99, iodine-129, and future removal of uranium. The DOE guide (DOE/RL-2006-29) was used to calculate the unabated release potential for radiological constituents. Modeled results show that potential radionuclide emissions are determined to be from a minor source per WAC 246-247.	Periodic confirmatory measurement as described in O&M plan, Appendix C ("Air Monitoring Plan for the 200 West Pump and Treat) will be used to confirm emissions do not exceed criteria. Measurements consist of engineering calculations combined with the results of *Near-Facility Environmental Monitoring Quality Assurance Project Plan* (HNF-EP-0538-11, dated June 2008), which are summarized in an annual environmental monitoring report. Existing near facility monitoring network will be used with monitoring locations added if needed.
28	ARAR (WAC 246-247-035[1][a][ii])	Incorporates the requirements of 40 CFR 61, Subpart H by reference. Requires that emissions of radionuclides to the ambient air from DOE facilities shall not exceed amounts that would cause any member of the public to receive, in any year, an effective dose equivalent of greater than 10 mrem/yr.	200-ZP-1 OU emission control equipment will meet the substantive requirements of these standards. The emission control equipment for radionuclides includes ion-exchange columns to remove technetium-99, iodine-129, and future removal of uranium.	O&M plan, Appendix C ("Air Monitoring Plan for the 200 West Pump and Treat') has results that show control equipment is consistent with applicable best or reasonably achieved control technologies. The DOE guide (DOE/RL-2006-29) was used to calculate the unabated release potential for radiological constituents. The modeled results show that potential radionuclide emissions are determined be from a minor source per WAC 246-247. Periodic confirmatory measurement will be used to monitor radiological emissions that consist of engineering calculations combined with the results of HNF-EP-0538-11, which are summarized in an annual environmental monitoring report. Notification will be provided to EPA in the event any air sample that exceeds 10 percent of the values listed in Table 2 of Appendix E in the 40 CFR 61, as measured in the Hanford near-facility ambient air monitors.
29	ARAR (WAC 173-303-071)	Describes those categories of wastes that are excluded from the requirements of WAC 173-303 (excluding WAC 173-303-050) because they are generally not dangerous or are regulated under other state and federal programs or are recycled in ways that do not threaten public health or the environment.	Wastes generated from 200-ZP-1 OU remedial action will be reviewed against the categories identified in WAC 173-303-071.	O&M plan, Appendix B ("Waste Management Plan for the 200 West Pump and Treat") designation and corresponding waste profiles are completed by the Waste Management lead. The waste profiles are documented on the WPLIS.
30	ARAR (WAC 173-303-073)	Establishes the conditional exclusions and the management requirements of special wastes, as defined in WAC 173-303-040.	IDW and remediation waste generated during the remedial action will be reviewed against these exclusions.	O&M plan, Appendix B ("Waste Management Plan for the 200 West Pump and Treat") designation and corresponding waste profiles are completed by the Waste Management lead. The waste profiles are documented on the WPLIS.

Table A-1. 200 West P&T Compliance Matrix for the 200-ZP-1 Groundwater OU

Line #	Source Documents	Requirement	Compliance Methodology	Comments
31	ARAR (WAC 173-303-077)	Identifies those wastes exempted from regulation under WAC 173-303-140 and WAC 173-303-170 through -9906 (excluding WAC 173-303-960). These wastes are subject to regulation under WAC 173-303-573.	IDW and remediation waste generated from the 200-ZP-1 OU remedial action will be reviewed against universal waste criteria and will comply with the substantive requirements provided in WAC 173-303-573.	O&M plan, Appendix B ("Waste Management Plan for the 200 West Pump and Treat") designation and corresponding waste profiles are completed by the Waste Management lead. The waste profiles are documented on the WPLIS.
32	ARAR (WAC 173-303-120[3] and [4])	These regulations define 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.	IDW and remediation waste generated from the 200-ZP-1 OU remedial action will be reviewed against the requirements for recyclable materials. If recyclable materials are generated, the material will be managed according to the substantive requirements of WAC 173-303-120(3).	O&M plan, Appendix B ("Waste Management Plan for the 200 West Pump and Treat") designation and corresponding waste profiles are completed by the Waste Management lead. The waste profiles are documented on the WPLIS.
33	ARAR (WAC 173-303-140[4])	Establishes state standards for land disposal of dangerous waste and incorporates, by reference, the federal restrictions of 40 CFR 268 that are relevant and appropriate to solid waste that is designated as dangerous or mixed waste. The requirements prohibit the placement of restricted RCRA hazardous waste in land-based units such as landfills surface impoundments, and waste piles until treated to standards considered protective for disposal. Specific treatment standards are included in requirements.	200-ZP-1 OU remediation waste and IDW dangerous waste destined for onsite land disposal will be managed in accordance with these restrictions.	Treatment residuals disposal/treatment occurs on an as-needed basis and will follow applicable waste management functions identified in the O&M plan, Appendix B ("Waste Management Plan for the 200 West Pump and Treat"). Waste designation and corresponding waste profiles are completed by the Waste Management lead. The waste profiles are documented on the WPLIS. Waste acceptance criteria for disposal at ERDF including LDRs are provided in WCH-191, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*.
34	ARAR (WAC-246-040[3] and [4]), ARAR (WAC 246-247-075[1][2][3][4][8])	Requires that emissions be controlled to ensure that radiation emission standards are not exceeded from new construction and existing sources. Establishes monitoring, testing, and quality assurance requirements for emissions.	200-ZP-1 OU emission control equipment will meet the substantive requirements of these standards. The emission control equipment for radionuclides includes ion-exchange columns to remove technetium-99, iodine-129, and future removal of uranium.	Periodic confirmatory measurement, as described in O&M plan, Appendix D ("200 West Pump and Treat Sampling and Analysis Plan"), will be used to confirm emissions do not exceed criteria. Measurements consist of engineering calculations combined with HNF-EP-0538-11, which is summarized in an annual environmental monitoring report. Existing near-facility monitoring network will be used. Monitoring locations will be added if needed.

Note: The references cited in this table are provided in the Reference section of this appendix. The acronyms used in this table are included in the List of Terms at the beginning of this appendix.

Table A-2. Identification of Federal ARARs for the 200-UP-1 Groundwater OU

ARAR Citation	Relevancy and Category	Requirement	Rationale for Use
Safe Drinking Water Act of 1974 **(Pub. L. 93-523, as amended; 42 USC 300f, et seq.); "National Primary Drinking Water Regulations" (40 CFR 141)**			
"Maximum Contaminant Levels for Organic Contaminants" (40 CFR 141.61)	ARAR; chemical	Establishes MCLs for drinking water that are designed to protect human health from the potential adverse effects of organic contaminants in drinking water.	The groundwater in the 200-UP-1 OU is not currently used for drinking water. However, Central Plateau groundwater is considered a potential drinking water source. Thus, the substantive requirements in 40 CFR 141.62 for organic, inorganic, and radionuclide constituents are relevant and appropriate, except for iodine-129, which is waived. MCLs will be achieved through groundwater treatment and MNA.
"Maximum Contaminant Levels for Inorganic Contaminants" (40 CFR 141.62)	ARAR; chemical	Establishes MCLs for drinking water that are designed to protect human health from the potential adverse effects of inorganic contaminants in drinking water.	
"Maximum Contaminant Levels for Radionuclides" (40 CFR 141.66)	ARAR; chemical	Establishes MCLs for drinking water that are designed to protect human health from the potential adverse effects of radionuclides in drinking water.	
Other Federal ARARs			
Archeological and Historic Preservation Act of 1974 (16 USC 469a-1 – 469a-2[d])	ARAR; location	Provides for the preservation of archaeological and historic data. This act mandates preservation of the data and does not require protection of the actual historical sites.	Archeological and historic sites have been identified within the 200 Areas and may be present in areas where remedial action will be taken pursuant to this ROD; therefore, the substantive requirements of this act are applicable to actions that might result in loss of archaeological or historic data.
National Historic Preservation Act of 1966 (16 USC 470, Section 106, et seq.) "Protection of Historic Properties" (36 CFR 800)	ARAR; location	Requires federal agencies to consider the impacts of their undertaking on historic properties through identification, evaluation, and avoidance and if impact cannot be avoided through minimization and mitigation.	Cultural and historic sites have been identified within the 200 Areas and may be present in areas where remedial action will be taken pursuant to this ROD; therefore, the substantive requirements of this act are applicable to actions that might disturb these types of sites.
Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001, et seq.) "Native American Graves Protection and Repatriation Regulations" (43 CFR 10)	ARAR; location	Establishes federal agency responsibility for discovery of human remains, associated and unassociated funerary objects, sacred objects, and items of cultural patrimony.	Substantive requirements of this act are applicable if remains and sacred objects are found during remediation. The Tribal Nations will be consulted if such items are found during remediation.
Endangered Species Act of 1973 (7 USC Section 136; 16 USC 1531, et seq.) (50 CFR 402, "Interagency Cooperation—Endangered Species Act of 1973, as Amended")	ARAR; location	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. Mitigation measures must be applied to actions that occur within critical habitats or surrounding buffer zones of listed species, in order to protect the resource.	Substantive requirements of this act are applicable if threatened or endangered species are identified in areas where remedial action will occur or if remedial action occurs in critical habitats or surrounding buffer zones of listed species.

Table A-2. Identification of Federal ARARs for the 200-UP-1 Groundwater OU

ARAR Citation	Relevancy and Category	Requirement	Rationale for Use
Migratory Bird Treaty Act of 1918 (16 USC 703-712, et seq.)	ARAR; location	Protects all migratory bird species and prevents “take” of protected migratory birds, their young, or their eggs.	Migratory birds occur in the 200 West Area where 200-UP-1 OU remedial activities will take place.

Notes: The state of Washington dangerous waste program has been authorized under RCRA and WAC 173-303, “Dangerous Waste Regulations” to operate in lieu of federal RCRA hazardous waste regulations.

The references cited in this table are provided in the Reference section of this appendix. The acronyms used in this table are included in the List of Terms at the beginning of this appendix.

Table A-3. Identification of State ARARs for the 200-UP-1 Groundwater OU

ARAR Citation	Relevancy and Category	Requirement	Rationale for Use
"Hazardous Waste Cleanup -- Model Toxics Control Act" (RCW 70.105D, as amended);"Model Toxics Control Act—Cleanup" (WAC 173-340)			
"Ground Water Cleanup Standards" (WAC 173-340-720)	ARAR; chemical	These groundwater cleanup requirements are ARARs where they are more stringent than federal MCL ARARs. Method B equations (720-1 and 720-2) will be used to calculate groundwater cleanup levels for noncarcinogens and carcinogens, respectively. Requires an adjustment downward of Method B groundwater cleanup levels based on existing state or federal cleanup standard so that the total excess cancer risk does not exceed 1×10^{-5} and the hazard index does not exceed one.	The groundwater in the 200-UP-1 OU is not currently used for drinking water. However, the 200-UP-1 OU groundwater is considered a potential drinking water source and is considered potable under WAC 173-340-720.
"Public Health and Safety," "Hazardous Waste Management" (RCW 70.105, as amended); "Dangerous Waste Regulations" (WAC 173-303)			
"Identifying Solid Waste" (WAC 173-303-016)	ARAR; action	Identifies those materials that are and are not solid wastes.	Substantive requirements of these regulations are applicable because they define how to determine which materials generated in conducting the selected remedial action are solid waste subject to the requirements for solid wastes and to dangerous waste designation requirements.
"Recycling Processes Involving Solid Waste" (WAC 173-303-017)	ARAR; action	Identifies materials that are and are not solid wastes when recycled.	
"Designation of Dangerous Waste" (WAC 173-303-070[3])	ARAR; action	Establishes whether a solid waste is, or is not, a dangerous waste or an extremely hazardous waste.	Substantive requirements of these regulations are applicable to solid wastes generated during the remedial action. Specifically, solid waste that is generated during this remedial action would, if a dangerous waste, be subject to the dangerous waste regulations.
"Excluded Categories of Waste" (WAC 173-303-071)	ARAR; action	Describes those categories of wastes that are excluded from the requirements of WAC 173-303 (excluding WAC 173-303-050).	This exclusion is applicable to waste from remedial actions in the 200-UP-1 OU, should wastes identified in WAC 173-303-071 be generated.
"Conditional Exclusion of Special Wastes" (WAC 173-303-073)	ARAR; action	Establishes the conditional exclusion and the management requirements of special wastes, as defined in WAC 173-303-040.	Substantive requirements of this conditional exclusion are applicable to special wastes generated during the remedial action.
"Requirements for Universal Waste" (WAC 173-303-077)	ARAR; action	Identifies those wastes exempted 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.	Substantive requirements of these regulations are applicable to universal waste generated during the remedial action.
"Recycled, Reclaimed, and Recovered Wastes" (WAC 173-303-120) Specific subsections: WAC 173-303-120(3) WAC 173-303-120(5)	ARAR; action	These regulations define 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.	Substantive requirements of these regulations are applicable to certain materials that might be generated during the remedial action. Eligible recyclable materials can be recycled and/or conditionally excluded from certain dangerous waste requirements.
"Land Disposal Restrictions" (WAC 173-303-140)	ARAR; action	This regulation establishes state standards for land disposal of dangerous waste and incorporates, by reference, federal LDRs of 40 CFR 268 that are ARARs for solid waste that is designated as dangerous or mixed waste in accordance with WAC 173-303-070(3).	The substantive requirements of this regulation are applicable to materials generated during the remedial action. Specifically, dangerous/mixed waste that is generated during the remedial action would be subject to LDRs. The offsite treatment, disposal, or management of such waste would be subject to all applicable substantive and procedural laws and regulation, including LDR requirements.

Table A-3. Identification of State ARARs for the 200-UP-1 Groundwater OU

ARAR Citation	Relevancy and Category	Requirement	Rationale for Use
"Requirements for Generators of Dangerous Waste" (WAC 173-303-170)	ARAR; action	Establishes the requirements for dangerous waste generators.	Substantive requirements of this regulation are applicable to dangerous waste generated during the remedial action. Specifically, the substantive standards for management of dangerous or mixed waste are ARARS to the management of dangerous waste that will be generated during the remedial action.
"Closure and Post-Closure" (WAC 173-303-610)	ARAR; action	Establishes requirements for clean closure of a treatment, storage, and disposal unit.	The substantive requirements of this regulation are applicable to the 200 West P&T since it treats groundwater that contains dangerous waste and is subject to closure requirements of a dangerous waste treatment unit.
"Use and Management of Containers" (WAC 173-303-630)	ARAR; action	Establishes requirements for dangerous waste facilities that store containers of dangerous waste	The substantive requirements of this regulation are applicable to the 200 P&T since the treatment process will result in the use of containers that store dangerous waste while awaiting disposal.
"Solid Waste Management—Reduction and Recycling" (RCW 70.95, as amended); "Solid Waste Handling Standards" (WAC 173-350)			
"On-Site Storage, Collection and Transportation Standards," (WAC 173-350-300)	ARAR; action	Establishes the requirements for the temporary storage of solid waste in a container onsite and the collecting and transporting of the solid waste.	The substantive requirements of this newly promulgated rule are applicable to the onsite collection and temporary storage of solid wastes for the 200-UP-1 OU remediation activities.
"Water Well Construction" (RCW 18.104, as amended); "Minimum Standards for Construction and Maintenance of Wells" (WAC 173-160)			
"How Shall Each Water Well Be Planned and Constructed?" (WAC 173-160-161)	ARAR; action	Identifies well planning and construction requirements.	The substantive requirements of these regulations are ARARs to actions that include construction and maintenance of wells used for groundwater extraction, monitoring, or injection of treated groundwater. The substantive requirements of WAC 173-160-161, 173-160-171, 173-160-181, 173-160-400, 173-160-420, 173-303-430, 173-160-440, 173-160-450, and 173-160-460 are ARARs to groundwater well construction, monitoring, or injection of treated groundwater or wastes in the 200-UP-1 OU.
"What Are the Requirements for the Location of the Well Site and Access to the Well?" (WAC 173-160-171)	ARAR; action	Identifies the requirements for locating a well.	
"What Are the Requirements for Preserving the Natural Barriers to Ground Water Movement Between Aquifers?" (WAC 173-160-181)	ARAR; action	Identifies the requirements for preserving natural barriers to groundwater movement between aquifers.	
"What Are the Minimum Standards for Resource Protection Wells and Geotechnical Soil Borings?" (WAC 173-160-400)	ARAR; action	Identifies the minimum standards for resource protection wells and geotechnical soil borings.	
"What Are the General Construction Requirements for Resource Protection Wells?" (WAC 173-160-420)	ARAR; action	Identifies the general construction requirements for resource protection wells.	

Table A-3. Identification of State ARARs for the 200-UP-1 Groundwater OU

ARAR Citation	Relevancy and Category	Requirement	Rationale for Use
"What Are the Equipment Cleaning Standards?" (WAC 173-160-430)	ARAR; action	Identifies the minimum casing standards.	
"What Are the Minimum Casing Standards?" (WAC 173-160-440)	ARAR; action	Identifies the equipment cleaning standards.	
"What Are the Well Sealing Requirements?" (WAC 173-160-450)	ARAR; action	Identifies the well sealing requirements.	
"What Is the Decommissioning Process for Resource Protection Wells?" (WAC 173-160-460)	ARAR; action	Identifies the decommissioning process for resource protection wells.	
"Underground Injection Control" (WAC 173-218)			
"UIC Well Classification Including Allowed and Prohibited Wells" (WAC 173-218-040)	ARAR; action	Identifies what an injection well is and types of prohibited wells.	The substantive requirements of these regulations are ARARs to actions that discharge liquid effluents to injection wells. WAC 173-218-040(4) allows for injection of treated groundwater into the same formation from where it was drawn as part of a removal or remedial action approved by EPA in accordance with CERCLA.
"Decommissioning of UIC Well" (WAC 173-218-120)	ARAR; action	Identifies requirements for decommissioning of underground injection control wells.	The substantive requirements of these regulations are ARARs to actions that deal with decommissioning underground injection control wells.
"Washington Clean Air Act" (RCW 70.94, as amended); "General Regulations for Air Pollution Sources" (WAC 173-400)			
"General Regulations for Air Pollution Sources" (WAC 173-400)	ARAR; action	Defines 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 best available control technology.	Groundwater remedial actions implemented in the 200 Areas pursuant to this ROD provide the potential for emissions subject to these standards because hazardous contaminants detected in 200-UP-1 OU groundwater include covered hazardous air pollutants.
"General Standards for Maximum Emissions" (WAC 173-400-040) "Emission Standards for Sources Emitting Hazardous Air Pollutants" (WAC 173-400-075)	ARAR; action	Requires all sources of air contaminants to meet emission standards for visible, particulate, fugitive, odors, and hazardous air emissions. Requires use of reasonably available control technology. Establishes national emission standards for hazardous air pollutants. Adopts, by reference, 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," and appendices.	Substantive requirements of these standards are ARARs to this remedial action when visible, particulate, fugitive, and hazardous air emissions and odors resulting from remedial activities will require assessment and reporting. This requirement is action-specific.

Table A-3. Identification of State ARARs for the 200-UP-1 Groundwater OU

ARAR Citation	Relevancy and Category	Requirement	Rationale for Use
"Washington Clean Air Act" (RCW 70.94, as amended); "Controls for New Sources of Toxic Air Pollutants" (WAC 173-460)			
"Purpose" (WAC 173-460-010) "Applicability" (WAC 173-460-030) "Control Technology Requirements" (WAC 173-460-060) "Ambient Impact Requirement" (WAC 173-460-070) "First Tier Review" (WAC 173-460-080) "Table of ASIL, SQER and de Minimis Emission Values" (WAC 173-460-150) "Second Tier Review" (WAC 173-460-090)	ARAR; action	Requires that new sources of air emissions meet emission requirements identified in this regulation.	Substantive requirements of these standards are ARARs to this remedial action because of the potential for toxic air pollutants to become airborne as a result of remedial activities.
"Washington Clean Air Act" (RCW 70.94, as amended); "Ambient Air Quality Standards and Emission Limits for Radionuclides" (WAC 173-480)			
"General Standards for Maximum Permissible Emissions" (WAC 173-480-050[1])	ARAR; action	All radionuclide emission units are required to meet emission standards. At a minimum all emission units shall meet WAC 246-247 or WAC 246-248 (as applicable) requiring every reasonable effort to maintain radioactive materials in effluents to unrestricted areas ALARA.	Substantive requirements are ARARs when fugitive and diffuse emissions resulting from excavation occur, and related activities will require assessment and reporting. This requirement is action-specific.
"Emission Monitoring and Compliance Procedures" (WAC 173-480-070[2])	ARAR; action	Requires that radionuclide emissions shall be 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. This state regulation is as (or more) stringent than the equivalent federal program requirement.	The substantive requirements of this standard are ARARs to remedial actions involving disturbance or ventilation of radioactively contaminated areas or structures, because airborne radionuclides may be emitted to unrestricted areas where any member of the public may be. This requirement is action-specific.
"Emission Standards for New and Modified Emission Units" (WAC 173-480-060)	ARAR; action	Requires that construction, installation, or establishment of new air emission control units use best available radionuclide control technology.	Hazardous contaminants detected in 200-UP-1 groundwater include radionuclides that could be emitted from air emission control units during remedial actions.

Table A-3. Identification of State ARARs for the 200-UP-1 Groundwater OU

ARAR Citation	Relevancy and Category	Requirement	Rationale for Use
"Nuclear Energy and Radiation" (RCW 70.98, as amended); "Radiation Protection—Air Emissions" (WAC 246-247)			
"National Standards Adopted by Reference for Sources of Radionuclide Emissions" (WAC 246-247-035) (WAC 246-247-035[1][a][i]) (adopts, by reference, 40 CFR 61.12, "Compliance with Standards and Maintenance Requirements")	ARAR; action	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 "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.	Substantive requirements of this standard are ARARs because this remedial action may provide airborne emissions of radioactive particulates. As a result, requirements limiting emissions apply.
"National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities" (WAC 246-247-035[1][a][ii]) (adopts, by reference, 40 CFR 61.93, "Emission Monitoring and Test Procedures")	ARAR; action	This regulation incorporates requirements of 40 CFR 61, Subpart H by reference. Radionuclide airborne emissions from the facility shall be controlled so as not to exceed amounts that would cause an exposure greater than 10 mrem/yr effective dose equivalent. This state regulation is as (or more) stringent that the equivalent federal program requirement.	Substantive requirements of this standard are ARARs because this remedial action may provide airborne emissions of radioactive particulates. As a result, requirements limiting emissions apply. This is a risk-based standard for the purposes of protecting human health and the environment.
"General Standards" (WAC 246-247-040[3]) (WAC 246-247-040[4])	ARAR; action	Requires that emissions be controlled to ensure ALARA-based and best available control standards are not exceeded.	Substantive requirements of this standard are ARARs because fugitive, diffuse, and point source emissions of radionuclides to the ambient air may result from remedial activities, such as excavation of contaminated soils and operation of exhauster and vacuums, performed during the remedial action. This standard exists to ensure compliance with emission standards.
"Monitoring, Testing and Quality Assurance" (WAC 246-247-075)	ARAR; action	Establishes the monitoring, testing, and quality assurance requirements for radioactive air emissions. Emissions from nonpoint and fugitive sources of airborne radioactive material will be measured. Measurement techniques may include but are not limited to sampling, calculation, smears, or other reasonable method for identifying emissions.	Substantive requirements of this standard are ARARs when fugitive and nonpoint source emissions of radionuclides to the ambient air may result from activities, such as operation of exhauster and vacuums, performed during the 200-UP-1 OU remedial action. This standard exists to ensure compliance with emission standards.

Note: The references cited in this table are provided in the Reference section of this appendix. The acronyms used in this table are included in the List of Terms at the beginning of this appendix.

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Table A-4. Identification of Federal ARARs for the 200-DV-1 Groundwater OU

ARAR Citation	ARAR or TBC	Requirement	Rationale for Use
Archeological and Historic Preservation Act of 1974 16 USC 469a-1 through 468a-2(d)	ARAR	Requires that the removal action at the 200-DV-1 OU does not cause the loss of any archaeological or historic data. This act mandates preservation of the data and does not require protection of the actual historical sites.	Archeological and historic sites have been identified within the 200 Areas; therefore, the substantive requirements of this act are applicable to actions that might disturb these sites. This requirement is action-specific.
National Historic Preservation Act of 1966, 16 USC 470, Section 106 36 CFR 60, "National Register of Historic Places" 36 CFR 65, "National Historic Landmarks Program" 36 CFR 800.5, "Protection of Historic Properties"	ARAR	Requires federal agencies to consider the impacts of their undertaking on cultural properties through identification, evaluation, and mitigation processes.	Cultural and historical sites have been identified within the 200 Areas; therefore, the substantive requirements of this act are applicable to actions that might disturb these types of sites. This requirement is location-specific.
Native American Graves Protection and Repatriation Act of 1990, 25 USC 3001, et seq. 43 CFR 10, "Native American Graves Protection and Repatriation Regulations"	ARAR	Establishes federal agency responsibility for the discovery of human remains, associated and unassociated funerary objects, sacred objects, and items of cultural patrimony.	Substantive requirements of this act are applicable if remains and sacred objects are found during remediation. This is a location-specific requirement.
Endangered Species Act of 1973, 16 USC 1531 et seq., 16 USC 1536(c) 50 CFR 402, "Interagency Cooperation" *Migratory Bird Treaty Act of 1918*, 16 USC 703-712, et seq.	ARAR	Establishes requirements for actions by federal agencies that are likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. If remediation is within critical habitat or buffer zones surrounding threatened or endangered species, mitigation measures must be taken to protect the resource.	Substantive requirements of this act are applicable if threatened or endangered species are identified in areas where removal action will occur. This is a location-specific requirement.

ARAR = applicable or relevant and appropriate requirement
OU = operable unit
TBC = to be considered

Table A-5. Identification of State ARARs for the 200-DV-1 Groundwater OU

ARAR Citation	ARAR	Requirement	Rationale for Use
WAC 173-303, "Dangerous Waste Regulations"			
WAC 173-303-016, "Identifying Solid Waste"	ARAR	Identifies those materials that are and are not solid waste.	Substantive requirements of these regulations are applicable because they define which materials are subject to the designation regulations. Specifically, materials that are generated during the removal action would, if a solid waste, be subject to the substantive requirements for evaluating solid wastes for subsequent management. This requirement is action-specific.
WAC 173-303-017, "Recycling Processes Involving Solid Waste"	ARAR	Identifies materials that are and are not solid wastes when recycled and includes provisions for exemption from WAC 173-303.	Substantive requirements of these regulations are applicable because they define which materials are subject to the designation regulations. Specifically, materials that are generated during the removal action that qualify as solid wastes may be managed in accordance with these recycling provisions as appropriate. This requirement is action-specific.
WAC 173-303-070(3), "Designation of Dangerous Waste"	ARAR	Establishes whether a solid waste is, or is not, a dangerous waste or an extremely hazardous waste.	Substantive requirements of these regulations are applicable to materials generated during the removal action. Specifically, solid waste that is generated during this removal action that also designates as a dangerous waste would be subject to the substantive provisions of these dangerous waste requirements. This requirement is action-specific.
WAC 173-303-071, "Excluded Categories of Waste"	ARAR	Describes those categories of wastes that are excluded from the requirements of WAC 173-303.	This regulation is applicable to 200-DV-1 OU should wastes identified in WAC 173-303-071 be generated. This requirement is action-specific.
WAC 173-303-077, "Requirements for Universal Waste"	ARAR	This regulation provides alternate reduced standards for certain solid wastes (i.e., batteries, mercury-containing equipment, and lamps) as described in WAC 173-303-573.	There is a potential for generating materials during the NTCRA that would qualify for management under the substantive provisions of these regulations, which would be used as appropriate during the NTCRA. These standards are optional for management of universal wastes, which could alternatively be managed in accordance with WAC 173-303-170(3). This requirement is action-specific.

