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MAR 27 2019

19-SGD-0011

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Addressees:

PROPOSED PLAN FOR INTERIM ACTION REMEDIATION OF THE 200-BP-5 AND 200-PO-1 OPERABLE UNITS, DOE/RL-2018-58, DRAFT A

This letter transmits Proposed Plan for Interim Action Remediation of the 200-BP-5 and 200-PO-1 Operable Units, DOE/RL-2018-58, Draft A to the Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA) for review and comment.

The submittal of this document completes Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) Milestone M-015-21A, Submit 200-BP-5 and 200-PO-1 Operable Unit Feasibility Study Report and Proposed Plan(s) for an Interim Action to Ecology. The 200-BP-5 and 200-PO-1 Groundwater Operable Units Feasibility Study for Interim Action, DOE/RL-2018-30, Draft A was transmitted for review on December 18, 2018, by letter (19-AMRP-0041).

My staff have worked with Nina Menard of Ecology and Craig Cameron of EPA on this document. Per the Tri-Party Agreement Action Plan Figure 9-1, Ecology and EPA have 45 days to perform their reviews.

If you have any questions, please contact me, or your staff may contact, Mike Cline, of my staff, on (509) 376-6070.

Sincerely,

William F. Hamel, Assistant Manager
for the River and Plateau

SGD:JPH

Attachment

cc w/attach:
J. Atwood, YN
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C. E. Cameron, EPA
L. Contreras, YN
M. Johnson, CTUIR
S. Leckband, HAB
N. M. Menard, Ecology
K. Niles, ODOE
Administrative Record (200-BP-5, 200-PO-1)
Environmental Portal

cc w/o attach:
S. G. Austin, CHPRC
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S. W. Davis, MSA
M. H. Doornbos, CHPRC
W. R. Faught, CHPRC
L. K. O'Mara, CHPRC

DOE/RL-2018-58
Draft A

PROPOSED PLAN FOR INTERIM ACTION REMEDIATION OF THE 200-BP-5 AND 200-PO-1 OPERABLE UNITS

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

U.S. DEPARTMENT OF ENERGY | Richland Operations Office

P.O. Box 550
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

DOE/RL-2018-58
Draft A

PROPOSED PLAN FOR INTERIM ACTION REMEDIATION OF THE 200-BP-5 AND 200-PO-1 OPERABLE UNITS

Date Published
March 2019

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

U.S. DEPARTMENT OF ENERGY | Richland Operations Office
P.O. Box 550
Richland, Washington 99352

APPROVED
By Janis D. Aardal at 10:54 am, Mar 21, 2019

Release Approval | Date

Approved for Public Release;
Further Dissemination Unlimited

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Central Plateau Remediation at the Department of Energy Hanford Site — EPA Region 10

Proposed Plan for Interim Action Remediation of the 200-BP-5 and 200-PO-1 Operable Units

DOE/RL-2018-58, Draft A
March 2019

U.S. Department of Energy,
Richland Operations Office
U.S. Environmental Protection Agency
Washington State Department of Ecology

Public Comment Period
MONTH DATE to
MONTH DATE, 2019

How You Can Participate:

Read this Proposed Plan and review documents in the Administrative Record at. http://pdw.hanford.gov/arpir/TBD.

Comment on this Proposed Plan by mail or email on or before MONTH DATE, 2019.

Richard Buel, U.S. Department of Energy, Richland Operations Office
P.O. Box 550, A7-75
Richland, WA 99352
Email: 200BP5PP@rl.gov

See Community Participation section for more information about public involvement and contact information.

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Introduction

The U.S. Department of Energy (DOE), Washington State Department of Ecology (Ecology), and U.S. Environmental Protection Agency (EPA) (also known as the ***Tri-Parties***[1]) invite the Tribal Nations and the public to comment on this ***Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Proposed Plan*** for ***interim action*** cleanup of contaminated ***groundwater*** in the 200-BP-5 and 200-PO-1 Groundwater ***Operable Units (OUs)*** in the 200 East Area of the Hanford Site, located near Richland, Washington (Figure 1). The two OUs are referred to collectively herein as the 200-BP-5/200-PO-1 OUs.