Table A-5. Identification of State ARARs for the 200-DV-1 Groundwater OU

ARAR Citation	ARAR	Requirement	Rationale for Use
WAC 173-303-120, "Recycled, Reclaimed, and Recovered Wastes" Specific subsections: WAC 173-303-120(3) WAC 173-303-120(5)	ARAR	These regulations define 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.	Substantive requirements of these regulations are applicable to certain materials that might be generated during the removal action. Eligible recyclable materials can be recycled and/or conditionally excluded from certain dangerous waste requirements. This requirement is action-specific.
WAC 173-303-140(4), "Land Disposal Restrictions"	ARAR	This regulation establishes state standards for land disposal of dangerous waste and incorporates, by reference, federal land disposal restrictions of 40 CFR 268 to solid waste that is designated as dangerous or mixed waste in accordance with WAC 173-303-070(3).	The substantive requirements of this regulation are applicable to materials generated during the removal action. Specifically, dangerous/mixed waste that is generated during the removal action would be subject to the substantive requirements of the land disposal restrictions. This requirement is action-specific.
WAC 173-303-170, "Requirements for Generators of Dangerous Waste" Specific subsections: WAC 173-303-170(3) WAC 173-303-170(4)	ARAR	Establishes the requirements for dangerous waste generators.	Substantive requirements of these regulations are applicable to materials generated during the removal action. Specifically, the substantive standards for management of dangerous/mixed waste are applicable to the management of dangerous waste that will be generated during the removal action. For purposes of this removal action, WAC 173-303-170(3) includes the substantive provisions of WAC 173-303-200 by reference. WAC 173-303-200 further includes certain substantive standards from WAC 173-303-630 and -640 by reference. This requirement is action-specific.
WAC 173-303-64620(4) "Requirements"	ARAR	Requires Corrective Action to be "consistent with" specified section in WAC 173-340.	Substantive requirements of this regulation establish minimum requirements for Hazardous Waste Management Act corrective action.

Table A-5. Identification of State ARARs for the 200-DV-1 Groundwater OU

ARAR Citation	ARAR	Requirement	Rationale for Use
WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"			
WAC 173-160-161	ARAR	Identifies well planning and construction requirements.	The substantive requirements of these regulations are ARAR to actions that include construction of wells used for groundwater extraction and monitoring. The substantive requirements of WAC 173-160-161, 173-160-171, 173-160-181, 173-160-400, 173-160-420, 173-303-430, 173-160-440, 173-160-450, and 173-160-460 are relevant and appropriate to groundwater well construction and monitoring. These requirements are action-specific.
WAC 173-160-171	ARAR	Identifies the requirements for locating a well.	
WAC 173-160-181	ARAR	Identifies the requirements for preserving natural barriers to groundwater movement between aquifers.	
WAC 173-160-400	ARAR	Identifies the minimum standards for resource protection wells and geotechnical soil borings.	
WAC 173-160-420	ARAR	Identifies the general construction requirements for resource protection wells.	
WAC 173-160-430	ARAR	Identifies the minimum casing standards.	
WAC 173-160-440	ARAR	Identifies the equipment cleaning standards.	
WAC 173-160-450	ARAR	Identifies the well sealing requirements.	
WAC 173-160-460	ARAR	Identifies the decommissioning process for resource protection wells	

Table A-5. Identification of State ARARs for the 200-DV-1 Groundwater OU

ARAR Citation	ARAR	Requirement	Rationale for Use
WAC 173-400 and WAC 173-460, General Regulations for Air Pollution Sources			
RCW 70.94, "Department of Ecology," and RCW 43.21A, "Washington Clean Air Act" WAC 173-400, "General Regulations for Air Pollution" Specific subsections: WAC 173-400-040(3) WAC 173-400-040(8) WAC 173-400-113	ARAR	These laws and regulations require all sources of air contaminants to meet standards for visible emissions, fallout, fugitive emissions, odors, emissions detrimental to persons or property, sulfur dioxide, concealment and masking, and fugitive dust. Requires use of RACT. WAC 173-400-113 applies to new and modified sources and requires controls to minimize the releases of associated criteria and toxic air emissions. Emissions are to be minimized through application of the BACT.	Substantive requirements of the general standards for control of fugitive emissions would be applied as appropriate to minimize the generation of dust that may occur during work under the NTCRA. These requirements are action-specific. It is unlikely that the substantive provisions of WAC 173-400-113 would be triggered during the NTCRA. However, substantive requirements of this regulation potentially would be applicable if a treatment technology that emits regulated air emissions were necessary during the implementation of the NTCRA. This requirement is action-specific.
WAC 173-460, "Controls for New Sources of Toxic Air Pollutants" Specific subsections: WAC 173-460-060 WAC 173-460-150	ARAR	These regulations apply for determination of de minimis emission values and for establishment of control technology as appropriate for new or modified toxic air pollutant emissions. Requires BACT for regulated emissions of toxic air pollutants (T-BACT) and demonstration that emissions of toxic air pollutants will not endanger human health.	It is not anticipated that work done under the NTCRA will trigger standards for T-BACT. However, substantive requirements of these regulations potentially would be applicable to activities performed onsite, if a treatment technology that emits toxic air emissions were necessary during the implementation of the NTCRA. These requirements are action-specific.
WAC 246-247, "Radiation Protection – Air Emissions"			
WAC 246-247-040(3) and WAC 246-247-040(4), "General Standards"	ARAR	These regulations require all new construction and significant modifications of emission units to use BARCT and require all existing emission units and nonsignificant modifications to use ALARACT in controlling emissions to the environment.	There is potential for encountering radionuclide contamination during the activities covered by this NTCRA. Substantive requirements of these standards are potentially applicable because fugitive, diffuse, and point source emissions of radionuclides to the ambient air may result from the removal activities associated with pipeline installation. These requirements are action-specific.

Table A-5. Identification of State ARARs for the 200-DV-1 Groundwater OU

ARAR Citation	ARAR	Requirement	Rationale for Use
WAC 246-247-075, "Monitoring, Testing, and Quality Assurance" Specific subsections: WAC 246-247-075(1) WAC 246-247-075(2) WAC 246-247-075(3) WAC 246-247-075(4) WAC 246-247-075(8)	ARAR	These regulations establish the monitoring, testing, and quality assurance requirements for radioactive air emissions from major sources. These regulations also include requirements for continuous sampling and provide for periodic sampling (grab samples) in cases where continuous sampling is not practical and radionuclide emission rates are relatively constant. These regulations also provide for the waste site owner or operator to use alternative effluent flow rate measurement procedures or site selection and sample extraction procedures, as approved by the lead agency. These regulations also establish requirements to monitor nonpoint and fugitive emissions of radioactive material.	There is a potential for generating fugitive, diffuse, and/or point source emissions during the NTCRA. Substantive requirements of these standards are potentially applicable because fugitive and nonpoint source emissions of radionuclides to the ambient air may result from activities, such as operation of exhausters and vacuums, performed during the removal action. These requirements are action-specific.
WAC 173-480-050(1), "General Standards for Maximum Permissible Emissions"	ARAR	This regulation establishes general standards for all radionuclide emission units and requires emission units to meet WAC 246-247 requiring every reasonable effort to maintain radioactive materials in effluents to unrestricted areas as low as reasonably achievable (ALARA). The regulation indicates that control equipment of sites operating under ALARA shall be defined as RACT and as ALARACT.	The potential for fugitive and diffuse emissions due to demolition and excavation and related activities may require efforts to minimize those emissions by meeting WAC 246-247. This requirement is action-specific.

Table A-5. Identification of State ARARs for the 200-DV-1 Groundwater OU

ARAR Citation	ARAR	Requirement	Rationale for Use
WAC 173-480-070(2), "Emission Monitoring and Compliance Procedures"	ARAR	This regulation applies for determining compliance with the radionuclide emission standard. Compliance with the public dose standard is determined by calculating exposure at the point of maximum annual air concentration in a location.	Removal action activities associated with pipeline installation have potential to emit radionuclides to unrestricted areas above maximum acceptable levels.

Note: The references cited in this table are provided in the reference section for this appendix.

ALARACT	=	as low as reasonably achievable control technology	NTCRA	=	non-time-critical removal action
ARAR	=	applicable or relevant and appropriate requirement	OU	=	operable unit
BACT	=	best available control technology	RACT	=	reasonably available control technology
BARCT	=	best available radionuclide control technology	T-BACT	=	best available control technology for toxics

Table A-6. Identification of TBC Criteria for the 200-DV-1 Groundwater OU

Criteria to Be Considered	TBC	Requirement	Rationale for Use
EPA et al., 2008, *Record of Decision, Hanford 200 Area 200-ZP-1 Superfund Site, Benton County, Washington*	TBC	This document provides the cleanup levels for effluent treated at the 200 West Pump and Treat.	Perched water extracted from the 200-DV-1 OU and added to the 200 West Pump and Treat influent for treatment will attain the cleanup levels for treated effluent.
DOE/RL-2013-07, *200-UP-1 Groundwater Operable Unit Remedial Design/Remedial Action Work Plan*	TBC	This document provides the cleanup levels for effluent treated at the 200 West Pump and Treat.	Perched water extracted from the 200-DV-1 OU and added to the 200 West Pump and Treat influent for treatment will attain the cleanup levels for treated effluent.
DOE/RL-2009-124, *200 West Pump and Treat Operations and Maintenance Plan*	TBC	This document will incorporate operational and monitoring changes based on receiving the 200-DV-1 OU perched water for treatment.	Perched water extracted from the 200-DV-1 OU will meet the design requirements that allow the addition of the perched water to the 200 West Pump and Treat influent for treatment.

TBC = to be considered

Table A-7. Identification of Federal ARARs for the 200-BP-5 OU Treatability Test

ARAR Citation	ARAR or TBC	Requirement	Rationale for Use
Other Federal ARARs			
Archeological and Historic Preservation Act of 1974 16 USC 469a-1 through 469a-2(d)	ARAR	Requires that the treatability test at the 200-BP-5 Groundwater OU does not cause the loss of any archaeological or historic data. This act mandates preservation of the data and does not require protection of the actual historical sites.	Archeological and historic sites have been identified within the 200 Areas; therefore, the substantive requirements of this act are applicable to actions that might disturb these sites. This requirement is action specific.
National Historic Preservation Act of 1966 36 CFR 60, "National Register of Historic Places" 36 CFR 65, "National Historic Landmarks Program" 36 CFR 800.5, "Protection of Historic Properties"	ARAR	Requires federal agencies to consider the impacts of their undertaking on cultural properties through identification, evaluation and mitigation processes.	Cultural and historic sites have been identified within the 200 Areas; therefore, the substantive requirements of this act are applicable to actions that might disturb these types of sites. This requirement is location specific.
Native American Graves Protection and Repatriation Act of 1990, 25 USC 3001, et seq. 43 CFR 10, "Native American Graves Protection and Repatriation Regulations	ARAR	Establishes federal agency responsibility for discovery of human remains, associated and unassociated funerary objects, sacred objects, and items of cultural patrimony.	Substantive requirements of this act are applicable if remains and sacred objects are found during remediation. This is a location specific requirement.

Table A-7. Identification of Federal ARARs for the 200-BP-5 OU Treatability Test

ARAR Citation	ARAR or TBC	Requirement	Rationale for Use
Other Federal ARARs			
Endangered Species Act of 1973 *Endangered Species Act of 1973*, 16 USC 1531 et seq., 16 USC 1536(c) 50 CFR 402, "Interagency Cooperation"	ARAR	Establishes requirements for actions by federal agencies that are likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. If remediation is within critical habitat or buffer zones surrounding threatened or endangered species, mitigation measures must be taken to protect the resource.	Substantive requirements of this act are applicable if threatened or endangered species are identified in areas where treatability test will occur. This is a location specific requirement.
Migratory Bird Treaty Act of 1918, 16 USC 703-712, et seq.	ARAR	Protects all migratory bird species and prevents "take" of protected migratory birds, their young, or their eggs."	Remedial actions that require mitigation measures to deter nesting by migratory birds on, around, or within remedial action site and methods to identify and protect occupied bird nests. This requirement is location specific.

Table A-8. Identification of State ARARs for the 200-BP-5 OU Treatability Test

ARAR Citation	ARAR	Requirement	Rationale for Use
"Dangerous Waste Regulations," WAC 173-303			
"Identifying Solid Waste," WAC 173-303-016	ARAR	Identifies those materials that are and are not solid wastes.	Substantive requirements of these regulations are applicable because they define which materials are subject to the designation regulations. Specifically, materials that are generated during the treatability test would, if a solid waste, be subject to the requirements for solid wastes. This requirement is action specific.

Table A-8. Identification of State ARARs for the 200-BP-5 OU Treatability Test

ARAR Citation	ARAR	Requirement	Rationale for Use
"Recycling Processes Involving Solid Waste," WAC 173-303-017	ARAR	Identifies materials that are and are not solid wastes when recycled.	Substantive requirements of these regulations are applicable because they define which materials are subject to the designation regulations. Specifically, materials that are generated during the treatability test would if a solid waste be subject to the requirements for solid wastes. This requirement is action specific.
"Designation of Dangerous Waste," WAC 173-303-070(3)	ARAR	Establishes whether a solid waste is, or is not, a dangerous waste or an extremely hazardous waste.	Substantive requirements of these regulations are applicable to materials generated during the treatability test. Specifically, solid waste that is generated during this treatability test would if a dangerous waste be subject to the dangerous waste requirements. This requirement is action specific.
"Excluded Categories of Waste," WAC 173-303-071	ARAR	Describes those categories of wastes that are excluded from the requirements of WAC 173-303 (excluding WAC 173-303-050).	This regulation is applicable to treatability test in the 200-BP-5 Groundwater OU should wastes identified in WAC 173-303-071 be generated. This requirement is action specific.
"Conditional Exclusion of Special Wastes," WAC 173-303-073	ARAR	Establishes the conditional exclusion and the management requirements of special wastes, as defined in WAC 173-303-040.	Substantive requirements of these regulations are applicable to special wastes generated during the treatability test. Specifically, the substantive standards for management of special waste are relevant and appropriate to the management of special waste that will be generated during the treatability test. This requirement is action specific.
"Requirements for Universal Waste," WAC 173-303-077	ARAR	Identifies those wastes exempted 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.	Substantive requirements of these regulations are applicable to universal waste generated during the treatability test. Specifically, the substantive standards for management of universal waste are relevant and appropriate to the management of universal waste that will be generated during the treatability test. This requirement is action specific.

Table A-8. Identification of State ARARs for the 200-BP-5 OU Treatability Test

ARAR Citation	ARAR	Requirement	Rationale for Use
"Recycled, Reclaimed, and Recovered Wastes," WAC 173-303-120 Specific subsections: WAC 173-303-120(3) WAC 173-303-120(5)	ARAR	These regulations define 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.	Substantive requirements of these regulations are applicable to certain materials that might be generated during the treatability test. Eligible recyclable materials can be recycled and/or conditionally excluded from certain dangerous waste requirements. This requirement is action specific.
"Land Disposal Restrictions," WAC 173-303-140(4)	ARAR	This regulation establishes state standards for land disposal of dangerous waste and incorporates, by reference, Federal land disposal restrictions of 40 CFR 268 that are relevant and appropriate to solid waste that is designated as dangerous or mixed waste in accordance with WAC 173-303-070(3).	The substantive requirements of this regulation are applicable to materials generated during the treatability test. Specifically, dangerous/mixed waste that is generated during the treatability test would be subject to the relevant and appropriate substantive land disposal restrictions. The offsite treatment, disposal or management of such waste would be subject to all applicable substantive and procedural laws and regulations, including land disposal restriction requirements. This requirement is action specific.
"Requirements for Generators of Dangerous Waste," WAC 173-303-170	ARAR	Establishes the requirements for dangerous waste generators.	Substantive requirements of these regulations are applicable to materials generated during the treatability test. Specifically, the substantive standards for management of dangerous/mixed waste are relevant and appropriate to the management of dangerous waste that will be generated during the treatability test. For purposes of this treatability test, WAC 173-303-170(3) includes the substantive provisions of WAC 173-303-200 by reference. WAC 173-303-200 further includes certain substantive standards from WAC 173-303-630 and -640 by reference. This requirement is action specific.
"Tank Systems," WAC 173-303-640(3)	ARAR	This regulation establishes state design standards for tank systems.	The substantive portions of this regulation are pertinent if a tank is needed as part of the treatability test operations. This requirement is action specific.

Table A-8. Identification of State ARARs for the 200-BP-5 OU Treatability Test

ARAR Citation	ARAR	Requirement	Rationale for Use
"Solid Waste Handling Standards," WAC 173-350			
"On-Site Storage, Collection and Transportation Standards," WAC 173-350-300	ARAR	Establishes the requirements for the temporary storage of solid waste in a container onsite and the collecting and transporting of the solid waste.	The substantive requirements of this newly promulgated rule are applicable to the onsite collection and temporary storage of solid wastes for the 200-BP-5 Groundwater OU treatability test activities. Compliance with this regulation is being implemented in phases for existing facilities. These requirements are location specific.
"Minimum Standards for Construction and Maintenance of Wells," WAC 173-160			
WAC 173-160-161	ARAR	Identifies well planning and construction requirements.	The substantive requirements of these regulations are ARAR to actions that include construction of wells used for groundwater extraction and monitoring. The substantive requirements of WAC 173-160-161, 173-160-171, 173-160-181, 173-160-400, 173-160-420, 173-303-430, 173-160-440, 173-160-450, and 173-160-460 are relevant and appropriate to groundwater well construction and monitoring for 200-BP-5 Groundwater OU treatability test. These requirements are action-specific.
WAC 173-160-171	ARAR	Identifies the requirements for locating a well.	
WAC 173-160-181	ARAR	Identifies the requirements for preserving natural barriers to groundwater movement between aquifers.	
WAC 173-160-400	ARAR	Identifies the minimum standards for resource protection wells and geotechnical soil borings.	
WAC 173-160-420	ARAR	Identifies the general construction requirements for resource protection wells.	
WAC 173-160-430	ARAR	Identifies the minimum casing standards.	
WAC 173-160-440	ARAR	Identifies the equipment cleaning standards.	
WAC 173-160-450	ARAR	Identifies the well sealing requirements.	
WAC 173-160-460	ARAR	Identifies the decommissioning process for resource protection wells.	

A2 References

36 CFR 800, "Protection of Historic Properties," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=877d0a95450a18185e2bb887ded529c7&node=36:3.0.6.1.1&rgn=div5.

40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=877d0a95450a18185e2bb887ded529c7&node=40:9.0.1.1.1&rgn=div5.

40 CFR 61.12, "Compliance with Standards and Maintenance Requirements."

40 CFR 61.13, "Emission Tests and Waiver of Emission Tests."

40 CFR 61.93, "Emission Monitoring and Test Procedures."

Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities."

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=877d0a95450a18185e2bb887ded529c7&node=40:23.0.1.1.3&rgn=div5.

40 CFR 141.61, "Maximum Contaminant Levels for Organic Contaminants."

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

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

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=877d0a95450a18185e2bb887ded529c7&node=40:27.0.1.1.3&rgn=div5.

40 CFR 300.430, "National Oil and Hazardous Substances Pollution Contingency Plan," "Remedial Investigation/Feasibility Study and Selection of Remedy," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=877d0a95450a18185e2bb887ded529c7&node=40:28.0.1.1.1&rgn=div5#40:28.0.1.1.1.5.1.7.

43 CFR 10, "Native American Graves Protection and Repatriation Regulations," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=1395d3ed9af45ea3f0c5531198472bf2&node=43:1.1.1.1.10&rgn=div5.

50 CFR 402, "Interagency Cooperation—Endangered Species Act of 1973, as Amended," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2009-title50-vol7/xml/CFR-2009-title50-vol7-part402.xml.

Archeological and Historic Preservation Act of 1974, 16 USC 469 – 469c-2. Available at: http://www.nps.gov/history/local-law/fhpl_archhistpres.pdf.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: http://epw.senate.gov/cercla.pdf.

DOE/EIS-0391, 2012, *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*, U.S. Department of Energy, Washington, D.C. Available at: http://www.doe.gov/nepa/downloads/eis-0391-final-environmental-impact-statement.

DOE/RL-95-11, 2006, *Ecological Compliance Assessment Management Plan*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0084174.

DOE/RL-96-32, 2001, *Hanford Site Biological Resources Management Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://nerp.pnnl.gov/docs/ecology/management/brmap/BRMaP.pdf.

DOE/RL-98-10, 2003, *Hanford Cultural Resources Management Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0088380.

DOE/RL-2001-41, 2014, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions and RCRA Corrective Actions*, Rev. 7, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0085328.

DOE/RL-2003-13, 2003, *Hanford Site Well Management Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2006-29, 2006, *Calculating Potential-to-Emit Radiological Releases and Doses*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0904290337.

DOE/RL-2008-57, 2008, *Sampling and Analysis Plan for the First Set of Remedial Action Wells in the 200-ZP-1 Groundwater Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0901300169.

DOE/RL-2008-78, 2009, *200 West Area 200-ZP-1 Pump-and-Treat Remedial Design/Remedial Action Work Plan*, Rev. 0 REISSUE, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0096137.

DOE/RL-2009-115, 2014, *Performance Monitoring Plan for the 200-ZP-1 Groundwater Operable Unit Remedial Action*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=1411040775.

DOE/RL-2009-124, 2015, *200 West Pump and Treat Operations and Maintenance Plan*, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0080208H.

DOE/RL-2010-13, 2010, *200 West Area Groundwater Pump-and-Treat Remedial Design Report*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0084153.

DOE/RL-2010-74, 2015, *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0081243H

DOE/RL-2014-34, *Action Memorandum for 200-DV-1 Operable Unit Perched Water Pumping / Pore Water Extraction*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0082284H

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.hanford.gov/?page=81.

ECR #2009-200-022, 2009, *Biological Review of the 200 West Pump and Treat System HDPE Piping and Electrical Cable Project, 200 West Area*, Pacific Northwest National Laboratory, Richland, Washington.

ECR #2009-200-023, 2009, *Biological Review of the 200 West Pump and Treat System Mobile Office Installation Project, 200 West Area*, Pacific Northwest National Laboratory, Richland, Washington.

Endangered Species Act of 1973, Pub. L. 93-205, as amended, 7 USC 136, 16 USC 1531, et seq. Available at: http://www.nmfs.noaa.gov/pr/pdfs/laws/esa.pdf.

EPA, Ecology, and DOE, 2008, *Record of Decision, Hanford 200 Area, 200-ZP-1 Superfund Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.epa.gov/superfund/sites/rods/fulltext/r2008100003103.pdf.

EPA, Ecology, and DOE, 2012, *Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0091413.

HNF-EP-0538-11, 2008, *Near-Facility Environmental Monitoring Quality Assurance Project Plan*, Rev. 0, Fluor Hanford, Inc., Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0807140230.

Interagency Cooperation, 16 USC 1536, et seq. Available at: http://www4.law.cornell.edu/uscode/uscode16/usc_sec_16_00001536----000-.html.

Interim Control of Hazardous Waste Injection, 42 USC 6939b, et seq. Available at: http://www.law.cornell.edu/uscode/text/42/6939b.

Migratory Bird Treaty Act of 1918, 16 USC 703-712, Ch. 128, July 13, 1918, 40 Stat. 755, as amended. Available at: http://www.animallaw.info/statutes/stusmba.htm.

National Historic Preservation Act of 1966, Pub. L. 89-665, as amended, 16 USC 470, et seq. Available at: http://www.achp.gov/docs/nhpa%202008-final.pdf.

Native American Graves Protection and Repatriation Act of 1990, Pub. L. 101-601, as amended, 25 USC 3001, et seq. Available at: http://www.nps.gov/history/local-law/FHPL_NAGPRA.pdf.

OSWER Directive 9234.1-06, 1989, *Applicability of Land Disposal Restrictions to RCRA and CERCLA Ground Water Treatment Reinjection Superfund Management Review: Recommendation No. 26*, U.S. Environmental Protection Agency, U.S. Department of Energy, and Washington State Department of Ecology, Olympia, Washington. Available at: http://clu-in.org/products/regs/9234106.htm.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq. Available at: http://www.epa.gov/epawaste/inforesources/online/index.htm.

RCW 18.104, "Water Well Construction," *Revised Code of Washington*, Olympia, Washington. Available at: http://apps.leg.wa.gov/RCW/default.aspx?cite=18.104&full=true.

RCW 43.21A, "Department of Ecology," *Revised Code of Washington*, Olympia, Washington. Available at: http://apps.leg.wa.gov/RCW/default.aspx?cite=43.21A.

RCW 70.94, "Washington Clean Air Act," *Revised Code of Washington*, Olympia, Washington. Available at: http://apps.leg.wa.gov/RCW/default.aspx?cite=70.94.

RCW 70.95, "Public Health and Safety," "Solid Waste Management—Reduction and Recycling," *Revised Code of Washington*, Washington State, Olympia, Washington. Available at: http://apps.leg.wa.gov/RCW/default.aspx?cite=70.95.

RCW 70.98, "Nuclear Energy and Radiation," *Revised Code of Washington*, Olympia, Washington. Available at: http://apps.leg.wa.gov/RCW/default.aspx?cite=70.98.

RCW 70.105, "Hazardous Waste Management," *Revised Code of Washington*, Olympia, Washington. Available at: http://apps.leg.wa.gov/RCW/default.aspx?cite=70.105.

RCW 70.105D, "Hazardous Waste Cleanup – Model Toxics Control Act," *Revised Code of Washington*, Olympia, Washington. Available at: http://apps.leg.wa.gov/RCW/default.aspx?cite=70.105D.

Safe Drinking Water Act of 1974, Pub. L. 93-523, as amended, 42 USC 300f, et seq. Available at: http://uscode.house.gov/download/pls/42C6A.txt.

SGW-48726, 2013, *Mitigation Action Plan for the 200 West Area Groundwater Remediation Project*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington.

TPA-CN-525, 2012, *Change Notice for Modifying Approved Documents/Workplans in Accordance with the Tri-Party Agreement Action Plan, Section 9.0, Documentation and Records: DOE/RL-2009-124, 200 West Area Pump-and-Treat Facility Operations and Maintenance Plan, Rev. 1*, dated June 4, U.S. Department of Energy, Richland Operations Office, and U.S. Environmental Protection Agency, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0092656.

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-160.

WAC 160-161, "How Shall Each Water Well Be Planned and Constructed?"

WAC 160-171, "What Are the Requirements for the Location of the Well Site and Access to the Well?"

WAC 160-181, "What Are the Requirements for Preserving the Natural Barriers to Ground Water Movement Between Aquifers?"

WAC 160-400, "What Are the Minimum Standards for Resource Protection Wells and Geotechnical Soil Borings?"

WAC 160-420, "What Are the General Construction Requirements for Resource Protection Wells?"

WAC 160-430, "What Are the Minimum Casing Standards?"

WAC 160-440, "What Are the Equipment Cleaning Standards?"

WAC 160-450, "What Are the Well Sealing Requirements?"

WAC 160-460, "What Is the Decommissioning Process for Resource Protection Wells?"

WAC 173-218, "Underground Injection Control Program," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-218.

WAC 173-218-040, "UIC Well Classification Including Allowed and Prohibited Wells."

WAC 173-218-120, "Decommissioning a UIC Well."

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-303.

WAC 303-016, "Identifying Solid Waste."

WAC 303-017, "Recycling Processes Involving Solid Waste."

WAC 303-040, "Definitions."

WAC 303-050, "Department of Ecology Cleanup Authority."

WAC 303-070, "Designation of Dangerous Waste."

WAC 303-071, "Excluded Categories of Waste."

WAC 303-073, "Conditional Exclusion of Special Wastes."

WAC 303-077, "Requirements for Universal Waste."

WAC 303-120, "Recycled, Reclaimed, and Recovered Wastes."

WAC 303-140, "Land Disposal Restrictions."

WAC 303-170, "Requirements for Generators of Dangerous Waste."

WAC 303-200, "Accumulating Dangerous Waste On-Site."

WAC 303-573, "Standards for Universal Waste Management."

WAC 303-610, "Closure and Post-Closure."

WAC 303-630, "Use and Management of Containers."

WAC 303-640, "Tank Systems."

WAC 303-64620, "Requirements."

WAC 303-960, "Special Powers and Authorities of the Department."

WAC 173-304, "Minimum Functional Standards for Solid Waste Handling," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/wac/default.aspx?cite=173-304.

WAC 304-190, "Minimum Functional Standards for Solid Waste Handling."

WAC 304-200, "On-Site Containerized Storage, Collection and Transportation Standards for Solid Waste."

WAC 304-460, "Landfilling Standards."

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

WAC 340-720, "Ground Water Cleanup Standards."

WAC 173-350, "Solid Waste Handling Standards," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-350.

WAC 350-300, "On-Site Storage, Collection and Transportation Standards."

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 400-040, "General Standards for Maximum Emissions."

WAC 400-075, "Emission Standards for Sources Emitting Hazardous Air Pollutants."

WAC 400-113, "Requirements for New Sources in Attainment or Unclassifiable Areas."

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.

WAC 460-010, "Purpose."

WAC 460-030, "Applicability."

WAC 460-060, "Control Technology Requirements."

WAC 460-070, "Ambient Impact Requirement."

WAC 460-080, "First Tier Review."

WAC 460-090, "Second Tier Review."

WAC 460-150, "Table of ASIL, SQER and de Minimus Emission Values."

WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-480.

WAC 480-050, "General Standards for Maximum Permissible Emissions."

WAC 480-060, "Emission Standards for New and Modified Units."

WAC 480-070, "Emission Monitoring and Compliance Procedures."

WAC 246-247, "Radiation Protection—Air Emissions," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=246-247.

WAC 247-035, "National Standards Adopted by Reference for Sources of Radionuclide Emissions."

WAC 247-040, "General Standards."

WAC 247-075, "Monitoring, Testing and Quality Assurance."

WAC 246-248, "Workshop Regulations for Federal Licensees," *Washington Administrative Code*, Olympia, Washington.

WCH-191, 2014, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, Rev. 3, Washington Closure Hanford, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0085617.

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Appendix B

Waste Management Plan for the 200 West Pump and Treat

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Terms

ARAR	applicable or relevant and appropriate requirement
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
DOE	U.S. Department of Energy
DOT	Department of Transportation
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ETF	Effluent Treatment Facility
GAC	granular activated carbon
ID	identification
IDW	investigation-derived waste
MSU	modular storage unit
MSW	miscellaneous solid waste
O&M	operations and maintenance
OU	operable unit
P&T	pump and treat
ROD	Record of Decision
WMP	waste management plan

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B1 Purpose

This waste management plan (WMP) establishes the requirements for the management and disposal of investigation-derived waste (IDW) and remediation waste associated with operation of the 200 West pump and treat (P&T).

The 200 West P&T was constructed to capture and treat contaminated groundwater in the 200-ZP-1 and 200-UP-1 Operable Units (OUs), as required by the *Record of Decision, Hanford 200 Area, 200-ZP-1 Superfund Site, Benton County, Washington* (EPA et al., 2008) (issued in September 2008); and the *Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit* (EPA et al., 2012) (issued in September 2012), respectively. The 200 West P&T also treated condensate from soil vapor extraction operations in the 200-PW-1 OU in accordance with the *Record of Decision, Hanford 200 Area Superfund Site, 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units* (EPA et al., 2011). In addition, the 200 West P&T is the preferred alternative to treat contaminated water from the 200-DV-1 OU perched water, as described in *Action Memorandum for 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction* (DOE/RL-2014-34, 2014); contaminated water from the treatability test in 200-BP-5 OU described in *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit* (DOE/RL-2010-74, 2015); and leachate from ERDF described in *U.S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site 200 Area Benton County, Washington, Amended Record of Decision Summary and Responsiveness Summary* (EPA, 1999) and *Explanation of Significant Differences for the U.S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site – 200 Area, Benton County, Washington* (ESD; EPA, 2015).

The 200 West P&T extracts groundwater from a network of extraction wells and then treats the contaminated groundwater to reduce the mass of carbon tetrachloride, total chromium (trivalent and hexavalent), nitrate, trichloroethene, iodine-129, technetium-99, uranium, and other constituents within the 200-ZP-1, 200-UP-1, 200-DV-1, and 200-BP-5 OUs as well as leachate from ERDF. Treated water, cleaned to the levels specified by the Records of Decision (RODs) for the 200-ZP-1 and 200-UP-1 OUs, by the Action Memorandum for the 200-DV-1 OU, by the Treatability Test Plan for the 200-BP-5 OU, and by the ESD for ERDF leachate, is injected into the aquifer through a network of injection wells. Waste generated by these remedial activities is managed in accordance with substantive portions of the applicable or relevant and appropriate requirements (ARARs), as identified in the 200-ZP-1 OU ROD; the 200-UP-1 OU interim ROD; the 200-DV-1 OU Action Memorandum; the 200-BP-5 OU Treatability Test Plan; and the ESD for ERDF leachate.

This WMP includes the requirements for the management and disposal of IDW generated from the installation, monitoring, sampling, maintenance, and decommissioning of wells at the 200-ZP-1 OU in accordance with the *Hanford Site Strategy for Management of Investigation Derived Waste* (DOE/RL-2011-41).

Tables B-1 and B-2 provide the well numbers, and Figures B-1 and B-2 illustrate the locations of the wells in the 200 West Area. If additional wells are identified to support groundwater monitoring or remediation activities, this WMP will be updated accordingly.

B2 Waste Generation Activities and Projected Waste Streams

The following activities are expected to generate waste subject to the requirements of this WMP:

- Construction, modification, and operations and maintenance (O&M) of the 200 West P&T

- Installation, development, testing, monitoring, sampling, O&M, and decommissioning of groundwater monitoring, extraction, and injection wells
- Subsurface characterization activities, including water level and other in situ groundwater or vadose zone measurements
- Aquifer testing and geophysical logging
- Treatability studies
- Decontamination of equipment, tools, and material
- Process sampling and analysis of samples

Table B-1. 200 West Area Groundwater Wells

299-W10-1	299-W15-33	299-W19-48	699-36-61A
299-W10-14	299-W15-37	299-W19-49	699-36-66B
299-W10-27	299-W15-42	299-W19-6	699-36-70A
299-W10-30	299-W15-46	299-W21-2	699-36-70B
299-W10-31	299-W15-49	299-W22-47	699-37-66
299-W10-33	299-W15-50	299-W22-72	699-38-61
299-W11-13	299-W15-7	299-W22-86	699-38-65
299-W11-18	299-W15-763	299-W22-87	699-38-68A
299-W11-33Q	299-W15-765	299-W22-88	699-38-70B
299-W11-43	299-W15-83	299-W23-19	699-38-70C
299-W11-45	299-W15-94	299-W23-4	699-40-62
299-W11-47	299-W18-1	299-W26-13	699-40-65
299-W11-48	299-W18-15	299-W27-2	699-43-69
299-W11-87	299-W18-16	299-W5-2	699-44-64
299-W11-88	299-W18-21	299-W6-3	699-45-69A
299-W13-1	299-W18-22	299-W6-6	699-45-69C
299-W13-2	299-W18-40	299-W7-3	699-47-60
299-W14-11	299-W19-105	299-W9-2	699-48-71
299-W14-13	299-W19-107	699-30-66	699-50-74
299-W14-14	299-W19-34A	699-32-62	699-51-63
299-W14-71	299-W19-34B	699-32-72A	C9625[a]
299-W14-72	299-W19-36	699-33-75	C9626 [a]
299-W15-11	299-W19-4	699-34-61	C9627 [a]
299-W15-152	299-W19-41	699-35-66A	
299-W15-17	299-W19-47	699-35-78A	

a. Potential new wells to support groundwater monitoring beneath Low Level Waste Management Area 3 in the northwest corner of 200-ZP-1 OU.

Table B-2. 200 West P&T Wells

Well Code	Well Identification	Well Number
Extraction Wells		
YE-1	C7017	299-W15-225
YE-2	C7018	299-W14-20
YE-3	C7021	299-W14-73
YE-4	C7024	299-W14-74
YE-5	C7027	299-W12-2
YE-6	C7020	299-W11-50
YE-7	C7022	299-W11-90
YE-8	C7754	299-W11-96
YE-9	C7577	299-W17-3
YE-10	C7576	299-W17-2
YE-11	C8718	299-W19-111
YE-12	C7019	299-W11-49
YE-13	C8719	299-W11-97
YE-14	C8720	299-W6-15
YE-15	C7494	299-W14-21
YE-16	C7025	299-W11-92
YE-17	C8721	299-W5-1
YE-18	C7028	299-W12-3
YE-19	C7029	299-W12-4
YE-20	C7030	299-W14-22
YE-21	C8095	299-W22-90
YE-22	C8096	299-W22-91
YE-23	C8097	299-W22-92
YE-25	C8927	299-W19-113
YE-26	C8928	299-W19-114
YE-27	C8243	299-E33-268
YE-28	C5859	299-E33-344
YE-29	C8914	299-E33-350
YE-30	C8915	299-E33-351
YE-31	C8923	299-E33-360

Table B-2. 200 West P&T Wells

Well Code	Well Identification	Well Number
Injection Wells		
YJ-1	C8064	299-W6-13
YJ-2	C8065	299-W6-14
YJ-3	C8066	299-W10-36
YJ-4	C7573	299-W10-35
YJ-5	C7574	299-W15-226
YJ-6	C7575	299-W15-227
YJ-7	C8716	299-W15-228
YJ-8	C8920	299-W18-41
YJ-9	C8786	699-49-69
YJ-10	C8717	699-45-67B
YJ-11	C7578	699-45-67
YJ-12	C8068	699-44-67
YJ-13	C7579	699-43-67
YJ-14	C8069	699-42-67
YJ-15	C8070	699-40-67
YJ-16	C8921	699-38-64
YJ-17	C8386	699-43-67B
YJ-18	B2409	299-W15-29
YJ-19	B2747	299-W18-36
YJ-21	B2757	299-W18-38
YJ-22	B2758	299-W18-39
YJ-23	C8067	699-46-68
YJ-24	C8944	299-W15-229
YJ-25	C9521	299-W7-14
YJ-26	C9482	299-E20-1
YJ-27	C9483	299-E20-2
YJ-28	C9484	299-E11-1

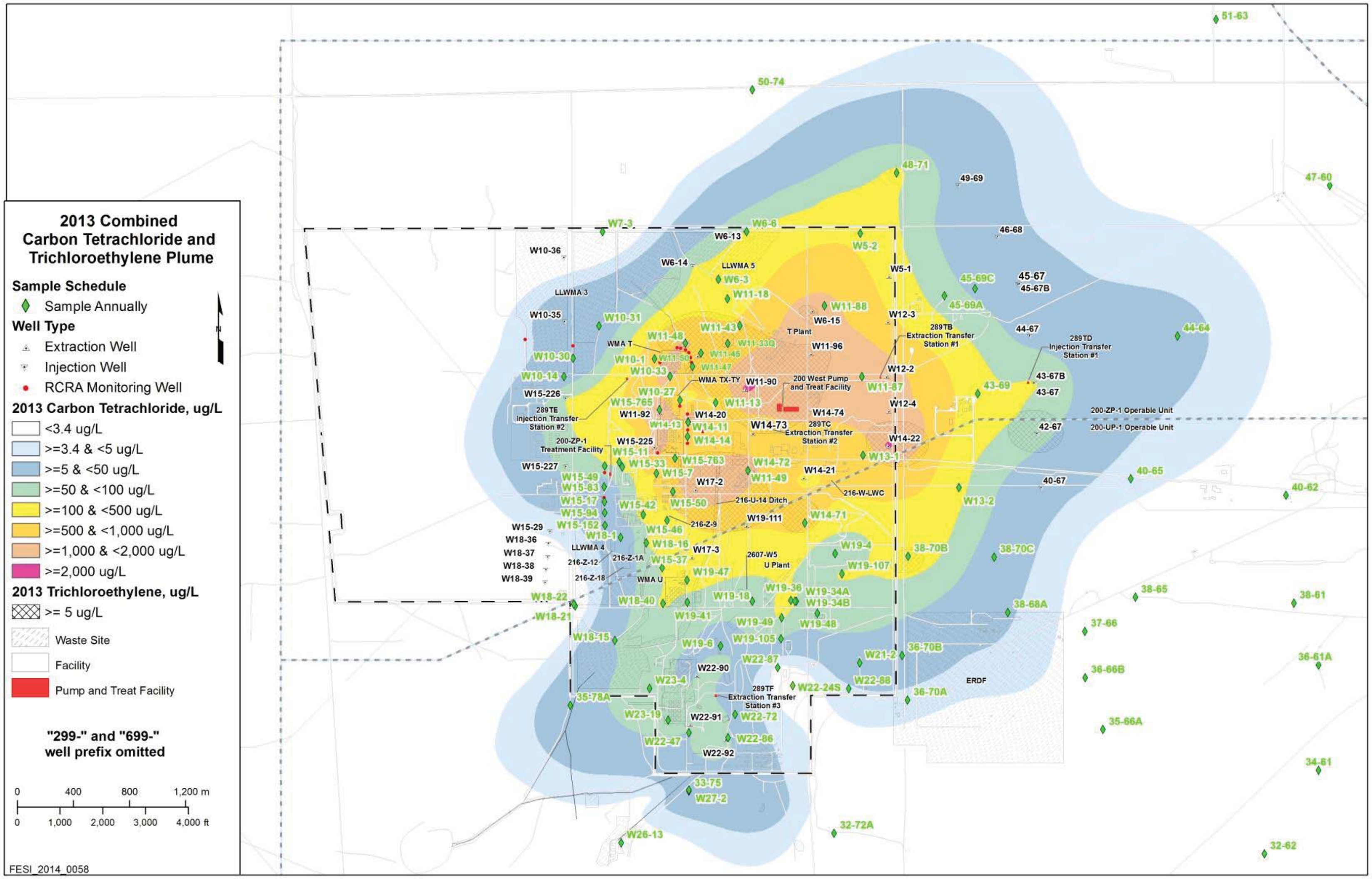

Figure B-1. 200 West Groundwater Well Locations

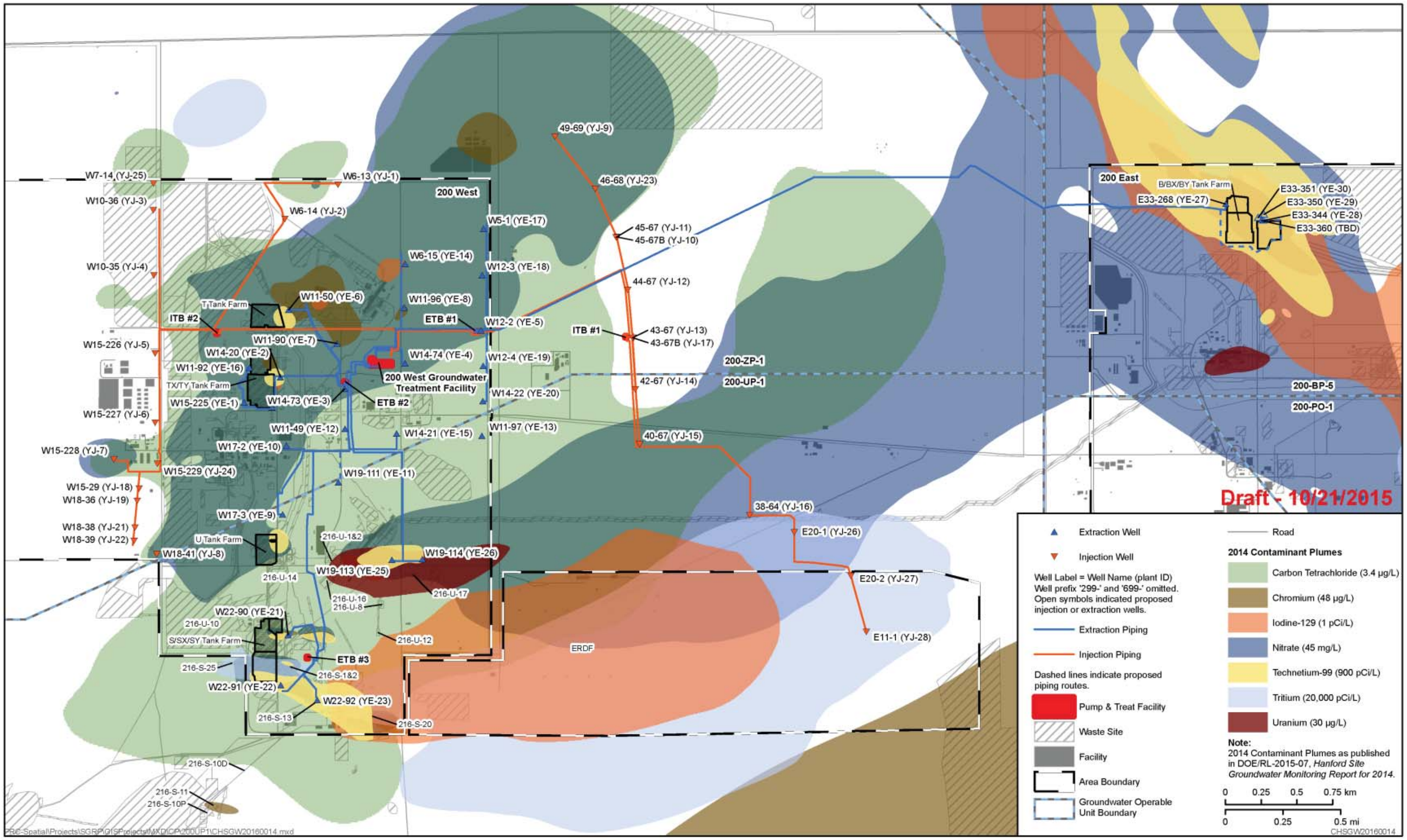

Figure B-2. 200 West P&T Well Locations and Contaminant Plumes

The following waste streams are generated from the investigation and remediation activities previously described:

- Loaded and spent granular activated carbon (GAC), resin, sludge, and filter elements (loaded GAC has reached its sorption capacity, is in good physical condition, and is able to be regenerated; spent GAC has reached its sorption capacity and is no longer capable of being regenerated)
- Biosolids
- Off-specification in-process groundwater
- Drill cuttings (vadose and saturated zone soil)
- Miscellaneous solid waste (MSW) (e.g., paper, wipes, personal protective equipment, cloth, tools, syringes, pumps, metal, glass, and plastic)
- Decommissioning debris (e.g., concrete, wood, rebar, metal or plastic pipe and screens, wire, bentonite, sand, gravel, equipment, pumps, and tanks)
- Replaced treatment system components (e.g., air stripper tower packing, vessels, valves, and piping)
- Equipment and construction materials (e.g., well casing, drill strings, drive barrels, construction equipment and material, sampling equipment, and wooden pallets)
- Spent or expired chemicals, reagents, and used oil
- Unplanned releases and associated cleanup material
- Liquids include, but are not limited to, the following:
  - Purgewater generated during well installation, development, testing, sampling, monitoring, maintenance, decommissioning, and decanting of saturated zone soil and water drained from GAC and resins
  - Condensate from soil vapor extraction systems
  - Algae treatment fluid
  - Decontamination fluid
  - Liquid from sample analysis and screening
  - Liquid from unplanned release
  - ERDF leachate
- Sampling-related waste from any field laboratory (if used) testing, as well as other Hanford Site laboratory 200-ZP-1 OU, 200-UP-1 OU, 200-DV-1 OU, 200-BP-5 OU, or ERDF leachate sample returns
- Treatability test waste in support of the remedial action and P&T process

B3 Waste Management Requirements

The 200-ZP-1 and 200-UP-1 OU IDW and remediation waste will be managed in accordance with this WMP and substantive compliance with the ARARs, as identified in the 200-ZP-1 OU ROD and the 200-UP-1 OU interim ROD. The 200-DV-1 OU, 200-BP-5 OU groundwater, and ERDF leachate is comingled and becomes process water at the 200 West P&T and will also be managed under this waste management plan. Every effort will be made to minimize waste generated from investigation and remediation activities.

B3.1 Waste Generation

All waste generated from 200 West P&T drilling activities will be managed in accordance with project procedures and/or waste planning documents.

B3.2 Waste Packaging and Labeling

Waste packaging and labeling are performed in accordance with a waste packaging and labeling instruction sheet, or as directed by the waste management specialist.

Packaging and labeling during storage and transportation will meet the substantive requirements of WAC 173-303, "Dangerous Waste Regulations," and WAC 173-304, "Minimum Functional Standards for Solid Waste Handling," as identified in the RODs as being applicable, or relevant and appropriate. For onsite waste shipments, non-Department of Transportation (DOT) packaging may be used if the container will provide an equivalent degree of safety and approval documents are in place. Materials requiring collection will be placed in containers appropriate for the material and the receiving facility. DOT-approved drums may be used for some materials (e.g., drill cuttings); however, packaging and containment for large or irregular waste or large volume waste (e.g., GAC and resin) may require containers other than drums. The packaging and containment may include, but are not limited to, plastic wrap, 4 ft by 4 ft by 8 ft boxes, Environmental Restoration Disposal Facility (ERDF) roll-on/roll-off containers, and GAC canisters.

Waste generated from groundwater monitoring activities (e.g., well sampling, well maintenance, well decommissioning, and geophysical logging) may be bagged, taped, and labeled with the well number and the date the waste was generated. The bagged material would be transported in a protective manner (i.e., containment of the material is maintained) while proceeding from well to well in the OU. Waste bags will be placed in appropriate containers and stored at the established OU storage location or other approved consolidated storage location, or may be disposed directly to ERDF without storage, as directed by the waste management specialist.

Containers will be labeled and marked appropriately to match the waste designation established for each waste stream. The containers will be sealed and shipped to the identified disposal facility or storage area.

B3.3 Waste Storage

Segregation and staging of waste containers and packages will be performed in accordance with the waste packaging and labeling instruction sheet, or as directed by the waste management specialist. The amount of waste stored at the storage area should be kept to a minimum. Full containers should be prepared for disposal as quickly as economically feasible. Designated dangerous waste will be stored in defined storage areas. Designated dangerous waste and waste awaiting sampling, or pending analysis in defined storage areas, will be inspected weekly. Nondangerous waste storage areas will be inspected monthly or at the frequency directed by Soil and Groundwater Remediation Project operations.

Remediation waste (e.g., resin, sludge, spent GAC, bag filters, and MSW) destined for disposal, and loaded GAC for offsite regeneration or disposal, may be stored on the pad within the 200 West P&T boundary (Figure B-3) for up to one year or longer with U.S. Department of Energy (DOE) and U.S. Environmental Protection Agency (EPA) concurrence. Larger volumes of waste (e.g., from well redevelopment) may be stored at the respective well pad until disposal at ERDF.

Figure B-3. 200 West P&T Waste Storage Location

The IDW waste (e.g., drill cuttings) may be accumulated near the point of generation while awaiting analytical laboratory test results. IDW also may be accumulated at the 200-ZP-1 *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) waste storage area (Figure B-4). Waste from 200-UP-1 and 200-PW-1 OUs may also be stored at this location; however, the waste is kept segregated by operable unit and will not be co-mingled. If IDW must be stored for longer than 6 months after designation, concurrence from the lead regulatory agency will be obtained on storage, treatment, and disposal options of the waste, along with the disposition schedule.

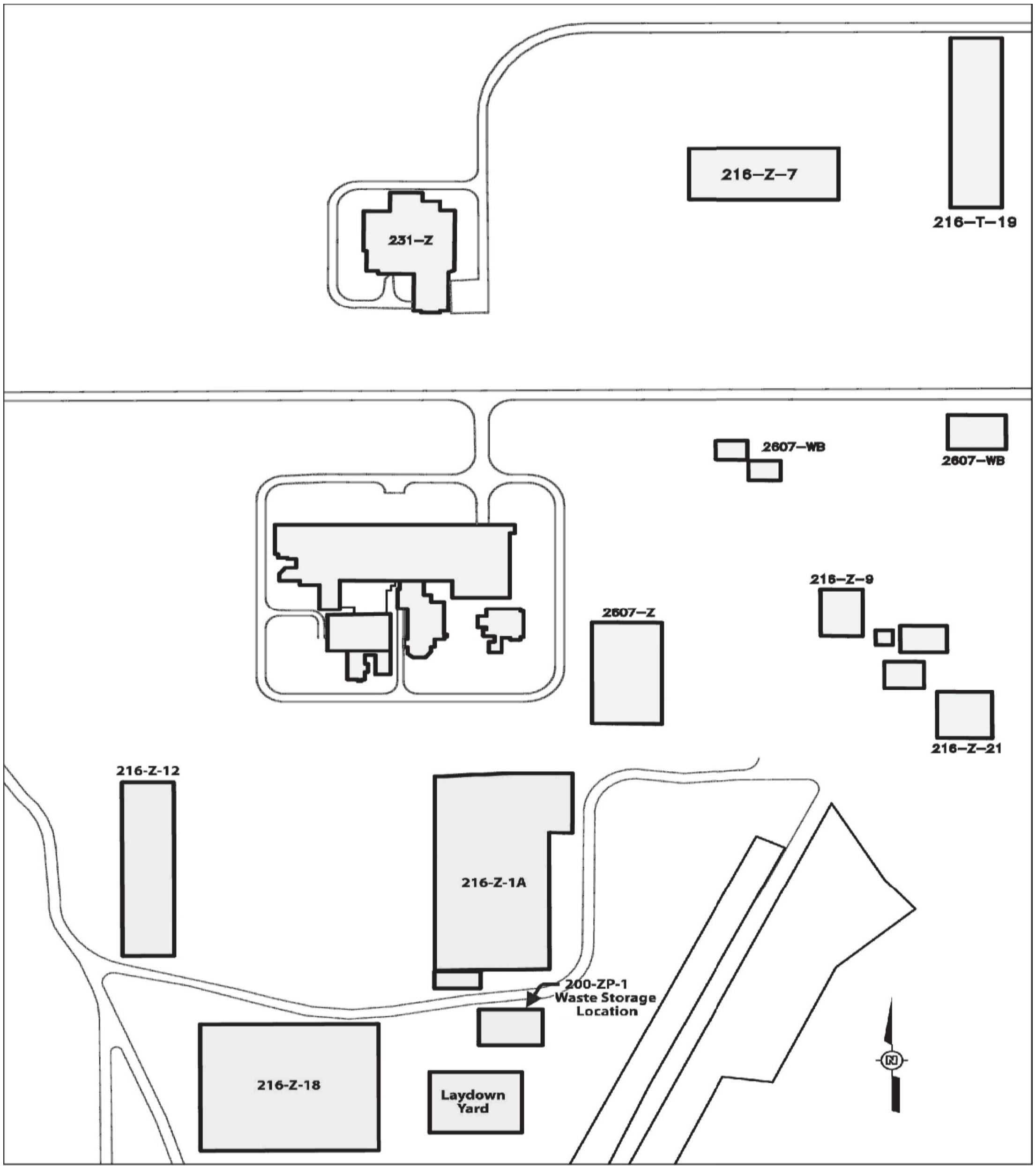

Figure B-4. 200-ZP-1 OU Waste Storage Location

Radioactive waste will be managed separately from nonradioactive waste. The containers bearing radioactive waste will be sealed, labeled, and shipped to the appropriate identified disposal facility in accordance with the criteria established for the respective material.