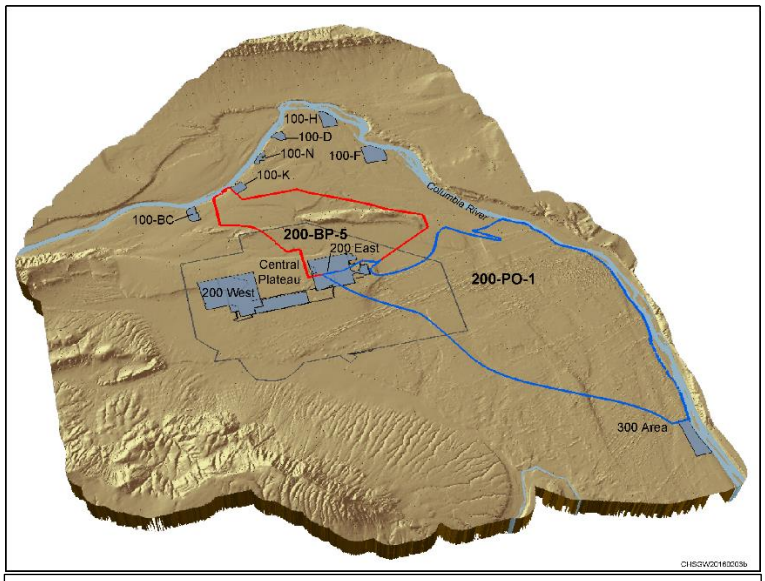


Figure 1. Location of the 200-BP-5 and 200-PO-1 Groundwater OUs at the Hanford Site

[1] Important technical and administrative terms are used throughout this Proposed Plan. When these terms are first used, they appear in ***bold italics***. Explanations of these terms are provided in the "Glossary" at the end of this Proposed Plan.

The 200-BP-5/200-PO-1 OUs beneath the 200 East Area are undergoing the CERCLA ***remedial investigation (RI)*** and ***feasibility study (FS)*** process. For the 200-BP-5 OU, a remedial investigation report has been prepared (DOE/RL-2009-127, *Remedial Investigation for the 200-BP-5 Groundwater Operable Unit*). For 200-PO-l, a remedial investigation report (DOE/RL-2009-85, *Remedial Investigation Report for the 200-PO-1 Groundwater Operable Unit*) and an addendum to the report (DOE/RL-2009-85-ADD1, *Remedial Investigation Report for the 200-PO-1 Groundwater Operable Unit*, Addendum 1) have been completed. The overlying source OUs (e.g., 200-DV-l, 200-EA-1, 200-IS-l, 200-SW-2, and canyon OUs) and ***waste management areas (WMAs)*** are in the early stages of the CERCLA RI/FS and *Resource Conservation and Recovery Act* (RCRA) Facility Investigation/Corrective Measures Study process.

Considering that the source investigations are not complete, the Tri-Parties agree that the necessary information is not available to prepare a FS that supports a final (non-interim) ***Record of Decision (ROD)*** for the groundwater OUs. Therefore, the Tri-Parties are pursuing an ***Interim Record of Decision (IROD)*** for the groundwater OUs to expedite the remediation of some groundwater contaminant plumes and coordinate with actions at C Farm. This interim action decision in the C Farm area can be used to support tank farm closure decisions. The Tri-Parties agree that a final (non-interim) ROD for the 200 East Area groundwater OUs will be developed after contaminant sources are adequately characterized.

The 200-BP-5 RI, 200-PO-1 RI, and 200-PO-1 RI Addendum identified several contaminants in the groundwater that warrant near-term interim action because they exceed ***drinking water standards (DWSs)*** and because they exhibit the following characteristics:

- The plumes are large and exhibit relatively high concentrations compared to DWSs. The plumes constitute the majority of the mobile mass of uranium and technetium-99 in the 200-BP-5/ 200-PO-1 OUs.
- The B Complex plume area, and the C Farm and A-AX Farms plume area contaminants are mobile, and the plumes are expanding downgradient from the source. Contaminants associated with the Gable Gap plume area are not mobile and the groundwater is considered stagnant.
- The B Complex plume area, and C Farm and A-AX Farms plume areas have continuing sources of contamination from the overlying soil (***vadose zone***) creating uncertainty until the overlying vadose zone is characterized and evaluation information are incorporated into future decision documents. The Gable Gap plume does not have a continuing source.
- The aquifer in the target plume areas is highly transmissive. Therefore, the targeted contaminant plumes are conducive to remediation by ***pump and treat (P&T)***, as previously demonstrated at the B Complex plume area through the successful and ongoing P&T removal action.