B3.4 Waste Designation

Waste will be designated in accordance with WAC 173-303-070(3) using process knowledge, historical analytical data, and laboratory analyses. According to "Application of Listed Waste Codes to Secondary Solid Wastes Related to Well Construction, Maintenance, and Sampling" (CCN 081034) groundwater associated with the 200-ZP-1 and 200-UP-1 OUs carry the following listed waste codes:

- **F001:** carbon tetrachloride and 1,1,1 trichloroethane
- **F002:** methylene chloride
- **F003:** acetone and methyl isobutyl ketone
- **F004:** cresols and cresylic acid (o-cresols and p-cresols)
- **F005:** methyl ethyl ketone

Therefore, IDW and remediation waste that come into contact with 200-ZP-1 and 200-UP-1 OU contaminated groundwater will also carry "F001" through "F005" listed waste codes.

B3.5 Waste Disposal

The IDW and remediation waste generated at the 200-ZP-1, 200-UP-1, 200-DV-1, and 200-BP-5 OUs may be disposed at ERDF if the waste meets the facility's waste acceptance criteria, as defined in *Environmental Restoration Disposal Facility Waste Acceptance Criteria* (WCH-191) and *Supplemental Waste Acceptance Criteria for Bulk Shipments to the Environmental Restoration Disposal Facility* (0000X-DC-W0001). Waste that does not meet ERDF waste acceptance criteria will be evaluated for additional treatment at an onsite or offsite facility. If additional treatment is deemed necessary, treatment options will be evaluated based on the characteristics of the waste and the concentration reduction requirements. If treatment options are not available, the waste may be managed within the Hanford Site Solid Waste Operations Complex (e.g., Central Waste Complex), until an appropriate offsite disposal facility is identified and approved by EPA.

B3.6 Records

Completed waste inventory documentation will be used to initiate waste tracking in the Solid Waste Information Tracking System. All records will be managed in accordance with applicable records management processes.

B4 Stream-Specific Waste Management Requirement

Specific waste management guidance for each projected waste stream is provided in the following subsections.

B4.1 Loaded and Spent Granular Activated Carbon

Loaded GAC may be sent offsite for regeneration at an EPA-approved facility (e.g., Siemens Water Technologies in Parker, Arizona) and may be re-used in the treatment system in accordance with 40 CFR 300.440. The GAC sent offsite must meet the authorized limit requirements listed in "Contract No. DE-AC06-08RL14788 – Request for Approval of Use of Authorized Limits for Regeneration of Ion Exchange Resin and Granular Activated Carbon," Attachment 2, "Authorized Limits Approved for Use by CHPRC for Off-Site Shipment and Regeneration of Granular Activated Carbon from the 200-ZP-1 an 200-PW-1 Pump and Treat Operations" (09-SED-0003), as summarized below.

The transfer of the GAC canisters to the offsite regeneration facility constitutes a release from DOE control. Therefore, before the GAC is sent to the regeneration facility, the potential for residual radioactive contamination on the GAC and demonstration of compliance with the requirements of DOE O 458.1 Admin Chg 3, *Radiation Protection of the Public and the Environment*, must be assessed. For any potential residual radioactive contamination, DOE O 458.1 requires that radiological release criteria (i.e., authorized limits) be developed and submitted to the applicable DOE field office. The following authorized limits are established low enough to ensure that the public dose limit of 100 mrem/yr is not approached. If any radionuclide listed in Table B-3 is detected at an activity greater than the authorized limit shown in this table, then each canister or drum must be reanalyzed separately for that radionuclide to ensure that the authorized limit is not exceeded for the radionuclide in question.

If the loaded GAC canisters and drums cannot meet the authorized limits listed in Table B-3, the GAC canisters may be disposed at ERDF if they meet the facility's waste acceptance criteria. GAC waste that does not meet ERDF waste acceptance criteria will be evaluated for additional treatment at an onsite or offsite facility. If treatment options are not available, the waste may be managed within the Hanford Site Solid Waste Operations Complex. Spent GAC will be similarly evaluated for ERDF disposal and additional treatment if necessary.

Table B-3. Authorized Limits for Offsite Transfer of 200 West P&T GAC

Radionuclide	Authorized Limit (pCi/g)
Americium-241	29
Carbon-14	3,000
Cesium-137	80
Cobalt-60	21
Europium-152	40
Europium-154	40
Europium-155	700
Iodine-129	50
Neptunium-237	50

Table B-3. Authorized Limits for Offsite Transfer of 200 West P&T GAC

Radionuclide	Authorized Limit (pCi/g)
Nickel-63	100
Plutonium-231	10
Plutonium-238	26
Plutonium-239	24
Plutonium-240	24
Protactinium-231	10
Selenium-79	2,000
Strontium-90	100
Technetium-99	500
Thorium-232 + Progeny	6
Tritium	300,000
Uranium-234	100
Uranium-235	100
Uranium-238 + Short Lived Progeny	100

B4.2 Filter Elements

The 200 West P&T has bag filters and other filter elements. Fine particles present in the groundwater collect on the bag filters located in filter housings. The bag filters are removed from the filter housings and replaced as needed to maintain system efficiency. The bag filters are dewatered and transferred into appropriate containers for onsite shipment to ERDF. Water from the filter removal process will be reintroduced to the influent side of the P&T system.

B4.3 Drill Cuttings

Drill cuttings are considered IDW and are managed in accordance with DOE/RL-2011-41 and the requirements identified in this WMP. Due to the amount of data from the very large number of wells and samples obtained in the vadose zone and saturated zone in the 200 West Area, acceptable generator knowledge may be used to determine if drill cuttings will be contaminated and whether the drill cuttings need to be sampled prior to waste disposition. Drill cuttings from the vadose zone and saturated zone will be segregated. Vadose zone drill cuttings suspected to be contaminated will be containerized. Vadose zone drill cuttings that are not suspected to be contaminated based on generator knowledge may be stockpiled on plastic or placed in containers near the point of generation. All saturated zone drill cuttings will be containerized.

Vadose zone drill cuttings that are not designated as dangerous waste (in accordance with WAC 173-303) are below the cleanup standards of WAC 173-340-740 ("Model Toxics Control Act-Cleanup," "Unrestricted Land Use Soil Cleanup Standards") and have been released from a radiological perspective may be returned to the environment.

Vadose zone drill cuttings that do not meet the return-to-environment criteria will be disposed at ERDF if the facility's waste acceptance criteria are met. If the acceptance criteria cannot be met, the material will be evaluated for additional treatment at an onsite or offsite facility. If treatment options are not available, the waste may be managed within the Hanford Site Solid Waste Operations Complex.

Saturated zone drill cuttings will be placed in containers near the point of generation. Contained drilling slurries (e.g., decanted water) will be safely removed from the containers (i.e., suctioned, ladled, or drained), and free liquids greater than 1 percent remaining in the container will be reduced by evaporation and/or stabilized by the addition of sorbent material prior to disposal. Removed drilling slurries will be managed as purgewater.

Drill cuttings may also be sampled in accordance with project-specific sampling and analysis plans.

B4.4 Liquids

Various liquid wastes are generated from O&M for well-related activities (as described in Section B2) and for 200 West P&T and soil vapor extraction operations.

B4.4.1 Purgewater

Purgewater generated from investigation and remediation activities within the 200-ZP-1, 200-UP-1, 200-DV-1, 200-BP-5, and 200-PW-1 OUs will be managed in accordance with DOE/RL-2011-41 and *Investigation Derived Waste Purgewater Management Work Plan* (DOE/RL-2009-80). For wells already connected to the 200 West P&T, purgewater may be taken to the 200 West P&T for treatment. All incoming purgewater goes through a filter bank at the 200 West P&T prior to being sent to the influent tank to avoid sediment-laden water from entering the system. For wells not already connected to the 200 West P&T, purgewater associated with installation, development, testing, monitoring, sampling, and maintenance, as well as any water decanted from saturated drill cuttings, is generally collected in a purgewater truck at the time of generation and transported to the purgewater modular storage units (MSUs) or the Effluent Treatment Facility (ETF), provided ETF waste acceptance criteria can be met. The 200 West P&T may also be used for purgewater disposition after its use is approved in DOE/RL-2009-80. In instances where this does not occur (e.g., during drilling activities), the purgewater is stored near the point of generation until drilling and well development activities are complete.

Contaminated groundwater or liquids undergoing treatment (in process) at the 200 West P&T that are off-specification may be returned to the influent side of the treatment facility or may be sent to the MSUs, as needed. Small volumes of liquid that have been stabilized may also be disposed at ERDF if the facility's waste acceptance criteria can be met. Liquid waste that cannot be pre-treated to meet ERDF waste acceptance criteria will be evaluated for additional treatment at an onsite or offsite facility.
If treatment options are not available, the waste may be managed within the Hanford Site Solid Waste Operations Complex.

B4.4.2 Water Drained from Granular Activated Carbon and Resin Roll-Off Boxes

During replacement or removal of GAC and ion-exchange resin at the 200 West P&T, water may be drained from the GAC and resin roll-off boxes. The water drained from the GAC and resin roll-off boxes will be reintroduced to the influent side of the 200 West P&T.

B4.4.3 Condensate from Soil Vapor Extraction Operations

Condensate (i.e., knockout water) generated from both active and passive soil vapor extraction operations is processed at the 200 West P&T. In the event that the water cannot be processed at the 200 West P&T, it will be dispositioned to the MSUs or the ETF.

B4.4.4 Algae Removal Liquids

Water generated during algae removal activities may be contained and returned to the influent side of the 200 West P&T, to the MSUs, or to the ETF.

B4.4.5 Decontamination Fluids

Decontamination fluids (i.e., water or nonhazardous cleaning solutions) generated from cleaning equipment, tools, and materials will be contained and returned to the influent side of the 200 West P&T or may be dispositioned to the MSUs, ETF (if waste acceptance criteria can be met), or other approved facility. Small volumes (generally less than 208 L [55 gal]) of decontamination fluids may be stabilized to less than or equal to 1 percent free liquid and disposed at the ERDF if the facility's waste acceptance criteria can be met.

Decontamination of some equipment (e.g., split-spoon samplers) may be conducted at the Soil and Groundwater Remediation Project sampling equipment cleaning facility because decontamination and containment systems are already established at this location. The decontamination waste liquids will be returned to the influent side of the 200 West P&T or dispositioned to the MSUs, ETF (if waste acceptance criteria can be met), or other approved facility.

B4.4.6 Sample Analysis and Screening Liquids

Unaltered liquid waste (i.e., unused groundwater) generated during sample screening and analysis will be managed as purgewater. Altered samples will be contained and returned to the influent side of the facility for treatment. Altered samples also may be disposed at the MSUs, ETF, ERDF, or other appropriate facility, depending on the waste designation. Some liquids may be neutralized and/or stabilized to meet the disposal facility's waste acceptance criteria.

B4.4.7 Liquids from Unplanned Releases

Liquids generated by unplanned releases from the 200 West P&T may be returned to the influent side of the 200 West P&T. If liquids cannot be returned to the treatment facility, they will be managed in accordance with the appropriate containment, storage, and disposal requirements and disposed at the MSUs, ETF, or ERDF. Liquids may be evaporated or stabilized (generally less than 208 L [55 gal]) and stabilized material transported to ERDF if the facility's waste acceptance criteria can be met.

B4.5 Incidental Solid Waste

Equipment and tools having only incidental nonroutine contact with contaminated groundwater will be air dried to remove volatile organic compounds. After the materials have been dried, the equipment and tools will no longer be considered contaminated with "F001" through "F005" listed waste in accordance with WAC 173-303-070(2)(c)(ii).

In addition, water washing, spraying, or high-pressure steam cleaning of equipment and tools with or without nonhazardous cleaning solutions meets the alternative treatment standards for hazardous debris identified in Table 1 of 40 CFR 268.45, "Land Disposal Restrictions," "Treatment Standards for Hazardous Debris." These equipment and tools will no longer be considered contaminated with "F001" through "F005" listed waste, provided the equipment and tools meet the definition of a clean debris surface. As described in 40 CFR 268.45, a clean debris surface is defined as "…the surface, when viewed without magnification, shall be free of all visible contaminated soil and hazardous waste, except that residual staining from soil and waste consisting of light shadows, light streaks, or minor discolorations; and soil and waste in cracks, crevices, and pits may be present, provided that such staining and waste and soil in cracks, crevices, and pits shall be limited to no more than 5 percent of each square inch of surface area."

B4.6 Miscellaneous Solid Waste

MSW may be generated from construction and O&M activities at the 200 West P&T or from well-related activities. Contaminated and noncontaminated MSW will be segregated and placed in containers that are appropriate for the material, the contaminant, and the disposal facility. MSW contacted with contaminated media may be disposed at ERDF if the facility's waste acceptance criteria are met. If the waste acceptance criteria cannot be met, the waste will be evaluated for additional treatment at an onsite or offsite facility prior to ERDF disposal. If treatment options are not available, the waste may be managed within the Hanford Site Solid Waste Operations Complex. MSW that has not contacted chemically or radiologically contaminated media, and is not a WAC 173-303 dangerous waste, may be disposed at an offsite solid waste landfill or recycled.

B4.7 Decommissioning Debris

Decommissioning debris (e.g., concrete, wood, rebar, metal or plastic pipe and screens, wire, bentonite, sand, gravel, equipment, and pumps) is generated during decommissioning of wells or other equipment. Debris contacted with contaminated media may be disposed at ERDF if the facility's waste acceptance criteria are met. If ERDF waste acceptance criteria cannot be met, the waste will be evaluated for additional treatment at an onsite or offsite facility prior to ERDF disposal. If treatment options are not available, the waste may be managed within the Hanford Site Solid Waste Operations Complex. Debris that has not contacted potentially contaminated media, is not a WAC 173-303 dangerous waste, and has been radiologically released per PRC-PRO-RP-40026, may be disposed offsite at a solid waste landfill or at an onsite demolition landfill, or the debris may be recycled, as appropriate.

B4.8 Spent or Expired Chemicals/Reagents and Used Oil

Spent or expired chemicals/reagents that are generated during field sampling and analysis or from 200 West P&T operations will be managed, designated, and disposed as appropriate for the specific chemical or reagent. Used oil generated during operation of the treatment system will be managed by the Hanford Site used oil program administered by the Consolidated Central Recycle Center, or will properly be dispositioned as waste, as appropriate.

Offsite facilities that receive CERCLA-contaminated waste must be approved by EPA in accordance with 40 CFR 300.440. Exceptions include used oil, spent or expired chemicals and reagents, and solid waste that has not contacted contaminated media and is recycled or disposed at an offsite solid waste landfill.

B4.9 Sampling-Related Waste

Screening and analysis of solid and liquid samples may be conducted in the field during 200 West P&T operations. Once testing is complete, liquid sample material may be returned to the influent side of the 200 West P&T or properly dispositioned to the MSUs, ETF, or ERDF.

B4.10 Treatability Test Waste

Wastes generated by treatability testing in support of remedial actions and the P&T process will be managed, designated, and disposed at the ETF, ERDF, or other appropriate facility, depending on the waste designation. If waste acceptance criteria cannot be met, the waste will be evaluated for additional treatment at an onsite or offsite facility prior to disposal. If treatment options are not available, the waste may be managed within the Hanford Site Solid Waste Operations Complex.

B4.11 ERDF Leachate

Leachate derived from landfill operations at the ERDF may be managed at the 200 West P&T provided 200 West P&T waste acceptance criteria can be met.

B5 References

0000X-DC-W0001, 2010, *Supplemental Waste Acceptance Criteria for Bulk Shipments to the Environmental Restoration Disposal Facility*, Rev. 12, Washington Closure Hanford, Richland, Washington.

09-SED-0003, 2008, "Contract No. DE-AC06-08RL14788 – Request for Approval of Use of Authorized Limits for Regeneration of Ion Exchange Resin and Granular Activated Carbon," external letter to J.G. Lehew III (CH2M HILL Plateau Remediation Company) from D.S. Shoop and J.C. Connerly, Attachment 2, "Authorized Limits Approved for Use by CHPRC for Off-Site Shipment and Regeneration of Granular Activated Carbon from the 200-ZP-1 and 200-PW-1 Pump and Treat Operations," U.S. Department of Energy, Richland Operations Office, Richland, Washington, October 7.

40 CFR 268.45, "Land Disposal Restrictions," "Treatment Standards for Hazardous Debris," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=53e20a19c7da5c2c1fd597a3ac6e39ef&node=40:27.0.1.1.3.4.27.6&rgn=div8.

40 CFR 300.440, "National Oil and Hazardous Substances Pollution Contingency Plan," "Procedures for Planning and Implementing Off-Site Response Actions," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=53e20a19c7da5c2c1fd597a3ac6e39ef&node=40:28.0.1.1.1.5.1.9&rgn=div8.

CCN 081034, 2000, "Application of Listed Waste Codes to Secondary Solid Wastes Related to Well Construction, Maintenance, and Sampling" (interoffice memorandum to distribution from J.V. Borghese), Bechtel Hanford, Inc., Richland, Washington, August 1.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: http://epw.senate.gov/cercla.pdf.

DOE O 458.1 Admin Chg 3, 2011, *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, Washington, D.C. Available at: https://www.directives.doe.gov/directives-documents/400-series/0458.1-BOrder-AdmChg3.

DOE/RL-2009-80, 2013, *Investigation Derived Waste Purgewater Management Work Plan*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2010-74, 2015, *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0081243H.

DOE/RL-2011-41, 2011, *Hanford Site Strategy for Management of Investigation Derived Waste*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0093937.

DOE/RL-2014-34, 2014, *Action Memorandum for 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0082284H

EPA, 1999, *U. S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site - 200 Area, Benton County, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 2015, *Explanation of Significant Differences for the U.S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site – 200 Area, Benton County, Washington*. U.S. Environmental Protection Agency, Region 10, Seattle, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0079657H.

EPA, Ecology, and DOE, 2008, *Record of Decision, Hanford 200 Area, 200-ZP-1 Superfund Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.epa.gov/superfund/sites/rods/fulltext/r2008100003103.pdf.

EPA, Ecology, and DOE, 2011, *Record of Decision, Hanford 200 Area Superfund Site, 200-CW-5 and 200-PW-1, 200-PW-3 and 200-PW-6 Operable Units*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0093644.

EPA, Ecology, and DOE, 2012, *Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0091413.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/wac/default.aspx?cite=173-303.

WAC 173-303-070, "Designation of Dangerous Waste."

WAC 173-304, "Minimum Functional Standards for Solid Waste Handling," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/wac/default.aspx?cite=173-304.

WAC 173-340-740, "Model Toxics Control Act—Cleanup," "Unrestricted Land Use Soil Cleanup Standards," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340-740.

WCH-191, 2014, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, Rev. 3, Washington Closure Hanford, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0085617.

Appendix C

Air Monitoring Plan for the 200 West Pump and Treat

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Terms

AMP	air monitoring plan
ARAR	applicable or relevant and appropriate requirement
ASIL	acceptable source impact level
CAS	Chemical Abstracts Service
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC	contaminant of concern
DOE	U.S. Department of Energy
EDE	effective dose equivalent
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FBR	fluidized bed reactor
GAC	granular activated carbon
gpm	gallons per minute
IX	ion exchange
N/A	not applicable
OU	operable unit
P&T	pump-and-treat
ROD	Record of Decision
scfm	standard cubic feet per minute
SQER	small quality emission rate
TAP	toxic air pollutant

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C1 Introduction

In accordance with the *Record of Decision, Hanford 200 Area, 200-ZP-1 Superfund Site, Benton County, Washington* (EPA et al., 2008), the design, construction, and operation of a groundwater pump-and-treat (P&T) facility were required to clean up contaminants of concern (COCs) in the 200 West Area carbon tetrachloride plume. As required by the Record of Decision (ROD), the 200 West P&T captures and treats contaminated groundwater to reduce the mass of COCs (carbon tetrachloride, chromium [total and hexavalent], nitrate, trichloroethene, iodine-129, and technetium-99) specified in the ROD, as well as other constituents. The 200-UP-1 remedy selected in *Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit*[1] (hereafter referred to as the 200-UP-1 OU interim ROD) is a combination of groundwater extraction and treatment using P&T, MNA, hydraulic containment of the iodine-129 plume, an iodine-129 treatment technology evaluation, remedy performance monitoring, and ICs. The COCs identified for the 200-UP-1 OU are carbon tetrachloride, total chromium (trivalent and hexavalent), nitrate, trichloroethene, iodine-129, technetium-99, tritium, and uranium. The 200 West P&T is also the preferred alternative to treat contaminated water from the 200-DV-1 OU perched water, as described in *Action Memorandum for 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction* (DOE/RL-2014-34, 2014); contaminated water from the treatability test in 200-BP-5 OU described in *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit* (DOE/RL-2010-74, 2015); and leachate from Environmental Restoration Disposal Facility (ERDF) described in *U.S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site-200 Area, Benton County, Washington, Amended Record of Decision Summary and Responsiveness Summary (EPA, 1999)* and in *Explanation of Significant Differences for the U.S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site – 200 Area, Benton County, Washington (EPA, 2015)*.

This air monitoring plan (AMP) is needed because groundwater treatment activities may cause emission of *Washington Administrative Code* criteria/toxic compounds (WAC 173-400, "General Regulations for Air Pollution Sources," and WAC 173-460, "Controls for New Sources of Toxic Air Pollutants") to the atmosphere and because there is a potential for release of radionuclides to the atmosphere. Therefore, substantive requirements from WAC 246-247, "Radiation Protection–Air Emissions," apply so far as abatement controls and emissions monitoring. These activities are being conducted under the authority of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) in the 200-ZP-1 Operable Unit (OU). Other contaminants not specified in the ROD may either be present in extracted groundwater or may be present as byproducts of the treatment processes within the 200 West P&T, including tritium; uranium; 1,1,1-trichloroethane; 1,2-dichloroethane; benzene; acetone; chloroform; dibromochloromethane; dichloromethane; 1,1-dichloroethylene; and vinyl chloride.

The 200 West P&T consists of a radiological processing facility with ion exchange (IX) columns for removal of technetium-99, iodine-129 (as a particulate), and isotopes of uranium. The main treatment facility consists of the following:

- An anoxic fluidized bed bioreactor (FBR) for removal of nitrate, metals, and carbon tetrachloride
- An aerobic membrane bioreactor for removal of residual carbon substrate, total suspended solids, biomass, and carbon tetrachloride

[1] EPA, Ecology, and DOE, 2012, *Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.

- A packed bed tower air stripper to remove remaining carbon tetrachloride and other volatile organic compounds

Biomass sludge undergoes thickening prior to disposal as waste. Offgas from the stripper, FBR, membrane bed reactor, and sludge thickener are commingled and treated by granular activated carbon (GAC) prior to discharge via powered exhaust. The maximum groundwater throughput is approximately 9,464 L/min (2,500 gallons per minute [gpm]), and the associated powered exhaust average flow rate is up to 40,000 standard cubic feet per minute (scfm) for a single stack. The biomass sludge is treated with lime (to reduce odors) and ammonia, and a scrubber is used to remove ammonia. Extracted groundwater is pumped directly to the radiological processing facility or to the main treatment facility, depending on the contaminants present.

The results of groundwater monitoring for the entire 200 West Area were used in this evaluation, which includes groundwater in both the 200-ZP-1 and 200-UP-1 OUs. This update to the air monitoring plan also includes evaluation of the 200-DV-1, 200-BP-5, and ERDF waste streams.

The emission rate for each air toxic compound exceeding de minimis values was compared to its small quantity emission rate (SQER) for the appropriate averaging period. Most were below their respective SQER value. The air pollution dispersion model approved by the U.S. Environmental Protection Agency (EPA), TSCREEN Model Version 95250, was initially used to calculate the maximum ambient concentrations of toxic air pollutants (TAPs) that were expected to exceed the SQER values following treatment. The modeled concentrations of the air toxics were compared to the acceptable source impact level (ASIL) for each compound, as specified in WAC 173-460. In each case, the modeled emission value was less than the ASIL for the respective compound. The dispersion model results were updated again in November 2014 using the results of quarterly sampling in calendar year 2014. AERMOD Version 14134 was used to calculate maximum ambient concentrations of toxic air pollutants. AERMOD is the EPA's latest generation dispersion model for calculating conservative downwind concentrations from a source of air emissions.

Calculating Potential-to-Emit Radiological Releases and Doses (DOE/RL-2006-29) was used to calculate the unabated release potential for radiological constituents. Accordingly, the potential emissions would be from a minor source according to WAC 246-247.

Abatement controls and environmental monitoring for air toxic and radiological constituents are described in Section C3 and Section C4.

C2 Air Emissions

Federal and state ambient air quality standards require that pollution control equipment be used to control emissions from new and existing sources. Because the 200 West P&T has the potential to discharge hazardous air pollutants, an evaluation was conducted to estimate the activity of radionuclides and concentration or mass of toxic air pollutants that could potentially be emitted from groundwater treatment operations. The results of this evaluation are presented in the following subsections.

C2.1 Radiological Air Emissions

RCW 70.94, "Washington Clean Air Act," requires the regulation of radioactive air pollutants. WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides," sets standards that are as or more stringent than the federal *Clean Air Act of 1990*, and under the federal implementing regulation 40 CFR 61, Subpart H, "National Emission Standards for Hazardous Air Pollutants," "National

Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities."

The EPA's partial delegation of the 40 CFR 61 authority to the state of Washington includes all substantive emissions monitoring, abatement, and reporting aspects of the federal regulation. The state standards protect the public by conservatively establishing exposure standards applicable to the maximally exposed (public) individual, be that individual real or hypothetical. To that end, the standards address any member of the public, at the point of maximum annual air concentration, in an unrestricted area where any member of the public may be.

All combined radionuclide airborne emissions from the U.S. Department of Energy's (DOE's) Hanford Site "facility" are not to exceed amounts that would cause an exposure to any said member of the public of greater than 10 mrem/yr effective dose equivalent (EDE). WAC 246-247 (which adopts the WAC 173-480 standards and the 40 CFR 61, Subpart H standard) requires verification of compliance with the 10 mrem/yr standard and would be applicable or relevant and appropriate to this remedial action.

WAC 246-247 addresses potential radioactive airborne emissions from point sources and from fugitive or diffuse sources by requiring monitoring of such sources. Such monitoring requires physical measurement of the effluent or ambient air and quality assurance measures to ensure the precision, accuracy, and completeness of the environmental measurements. The substantive provisions of WAC 246-247 that require monitoring of radioactive airborne emissions would be applicable or relevant and appropriate to this remedial action.

The above-stated implementing regulations further address control of radioactive airborne emissions where economically and technologically feasible (WAC 246-247-040[3] and -040[4], "Radiation Protection-Air Emissions," "General Standards"). To address the substantive aspect of these requirements, best or reasonably achieved control technology will be addressed by ensuring that applicable emission control technologies (i.e., those successfully operated in similar applications) will be used when economically and technologically feasible (i.e., based on cost/benefit).

C2.2 Criteria/Toxic Air Emissions

Under WAC 173-400 and WAC 173-460, requirements are established for the regulation of TAP emissions. Operation of the new 200 West P&T constitutes a new source of air toxics emissions. Potential criteria/toxic emissions resulting from this remedial action could be gaseous in nature. In accordance with WAC 173-400-040, "General Regulations for Air Pollution Sources," "General Standards for Maximum Emissions," reasonable precautions must be taken to prevent the release of air contaminants associated with point sources and fugitive emissions resulting from excavation, materials handling, or other operations. The use of treatment technologies for emissions of TAPs that would be subject to the substantive applicable requirements of WAC 173-400 and WAC 173-460 is anticipated to be a part of this remedial action. Calculations show that, after application of toxics best available control technology, maximum potential concentrations would be below regulatory thresholds.

Treatment of some waste encountered during this remedial action may be required to meet Environmental Restoration Disposal Facility (ERDF) waste acceptance criteria. In most cases, the type of treatment anticipated would consist of solidification or stabilization techniques such as macroencapsulation or grouting, and WAC 173-460 would not be considered an applicable or relevant and appropriate requirement (ARAR). If more aggressive treatment is required that would result in the emission of regulated air pollutants, the substantive requirements of WAC 173-460-060, "Controls for New Sources of Toxic Air Pollutants," "Control Technology Requirements," would be evaluated to determine applicability.

Treatment byproducts may occur during operations of the 200 West P&T. N-nitrosodimethylamine may be produced in the first hour of operation of a new technetium-99 resin bed at levels expected to be less than the de minimis value over the annual averaging period. Breakdown products of carbon tetrachloride may occur in the FBR. These constituents are already present in the 200-ZP-1 OU groundwater and are included in the evaluation versus de minimis values, small quantity emission rates, and ASILs. Ammonia is anticipated to be generated from the waste sludge at levels requiring lime treatment. Minor amounts of particulates are expected during lime load-in operations.

C2.3 Radiological Airborne Source Information

The radiological COCs for the 200-ZP-1 OU final remedy and for the 200-UP-1 OU interim action remedy are technetium-99, iodine-129, uranium, and tritium. DOE/RL-2006-29 is used to calculate the unabated release potential for radiological constituents. As such, Method 1, which is prescribed in 40 CFR 61, Appendix D ("Methods for Estimating Radionuclide Emissions") and in WAC 246-247-030 ("Definitions") is used. Method 1 states, "Multiply the annual possession quantity of each radionuclide by the release fraction for that radionuclide," depending on its physical state. The following release fractions are used:

- 1 for gases
- 10^{-3} (E-03) for liquids or particulate solids
- 10^{-6} (E-06) for solids

A release fraction of 1 is conservatively used for iodine-129 as a gas, although its removal in the treatment system is as a particulate. Tritium is also conservatively considered as a gas for dose calculation. A release fraction of E-03 is used for technetium-99 and for uranium isotopes. Uranium-233 is used to represent all uranium isotopes because its use in dose calculations results in a higher dose. The unabated annual possession quantity for the 200 West P&T is conservatively calculated by applying the maximum design flow for the entire facility to each constituent for a period of one year operating at 24 hours a day, 365 days a yr. The concentrations of the radiological constituents are provided in the integrated mass balance determination (382519-CALC-050, *Integrated Mass Balance*). In each case, the existing *Integrated Mass Balance* concentrations are greater than the blended concentrations which result from addition of the streams from 200-DV-1 OU, 200-BP-5 OU, and ERDF leachate. Therefore, the existing release calculations are bounding and do not need to be revised. Any isotope may be present in the influent. However, the representative isotopes and quantities, which are conservatively used, represent all isotopes potentially present. The uranium IX unit, the technetium-99 IX unit and the main treatment facility are located in series, with the uranium and the technetium-99 treatment units at the head end. The uranium IX unit is located upstream and in series with the Tc-99 IX unit. Depending upon contaminant concentrations, untreated groundwater is piped directly to the technetium-99 or uranium treatment unit or to the main treatment facility. Additional groundwater extraction wells are being installed to optimize contaminant removal. For instance, extraction wells are being drilled in areas with the highest technetium-99 concentrations. Extracted groundwater from these wells will be piped directly to the technetium-99 treatment unit. The treated effluent from the technetium-99 treatment unit becomes the influent, along with other untreated groundwater, to the main treatment facility. Groundwater treated in the technetium-99 IX unit flows through to the main treatment facility.

- The technetium-99 concentration is obtained by summing the concentration of influent to the technetium-99 IX treatment unit and the concentration of untreated groundwater to the main treatment facility:

$$14{,}700 \text{ pCi/L} + 175 \text{ pCi/L} = 14{,}875 \text{ pCi/L}$$

- The (technetium-99 concentration) × (annual pumpage) = (annual possession quantity):

(14,875 pCi/L) × (3.7854 L/gal) × (2,500 gpm) × (1,440 min/day)
× (365 days/yr) × (E-12 Ci/pCi) = 7.40 E+01 Ci/yr

- The (annual possession quantity) × (release fraction) = (unabated release rate):

(7.40 E+01 Ci/yr) × (1E-03) = 7.4 E-02 Ci/yr

- The iodine-129 concentration is obtained by summing the concentrations of raw groundwater influent to the technetium-99 IX unit, and untreated groundwater to the main treatment facility:

1.3 pCi/L + 0.825 pCi/L + 0.054 pCi/L = 2.18 pCi/L

- The (iodine-129 concentration) × (annual pumpage) = (annual possession quantity):

(2.18 pCi/L) × (3.7854 L/gal) × (2,500 gpm) × (1,440 min/day)
× (365 days/yr) × (E-12 Ci/pCi) = 1.08 E-02 Ci/yr

- The (annual possession quantity) × (release fraction) = (unabated release rate):

(1.08 E-02 Ci/yr) × (1E00) = 1.08 E-02 Ci/yr

- The tritium concentration is obtained from the combined influent to the main treatment facility (9,250 pCi/L).

- The (tritium concentration) × (annual pumpage) = (annual possession quantity):

(9,250 pCi/L) × (3.7854 L/gal) × (2,500 gpm) × (1,440 min/day)
× (365 days/yr) × (E-12 Ci/pCi) = 4.6 E+01 Ci/yr

- The (annual possession quantity) × (release fraction) = (unabated release rate):

(4.6 E+01 Ci/yr) × (1E00) = 4.6 E+01 Ci/yr

- The uranium concentration is obtained from summing the concentrations of untreated groundwater influent to the technetium-99 IX unit, and untreated groundwater influent to the main treatment facility:

570 pCi/L + 3.96 pCi/L + 3.47 pCi/L = 577.43 pCi/L

- The (uranium concentration) × (annual pumpage) = (annual possession quantity):

(577.43 pCi/L) × (3.7854 L/gal) × (2,500 gpm) × (1,440 min/day)
× (365 days/yr) × (E-12 Ci/pCi) = 2.87 E00 Ci/yr

- The (annual possession quantity) × (release fraction) = (unabated release rate):

(2.87 E00 Ci/yr) × (1 E-03) = 2.87 E-03 Ci/yr

- The annual total EDE to the maximally exposed individual is conservatively determined by multiplying the unabated release rate for each representative radiological constituent by the highest applicable unit dose conversion factors from DOE/RL-2006-29:
  - Technetium-99: (7.4 E-02 Ci/yr) × (1.8 E-02 mrem/Ci) = 1.33 E-03 mrem/yr
  - Iodine-129: (1.08 E-02 Ci/yr) × (7.62 E-02 mrem/Ci) = 8.21 E-04 mrem/yr

- Tritium: (4.6 E+01 Ci/yr) × (2.5 E-05 mrem/Ci) = 1.15 E-04 mrem/yr
- Uranium-233: (2.87 E-03 Ci/yr) × (8.6 mrem/Ci) = 2.47 E-02 mrem/yr

Total: 2.70 E-02 mrem/yr

Accordingly, the potential emissions would be from a minor source according to WAC 246-247.

C2.4 Criteria/Toxic Airborne Source Information

Compliance with the state air toxic rule was demonstrated according to the requirements of WAC 173-460. The groundwater database was used to identify chemical compounds detected in the 200-ZP-1 OU beyond those already identified as COCs, which are also listed as WAC 173-460 air toxic compounds. Table C-1 lists the constituents that were identified.

If de minimis and SQER values were exceeded, the constituent was further screened (382519-CALC-033, *Estimated Influent Concentrations of Constituents of Interest for Mass Balance*; 382519-CALC-048, *Supplemental Mass Balance*). The integrated mass balance calculation applies best available control technology for toxics to the remaining constituents (382519-CALC-050). After application of the best available control technology for toxics, the value was compared to the SQER for each TAP. If the emissions were lower than the SQER, no further air quality impact analysis was conducted. The comparison of emission rates to the SQERs is presented in Table C-2.

Table C-1 Potential Air Toxic Constituents

Constituent	CAS Number	De Minimis Value (lb/averaging period)	SQER Value	Averaging Period
1,1,1-Trichloroethane	71-55-6	6.570	131.0	day
1,1-Dichloroethane	75-34-3	6.000	120.0	year
1,1-Dichloroethylene	75-35-4	1.31	26.3	day
1,2-Dichloroethane	107-06-2	0.369	7.39	year
1,2-Dichloropropane	78-87-5	0.959	19.2	year
1,4-Dichlorobenzene	106-46-7	0.872	17.4	year
2-Napthylamine	91-59-8	0.0188	0.376	year
Ammonia	7664-41-7	0.465	9.31	day
Benzene	71-43 -2	0.331	6.62	year
Beryllium	7440-41-7	0.004	0.08	year
Bromoform	75-25-2	8.720	174,0	year
Cadmium	7440-43-9	0.00228	0.457	year
Carbon disulfide	75-15-0	5.26	105.0	day
Carbon tetrachloride	56-23-5	0.228	4.57	year
Chlorobenzene	108-90-7	6.57	131	day
Chloroform	67-66-3	0.417	8.35	year
Chromium (VI)	18540-29-9	6.4E-05	0.00128	year
Cobalt	7440-48-4	0.000657	0.013	day
Copper	7440-50-8	0.011	0.219	hour
Dibromochloromethane	124-48-1	0.355	7.10	year
Ethylbenzene	100-41-4	3.84	76.8	year
Fluoride	7782-41-4	0.0854	1.71	day
Lead	7439-92-1	10.0	16.0	year
Manganese	7439-96-5	0.000263	0.00526	day
Mercury	7439-97-6	0.000591	0.0118	day
Methyl tertiary butyl ether	1634-04-4	36.90	739.0	year
Methylene chloride	75-09-2	9.59	192.0	year
o-Xylene	95-47-6	1.45	29.0	day

Table C-1 Potential Air Toxic Constituents

Constituent	CAS Number	De Minimis Value (lb/averaging period)	SQER Value	Averaging Period
Phenol	108-95-2	1.31	26.3	day
Selenium	7782-49-2	0.131	2.63	day
Styrene	100-42-5	5.91	118.0	day
Toluene	108-88-3	32.90	657.0	day
Trichloroethene	79-01-6	4.80	95.9	year
Vanadium	7440-62-2	0.00131	0.0263	day
Vinyl chloride	75-01-4	0.123	2.46	year

CAS = Chemical Abstracts Service

SQER = small quantity emission rate

Table C-2 Comparison of Emission Rates to Small Quantity Emission Rates

Pollutant	Daily Emission Rate (lb/day)	Averaging Period	SQER (lb/averaging period)	Emission Rate (lb/averaging period)	Modeling Required
Carbon tetrachloride	7.90E-02	year	4.57	3.03E+01	Yes
Trichloroethene	1.47E-04	year	95.9	5.71E-02	No
1,1,1-TCA	1.08E-03	24 hours	131	1.12E-03	No
1,2-DCA	6.93E-04	year	7.39	2.60E-01	No
Benzene	3.92E-03	year	6.62	1.48E+00	No
Acetone	1.81E-04	N/A	N/A	N/A	No
Chloroform	6.00E-01	year	8.35	2.27E+02	Yes
DBCM	5.69E-04	year	7.1	2.13E-01	No
Methylene chloride	1.11E-01	year	192	41.98E+00	No
1,1-Dichloroethylene	6.36E-04	24 hours	26.3	6.71E-04	No
Vinyl chloride	1.86E-02	year	2.46	7.15E+00	Yes

N/A = not applicable (this pollutant is not listed as a toxic air pollutant in WAC 173-460, “Controls for New Sources of Toxic Air Pollutants”)

SQER = small quantity emission rate

If the expected emissions were above the SQER, ambient air quality modeling was completed (382519-CALC-053, Revision 2, *Air Emissions Modeling*). Modeling was performed according to the procedures identified in 40 CFR 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans," Appendix W, "Guideline on Air Quality Models." WAC 173-460 requires that new stationary sources that have the potential to emit TAPs demonstrate that the TAP emissions would be sufficiently low to protect human health and safety from potential carcinogenic or other toxic effects. The EPA-approved model, AERMOD Model Version 14134, was used to calculate maximum ambient concentrations of TAPs that exceeded the SQER values in 2014. The dispersion model results were updated using the results of quarterly sampling in calendar year 2014. In 2014 two TAPs had emission rates that exceeded the respective SQERs; they were carbon tetrachloride and chloroform.

Concentrations from the ambient air quality analysis are compared to the ASIL to demonstrate compliance with WAC 173-460.

Table C-3 presents the updated model results compared to the applicable standards. Model results show no TAPs that would exceed the applicable ASIL.

Plant emissions are calculated for a single stack. Model results show that carbon tetrachloride and chloroform would not exceed their applicable ASIL.

Table C-3 Comparison of Concentrations to ASIL

Pollutant	AERMOD Input Values (gram/sec)	Annual Average Concentration (µg/m^3)	Annual Acceptable Source Impact Level (µg/m^3)
Carbon tetrachloride	0.0331	0.00201	0.0238
Chloroform	0.000544	0.0000331	0.0435

C3 Emission Controls

Highly efficient IX columns are being used at the 200 West P&T to remove uranium, technetium-99, and iodine-129. Purolite[2] A530E resin was selected for technetium-99 removal based on treatability testing conducted in the 200-ZP-1 OU in 2007. Iodine-129 is also expected to be removed by the Purolite A530E resin. Dowex[3] 21K resin was selected for uranium removal based on its highly successful performance for remediation of uranium contaminated groundwater at DOE's Fernald site in Ohio. Other resins may be used if treatability testing reveals comparable or better performance. An anoxic FBR is being used to remove nitrate, metals, and carbon tetrachloride. An aerobic membrane bioreactor is being used to remove residual carbon substrate, total suspended solids, biomass, and carbon tetrachloride. A packed bed tower air stripper is being used to remove the remaining carbon tetrachloride and other volatile organic compounds. Offgas from the stripper, FBR, membrane bioreactor, and waste sludge thickener are commingled and treated by GAC prior to discharge via powered exhaust. The biomass sludge is treated with lime to reduce odors and ammonia, and a scrubber is used to remove ammonia. A bag-house (or equivalent) is used to reduce lime particulate.

[2] Purolite® is a registered trademark of The Purolite Company, Bala Cynwyd, Pennsylvania.

[3] Dowex® is a registered trademark of the Dow Chemical Company, Midland, Michigan.

Tritium, which is bound with the groundwater, is removed with water vapor in a demister located upstream from the GAC treatment unit and it is commingled with the treated groundwater prior to injection back into the aquifer.

C4 Monitoring

Quarterly sampling will occur for annual determination of compliance with SQERs and ASILs. Grab samples will be collected in each stack. Additional modeling to confirm compliance with ASILs would be completed only if needed and if emissions are higher than previously calculated or modeled.

Periodic confirmatory measurement will be used to confirm low radiological air emissions. This will consist of engineering calculations combined with the Hanford Site near-facility monitoring program results. The existing near-facility monitoring network will be used. The nearest air monitors are N161, N304, N975, and N987. EPA will be informed if any air sample exceeds 10 percent of the values listed in 40 CFR 61, Appendix E, Table 2, as measured by the Hanford Site near-facility ambient air monitors.

C5 References

40 CFR 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans," Appendix W, "Guideline on Air Quality Models," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=336d0b82f2589d645fb0c5143633abc7&node=40:2.0.1.1.2&rgn=div5.

40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=336d0b82f2589d645fb0c5143633abc7&node=40:9.0.1.1.1&rgn=div5.

Appendix D, "Methods for Estimating Radionuclide Emissions."

Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities."

382519-CALC-033, 2010, *Estimated Influent Concentrations of Constituents of Interest for Mass Balance*, Rev. 4, CH2M HILL Plateau Remediation Company, Richland, Washington.

382519-CALC-048, 2010, *Supplemental Mass Balance*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington.

382519-CALC-050, 2010, *Integrated Mass Balance*, Rev. 1, CH2M HILL Plateau Remediation Company, Richland, Washington.

382519-CALC-053, 2010, *Air Emissions Modeling*, Rev. 2, CH2M HILL Plateau Remediation Company, Richland, Washington.

Clean Air Act of 1990, Pub. L. 101-549, as amended, 42 USC 7401, et seq. Available at: http://www.epa.gov/air/caa/.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: http://epw.senate.gov/cercla.pdf.

DOE/RL-2006-29, 2010, *Calculating Potential-to-Emit Radiological Releases and Doses*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=1009270905.

DOE/RL-2010-74, 2015, *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0081243H

DOE/RL-2014-34, 2014, *Action Memorandum for 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0082284H

EPA, 1999, *U. S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site - 200 Area, Benton County, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 2015, *Explanation of Significant Differences for the U.S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site – 200 Area, Benton County, Washington.* U.S. Environmental Protection Agency, Region 10, Seattle, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0079657H.

EPA, Ecology, and DOE, 2012, *Record of Decision for Interim Remedial Action ,Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0091413.

EPA, Ecology, and DOE, 2008, *Record of Decision, Hanford 200 Area, 200-ZP-1 Operable Unit Superfund Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.epa.gov/superfund/sites/rods/fulltext/r2008100003103.pdf.

RCW 70.94, "Washington Clean Air Act," *Revised Code of Washington*, Olympia, Washington. Available at: http://apps.leg.wa.gov/RCW/default.aspx?cite=70.94.

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 400-040, "General Standards for Maximum Emissions."

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.

WAC 173-460-060, "Control Technology Requirements."

WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-480.

WAC 246-247, "Radiation Protection—Air Emissions," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=246-247.

WAC 247-030, "Definitions."

WAC 247-040, "General Standards."

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Appendix D

200 West Pump and Treat Sampling and Analysis Plan

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Terms

AMP	air monitoring plan
CAS	Chemical Abstracts Service
CHPRC	CH2M HILL Plateau Remediation Company
COC	contaminant of concern
DOE	U.S. Department of Energy
DQA	data quality assessment
DQI	data quality indicator
DQO	data quality objective
EB	equipment rinsate blank
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FBR	fluidized bed reactor
FTB	field trip blank
FXR	field transfer blank
GAC	granular activated carbon
gpm	gallons per minute
HEIS	Hanford Environmental Information System
IC	ion chromatography
ICP	inductively coupled plasma
IX	ion exchange
MCL	maximum contaminant level
MDL	method detection limit
O&M	operations and maintenance
OU	operable unit
P&T	pump-and-treat
QA	quality assurance
QAPjP	quality assurance project plan
QC	quality control
RCT	radiological control technician

RDL	required detection limit
ROD	record of decision
RPD	relative percent difference
SAP	sampling and analysis plan
SMR	Sample Management and Reporting
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
VOA	volatile organic analysis
VOC	volatile organic compound
VPGAC	vapor-phase granular activated carbon
WMP	waste management plan

D1 Introduction

This sampling and analysis plan (SAP) has been prepared to support the 200 West pump and treat (P&T) remedial action for the 200-ZP-1 Groundwater Operable Unit (OU), the interim remedial action for the 200-UP-1 OU, the non-time critical removal action of the 200-DV-1 OU perched water, the treatability testing for the 200-BP-5 OU, and for the treatment of leachate collected from ERDF. The 200 West P&T is a principal component of the selected remedy presented in the *Record of Decision, Hanford 200 Area, 200-ZP-1 Superfund Site, Benton County, Washington* (EPA et al., 2008), the *Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit* (EPA et al., 2012), the *Action Memorandum for the 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction* (DOE/RL-2014-34, 2014), in the *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit* (DOE/RL-2010-74, 2015), and in *Explanation of Significant Differences for the U.S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site-200 Area, Benton County, WA* (hereafter referred to as the ESD; EPA, 2015). The system was operational in 2012. This SAP supersedes all previous monitoring plans for the 200 West P&T.

The 200 West P&T is designed to treat contaminated water from the 200-ZP-1, 200-UP-1, 200-DV-1, and 200-BP-5 OUs. The contaminated water is treated to reduce concentrations of carbon tetrachloride, trichloroethene, total chromium (trivalent and hexavalent), nitrate, iodine-129, technetium-99, uranium, and other constituents such as cyanide (from 200-BP-5 OU) and strontium (from ERDF leachate) and process byproducts. Extracted water, treated to the levels identified in each of the Records of Decision (RODs), action memorandum, treatability test, or ESD is then injected back into the aquifer.

The focus of this SAP is the characterization of the untreated water streams entering the treatment facility, treated water leaving the facility, and waste streams requiring disposal. Samples will be tested for the contaminants of concern (COCs) specified in each decision document. Atmospheric discharge of volatile organic compounds (VOCs) will be monitored according to the air monitoring plan (AMP) (included as Appendix C of this operations and maintenance [O&M] plan). This SAP does not include routine sampling, analysis, or related process control measurements on materials and flow streams contained wholly within the treatment facility. Process control measurements are covered under other O&M documents.

The effect of the 200 West P&T on the 200-ZP-1 Groundwater OU is monitored as described in the *Performance Monitoring Plan for the 200-ZP-1 Groundwater Operable Unit Remedial Action* (DOE/RL-2009-115).

The following documents were used to prepare this SAP:

- "Compliance Matrix for the 200 West Pump and Treat" (Appendix A of this O&M plan)
- "Waste Monitoring Plan for the 200 West Pump and Treat" (Appendix B of this O&M plan)
- "Air Monitoring Plan for the 200 West Pump and Treat" (Appendix C of this O&M plan)
- DOE/RL-2008-78, 2009, *200 West Area 200-ZP-1 Pump-and-Treat Remedial Design/Remedial Action Work Plan*
- DOE/RL-2009-115, 2014, *Performance Monitoring Plan for the 200-ZP-1 Groundwater Operable Unit Remedial Action*
- DOE/RL-2013-07, 2013, *200-UP-1 Groundwater Operable Unit Remedial Design/Remedial Action Work Plan*

- DOE/RL-2014-34, 2014, *Action Memorandum for the 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction*
- DOE/RL-2010-74, 2015, *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit*
- EPA, 1999, *U.S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site – 200 Area, Benton county, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary*.
- EPA, 2015, *Explanation of Significant Differences for the U.S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site-200 Area, Benton County, WA*
- EPA et al., 2008, *Record of Decision, Hanford 200 Area, 200-ZP-1 Superfund Site, Benton County, Washington*
- EPA et al., 2012, *Record of Decision for Interim Remedial Action Hanford 200 Area Superfund Site 200-UP-1 Operable Unit*
- Design documents (which include descriptions and the engineering design of the P&T process for the 200-ZP-1 OU)

The specific objectives of the SAP are to facilitate the following:

- Provide a schedule for sampling and analysis of 200 West P&T untreated influent water, treated effluent water, and process waste streams to meet the waste management plan (WMP) (Appendix B) and injected water (Appendix D) analytical data requirements
- Supply data needed for periodic evaluation of P&T system performance and process efficiency based on a calculated mass balance
- Monitor atmospheric discharge of VOCs from unit operations and storage tanks within the main treatment facility (Appendix C)

D1.1 Operations

The 200 West P&T currently treats groundwater from 30 extraction wells, and 26 injection wells receive the treated water. Extraction and injection wells will be added in the future as needed. The installed design capacity of the 200 West P&T is 9,464 L/min (2,500 gallons per minute [gpm]) with two parallel treatment trains. The treatment facility's design includes provisions for a third treatment train for a total design capacity of 14,195 L/min (3,750 gpm). The need for additional treatment capacity will be determined based on well field performance for the 200-ZP-1 OU and the amount of contaminated water that may be generated as part of the remedies for leachate from ERDF and from the 200-UP-1, 200-DV-1, and 200-BP-5 OUs.

D1.2 Description of Unit Operations

The following descriptions of the basic unit operations within the 200 West P&T provide the basis for identifying the waste streams and other sampling points to meet the objectives of this SAP. The descriptions are taken from engineering design documents.

D1.2.1 Uranium Ion Exchange

Contaminated water from ERDF leachate and from 200-UP-1, 200-DV-1, and 200-BP-5 OUs is pre-treated using ion exchange (IX) resin to reduce uranium concentrations. Incoming contaminated water is sent through bag filters to remove fine particulate matter. Filtered water flows to the IX columns containing a resin with a demonstrated ability to reduce uranium concentrations. The IX effluent flows through bag filters serving as a resin trap to the technetium-99 IX treatment system. The IX resin, once fully loaded, will be disposed.

D1.2.2 Technetium-99 Ion Exchange

Contaminated water from extraction wells in the 200-ZP-1, 200-UP-1, 200-DV-1, and 200-BP-5 OUs and leachate from ERDF (after uranium pre-treatment), which contains technetium-99 concentrations greater than 900 pCi/L, is pre-treated separately with IX resin to reduce the technetium-99 activity to less than 900 pCi/L.

Influent water is sent through bag filters to remove fine particulate matter. The filtered water then flows to the IX columns (up to three in series) containing Purolite[1] A530E resin (or similar substitute), which has demonstrated ability to reduce technetium-99 concentrations. The IX effluent flows through bag filters that serve as a resin trap and then to the main treatment facility for further treatment.

When the IX resin reaches its loading limit, it will be removed from the column. The loaded resin is sluiced with treated water and moved into a carbon tetrachloride stripping tank. In the stripping tank, the resin is submerged in treated water and heated to a temperature of approximately 71°C (160°F). Air is then bubbled through the resin to mix the bed and strip off the carbon tetrachloride. The vapor emission is treated with small vapor-phase granular activated carbon (VPGAC) adsorbers. After treatment, the stripping water is pumped to the influent side of the main treatment facility for treatment. The resin is sluiced with treated water to a roll-off container to allow drainage. The drainage is collected and pumped to the bag filters at the end of the technetium-99 IX system. The spent resin is sampled and analyzed to determine if it meets waste acceptance criteria and, if so, is disposed at the Environmental Restoration Disposal Facility (ERDF). Waste resin that does not meet ERDF waste acceptance criteria will be evaluated for additional treatment at an onsite or offsite facility. Appendix B contains additional information on waste handling.

D1.2.3 Main Treatment Facility

Water from the technetium-99 IX treatment system flows to the main treatment facility's equalization tank where it is blended with extracted groundwater from the remainder of the well field. From the equalization tank, the water is sent to the fluidized bed reactor (FBR) for removal of nitrate, VOCs, metals (including chromium), and other contaminants. The FBR is operated under anoxic condition (i.e., no dissolved oxygen) where heterotrophic facultative bacteria reduce nitrate to nitrogen gas (i.e., denitrification). Water is pumped into the bottom of the FBR, creating an upflow pattern to suspend the granular activated carbon (GAC) media to which the microorganisms attach. The FBR is seeded with microbes suited for nitrate removal and carbon tetrachloride degradation.

The effluent from the FBR flows by gravity to covered membrane filtration tanks for removal of residual carbon substrate and total suspended solids, including biomass carryover from the FBRs. The membrane tanks have aeration capacity to provide the oxygen needed for the aerobic biological process.

The treated water from the membranes is pumped to a packed bed tower air stripper for removal of the remaining carbon tetrachloride and other VOCs. Offgas from the stripper, influent equalization tank, FBR(s), membrane tanks, sludge holding tank(s), rotary drum thickeners, and centrifuges is combined and treated by VPGAC.

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[1] Purolite® is a registered trademark of The Purolite Company, Bala Cynwyd, Pennsylvania.

Solids from the membrane filter tanks are pumped to rotary drums for sludge thickening. The thickened solids are periodically pumped from the sludge holding tank to centrifuges for dewatering.

D1.2.4 Additional Vapor-Phase Granular Activated Carbon Requirements

The VPGAC train that serves the air stripper(s) also receives offgas from the equalization tank, the FBR(s), membrane tanks, sludge holding tank(s), recycle tank, rotary drum thickeners, stripping tank(s), and centrifuges. The storage tanks in extraction transfer buildings #1, #2, and #3 are fitted with separate VPGAC absorbers.