Uranium and technetium-99 are the ***contaminants of concern (COCs)*** for this interim action, whereas the other groundwater contaminants exceeding DWSs in the target remediation areas (e.g., tritium, I-129, nitrate, and cyanide) are identified as co-contaminants and are not the objective of this interim action. Because this is a proposed interim action that addresses two specific COCs in two specific areas, the RI/FS work plan will remain in effect and co-contaminants will continue to be monitored until the final (non-interim) ROD is decided. All contaminants will be re-evaluated for possible inclusion in the final (non-interim) ROD.

The interim action alternatives developed and evaluated in DOE/RL-2018-30, Draft A, *200-BP-5 and 200-PO-1 Operable Units Feasibility Study for Interim Action* (hereinafter referred to as the FS for interim action), and presented in this Proposed Plan for interim action are intended to address the following three uranium and technetium-99 contaminant plumes in the 200-BP-5/200-PO-1 OUs (Figure 2):

- B Complex plume area: uranium and technetium-99
- C Farm and A-AX Farms plume areas: technetium-99
- Gable Gap plume area: technetium-99 (identified as optional in one alternative as an efficiency measure while the 200 West P&T is operating because meeting the DWS in this area is possible since there is no continuing source.)

A final ROD may address future contamination in groundwater from the vadose zone sources after the overlying source OUs and ***waste management areas (WMAs)*** are adequately characterized to determine future risk to groundwater. The overlying source OUs (e.g., 200-DV-1 and 200-EA-1) and WMAs are in the early stages of the CERCLA RI/FS or RCRA/corrective measures study process.

DOE is issuing this Proposed Plan for interim action to seek Tribal Nations and public input on the cleanup alternatives considered and on the ***preferred alternative*** proposed for implementation. This Proposed Plan for interim action summarizes the evaluation of three remedial alternatives that were developed in the FS for interim action (DOE/RL-2018-30) and identifies the preferred alternative.

The three alternatives evaluated to address remediation of uranium and technetium-99 in the 200-BP-5 and 200-PO-1 OUs are as follows:

- Alternative 1 – ***No Action***
- Alternative 2 – P&T in B Complex and C Farm and A-AX Farms plume areas, with ***Institutional Controls (ICs)*** for groundwater
- Alternative 3 – P&T in B Complex, C Farm and A-AX Farms, and Gable Gap plume areas, with ICs for groundwater

In the 200-BP-5 OU, uranium and technetium-99 groundwater contaminant concentrations exceeding 10 times the DWSs in the B Complex plume area are currently being captured and treated under a non-time critical removal action. DOE/RL-2016-41, *Action Memorandum for 200-BP-5 Operable Unit Groundwater Extraction*, authorized groundwater extraction from the B Complex plume area, treatment at the 200 West P&T, and treated water injection in the 200 West Area. DOE/RL-2017-11, *Removal Action Work Plan for the 200-BP-5 Operable Unit Groundwater Extraction*, provides additional discussion on the 200-BP-5 OU removal action.

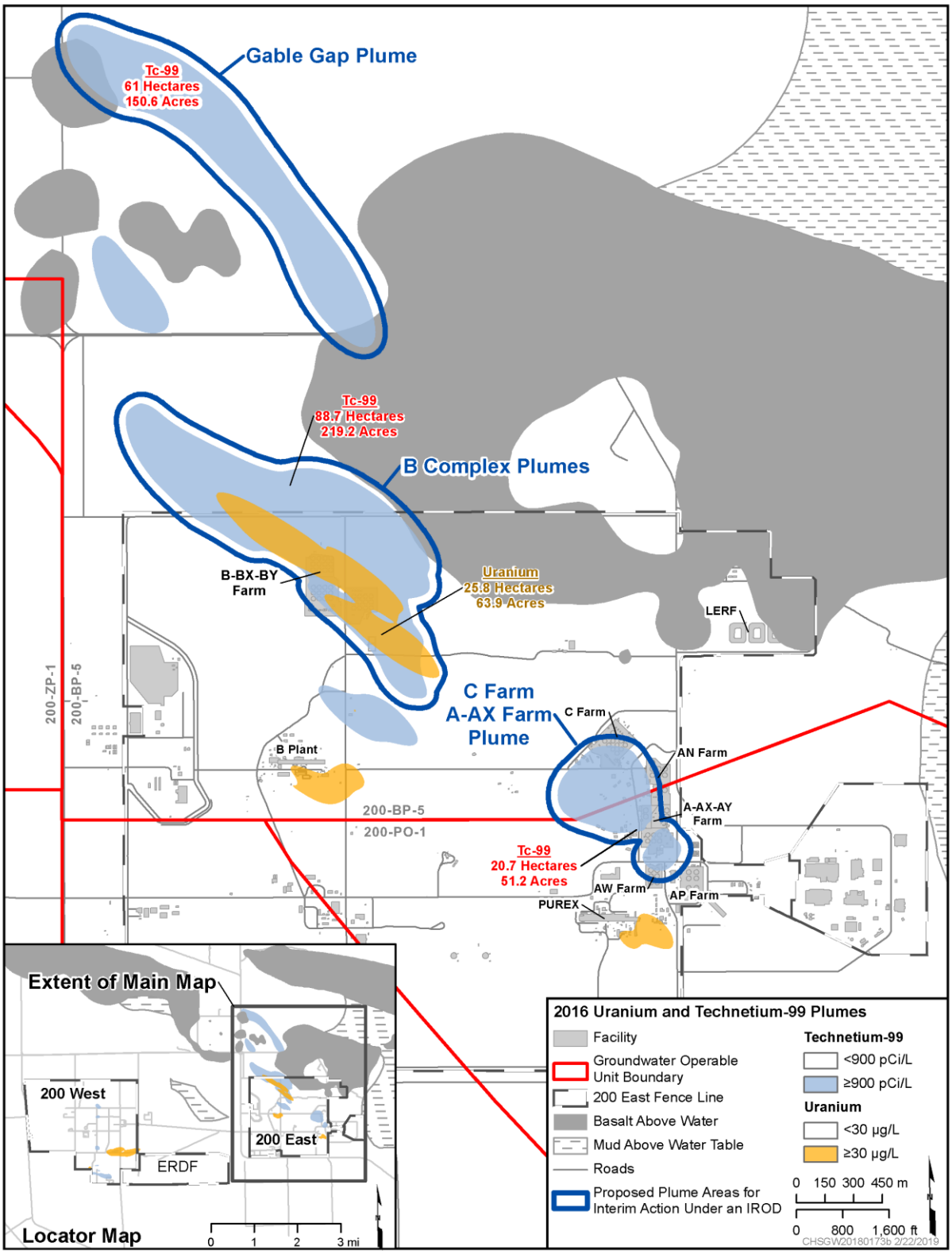


Figure 2. Uranium and Technetium-99 Plumes in the 200-BP-5/200-PO-1 OUs

Alternatives 2 and 3 incorporate the current B Complex P&T system under the regulatory approved removal action and expand this effort to remediate uranium and technetium-99 plumes in the 200-BP-5/200-PO-1 OUs. The alternatives include the following:

- Changes to the groundwater cleanup objectives criteria from 10 times the DWS to the DWS for both uranium and technetium-99 under the B Complex plume area (Alternatives 2 and 3)
- Increases the extraction rate to capture uranium and technetium-99 to approximately 757 L/min (200 gal/min) in the B Complex plume area (Alternatives 2 and 3); the number of extraction wells will be sufficient to capture the COCs and will be determined through modeling during the development of the ***remedial design/remedial action work plan (RD/RAWP)***
- Adds remediation DWS groundwater cleanup objective criteria to the C Farm and A-AX Farms technetium-99 plume area (Alternatives 2 and 3)
- Adds remediation DWS groundwater cleanup objective criteria to the Gable Gap technetium-99 plume area (Alternative 3)