D1.3 Waste Streams

Table D-1 lists the individual waste streams associated with the unit processes described above and provides brief descriptions of the principal expected contaminants.

Table D-1. 200 West P&T Waste Streams

Waste Stream	Contaminants
Uranium Ion-Exchange System	
Inflow bag filters	Fine mineral particulates
Outflow bag filters	Uranium-bearing resin particles and possible VOCs
Dewatered loaded resin	Uranium and VOCs
Loaded GAC (uranium system stripping tank)	Carbon tetrachloride and trichloroethene
Technetium-99 Ion-Exchange System	
Inflow bag filters	Fine mineral particulates
Outflow bag filters	Technetium-99-bearing resin particles and possible VOCs
Dewatered loaded resin	Technetium-99, possible VOCs, and traces of iodine-129 and uranium
Loaded GAC (technetium-99 system stripping tank)	Carbon tetrachloride and trichloroethene
Fluidized Bed Reactor/Aeration Filters	
Dewatered sludge	Carbon (GAC), biomass, and inorganic particulates
Air Stripper	
Loaded GAC	Carbon tetrachloride and trichloroethene
Extraction Transfer Building Storage Tanks	
Loaded GAC	Carbon tetrachloride and trichloroethene

GAC = granular activated carbon
VOC = volatile organic compound

D1.4 Sampling Points

For the purpose of this SAP, sampling points reflect the entry or exit of untreated water, treated water, and wastes from the treatment facilities. The sampling points fall into five general categories, as described in the following subsections. Requirements for characterizing and designating waste streams are addressed in the WMP (Appendix B).

D1.4.1 ERDF Leachate, Well Field Extraction, and Injection Streams

Well field operations include untreated water from ERDF leachate and extraction wells and treated water injected into the aquifer. Incoming flow from ERDF leachate and the extraction wells to the treatment facilities occurs as separate flow streams, while the outgoing flow of treated water returned to the aquifer is considered a single flow stream. Specific sampling points to the treatment facilities include the following:

- Inflow of ERDF leachate
- Well field inflow from extraction wells
  - Inflow to uranium pre-treatment IX system from the 200-UP-1, 200-DV-1, and 200-BP-5 OU wells
  - Inflow to the technetium-99 pre-treatment IX system directly from wells not requiring uranium pre-treatment and wells requiring uranium pre-treatment
  - Balance of well field inflow (requiring no uranium or technetium-99 pre-treatment)
- Treated water directed to injection wells

D1.4.2 Air Emissions Stacks

The VPGAC trains remove VOCs from the air. Air emission stacks from each VPGAC train discharge directly to the atmosphere. The performance of the VPGAC trains must be verified by monitoring carbon tetrachloride, trichloroethene, and other VOC contaminants potentially present, as described in the AMP (Appendix C). The discharge stacks include the following:

- Main VPGAC stack from air stripper and other plant sources (as described earlier)
- Extraction transfer buildings 1, 2, and 3 holding tank VPGAC stacks

D1.4.3 Process Waste Streams

Waste streams destined for disposal at ERDF are batch sampled and characterized for waste designation prior to disposal:

- Loaded uranium IX resin
- Loaded technetium-99 IX resin
- FBR and aeration filter sludge

The loaded GAC with carbon tetrachloride, trichloroethene, and other VOCs from the main VPGAC train is sampled and analyzed (Section D3.5) and then shipped to an offsite regeneration facility.

D1.4.4 Miscellaneous Waste

Bag filters used to prevent particulates from the well field inflow from entering the IX columns are handled as miscellaneous waste. Bag filters used as resin traps are handled similarly on the assumption that the trapped mass of resin is minimal.

D1.5 Untreated Water Quality

Initial COC concentration estimates for the untreated contaminated water entering the treatment facilities are presented in Table D-2. This information is based on historical groundwater and perched water sampling and analysis from selected monitoring wells in the 200-ZP-1, 200-UP-1, 200-DV-1, and 200-BP-5 OUs as well as historic sample data from ERDF leachate.

Before any additional *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA)-related contaminated water is sent to the 200 West P&T for treatment, the appropriate calculations must be made to ensure that the facility can effectively treat the contaminated water to meet the 200 West P&T waste acceptance criteria (SGW-59872) and the cleanup levels identified in each respective ROD or decision document for the 200-ZP-1, 200-UP-1, 200-DV-1, and 200-BP-5 OUs, and ERDF (EPA et al., 2008; EPA et al., 2012; DOE/RL-2014-34, 2014; DOE/RL-2010-74, 2015; and EPA, 2015 respectively).

Table D-2. Estimated Influent Water Quality to Unit Processes

Analyte	Average Uranium Pre-Treatment	Average Technetium-99 Pre-Treatment	Average Main Treatment Facility
COCs[a]			
Carbon tetrachloride	85 µg/L	566 µg/L	722 µg/L
Trichloroethene	1.0 µg/L	3.1 µg/L	3.3 µg/L
Chromium (total)	21 µg/L	38 µg/L	23 µg/L
Hexavalent chromium	15 µg/L	33 µg/L	20 µg/L
Nitrate as nitrogen	104 mg/L	64 mg/L	31 mg/L
Radionuclide COCs[a]			
Iodine-129	1.95 pCi/L	0.93 pCi/L	0.38 pCi/L
Technetium-99	4,689 pCi/L	958 pCi/L	70 pCi/L
Tritium	3,226 pCi/L	4,661 pCi/L	2,291 pCi/L
Uranium	930 µg/L	5.5 µg/L	2.5 µg/L
Other Constituents[a]			
Alkalinity (as $CaCO_3$)	132 mg/L	114 mg/L	104 mg/L
Calcium	104 mg/L	81 mg/L	68 mg/L
Chloride	43 mg/L	28 mg/L	31 mg/L
Chloroform	0.002 mg/L	0.006 mg/L	0.009 mg/L
Cyanide	36 µg/L	15 µg/L	4 µg/L
Fluoride	0.32 mg/L	0.41 mg/L	0.31 mg/L
Iron	0.11 mg/L	0.06 mg/L	0.18 mg/L
Magnesium	32 mg/L	25 mg/L	22 mg/L
Manganese	0.01 mg/L	0.003 mg/L	0.006 mg/L
Potassium	8.7 mg/L	6.6 mg/L	5.2 mg/L
Sodium	58 mg/L	41 mg/L	21 mg/L
Sulfate	129 mg/L	78 mg/L	56 mg/L
Total organic carbon	1.61 mg/L	0.99 mg/L	0.76 mg/L
Total suspended solids	2.28 mg/L	1.29 mg/L	0.35 mg/L
Total dissolved solids	569 mg/L	251 mg/L	68 mg/L

Note: The COCs listed in this table are those identified in the 200-ZP-1 OU ROD (*Record of Decision, Hanford 200 Area, 200-ZP-1 Superfund Site, Benton County, Washington* [EPA et al., 2008]) and the 200-UP-1 ROD (*Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit* [EPA et al., 2012]). The other constituents are identified as those of interest in the performance monitoring plan. Concentrations are based on estimates included in engineering design documents.

a. Concentrations for COCs and other constituents are 5-year averages.

COC = contaminant of concern
ROD = Record of Decision
OU = operable unit

D1.6 Treated Water Quality

The 200 West P&T is designed to meet or exceed the requirements of each ROD (EPA et al., 2008 and EPA et al., 2012) for the treated (effluent) water injected back into the aquifer. The treated water quality standards (as shown in Table D-3 and specified in each ROD) reflect the federal and state drinking water maximum contaminant levels and the state groundwater cleanup standards (where more stringent than the maximum contaminant levels) that are the applicable or relevant and appropriate requirements for the selected remedies (EPA et al., 2008; EPA et al., 2012). The design treatment goals shown in Table D-3 are more conservative than cleanup levels in each ROD to provide operational margins during periods of stressed or transient operation.

Table D-3. Treated Water Quality Requirements and Treatment System Design Goals

Parameter	Where Measured	Treated Water Quality Standards		Acceptance Standard Description	Design Treatment Goal
		Value	Unit		
Carbon tetrachloride*	Pipeline to injection wells	3.4	µg/L	Specified in ROD	2 µg/L
Trichloroethene*	Pipeline to injection wells	1	µg/L	Specified in ROD	0.6 to 1 µg/L
Chromium (total)	Pipeline to injection wells	100	µg/L	Federal MCL	60 to 100 µg/L
Hexavalent chromium	Pipeline to injection wells	48	µg/L	Specified in ROD	29 to 48 µg/L
Nitrate as nitrogen	Pipeline to injection wells	10,000	µg/L	Federal MCL	2,000 µg/L
Iodine-129	Pipeline to injection wells	1	pCi/L	Federal MCL	0.6 to 1 pCi/L
Technetium-99	Pipeline to injection wells	900	pCi/L	Federal MCL	540 pCi/L
Tritium	Pipeline to injection wells	20,000	pCi/L	Federal MCL	12,000 to 20,000 pCi/L
Uranium	Pipeline to injection wells	30	µg/L	Federal MCL	18 to 30 µg/L

* DOE will clean up contaminants of concern for the 200-ZP-1 Operable Unit subject to WAC 173-340, "Model Toxics Control Act—Cleanup," which includes carbon tetrachloride and trichloroethene, so the excess lifetime cancer risk does not exceed 1×10^{-5} at the conclusion of the remedy.

DOE = U.S. Department of Energy

MCL = maximum contaminant level

ROD = Record of Decision

D1.7 Air Emissions Quality

The treatment facility requires emissions control for offgases from the equalization tank, air stripper(s), FBR(s), membrane tanks, sludge holding tank(s), recycle tank, rotary drum thickeners, and centrifuges. Preliminary estimates of air emissions toxicity values indicated that the offgas treatment system would require a minimum capture rate of 94 percent to meet the proposed local air emission limit for carbon tetrachloride. Table D-4 presents the modeled ambient emission levels and acceptable concentration limits for volatile organics. Additional information is provided in the AMP (Appendix C).

Table D-4. Comparison of Concentrations to Acceptable Source Impact

Pollutant	Annual Average Concentration (µg/m³)	Annual Acceptable Source Impact Level (µg/m³)
Carbon tetrachloride	0.00201	0.0238
Chloroform	0.0000331	0.0435

D1.8 Data Needs

The 200 West P&T is an engineered system designed to remove contaminants from groundwater, return the treated water to the aquifer, and segregate and contain the mass of contaminants removed from the water for eventual disposal. For the purpose of this SAP, the data needs may be summarized as the body of measurements required to characterize the mass or volume of influent water and COCs entering the treatment facility, and the treated water and separate waste streams exiting the treatment facility (total effluents). This body of measurements serves to independently evaluate treatment system performance to determine if treatment objectives and quality requirements for water injection are met. Additional characterization to support waste designation may be required in accordance with the WMP (Appendix B).

Some trace constituents in the contaminated water from ERDF leachate and 200-ZP-1, 200-UP-1, 200-DV-1, and 200-BP-5 OUs that are not included in Table D-2 may become concentrated in some waste streams (e.g., by sorption onto IX resins or onto the GAC or biomass sludge from the main treatment facility). These other constituents shown in Table D-2 are also considered for waste designation.

D1.9 Sampling Design

The sampling design is systematic and intended to verify reported treatment system performance and compliance with the requirements in the 200-ZP-1 OU ROD (EPA et al., 2008) and in the 200-UP-1 OU interim ROD (EPA et al., 2012) for treated water quality. The sampling design relies neither on statistical interpretation nor on professional expertise. The measurements are a subset of those measurements needed to operate and control the treatment facility.

D1.10 Reporting Requirements

The sample collection and laboratory analysis results obtained under this SAP are reported in periodic briefings and in the performance monitoring reports, as described in this O&M plan.

D2 Quality Assurance Project Plan

A Quality Assurance Project Plan (QAPjP) establishes the quality requirements for environmental data collection. It includes planning, implementation, and assessment of sampling tasks, field measurements, laboratory analysis and data review. This chapter describes the applicable environmental data collection requirements and controls based on the QA elements found in EPA/240/B 01/003, EPA Requirements for Quality Assurance Project Plans (EPA QA/R 5) and DOE/RL 96 68, Hanford Analytical Services Quality Assurance Requirements Document (HASQARD). Sections 6.5 and 7.8 of the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement [TPA]) Action Plan (Ecology et al., 1989b) require the QA/quality control (QC) and sampling and analysis activities to specify the QA requirements for treatment, storage, and disposal units, as well as for past practice processes. This QAPjP also describes the applicable requirements and controls based on guidance found in Washington State Department of Ecology (Ecology) Publication No. 04 03 030, Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies, and EPA/240/R 02/009, Guidance for Quality Assurance Project Plans (EPA QA/G 5). This QAPjP is intended to supplement the contractor's environmental QA program plan.
This QAPjP is divided into the following four sections, which describe the quality requirements and controls applicable to Hanford Site OU groundwater monitoring activities: Project Management, Data Generation and Acquisition, Assessment and Oversight, and Data Review and Usability.

D2.1 Project Management

This section addresses project goals, the management approaches planned, and planned output documentation.

D2.1.1 Project and Task Organization

The contractor, or its approved subcontractor, is responsible for planning, coordinating, sampling, and shipping samples to the laboratory. The contractor is also responsible for preparing and maintaining configuration control of the SAP and assisting the RL project manager in obtaining approval of the SAP and future proposed revisions. Project organization (regarding routine groundwater monitoring) is described in the following sections and illustrated in Figure D-1.

D2.1.1.1 Regulatory Lead

The lead regulatory agency (LRA) is responsible for regulatory oversight of cleanup projects and activities. The LRA has SAP approval authority for the OUs they manage. The LRA works with the U.S. Department of Energy Richland Operations Office (DOE RL) to resolve concerns over the work described in this SAP in accordance with the TPA (Ecology et al., 1989a).

D2.1.1.2 DOE RL Project Manager

The DOE RL Project Manager is responsible for the following:

- Monitoring the contractor's performance of activities under CERCLA, RCRA, Atomic Energy Act of 1954, and TPA (Ecology et al., 1989a) for the Hanford Site
- Obtaining LRA approval of the SAP
- Authorizing field sampling activities
- Approving the SAP
- Functioning as primary interface with regulators

D2.1.1.3 DOE RL Technical Lead

The DOE RL Technical Lead is responsible for the following:

- Providing day-to-day oversight of the contractor's work scope performance
- Working with the contractor and the regulatory agencies to identify and resolve technical issues
- Providing technical input to the DOE RL Project Manager

D2.1.1.4 Operable Unit Project Manager

The OU Project Manager (or designee) is responsible and accountable for the following:

- Project-related activities
- Coordinating with DOE RL, regulators, and contactor management in support of sampling activities to ensure work is performed safely and cost effectively
- Managing sampling documents and requirements, field activities, subcontracted tasks, and for ensuring the project file is properly maintained.

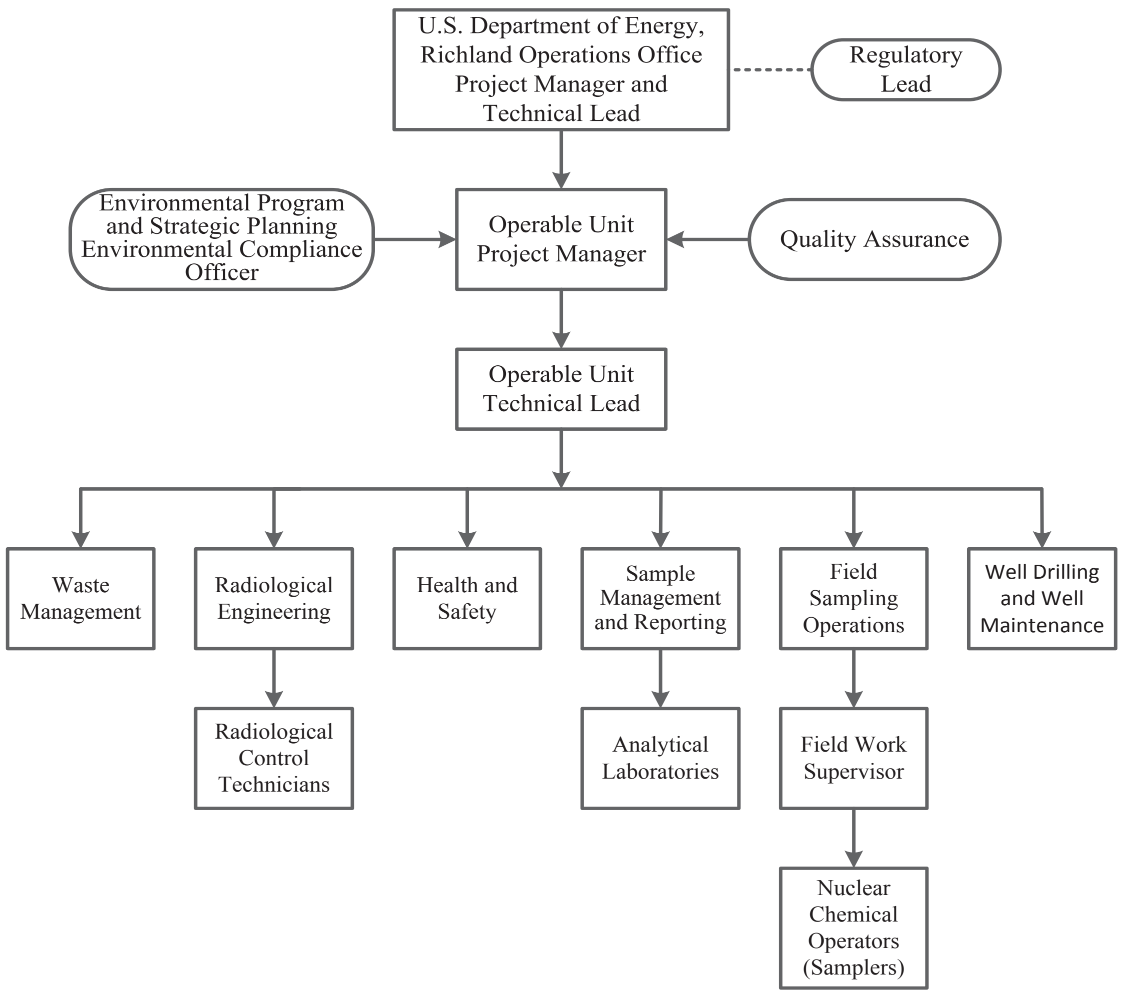

Figure D-1. Project Organization

D2.1.1.5 Operable Unit Technical Lead

The OU Technical Lead is responsible for the following:

- Developing specific sampling design, analytical requirements, and QC requirements; either independently or as defined through a systematic planning process
- Ensuring that sampling and analysis activities as delegated by OU Project Manager are carried out in accordance with the SAP
- Working closely with the Environmental Compliance Officer (ECO), QA, Health and Safety, the Field Work Supervisor (FWS), and the SMR organization to integrate these and other technical disciplines in planning and implementing the work scope

D2.1.1.6 Environmental Compliance Officer

The ECO is responsible for the following:

- Providing technical oversight, direction, and acceptance of project and subcontracted environmental work
- Developing appropriate mitigation measures to minimize adverse environmental impacts
- Reviewing plans, protocols, and technical documents to ensure environmental requirements have been addressed
- Identifying environmental issues affecting operations and developing cost-effective solutions
- Responding to environmental/regulatory issues or concerns
- Overseeing project implementation for compliance with applicable internal and external environmental requirements

D2.1.1.7 Quality Assurance

The QA point-of-contact is responsible for the following:

- Addressing QA issues on the project
- Overseeing implementation of the project QA requirements
- Reviewing project documents (including DQO summary report, QAPjP, and SAP)
- Reviewing data validation reports from third-party data validation contractors, as appropriate
- Participating in QA assessments on sample collection and analysis activities, as appropriate

D2.1.1.8 Health and Safety

The Health and Safety organization is responsible for the following:

- Coordinating industrial safety and health support within the project, in accordance with the health and safety program, job hazard analyses, and other pertinent federal regulation
- Assisting project personnel in complying with the applicable health and safety program
- Coordinating with Radiological Engineering to determine personal protective equipment (PPE) requirements

D2.1.1.9 Radiological Engineering

Radiological Engineering is responsible for the following:

- Radiological engineering and project health physics support
- Conducting as low as reasonably achievable (ALARA) reviews, exposure and release modeling, and radiological controls optimization

- Identifying radiological hazards and ensuring appropriate controls are implemented to maintain worker exposures to hazards at ALARA levels
- Interfacing with the project Health and Safety representative and other appropriate personnel, as needed, to plan and direct project Radiological Control Technician (RCT) support

D2.1.1.10 Sample Management and Reporting Organization

The SMR organization is responsible for the following activities:

- Interfacing between the OU Technical Lead, the Field Sampling Operations (FSO), the Well Maintenance Organization, and the analytical laboratories
- Generating field sampling documents, labels, and instructions for field sampling personnel
- Developing the Sample Authorization Form (SAF), which provides information and instruction to the analytical laboratories)
- Providing instructions to the FSO Nuclear Chemical Operators (NCOs) (samplers) on the collection of samples as specified in a SAP
- Monitoring the entire sample and data process
- Coordinating laboratory analytical work, and ensuring that the laboratories conform to Hanford Site QA requirements (or their equivalent), as approved by U. S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and the Ecology
- Resolving sample documentation deficiencies or issues associated with the FSO, laboratories, or other entities to ensure that project needs are met
- Receiving the analytical data from the laboratories
- Ensuring data is uploaded into the Hanford Environmental Information System (HEIS)
- Arranging for, and overseeing, data validation, as requested
- Informing the OU Project Manager and/or OU Technical Lead of any issues reported by the analytical laboratory

D2.1.1.11 Analytical Laboratories

Analytical laboratories are responsible for the following:

- Analyzing samples in accordance with established methods
- Providing data packages containing analytical and QC results
- Providing explanations in response to resolution of analytical issues
- Meeting the requirements of this plan
- Being on the Mission Support Alliance Evaluated Suppliers List
- Being accredited by Ecology for the analyses performed for the Soil and Groundwater Remediation Project

D2.1.1.12 Waste Management

Waste Management is responsible for the following:

- Communicating policies and protocols
- Ensuring compliance for waste storage, transportation, disposal, and tracking in a safe and cost effective manner
- Identifying waste management sampling/characterization requirements to ensure regulatory compliance

- Interpreting data to determine waste designations and profiles
- Preparing and maintaining other documents confirming compliance with waste acceptance criteria

D2.1.1.13 Field Sampling Organization

The FSO is responsible for the following:

- Planning, coordinating, and conducting field sampling activities
- The FWS directing the NCOs (samplers) and ensuring they are appropriately trained and available
- The FWS reviewing the SAP for field sample collection concerns, analytical requirements, and special sampling requirements
- Ensuring the sampling design is understood by the NCOs and can be performed as specified ; this is achieved by performing mock-ups and holding practice sessions with field personnel
- The NCOs collecting all salient samples in accordance with sampling documentation
- Completing field logbook entries, chain-of-custody forms, shipping paperwork, and ensuring delivery of the samples to the analytical laboratory
- The FWS acting as a technical interface between the OU Project Manager and the field crew supervisors (such as the Drilling Buyer's Technical Representative [BTR], and Geologist-BTR) and ensuring technical aspects of the field work are met in consultation with the OU Project Manager and SMR, resolving issues regarding arising from translation of technical requirements to field operations and coordinating resolution of sampling issues

D2.1.1.14 Well Maintenance

The Well Maintenance Manager is responsible for the following:

- Well maintenance activities
- Coordinating with the OU Technical Lead to identify field constraints that could affect groundwater sampling

D2.1.2 Quality Objectives and Criteria

The QA objective of this plan is to ensure the generation of analytical data of known and appropriate quality that are acceptable and useful for decision making. In support of this objective, statistics and data descriptors known as data quality indicators (DQIs) help determine the acceptability and utility of data to the user. The principal DQIs are precision, accuracy, representativeness, comparability, completeness, bias, and sensitivity. These are defined for the purposes of this document in Table D-5.

Data quality is defined by the degree of rigor in the acceptance criteria assigned to the DQIs. The applicable QC guidelines, DQI acceptance criteria, and levels of effort for assessing data quality are dictated by the intended use of the data and the requirements of the analytical method. DQIs are evaluated during the data quality assessment (DQA) process (Section D2.4.3).

Table D-5. Data Quality Indicators

DQI	Definition	Determination Methodologies	Corrective Actions
Precision	Precision measures the agreement among a set of replicate measurements. Field precision is assessed through the collection and analysis of field duplicates. Analytical precision is estimated by duplicate/replicate analyses, usually on laboratory control samples, spiked samples, and/or field samples. The most commonly used estimates of precision are the relative standard deviation and, when only two samples are available, the relative percent difference.	Use the same analytical instrument to make repeated analyses on the same sample. Use the same method to make repeated measurements of the same sample within a single laboratory. Acquire replicate field samples for information on sample acquisition, handling, shipping, storage, preparation, and analytical processes and measurements.	If duplicate data do not meet objective: • Evaluate apparent cause (e.g., sample heterogeneity) • Request reanalysis or re-measurement • Qualify the data before use
Accuracy	Accuracy is the closeness of a measured result to an accepted reference value. Accuracy is usually measured as a percent recovery. Quality control analyses used to measure accuracy include standard recoveries, laboratory control samples, spiked samples, and surrogates.	Analyze a reference material or reanalyze a sample to which a material of known concentration or amount of pollutant has been added (a spiked sample).	If recovery does not meet objective: • Qualify the data before use • Request re-analysis or re measurement
Representativeness	Sample representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. It is dependent on the proper design of the sampling program and will be satisfied by ensuring the approved plans were followed during sampling and analysis.	Evaluate whether measurements are made and physical samples collected in such a manner that the resulting data appropriately reflect the environment or condition being measured or studied.	If results are not representative of the system sampled: • Identify the reason for them not being representative • Flag for further review • Review data for usability • If data are usable, qualify the data for limited use and define the portion of the system that the data represent • If data are not usable, flag as appropriate • Redefine sampling and measurement requirements and protocols • Resample and reanalyze, as appropriate

Table D-5. Data Quality Indicators

DQI	Definition	Determination Methodologies	Corrective Actions
Comparability	Comparability expresses the degree of confidence with which one data set can be compared to another. It is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the approved plans are followed and that proper sampling and analysis techniques are applied.	Use identical or similar sample collection and handling methods, sample preparation and analytical methods, holding times, and quality assurance protocols.	If data are not comparable to other data sets: • Identify appropriate changes to data collection and/or analysis methods • Identify quantifiable bias, if applicable • Qualify the data as appropriate • Resample and/or reanalyze if needed • Revise sampling/analysis protocols to ensure future comparability
Completeness	Completeness is a measure of the amount of valid data collected compared to the amount planned. Measurements are considered to be valid if they are unqualified or qualified as estimated data during validation. Field completeness is a measure of the number of samples collected versus the number of samples planned. Laboratory completeness is a measure of the number of valid measurements compared to the total number of measurements planned.	Compare the number of valid measurements completed (samples collected or samples analyzed) with those established by the project's quality criteria (data quality objectives or performance/ acceptance criteria).	If data set does not meet completeness objective: • Identify appropriate changes to data collection and/or analysis methods • Identify quantifiable bias, if applicable • Resample and/or reanalyze if needed • Revise sampling/analysis protocols to ensure future completeness.
Bias	Bias is the systematic or persistent distortion of a measurement process that causes error in one direction (e.g., the sample measurement is consistently lower than the sample's true value). Bias can be introduced during sampling, analysis, and data evaluation. Analytical bias refers to deviation in one direction (i.e., high, low, or unknown) of the measured value from a known spiked amount.	Sampling bias may be revealed by analysis of replicate samples. Analytical bias may be assessed by comparing a measured value in a sample of known concentration to an accepted reference value or by determining the recovery of a known amount of contaminant spiked into a sample (matrix spike).	For sampling bias: • Properly select and use sampling tools • Institute correct sampling and subsampling procedures to limit preferential selection or loss of sample media • Use sample handling procedures, including proper sample preservation, that limit the loss or gain of constituents to the sample media Analytical data that are known to be affected by either sampling or analytical bias are

Table D-5. Data Quality Indicators

DQI	Definition	Determination Methodologies	Corrective Actions
			flagged to indicate possible bias. Laboratories that are known to generate biased data for a specific analyte are asked to correct their methods to remove the bias as best as practicable. Otherwise, samples are sent to other labs for analysis.
Sensitivity	Sensitivity is an instrument's or method's minimum concentration that can be reliably measured (i.e., instrument detection limit or limit of quantitation).	Determine the minimum concentration or attribute to be measured by an instrument (instrument detection limit) or by a laboratory (limit of quantitation). The lower limit of quantitation is the lowest level that can be routinely quantified and reported by a laboratory.	If detection limits do not meet objective: • Request reanalysis or re-measurement using methods or analytical conditions that will meet required detection or limit of quantitation • Qualify/reject the data before use

Source: SW-846, Pending, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update V, as amended.

D2.1.3 Special Training and Certification

A graded approach is used to ensure workers receive a level of training commensurate with their responsibilities and compliant with applicable DOE orders and government regulations. The FWS, in coordination with line management, will ensure special training requirements for field personnel are met.

In addition, pre-job briefings in accordance with work management and work release requirements document evaluation activities and associated hazards including the following:

- Objective of the activities
- Individual tasks to be performed
- Hazards associated with the planned tasks
- Controls applied to mitigate the hazards
- Environment in which the job will be performed
- Facility where the job will be performed
- Equipment and material required

Training records are maintained for each employee in an electronic training record database.
The contractor's training organization maintains the training records system. Line management confirms that an employee's training is appropriate and up-to-date prior to performing any field work.

D2.1.4 Documents and Records

The OU Project Manager (or designee) is responsible for ensuring the current version of the SAP is being used and providing updates to field personnel. Version control is maintained by the administrative document control process. Changes to the sampling document are handled consistent with HASQARD and the TPA Action Plan (Ecology et al., 1989b). The OU Project Manager is responsible for tracking all SAP changes, obtaining appropriate review, and alerting DOE-RL of these changes. Appropriate documentation will follow, in accordance with the requirements for the type of change. Table D-6 summarizes the changes that may be made and their documentation requirements.

The FWS, SMR, and appropriate BTR are responsible for ensuring that the field instructions are maintained and aligned with any revisions or approved changes to the SAP. The SMR will ensure that any deviations from the SAP are reflected in revised paperwork for the samplers and the analytical laboratory. The FWS or appropriate BTR will ensure that deviations from the SAP or problems encountered in the field are documented appropriately (e.g., in the field logbook) in accordance with corrective action protocols.

Table D-6. Change Control for Sampling Projects

Type of Change [a]	Type of Change (TPA Action Plan [b])	Action	Documentation
Minor Change. Change has no impact on the sample or field analytical result, and little or no impact on performance or cost. Further, the change does not affect the DQOs specified in the SAP.	**Minor Field Change.** Changes that have no adverse effect on the technical adequacy of the job or the work schedule.	The field personnel recognizing the need for a field change will consult with the OU Project Manager (or designee) prior to implementing the field change.	Minor field changes will be documented in the field logbook. The logbook entry will include the field change, the reason for the field change, and the names and titles of those approving the field change.
Significant Change. Change has a considerable effect on performance or cost, but still allow for meeting the DQOs specified in the SAP.	**Minor Change**. Changes to approved plans that do not affect the overall intent of the plan or schedule.	The OU Project Manager will inform the DOE-RL Project Manager and the Regulatory Lead of the change and seek concurrence at a Unit Manager's Meeting or comparable forum. The lead regulatory agency determines there is no need to revise the document.	Documentation of this change approval would be in the Unit Manager's Meeting minutes or comparable record such as a Change Notice [c].
Fundamental Change. Change has significant effect on the sample or the field analytical result, performance, or cost, and the change does not meet the requirements specified in the DQOs in the sampling document.	**Revision Necessary.** Lead regulatory agency determines changes to approved plans require revision to document.	If it is anticipated that a fundamental change will require the approval of the Regulatory Lead, the applicable DOE-RL Project Manager will be notified by the OU Project Manager and will be involved in the decision prior to implementation of a fundamental change. The LRA determines the	Formal revision of the sampling document.

Table D-6. Change Control for Sampling Projects

Type of Change [a]	Type of Change (TPA Action Plan [b])	Action	Documentation
		change requires a revision to the document.	

a. Consistent with DOE/RL-96-68, Hanford Analytical Services Quality Assurance Requirements Documents.

b. Consistent with Sections 9.3 and 12.4 of the Hanford Federal Facility Agreement and Consent Order Action Plan (Tri-Party Agreement [TPA]) Action Plan (Ecology et al., 1989b,).

c. The TPA Action Plan, Section 9.3, defines the minimum elements of a change notice.

DOE-RL = U.S. Department of Energy-Richland Operations Office
DQO = data quality objective
LRA = Lead regulatory agency
OU = operable unit
SAP = sampling and analysis plan

The OU Project Manager, FWS, or designee, is responsible for communicating field corrective action requirements and ensuring immediate corrective actions are applied to field activities. The OU Project Manager is also responsible for ensuring that project files are maintained. The project files will contain project records or references to their storage locations. Project files may include, as appropriate, the following information:

- Operational records and logbooks
- Data forms
- Global positioning system data (a copy will be provided to SMR)
- Inspection or assessment reports and corrective action reports
- Field summary reports
- Interim progress reports
- Final reports
- Forms required by WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," and the master drilling contract

The following records are managed and maintained by SMR personnel:

- Field sampling logbooks
- Groundwater sample reports and field sample reports
- Chain-of-custody forms
- Sample receipt records
- Laboratory data packages
- Analytical data verification and validation reports, if any
- Analytical data "case file purges" (i.e., raw data purged from laboratory files) provided by the offsite analytical laboratories

The laboratory is responsible for maintaining, and having available upon request, the following:

- Analytical logbooks
- Raw data and QC sample records
- Standard reference material and/or proficiency test sample data
- Instrument calibration information

Records may be stored in either electronic or hard copy format. Documentation and records, regardless of medium or format, are controlled in accordance with work requirements and processes to ensure stored records are accurate and can be retrieved. Records required by the TPA (Ecology et al., 1989a) will be managed in accordance with the requirements therein.

D2.2 Data Generation and Acquisition

The following sections present the requirements for analytical methods, measurement and analysis, data collection or generation, data handling, and field and laboratory QC. The requirements for instrument calibration and maintenance, supply inspections, and data management are also addressed.

D2.2.1 Analytical Methods Requirements

Analytical method performance requirements for samples collected are presented in Table D-7.

In consultation with the laboratory and the OU Project Manager, SMR can approve changes to analytical methods as long as the new method is based upon a nationally recognized standard method (e.g., EPA, American Society for Testing and Materials [ASTM]) and the new method delivers analytical data that are comparable to those provided by the old method. The new method must achieve project DQOs as well or better than the replaced method, and is required due to the nature of the sample (e.g., high radioactivity). The laboratory using the new method must be accredited by Ecology to perform that method. Issues that may affect analytical results are resolved by SMR in coordination with the OU Project Manager.

D2.2.2 Field Analytical Methods

Chemical field screening and radiological field survey data used for site characteristics will be measured in accordance with HASQARD requirements (as applicable). Field analytical methods may also be performed in accordance with the manufacturers' manuals. Chapter D3 provides the parameters identified for field survey analyses.

D2.2.3 Quality Control

The QC requirements specified in the SAP must be followed in the field and analytical laboratory to ensure that reliable data are obtained. Field QC samples will be collected to evaluate the potential for cross-contamination and provide information pertinent to sampling variability. Laboratory QC samples estimate the precision, bias, and matrix effects of the analytical data. Field and laboratory QC sample requirements are summarized in Table D-8. Acceptance criteria for field and laboratory QC are shown in Table D-9.

Data will be qualified and flagged in HEIS, as appropriate.

Table D-7. Performance Requirements for Groundwater Analysis

CAS No.	Analyte	Survey or Analytical Method	Units	Action Level	Target Detection Limit	Precision Required (%)	Accuracy Required (%)
56-23-5	Carbon tetrachloride LL (COC)	SW-846, Method 8260	µg/L	3.4	1	% recovery	Statistically derived
67-66-3	Chloroform (TP)	SW-846, Method 8260	µg/L	7.17	5	% recovery	Statistically derived
75-09-2	Dichloromethane (TP)	SW-846, Method 8260	µg/L	5	5	% recovery	Statistically derived
74-87-3	Chloromethane (TP)	SW-846, Method 8260	µg/L	N/A	10	% recovery	Statistically derived
79-01-6	Trichloroethene (COC)	SW-846, Method 8260	µg/L	1	1	% recovery	Statistically derived
156-59-2	cis-1,2-Dichloroethene (TP)	SW-846, Method 8260	µg/L	70	5	% recovery	Statistically derived
75-01-4	Vinyl chloride (TP-LL)	SW-846, Method 8260	µg/L	2	2	% recovery	Statistically derived
7440-47-3	Chromium (total) (COC)	SW-846, SW6010/6020 or EPA 200.8	µg/L	100	10	≤20%	80-120% recovery
18540-29-9	Hexavalent chromium (COC)	Method 7196	µg/L	48	10	≤20%	80-120% recovery
14697-55-8	Nitrate–N (COC)	SW-846, EPA 300.0 or 9056	mg/L	10	0.25	≤20%	80-120% recovery
14797-65-0	Nitrite–N (TP)	EPA 300.0 or 9056	mg/L	1	0.25	≤20%	80-120% recovery
15046-84-1	Iodine-129 (COC)	Low-energy photon spectroscopy - LL	pCi/L	1	1	≤20%	80-120% recovery
14133-76-7	Technetium-99 (COC)	Liquid scintillation	pCi/L	900	50	≤20%	80-120% recovery
10098-97-2	Strontium-90	Gas proportional counting	pCi/L	8	2	≤20%	80-120% recovery
10028-17-8	Tritium (COC)	Liquid scintillation	pCi/L	20,000	700	≤20%	80-120% recovery
7440-61-1	Uranium (from 200-UP-1 OU)	SW-846, SW6010/6020 or EPA 200.8	µg/L	30	1	≤20%	80-120% recovery
N/A	Total organic carbon (NAP)	EPA 415.1	µg/L	N/A	1,000	≤20%	80-120% recovery
N/A	Total dissolved solids	EPA 160.1	mg/L	500	10	≤20%	80-120% recovery
14808-79-8	Sulfate (NAP)	EPA 300.0A or 9056	mg/L	250	0.55	≤20%	80-120% recovery
18496-25-8	Sulfide (NAP)	EPA 9215	mg/L	N/A	0.50	≤20%	80-120% recovery
7439-89-6	Iron (NAP)	SW-846, SW6010/6020	µg/L	300	100	≤20%	80-120% recovery

Table D-7. Performance Requirements for Groundwater Analysis

CAS No.	Analyte	Survey or Analytical Method	Units	Action Level	Target Detection Limit	Precision Required (%)	Accuracy Required (%)
7439-96-5	Manganese (NAP)	SW-846, SW6010/6020	µg/L	50	15 / 5	≤20%	80-120% recovery
N/A	Alkalinity (NAP)	EPA 310.1	mg/L	N/A	5	≤20%	80-120% recovery
16887-00-6	Chloride	EPA 300.0 or 9056	mg/L	250	0.40	≤20%	80-120% recovery

Source: SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B.

CAS	=	Chemical Abstracts Service	LL	=	low level
COC	=	contaminant of concern	N/A	=	not applicable
EPA	=	U.S. Environmental Protection Agency	NAP	=	natural attenuation evaluation parameter
TP	=	transformation product	OU	=	operable unit

Table D-8. Project Quality Control Requirements

Sample Type	Frequency	Characteristics Evaluated
Field Quality Control		
Field Duplicates	One in 20 well trips	Precision, including sampling and analytical variability
Field Splits (SPLIT)	As needed When needed, the minimum is one for every analytical method, for analyses performed where detection limit and precision and accuracy criteria have been defined in the Analytical Performance Requirements table	Precision, including sampling, analytical, and inter-laboratory
Full Trip Blanks (FTB)	One in 20 well trips	Cross-contamination from containers or transportation
Field Transfer Blanks (FXR)	One each day volatile organic compounds (VOCs) are sampled	Contamination from sampling site
Equipment Blanks (EB)	As needed If only disposable equipment is used or equipment is dedicated to a particular well, then an EB is not required Otherwise, one for every 20 samples [a]	Adequacy of sampling equipment decontamination and contamination from non-dedicated equipment
Analytical Quality Control [b]		
Laboratory Duplicates	1 per analytical batch [c]	Laboratory Reproducibility and Precision
Matrix Spikes (MS)	1 per analytical batch [c]	Matrix Effect/Laboratory Accuracy
Post-Preparation Spike	1 per analytical batch [c]	Matrix Effect/Laboratory Accuracy

Table D-8. Project Quality Control Requirements

Sample Type	Frequency	Characteristics Evaluated
Matrix Spike Duplicates (MSD)	1 per analytical batch [c]	Laboratory Accuracy and Precision
Laboratory Control Samples (LCS)	1 per analytical batch [c]	Evaluate Laboratory Accuracy
Method Blanks (MB)	1 per analytical batch [c]	Laboratory Contamination
Surrogates (SUR)	1 per analytical batch [c]	Recovery/Yield
Tracers	1 per analytical batch [c]	Recovery/Yield

a. For portable pumps, EBs are collected one for every 10 well trips. Whenever a new type of non-dedicated equipment is used, an EB will be collected every time sampling occurs until it can be shown that less frequent collection of EBs is adequate to monitor the decontamination methods for the non-dedicated equipment.

b. Batching across projects is allowed for similar matrices (e.g., all Hanford groundwater).

c. Unless not required by, or different frequency is called out in laboratory analysis methods.

Table D-9. Field and Laboratory QC Elements and Acceptance Criteria

Analyte [a]	Quality Control Element	Acceptance Criteria	Corrective Action
General Chemical Parameters			
Alkalinity Conductivity Hexavalent Chromium pH Total Dissolved Solids Total Organic Carbon Total Organic Halides	MB [b]	< MDL < 5% Sample concentration	Flagged with “C”
	LCS	80 – 120% recovery [c]	Data reviewed [d]
	Laboratory Duplicate or MS/MSD	≤ 20% RPD	Data reviewed [d]
	Post-preparation spike [b]	75 – 125% recovery [c]	Flagged with “N”
	EB	<2 X MDL	Flagged with “Q”
	Field Duplicate	≤20% RPD [e]	Flagged with “Q”
Ammonia, Anions, and Cyanide			
Ammonia Anions by IC Cyanide	MB	< MDL < 5% Sample concentration	Flagged with “C”
	LCS	80 – 120% recovery [c]	Data reviewed [d]

Table D-9. Field and Laboratory QC Elements and Acceptance Criteria

Analyte [a]	Quality Control Element	Acceptance Criteria	Corrective Action
	Laboratory Duplicate or MS/MSD	≤ 20% RPD	Data reviewed [d]
	MS	75 – 125% recovery [c]	Flagged with "N"
	EB, FTB	<2X MDL	Flagged with "Q"
	Field Duplicate	≤20% RPD [e]	Flagged with "Q"
Metals			
ICP Metals ICP/MS Metals Mercury	MB	< MDL < 5% Sample concentration	Flagged with "C"
	LCS	80 – 120% recovery [c]	Data reviewed [d]
	MS	75 – 125% recovery [c]	Flagged with "N"
	MSD	75 – 125% recovery [c]	Flagged with "N"
	MS/MSD	≤ 20% RPD	Data reviewed [d]
	EB, FTB	<2X MDL	Flagged with "Q"
	Field Duplicate	≤20% RPD [e]	Flagged with "Q"
Volatile Organic Compounds			
Volatiles by GC/MS Total Petroleum Hydrocarbons by GC	MB	< MDL [f] < 5% Sample concentration	Flagged with "B"
	LCS	70-130%	Data reviewed [d]
	MS	70-130%	Flagged with "T" if analyzed by GC/MS, otherwise "N" based on FEAD
	MSD	70-130%	Flagged with "T" if analyzed by GC/MS, otherwise "N" based on FEAD
	MS/MSD	≤20%	Data reviewed [d]
	SUR	70-130%	Data reviewed [d]
	EB, FTB, FXR	<2XMDL [f]	Flagged with "Q"
	Field Duplicate	≤20% RPD [e]	Flagged with "Q"

Table D-9. Field and Laboratory QC Elements and Acceptance Criteria

Analyte [a]	Quality Control Element	Acceptance Criteria	Corrective Action
Semi-volatile Organic Compounds			
Semi-volatiles by GC/MS	MB	< MDL [f] < 5% Sample concentration	Flagged with “B”
	LCS	Statistically derived [c]	Data reviewed [d]
	MS	% Recovery statistically derived [c]	Flagged with “T” if analyzed by GC/MS, otherwise “N” based on FEAD
	MSD	% Recovery statistically derived [c]	Flagged with “T” if analyzed by GC/MS, otherwise “N” based on FEAD
	MS/MSD	% RPD statistically derived [c]	Data reviewed [d]
	SUR	Statistically derived [c]	Data reviewed [d]
	EB, FTB	<2X MDL [f]	Flagged with “Q”
	Field Duplicate	≤20% RPD [e]	Flagged with “Q”
Radiochemical Analyses			
Americium (Isotopic) Carbon-14 Gamma Scan Gross Alpha Gross Beta Iodine-129 Plutonium (Isotopic) Strontium-89/90 Technetium-99 Tritium Tritium (low level) Uranium (Isotopic) Uranium (total)	MB	< MDC < 5% Sample concentration	Flagged with “B”
	LCS	80 – 120% recovery	Data reviewed [d]
	Laboratory Duplicate [e]	≤ 20% RPD	Data reviewed [d]
	MS [g]	75 – 125% recovery	Flagged with “N”
	Tracer (where applicable)	30 – 105% recovery	Data reviewed [d]
	Carrier (where applicable)	40 – 110% recovery	Data reviewed [d]
	EB, FTB	<2X MDC	Flagged with “Q”

Table D-9. Field and Laboratory QC Elements and Acceptance Criteria

Analyte [a]	Quality Control Element	Acceptance Criteria	Corrective Action
	Field Duplicate	≤20% RPD [e]	Flagged with "Q"

Notes:

a. Specific analytes and method for determination are available from the Sample Management and Reporting organization.

b. Does not apply to pH, conductivity, total dissolved solids, or alkalinity.

c. Determined by the laboratory based on historical data or statistically-derived control limits. Limits are reported with the data. Where specific acceptance criteria are listed, those acceptance criteria may be used in place of statistically derived acceptance criteria.

d. After review, corrective actions are determined on a case-by-case basis.

e. Applies only in cases where both results are greater than 5 times the minimum detectable concentration.

f. For common laboratory contaminants such as acetone, methylene chloride, 2-butanone, toluene, and phthalate esters, the acceptance criteria is < 5 times the MDL.

g. Applies only to isotopic technetium-99, total uranium by ICP-MS, and tritium.

EB = equipment blank
FEAD = format for electronic analytical data
FTB = full trip blank
FXR = field transfer blank
GC = Gas chromatography
GC/MS = Gas chromatography-mass spectrometry
IC = Ion Chromatography
ICP = Inductively coupled plasma
ICP/MS = Inductively coupled plasma-mass spectrometry
LCS = Laboratory control sample MB = Method blank
MB = Method Blank
MDC = minimum detectable activity
MDL = Method detection limit
MS = Matrix spike
MSD = Matrix spike duplicate
RPD = Relative percent difference
SUR = Surrogate

Data Flags:

B (organics)/C (inorganics/wetchem) = Analyte was detected in both the associated quality control blank and the sample).
N = All except GC/MS – Matrix Spike outlier.
T = VOA and Semi-VOA GC/MS – Matrix Spike outlier.
Q = Associated quality control sample is out of limits

D2.2.3.1 Field QC Samples

Field QC samples are collected to evaluate the potential for cross-contamination and provide information pertinent to field sampling variability and laboratory performance to help ensure reliable data are obtained. Field QC samples include field duplicates, split samples, and three types of field blanks (full trip, field transfer, and equipment). Field blanks are typically prepared using high-purity reagent water. The QC sample definitions and their required frequency for collection are described in this section.

Field Duplicates: independent samples collected as close as possible to the same time and same location as the schedule sample, and are intended to be identical. Field duplicates are placed in separate sample containers and analyzed independently. Field duplicates are used to determine precision for both sampling and laboratory measurements.

Field Splits (SPLIT): two samples collected as close as possible to the same time and same location and are intended to be identical. SPLITs will be stored in separate containers and analyzed by different laboratories for the same analytes. SPLITs are inter-laboratory comparison samples used to evaluate comparability between laboratories.

Full Trip Blanks (FTB): bottles prepared by the sampling team prior to traveling to the sampling site. The preserved bottle set is either for volatile organic analysis (VOA) only or identical to the set that will be collected in the field. It is filled with high-purity reagent water (or dead water from well 699-S11-E12AP for low-level tritium FTBs[2]) and the bottles are sealed and transported, unopened, to the field in the same storage containers used for samples collected that day. Collected FTBs are typically analyzed for the same constituents as the samples from the associated sampling event. FTBs are used to evaluate potential contamination of the samples attributable to the sample bottles, preservative, handling, storage, and transportation.

Field Transfer Blanks (FXR): are preserved VOA sample vials filled with high-purity reagent water at the sample collection site where volatile organic compound samples are collected. The samples will be prepared during sampling to evaluate potential contamination attributable to field conditions. After collection, FXR sample vials will be sealed and placed in the same storage containers with the samples collected the same day for the associated sampling event. FXR samples will be analyzed for volatile organic compounds (VOC) only.

Equipment Blanks (EB): reagent water passed through or poured over the decontaminated sampling equipment identical to the sample set collected and placed in sample containers, as identified on the SAF. The EB sample bottles are placed in the same storage containers with the samples from the associated sampling event. The EB samples will be analyzed for the same constituents as the samples from the associated sampling event. The EBs are used to evaluate the effectiveness of the decontamination process. EBs are not required for disposable sampling equipment.

D2.2.3.2 Laboratory QC Samples

Internal QA/QC programs are maintained by the laboratories utilized by the project. Laboratory QA includes a comprehensive QC program that includes the use of matrix spikes, matrix duplicates, matrix spike duplicates, laboratory control samples, surrogates, tracers, and method blanks. These samples are recommended in the guidance documents and are required by the EPA protocol (e.g., EPA/600/4-79/20, Methods for Chemical Analysis of Water and Wastes) and will be run at the frequency specified in the respective references unless superseded by agreement. QC checks outside of control limits are documented in analytical laboratory reports during DQAs, if performed. Laboratory QC and their typical frequencies are listed in Table D-8. Acceptance criteria are shown in Table D-9. The following text describes the various laboratory QC samples.

Laboratory Duplicate: an intra-laboratory replicate sample that is used to evaluate the precision of a method in a given sample matrix.

Matrix Spike (MS): an aliquot of a sample spiked with a known concentration of target analyte(s). The MS is used to assess the bias of a method in a given sample matrix. Spiking occurs prior to sample preparation and analysis.

Post preparation Spike: the same as a MS, however the spiking occurs after sample preparation.

Matrix Spike Duplicate (MSD): A replicate spiked aliquot of a sample that is subjected to the entire sample preparation and analytical process. MSD results are used to determine the bias and precision of a method in a given sample matrix.

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2 Because of the low detection levels achieved in the low-level tritium analysis, special low-level tritium water must be used. This low-level tritium water, known as "dead water," is collected yearly, or as needed, from well 699-S11-E12AP or other approved source.

Laboratory Control Sample (LCS): a control matrix (e.g., reagent water) spiked with analytes representative of the target analytes or a certified reference material that is used to evaluate laboratory accuracy.

Method Blank (MB): an analyte-free matrix to which all reagents are added in the same volumes or proportions as used in the sample processing. The method blank is carried through the complete sample preparations and analytical procedure. The MB is used to quantify contamination resulting from the analytical process.

Surrogate (SUR): a compound added to all samples in the analysis batch (field samples and QC samples) prior to preparation. The SUR is typically similar in chemical composition to the analyte being determined, yet is not normally encountered. SURs are expected to respond to the preparation and measurement systems in a manner similar to the analytes of interest. Because SURs are added to all standards, samples, and QC samples, they are used to evaluate overall method performance in a given matrix. SURs are used only in organic analyses.

Tracer: a tracer is a known quantity of radioactive isotope that is different from that of the isotope of interest but is expected to behave similarly and is added to an aliquot of sample. Sample results are generally corrected based on tracer recovery.

The laboratories are required to analyze samples within the holding time specified in Table D-10. In some instances, constituents in the samples not analyzed within the holding times may be compromised by volatilizing, decomposing, or by other chemical changes. Data from samples analyzed outside the holding times are flagged in the HEIS database with an "H."

Table D-10. Preservation, Container, and Holding Time Guidelines

Constituent or Parameter	Minimum volume	Container Type [a]	Preservation [b]	Holding Time
Gravimetric Determinations				
Residue, Filterable Total Dissolved Solids	500 mL	Poly or glass	Store ≤6°C	7 days
Organic Analyses				
Volatile organics	4 x 40 mL	Amber glass VOA vial with Teflon lined septum lid	Store ≤ 6°C (if free Cl_2 add 4 drops of 10% sodium thiosulfate), adjust pH to < 2 with HCl	14 days
Semi-volatile organics	4 x 1L	Amber glass with Teflon lined lid	Store ≤ 6°C (if residual Cl_2, add 3 ml 10% sodium thiosulfate/gal of sample)	7 days before extraction 40 days after extraction
WTPH-D	4 x 1L	Amber glass with Teflon lined lid	Store ≤ 6°C pH to < 2 with HCl	7 days before extraction (14 days if preserved) 40 days after extraction

Table D-10. Preservation, Container, and Holding Time Guidelines

Constituent or Parameter	Minimum volume	Container Type [a]	Preservation [b]	Holding Time
WTPH-G	4 x 40 mL	Amber glass VOA vial with Teflon lined septum-lid	Store ≤ 6°C, adjust pH to < 2 with HCl	14 days
Total Organic Halides	1 L	Glass with Teflon lined lid	Store ≤ 6°C, Adjust pH to <2 with H_2SO_4	28 days
Total Organic Carbon	250 mL	Amber glass with Teflon lined lid	Store ≤ 6°C, Adjust pH to <2 with H_2SO_4 or HCl	28 days
Metals [c]				
ICP/MS (with/without Mercury)	250 mL	Poly or glass	Adjust pH to < 2 with nitric acid	28 days/6 months [c]
ICP/AES (with/without Mercury)	250 mL	Poly or glass	Adjust pH to < 2 with nitric acid	28 days/6 months [c]
Dissolved Metals (with/without Mercury)	500 mL	Poly or glass	Filter prior to pH adjustment to < 2 with nitric acid	28 days/6 months [c]
Mercury	250 mL	Poly or glass	Adjust pH to < 2 with nitric acid	28 days
Miscellaneous Inorganic				
Alkalinity	500 mL	Poly or glass	Store ≤6°C	14 days
Cyanide	250 mL	Poly or glass	Store ≤ 6°C, Adjust pH to >12 with 50% NaOH. If oxidizing agents present, add 5 ml 0.1 N $NaAsO_2$/L or 0.06 g ascorbic acid/L.	14 days
Hexavalent chromium	60 mL	Poly or glass	Store ≤6°C	24 hours
pH	60 mL	Poly or glass	None required	Analyze immediately
Specific Conductivity	150 mL	Poly or glass	Store ≤6°C	28 days
Inorganic Ions				
Ammonia	500 mL	Poly or glass	Store ≤ 6°C, Adjust pH to <2 with H_2SO_4	28 days
Bromide	500 mL	Poly or glass	Store ≤6°C	28 days

Table D-10. Preservation, Container, and Holding Time Guidelines

Constituent or Parameter	Minimum volume	Container Type [a]	Preservation [b]	Holding Time
Chloride	500 mL	Poly or glass	Store ≤6°C	28 days
Fluoride	500 mL	Poly or glass	Store ≤6°C	28 days
Nitrate	500 mL	Poly or glass	Store ≤6°C	48 hours
Nitrite	500 mL	Poly or glass	Store ≤6°C	48 hours
Phosphate	500 mL	Poly or glass	Store ≤6°C	48 hours
Sulfate	500 mL	Poly or glass	Store ≤6°C	28 days
Sulfide	250 mL	Poly or glass	Store ≤ 6°C, ZnAc+NaOH to pH > 9	7 days
Radiochemical Analyses				
Gross Alpha/Beta (Plate Count)	500 mL	Poly or glass	Adjust pH to <2 with HNO_3	6 months
Americium/Curium by AEA	1L for all AEA	Poly or glass	Adjust pH to <2 with HNO_3	6 months
Carbon-14	2 x 1L	Poly or glass	None	6 months
Plutonium Isotopic by AEA	1L for all AEA	Poly or glass	Adjust pH to <2 with HNO_3	6 months
Uranium Isotopic by AEA	1L for all AEA	Poly or glass	Adjust pH to <2 with HNO_3	6 months
Gamma Energy Analysis (GEA)	500 mL	Square poly	Adjust pH to <2 with HNO_3	6 months
Iodine-129	2 x 4L	Poly or glass	None	6 months
Neptunium-237	1L	Poly or glass	Adjust pH to <2 with HNO_3	6 months
Strontium-90 (total beta radiostrontium)	2 x 1L	Poly or glass	Adjust pH to <2 with HNO_3	6 months
Technetium-99 by Liquid Scintillation	1L	Glass	Adjust pH to <2 with HCl	6 months
Tritium	250 mL	Glass	None	6 months
Total Uranium by Kinetic Phosphorescence Analysis	250 mL	Poly or glass	Adjust pH to <2 with HNO_3	6 months

Table D-10. Preservation, Container, and Holding Time Guidelines

Constituent or Parameter	Minimum volume	Container Type [a]	Preservation [b]	Holding Time

Note:

Teflon is a registered trademark of E.I. du Pont de Nemours and Company.