Tribal Nations and public input on this Proposed Plan will help DOE and EPA (with input from Ecology) select an alternative for interim action cleanup of the target uranium and technetium-99 contamination in the 200-BP-5/200-PO-1 OUs. Following consideration of Tribal Nations and public input on this Proposed Plan, an ***Interim Record of Decision (IROD)*** will be prepared by EPA. In accordance with CERCLA, the IROD will be issued by DOE and EPA (with Ecology concurrence) and identify the selected alternative for implementation.

Tribal Nations and Public Involvement

Input from the Tribal Nations and the public on this Proposed Plan, and the supporting analysis and information in the ***Administrative Record***, will be considered during selection of the interim remedy. Comments on the Proposed Plan can be submitted during the comment period (see sidebar on the left side of page 1). For additional information regarding how to participate, see the "Community Participation" section of this Proposed Plan.

This Proposed Plan summarizes information provided in greater detail in the supporting documents in the Administrative Record for the 200-BP-5/200-PO-1 OUs. The supporting documents were used to evaluate alternatives and to develop the preferred alternative. Those documents can be viewed online at http://pdw.hanford.gov/arpir/ and accessed electronically at the various information repositories identified in the "Community Participation" section of this Proposed Plan. The 200-BP-5/200-PO-1 OUs record index is available at [add AR index link when available].

After all input received during the comment period has been reviewed and considered, an IROD will be issued that identifies the selected remedy. This input could result in the selection of an interim action that differs from the preferred alternative. A summary of significant comments received and the responses will be published in the ***responsiveness summary*** issued with the IROD.

Agencies' Roles

DOE is the lead agency and is responsible for implementing the selected remedy. DOE is issuing this Proposed Plan as part of the public participation requirements under Section 117(a) of CERCLA (commonly known as "Superfund") and the ***Code of Federal Regulations (CFR)***, 40 CFR 300.430(f)(2), "***National Oil and Hazardous Substances Pollution Contingency Plan***" (commonly known as the National Contingency Plan [NCP]), "Remedial Investigation/Feasibility Study and Selection of Remedy"). CERCLA establishes the broad federal authority for conducting cleanup at Superfund sites, and the NCP includes the procedures and expectations for cleanup.

Ecology is the lead regulatory agency for the 200-BP-5/200-PO-1 OUs, and EPA is the non-lead regulatory agency per Ecology et al., 1989a, ***Hanford Federal Facility Agreement and Consent Order*** (***Tri-Party Agreement)***.

Preferred Alternative

Based on the results of the detailed and comparative evaluation of alternatives, the preferred alternative is Alternative 2 – P&T in B Complex, and C Farm and A-AX Farms plume areas, with ICs for Groundwater.

The preferred alternative meets the statutory requirements under CERCLA and the NCP (40 CFR 300) to select remedies that are protective of human health and the environment and comply with ***applicable or relevant and appropriate requirements (ARARs)***, are cost effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Alternative 2 is the preferred alternative because it is protective, meets ARARs, and provides the best balance of tradeoffs with respect to the criteria specified in the NCP (40 CFR 300.430). The alternative also satisfies the statutory preference for remedies that use, as a principal element, treatment that permanently and significantly reduces the toxicity, mobility, or volume (TMV) of hazardous substances, pollutants, and contaminants. In addition to the preferred alternative, other alternatives that were evaluated are described in the "Summary of Remedial Alternatives" section of this Proposed Plan. Except for the No Action alternative, each alternative includes a combination of actions, all of which are explained briefly in this Proposed Plan and more fully in the FS for interim action (DOE/RL-2018-30).

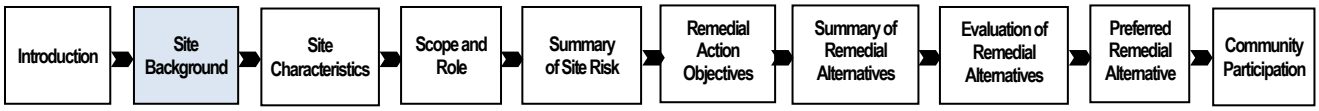
Proposed Plan Organization

The subsequent sections of this Proposed Plan provide the following information:

- **Site Background:** Provides facts about site contamination, investigations, interim actions, and previous public participation.
- **Site Characteristics:** Describes land and groundwater use, physical features influencing remedy selection, and the nature and extent of contamination in groundwater.
- **Scope and Role:** Discusses how this interim action fits into the overall Hanford Site cleanup strategy, and provides descriptions of previous and planned cleanup actions.
- **Summary of Site Risks:** Identifies the COCs, and summarizes the ***baseline risk assessment (BRA)*** results and land-use and groundwater-use assumptions.
- ***Remedial Action Objectives (RAOs)*:** Describes what the proposed site cleanup is expected to accomplish.
- **Summary of Remedial Alternatives:** Identifies options for attaining the identified RAOs and interim action objectives.

- **Evaluation of Remedial Alternatives:** Provides a comparison of the alternatives using CERCLA criteria.
- **Preferred Remedial Alternative:** Provides rationale for selecting the preferred alternative and affirmation that it is expected to fulfill statutory and regulatory requirements.
- **Community Participation:** Provides information on how the Tribal Nations and the public can provide input to the remedy selection process.

The following graphic is included before each new section to indicate where the new section fits within this Proposed Plan:



Site Background

The Hanford Site is a 1,502 km^2 (580 mi^2) federally owned property located within the semiarid, shrub-steppe Pasco Basin of the Columbia Plateau in south-central Washington State. Historical nuclear material production and processing at the Hanford Site released contamination to the environment, resulting in areas of contaminated soil and groundwater that pose a risk to human health and the environment. To facilitate cleanup, the Hanford Site has been divided into the River Corridor and the Central Plateau. The 200 West Area and 200 East Area are within the Central Plateau, which contains inactive reactor fuel reprocessing plants and associated waste management facilities. The 200-BP-5 and 200-PO-1 OUs are largely associated with the 200 East Area. The 200-BP-5 OU extends north from the northern portion the 200 East Area, through Gable Gap to the Columbia River. The 200-PO-1 OU extends southeast and east from the southern portion of the 200 East Area to the Columbia River (Figure 1).

Major process areas in the 200 East Area included B Plant (which overlies the 200-BP-5 OU) and the Plutonium-Uranium Extraction (PUREX) Plant (which overlies the 200-PO-1 OU) (Figure 2). Liquid waste was discharged to the ground in the 200 Areas since the inception of plutonium-production activities in the 1940s. Waste considered to be uncontaminated (e.g., cooling water and steam condensate) was discharged to open ditches and ponds, while low-level radiologically contaminated process waste was discharged to cribs and trenches. The liquid waste discharged to surface ponds (e.g., B Pond), cribs, and trenches was allowed to infiltrate into the soil. Radioactive waste derived from reprocessing reactor fuel was directed to underground tanks. Some of the unplanned releases to the soil column have been associated with tank overflow and associated piping. Sources continuing to affect groundwater include the B Complex and the C Farm overlying the 200-BP-5 OU, and the cribs associated with the PUREX Plant overlying the 200-PO-1 OU.

Investigations

The RIs were conducted for the 200-BP-5/200-PO-1 OUs to (1) collect data to define the nature and extent of contamination, (2) assess contaminant fate and transport; (3) evaluate potential risks to human health and the environment, and (4) determine whether a FS to develop and evaluate remedial alternatives is needed (DOE/RL-2009-127, *Remedial Investigation for the 200-BP-5 Groundwater Operable Unit*; DOE/RL-2009-85, *Remedial Investigation Report for the 200-PO-1 Groundwater Operable Unit*; DOE/RL-2009-85 ADD1, *Remedial Investigation Report for the 200-PO-1 Groundwater Operable Unit*, Addendum 1). The effort focused on characterization of groundwater, and the continuing source of contamination to groundwater from the vadose zone have not been characterized. The BRAs for both OUs determined that contaminants in groundwater pose a