The information in this table does not represent EPA requirement, but is intended solely as guidance. Selection of container, preservation techniques, and applicable holding times should be based on the stated project-specific DQOs.

a. Under the Container heading, the term poly stands for EPA clean polyethylene bottles.

b. For preservation identified as store at ≤6C, the sample should be protected against freezing unless it is known that freezing will not impact the sample integrity.

c. For metals analysis, 28 days/6 months holding time defines 28 days for mercury, 6 months for all other metals.

AEA = alpha emission analysis

DQO = data quality objects

EPA = U.S. Environmental Protection Agency

GEA = gamma energy analysis

ICP-AES = inductively coupled plasma atomic emission spectroscopy

ICP-MS = inductively coupled plasma mass spectrometry

VOA = volatile organic analysis

WTPH-D = Washington State Department of Ecology's total petroleum hydrocarbons as diesel

WTPH-G = Washington State Department of Ecology's total petroleum hydrocarbons as gasoline

D2.2.4 Measurement Equipment

Each user of the measuring equipment is responsible to ensure the equipment is functioning as expected, properly handled, and properly calibrated at required frequencies in accordance with methods governing control of the measuring equipment. Onsite environmental instrument testing, inspection, calibration, and maintenance will be recorded in accordance with approved methods. Field screening instruments will be used, maintained, and calibrated in accordance with the manufacturer's specifications and other approved methods.

D2.2.5 Instrument and Equipment Testing, Inspection, and Maintenance

Collection, measurement, and testing equipment should meet applicable standards (e.g., ASTM) or have been evaluated as acceptable and valid in accordance with instrument-specific methods, requirements, and specifications. Software applications will be acceptance tested prior to use in the field.

Measurement and testing equipment used in the field or in the laboratory will be subject to preventive maintenance measures to ensure minimization of downtime. Laboratories must maintain and calibrate their equipment. Maintenance requirements (e.g., documentation of routine maintenance) will be included in the individual laboratory and onsite organization's QA plan or operating protocols, as appropriate. Maintenance of laboratory instruments will be performed in a manner consistent with applicable Hanford Site requirements.

D2.2.6 Instrument and Equipment Calibration and Frequency

Specific field equipment calibration information is provided in Section D3.4. Analytical laboratory instruments are calibrated in accordance with the laboratory's QA plan and applicable Hanford Site requirements.

D2.2.7 Inspection and Acceptance of Supplies and Consumables

Consumables, supplies, and reagents will be reviewed in accordance with SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B requirements and will be appropriate for their use. Supplies and consumables used in support of sampling and analysis activities are procured in accordance with internal work requirements and processes. Responsibilities and interfaces necessary to ensure that items procured/acquired for the contractor meet the specific technical and quality requirements must be in place. The procurement system ensures purchased items comply with applicable procurement specifications. Supplies and consumables are checked and accepted by users prior to use.

D2.2.8 Non-Direct Measurements

Data obtained from sources such as computer databases, programs, literature files, and historical databases will be technically reviewed to the same extent as the data generated as part of any sampling and analysis QA/QC effort. All data used in evaluations will be identified by source.

D2.2.9 Data Management

The SMR organization, in coordination with the OU Project Manager, is responsible for ensuring that analytical data are appropriately reviewed, managed, and stored in accordance with the applicable programmatic requirements governing data management methods.

Electronic data access, when appropriate, will be through a Hanford Site database (e.g., HEIS) or a project-specific database, whichever is applicable for the data being stored. Where electronic data are not available, hard copies will be provided in accordance with Section 9.6 of the TPA Action Plan (Ecology et al., 1989b).

Laboratory errors are reported to the SMR organization on a routine basis. For reported laboratory errors, a sample issue resolution form will be initiated in accordance with applicable methods. This process is used to document analytical errors and to establish their resolution with the OU Project Manager. The sample issue resolution forms become a permanent part of the analytical data package for future reference and for records management.

D2.3 Assessment and Oversight

The elements in assessment and oversight address the effectiveness of project implementation and associated QA and QC activities. The purpose of assessment is to ensure that the QAPjP is implemented as prescribed.

D2.3.1 Assessments and Response Actions

Random surveillances and assessments verify compliance with the requirements outlined in this SAP, project field instructions, the project quality management plan, methods, and regulatory requirements. Deficiencies identified by these assessments will be reported in accordance with existing programmatic requirements. The project's line management chain coordinates the corrective actions/deficiencies resolutions in accordance with the QA program, the corrective action management program, and associated methods implementing these programs. When appropriate, corrective actions will be taken by the OU Project Manager (or designee).

Oversight activities in the analytical laboratories, including corrective action management, are conducted in accordance with the laboratories' QA plans. The contractor oversees offsite analytical laboratories and verifies the laboratories are qualified for performing Hanford Site analytical work.

D2.3.2 Reports to Management

Management will be made aware of deficiencies identified by self-assessments, corrective actions from ECOs, and findings from QA assessments and surveillances. Issues reported by the laboratories are communicated to the SMR organization, which then initiates a sample issue resolution form. This process is used to document analytical or sample issues and to establish resolution with the OU Project Manager.

D2.4 Data Review and Usability

This section addresses the QA activities that occur after data collection. Implementation of these activities determines whether the data conform to the specified criteria, thus satisfying the project objectives.

D2.4.1 Data Review and Verification

Data review and verification are performed to confirm that sampling and chain-of-custody documentation are complete. This review includes linking sample numbers to specific sampling locations, reviewing sample collection dates and sample preparation and analysis dates to assess whether holding times, if any, have been met, and reviewing QC data to determine whether analyses have met the data quality requirements specified in this SAP.

The criteria for verification include, but are not limited to, review for contractual compliance (samples were analyzed as requested), use of the correct analytical method, transcription errors, correct application of dilution factors, appropriate reporting of dry weight versus wet weight, and correct application of conversion factors.

Errors identified by the laboratories are reported to the SMR organization's project coordinator, who initiates a sample issue resolution form. This process is used to document analytical errors and to establish resolution with the OU Technical Lead.

Relative to analytical data in sample media, field screening results are of lesser importance in making inferences regarding risk. Field QA/QC results will be reviewed to ensure they are usable.

The OU Technical Lead data review will help determine if observed changes reflect improved/degraded groundwater quality or potential data errors and may result in submittal of a request for data review (RDR) on questionable data. The laboratory may be asked to check calculations or re-analyze the sample, or the well may be resampled. Results of the RDR process are used to flag the data appropriately in the HEIS database and/or to add comments.

D2.4.2 Data Validation

Data validation activities will be performed at the discretion of the OU Project Manager and under the direction of SMR. If performed, data validation activities will be based on EPA functional guidelines.

D2.4.3 Reconciliation with User Requirements

The DQA process compares completed field sampling activities to those proposed in corresponding sampling documents and provides an evaluation of the resulting data. The purpose of the DQA is to determine whether quantitative data are of the correct type and are of adequate quality and quantity to meet the project DQOs. For routine groundwater monitoring undertaken through this integrated SAP, the DQA is captured in QC associated with the Annual Groundwater Report, which evaluates field and lab QC and the usability of data. Further DQAs will be performed at the discretion of the OU Project Manager and documented in a report overseen by SMR.

D3 Field Sampling Plan

The previous sections presented an overall description of the 200 West P&T facility design, the COCs, and project performance and quality requirements. This section provides additional detail regarding the schedule and performance of onsite activities.

D3.1 Site Background and Objectives

A description of the treatment system was provided as site background information in Section D1. In addition, waste streams, sampling points, and COCs were presented in Tables D-1 through D-4. Specific objectives of sampling plan presented here are to establish a sampling schedule, target analytes for individual sampling points, and procedural requirements for conducting and documenting field activities.

D3.2 Documentation of Field Activities

Logbooks or data forms are required for onsite activities. Requirements for the logbook are provided in Section D2.1.4. Data forms may be used to collect specific information; however, the data forms must follow the same requirements as those for logbooks presented below, and the data forms must be referenced in the logbooks. The following is a summary of information to be recorded in logbooks:

- Purpose of activity
- Day, date, time, and weather conditions, as appropriate
- Names, titles, and organizations of personnel present
- Deviations from the QAPjP or procedures
- All site activities, including field tests
- Materials quality documentation (e.g., certifications)
- Details of samples collected (e.g., preparation, splits, duplicates, matrix spikes, and blanks)
- Location and types of samples
- Chain-of-custody details and variances relating to chain-of-custody
- Field measurements
- Field calibrations and surveys and equipment identification numbers as applicable
- Equipment decontaminated, number of decontaminations, and variations to any decontamination procedures
- Equipment failures or breakdowns and descriptions of any corrective actions
- Telephone calls relating to field activities

D3.3 Sampling Design

The sampling design presented in this SAP is systematic. Samples associated with this SAP will be collected on a routine basis and at specified locations during treatment system operations.

D3.4 Calibration of Equipment

Field water quality parameters including pH, specific conductance, temperature, turbidity, dissolved oxygen, and oxidation-reduction potential will be measured and recorded when the untreated and treated water samples are collected (Sections D3.5). Portable air monitoring equipment (e.g., photoionization detector) may also be used during GAC changeout or during stack emissions sampling. The sampling lead is responsible for ensuring that portable equipment is calibrated appropriately. Field water quality instruments are calibrated in accordance with the manufacturer's operating instructions, internal work requirements and processes, and work packages that provide direction for equipment calibration or verification of accuracy by analytical methods. The results from instrument calibration activities are recorded in logbooks or work packages or both; either hardcopy or electronic versions will be maintained.

Calibrations must be performed as follows:

- Before initial use (start of project)
- At the frequency recommended by the manufacturer or procedure, or as required by regulations
- Upon failure to meet specified QC criteria

Instrument, calibration, and QA checks will be performed in accordance with the following:

- Calibration of radiological field instruments on the Hanford Site is performed by Mission Support Alliance's Radiological Site Services, as specified in its program documentation.
- Daily calibration checks are performed and documented for each instrument used to characterize the media being evaluated. These checks will be made on standard materials sufficiently like the matrix under consideration for direct comparison of data. Measurement times will be sufficient to establish detection efficiency and resolution.

D3.5 Sample Location and Frequency

The physical locations for sampling untreated and treated water streams, air emissions, sludge, and loaded GAC and resin are expected to occur within the treatment system building or transfer buildings.

D3.5.1 ERDF Leachate, Well Field Extraction and Injection Streams

Sampling of the ERDF leachate to determine chemical concentrations will be performed. Sampling of the extraction well field is currently performed quarterly. Target analytes are those COCs shown in Table D-2. At the time of collection, field parameters (including pH, specific conductance, temperature, turbidity, dissolved oxygen, and oxidation-reduction potential) are also measured and recorded.

The treated water stream sent to the injection well field is sampled monthly for the COCs listed in Table D-3. Depending on treatment system performance and untreated water characteristics, constituents may be added to or deleted from the analyte list with DOE and EPA concurrence.

D3.5.2 Air Emission Stacks

A gas sample of air emitted from each VPGAC stack will be collected quarterly and submitted for analysis of the VOCs listed in Table D-4. Field air monitoring using a photoionization detector may be performed and the measurements recorded during air emissions sampling.

D3.5.3 Process Waste Streams

The process waste streams are discussed in the following subsections.

D3.5.3.1 Loaded Granular Activated Carbon

Loaded GAC is batch sampled. The actual sampling schedule depends on the rate at which individual canisters become loaded and must be exchanged. Measurement of VOCs (per Table D-4) is performed to determine if the canisters may be shipped offsite. Assuming release for offsite shipping, the canisters will be shipped offsite for regeneration.

D3.5.3.2 Loaded Ion-Exchange Resin

Loaded IX resin is batch sampled. The actual sampling schedule depends on the loading rate and resin capacity. Analytes include the COCs from Table D-3. During startup or at major changes to well field operations, additional characterization for waste designation may be needed and will be determined on a case-by-case basis.

D3.5.3.3 Dewatered Sludge

The dewatered sludge from the aeration filters is batch sampled. Initially, the analytes are the COCs (except tritium), as shown in Table D-3. During startup or at major changes to well field operations, additional characterization for waste designation may be needed and will be determined on a case-by-case basis.

These sampling requirements are summarized in Tables D-11 and D-12.

Table D-11. Water and Air Sampling Requirements

Sampling Point	Analyses	Reference
Water Quality Analysis		
Untreated water to uranium IX system	COCs	Table D-2
Untreated water to technetium-99 IX system	COCs	Table D-2
Balance of well field inflow	COCs	Table D-2
Treated water	COCs	Tables D-2 and D-3
Air Quality Monitoring		
Main VPGAC stack	VOCs at VPGAC stacks	Table D-4
Extraction transfer buildings		

COC = contaminant of concern
IX = ion exchange
VOC = volatile organic compound
VPGAC = vapor-phase granular activated carbon

Table D-12. Waste Stream Batch Sampling and Analysis Requirements

Waste Type	Initial Waste Profile	Routine Batch Analysis
Loaded uranium IX resin	Table D-3 COCs and COPCs from DQO	COCs (except tritium)
Loaded technetium-99 IX resin	Table D-3 COCs and COPCs from DQO	COCs (except tritium)
Dewatered aeration filter sludge	Table D-3 COCs and COPCs from DQO	COCs (except tritium)
Loaded granular activated carbon	Table D-4 COCs and COPCs from DQO	VOCs from Table D-4

COC = contaminant of concern
COPC = contaminant of potential concern
DQO = data quality objective (project-specific report as required by the waste management plan [Appendix B])
IX = ion exchange
VOC = volatile organic compound

D3.6 Sampling Methods

Ports for sampling untreated and treated water flow streams are specified and marked in the pre-treatment and main treatment facilities. Access to and operation of sample ports and valves will be controlled by plant operating procedures. Methods for practical collection of samples of resins, sludge, and loaded GAC will depend upon the physical characteristics of plant apparatus and will be included in the facility's operating procedures.

D3.6.1 Corrective Actions

The project lead, sampling lead, or designee must document deviations from procedures or other issues regarding sample collection, chain-of-custody, target analytes, contaminants of potential concern, sample transport, or other noncompliance. As appropriate, such deviations or issues will be documented in the field logbook or on nonconformance report forms in accordance with corrective action procedures. The project lead, sampling lead, or designee will be responsible for communicating field corrective action requirements and ensuring that immediate corrective actions are applied to sampling activities.

D3.6.2 Decontamination of Sampling Equipment

Equipment used during sampling of resins, sludge, or loaded GAC will be decontaminated in accordance with the facility operating procedure. To prevent contamination of the samples, care should be taken to use clean or dedicated equipment for each sampling activity. Special care should be taken to avoid the following common ways in which cross-contamination or background contamination may compromise the samples:

- Improperly storing or transporting sampling equipment and sample containers
- Contaminating equipment or sample containers by setting the equipment or sample container on or near potential contamination sources
- Handling bottles or equipment with dirty hands or gloves
- Improperly decontaminating equipment before sampling or between sampling events

D3.6.3 Radiological Screening

Radiological screening of waste samples will be performed by the RCT or other qualified personnel. The RCT will record field measurements.

The following information will be disseminated to personnel performing work in support of this SAP:

- Instructions will be provided to RCTs on the methods required to measure sample activity and media for gamma, alpha, and beta emissions, as appropriate.
- Information regarding the Geiger-Müller, portable alpha meter, dual phosphors beta/gamma, and sodium iodide portable instruments will include a physical description of the instruments, radiation and energy response characteristics, calibration and maintenance and performance testing descriptions, and the application and operation of the instrument. These instruments are commonly used on the Hanford Site for obtaining measurements of removable surface contamination and direct measurements of total surface contamination.
- Information on the characteristics associated with the hand-held probes to be used in the performance of direct radiological measurements will include a physical description of the probe, the radiation and energy response characteristics, calibration and maintenance and performance testing descriptions,

and the application and operation of the instrument. The hand-held probe is an alpha detection instrument commonly used on the Hanford Site for measuring removable surface contamination and direct measurements of the total surface contamination.

D3.7 Sample Handling

Certified clean sample containers will be used for waste and water samples collected for chemical analysis. Container materials, minimum volume or weight of samples, sample preservation, and holding times are summarized in Table D-13.

Table D-13. Analytical Methods, Sample Containers, Preservation, and Holding Times

Analytical Method	Container and Amount of Sample*	Preservative	Holding Time
Aromatic and halogenated VOA – 8260	G; 40 mL VOA vial (water) 125 mL jar (solid)	Cool to ≤6°C	14 days
Chromium (hexavalent) – 7196	P, G; 400 mL (water) 100 g (solid)	Cool to ≤6°C	24 hours (water) 30 days until extraction (solid)
ICP metals – 6010, 6020, or 200.8	P, G; 1 L (water) 200 g (solid)	HNO_3 to pH <2 (water) None (solid)	6 months
Radionuclides	P, G	HNO_3 to pH <2 (water) None (solid)	6 months

* Sample containers include glass (G) and plastic (P).

ICP = inductively coupled plasma

VOA = volatile organic analysis

D3.7.1 Container Labeling

The sample location, depth, and corresponding HEIS numbers are documented in the sampler's field logbook. A custody seal (e.g., evidence tape) is affixed to each sample container or the sample collection package, or both, in such a way as to detect potential tampering.

Each sample container will be labeled with the following information on firmly affixed water-resistant labels:

- Sample collector's name
- HEIS number
- Sample collection date and time
- Analysis required
- Preservation method (if applicable)
- Sampling authorization form number

Sample records must also include the following information:

- Analysis required
- Source of sample
- Matrix
- Field data (e.g., pH and radiological readings)

Except for VOA samples, a custody seal will be affixed to the lid of each sample container. The custody seal will be inscribed with the sampler's initials and the date. Custody seals are not applied directly to VOA bottles because of a potential for affecting analytical results. Custody seals and any other required labels or documentation can be fixed to the exterior of a plastic bag holding vials in such a manner to detect potential tampering.

D3.7.2 Sample Custody

Sample custody is maintained in accordance with existing CHPRC procedures to ensure the maintenance of sample integrity throughout the analytical process. Chain-of-custody procedures are followed throughout sample collection, transfer, analysis, and disposal to ensure that sample integrity is maintained. A chain-of-custody record is initiated in the field at the time of sampling and accompanies each set of samples shipped to any laboratory. Shipping requirements will determine how sample shipping containers are prepared for shipment. The analysis requested for each sample will be indicated on the accompanying chain-of-custody form. Each time the responsibility changes for the custody of the sample, the new and previous custodians will sign the record and note the date and time. The sampler will make a copy of the signed record before sample shipment and will transmit the copy to the SMR organization within 48 hours of shipping.

The following information is recorded on a completed chain-of-custody form:

- Project name
- Signature of sampler
- Unique sample number
- Date and time of collection
- Matrix
- Preservatives
- Signatures of individual involved in sample transfer
- Requested analyses or reference thereto

D3.7.3 Sample Transport

Sample transportation will be in compliance with the applicable regulations for packaging, marking, labeling, and shipping hazardous materials, hazardous substances, and hazardous waste mandated by the U.S. Department of Transportation (49 CFR, "Transportation," Chapter I, "Pipeline and Hazardous Materials Safety Administration, Department of Transportation;" and 49 CFR 171 "General Information, Regulations, and Definitions," through 49 CFR 177, "Carriage by Public Highway") in association with the International Air Transportation Authority, DOE requirements, and applicable program-specific implementing procedures.

D3.8 Waste Management

All waste (including unexpected waste) generated by sampling activities will be managed in accordance with the WMP (Appendix B). Pursuant to 40 CFR 300.440 ("National Oil and Hazardous Substances Pollution Contingency Plan," "Procedures for Planning and Implementing Off-Site Response Actions"), approval from the DOE Richland Operations Office project manager is required before returning unused samples or waste from offsite laboratories. Laboratories located on the Hanford Site (e.g., 222-S analytical laboratories or the Soil and Groundwater Remediation Project sampling equipment cleaning facility) are outside the "areal extent of contamination" and are, therefore, considered "offsite" (EH-231-020/0194, *The Off-Site Rule*). Authority is granted per the signature on this SAP that unused samples and associated laboratory waste for the analysis will be disposed in accordance with the laboratory contract and agreements for return to the project site.

D4 Health and Safety

Sampling operations will be performed in accordance with health and safety requirements and appropriate CHPRC Soil and Groundwater Remediation Project requirements. Additionally, work control documents will be prepared to provide further control of site operations. Safety documentation will include an activity hazard analysis and, as applicable, radiological work permits. The sampling procedures and associated activities will implement as low as reasonably achievable practices to minimize the radiation exposure to the sampling team, consistent with the requirements defined in 10 CFR 835, "Occupational Radiation Protection."

D5 References

10 CFR 830, "Nuclear Safety Management," Subpart A, "Quality Assurance Requirements," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title10-vol4/xml/CFR-2010-title10-vol4-part830-subpartA.xml.

10 CFR 835, "Occupational Radiation Protection," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title10-vol4/xml/CFR-2010-title10-vol4-part835.xml.

40 CFR 300.440, "National Oil and Hazardous Substances Pollution Contingency Plan," "Procedures for Planning and Implementing Off-Site Response Actions," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol27/xml/CFR-2010-title40-vol27-sec300-440.xml.

49 CFR, "Transportation," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?SID=14c7a61704a2b254a40069b5fd604b05&tpl=/ecfrbrowse/Title49/49tab_02.tpl.

49 CFR 171, "General Information, Regulations, and Definitions."

49 CFR 172, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans."

49 CFR 173, "Shippers—General Requirements for Shipments and Packagings."

49 CFR 174, "Carriage by Rail."

49 CFR 175, "Carriage by Aircraft."

49 CFR 176, "Carriage by Vessel."

49 CFR 177, "Carriage by Public Highway."

ANSI/ASQ E4-2004, 2004, *Quality Systems for Environmental Data and Technology Programs: Requirements with Guidance for Use*, American National Standards Institute/American Society for Quality, Milwaukee, Wisconsin.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: http://epw.senate.gov/cercla.pdf.

DOE O 414.1D Admin Chg 1, *Quality Assurance*, U.S. Department of Energy, Washington, D.C. Available at: https://www.directives.doe.gov/directives-documents/0414.1-BOrder-dadmchg1.

DOE/RL-96-68, 2014, Hanford Analytical Services Quality Assurance Requirements Document (HASQARD), Rev. 4, Volume 1, Administrative Requirements; Volume 2, Sampling Technical Requirements; Volume 3, Field Analytical Technical Requirements; and Volume 4, Laboratory Technical Requirements, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
http://www.hanford.gov/files.cfm/HASQARD_VOL_1.pdf
http://www.hanford.gov/files.cfm/HASQARD_VOL_2.pdf
http://www.hanford.gov/files.cfm/HASQARD_VOL_3.pdf
http://www.hanford.gov/files.cfm/HASQARD_VOL_4.pdf

DOE/RL-2008-78, 2009, *200 West Area 200-ZP-1 Pump-and-Treat Remedial Design/Remedial Action Work Plan*, Rev. 0 REISSUE, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0096137.

DOE/RL-2009-115, 2014, *Performance Monitoring Plan for the 200-ZP-1 Groundwater Operable Unit Remedial Action*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=1411040775.

DOE/RL-2010-74, 2015, *Treatability Test Plan for the 200-BP-5 Groundwater Operable Unit*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0081243H.

DOE/RL-2013-07, 2013, *200-UP-1 Groundwater Operable Unit Remedial Design/Remedial Action Work Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0087671.

DOE/RL-2014-34, 2014, *Action Memorandum for 200-DV-1 Operable Unit Perched Water Pumping/Pore Water Extraction*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
http://pdw.hanford.gov/arpir/pdf.cfm?accession=0082284H

Ecology, EPA, and DOE, 1989a, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at:
http://www.hanford.gov/?page=81.

Ecology, EPA, and DOE, 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.hanford.gov/?page=82.

EH-231-020/0194, 1994, *The Off-Site Rule*, CERCLA Information Brief, U.S. Department of Energy, Office of Environmental Guidance, Washington, D.C. Available at: http://homer.ornl.gov/sesa/environment/guidance/cercla/off-site.pdf.

EPA, 1999, *U. S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site - 200 Area, Benton County, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

EPA, 2015, *Explanation of Significant Differences for the U.S. Department of Energy Environmental Restoration Disposal Facility, Hanford Site – 200 Area, Benton County, Washington,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington. Available at: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0079657H.

EPA, Ecology, and DOE, 2008, *Record of Decision, Hanford 200 Area, 200-ZP-1 Superfund Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.epa.gov/superfund/sites/rods/fulltext/r2008100003103.pdf.

EPA, Ecology, and DOE, 2012, *Record of Decision for Interim Remedial Action ,Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0091413.

EPA/240/B-01/003, 2001, *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/QUALITY/qs-docs/r5-final.pdf.

EPA-505-B-04-900A, 2005, *Intergovernmental Data Quality Task Force, Uniform Federal Policy for Quality Assurance Project Plans, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs, Part 1: UFP-QAPP Manual*, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/swerffrr/pdf/ufp_qapp_v1_0305.pdf.

EPA-600/4-79-020, 1983, *Methods for Chemical Analysis of Water and Wastes*, Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D196018581.

SGW-59872, 2016, *200W Pump and Treat Waste Acceptance Criteria*, Rev. 0, CH2M Hill Plateau Remediation Company, Richland, Washington.

SW-846, 2007, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*, as amended, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/epawaste/hazard/testmethods/sw846/online/index.htm.

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