threat to human health under the EPA tap water (residential) exposure scenario (the "Groundwater Contamination" section of this Proposed Plan describes the contaminants; the RI reports present the BRA results). However, under current site use conditions, no complete human exposure pathways to groundwater exist. Fate and transport modeling simulations predict that without ***remedial action*** and without a continuing source, the times for existing dissolved-phase groundwater contaminant concentrations to decrease to DWSs are 65 years for uranium (B Complex plume area) and 800 years for technetium-99 (Gable Gap plume area) in the 200-BP-5 OU, and 15 years for technetium-99 (C Farm and A-AX Farms plume areas) in the 200-PO-1 OU. The RIs for both groundwater OUs concluded that an FS to evaluate remedial alternatives was required.

Previous Cleanup Actions and Decisions

A groundwater P&T system designed to capture and remove high concentrations of uranium and technetium-99 from the plume underlying the B Complex area in the 200-BP-5 OU was implemented in 2017 as a non-time-critical removal action. The removal action is described in DOE/RL-2016-41, *Action Memorandum for 200-BP-5 Operable Unit Groundwater Extraction;* and DOE/RL-2017-11, *Removal Action Work Plan for the 200-BP-5 Operable Unit Groundwater Extraction*. The removal action P&T system is designed to extract groundwater at a rate of approximately 568 L/min (150 gal/min) and convey extracted groundwater via an aboveground pipeline to the 200 West P&T for treatment. Operation of the P&T system is ongoing and is intended to continue until one of the following occurs: (1) uranium and technetium-99 concentrations in the B Complex plume fall below 10 times the respective DWSs; (2) the Tri-Parties decide to terminate the removal action; or (3) the removal action is superseded by a remedial action.

The Tri-Parties recommendation to pursue an IROD for the 200-BP-5/200-PO-1 OUs, as well as objectives, scope, and supporting rationale, is documented in DOE et al., 2018, *Hanford Federal Facility Agreement and Consent Order Interagency Management Integration Team (IAMIT) Decision/Determination/Action Assignment Number 2018-002, 200-BP-5 and 200-PO-1 Interim Record of Decision*. As discussed in the "Introduction" section of this Proposed Plan, the purpose of implementing interim action at the 200-BP-5/200-PO-1 OUs is to expedite the remediation of some groundwater contaminant plumes and coordinate with actions at C Farm.

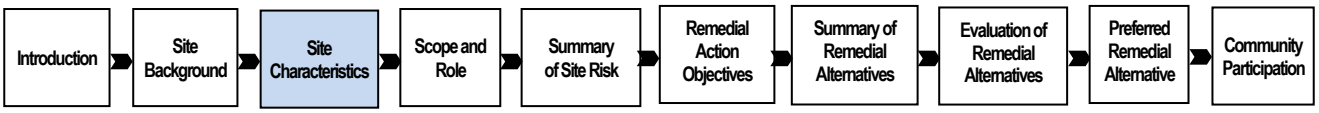
Previous Public Participation

Previous public participation for the 200-BP-5 OU has included a public review process from April 18 to May 20, 2016, for DOE/RL-2015-26, *Engineering Evaluation/Cost Analysis for the 200-BP-5 Operable Unit Groundwater Extraction*.

Previous Tribal Nations Participation

The Hanford Site is located on land ceded to the United States under separate treaties with the Confederated Tribes and Bands of the Yakama Nation and the Confederated Tribes of the Umatilla Indian Reservation. The Nez Perce Tribe also secured rights at what is now the Hanford Site in a separate treaty. DOE consults with the Tribal Nations and the Wanapum Band of Indians, who were historical residents on Hanford lands.

DOE has received comments from the Tribes on DOE/RL-2009-127, *Remedial Investigation for the 200-BP-5 Groundwater Operable Unit*, and discussions regarding their comments have been considered in the development of the FS for interim action (DOE/RL-2018-30), and this Proposed Plan for interim action. DOE has also received comments from the Tribes on the FS for interim action (DOE/RL-2018-30).



Site Characteristics

This section presents information on surface features overlying the 200-BP-5/200-PO-1 OUs, current land and groundwater uses, physical groundwater features, and the nature and extent of groundwater contamination.

Site Features, and Land and Groundwater Use

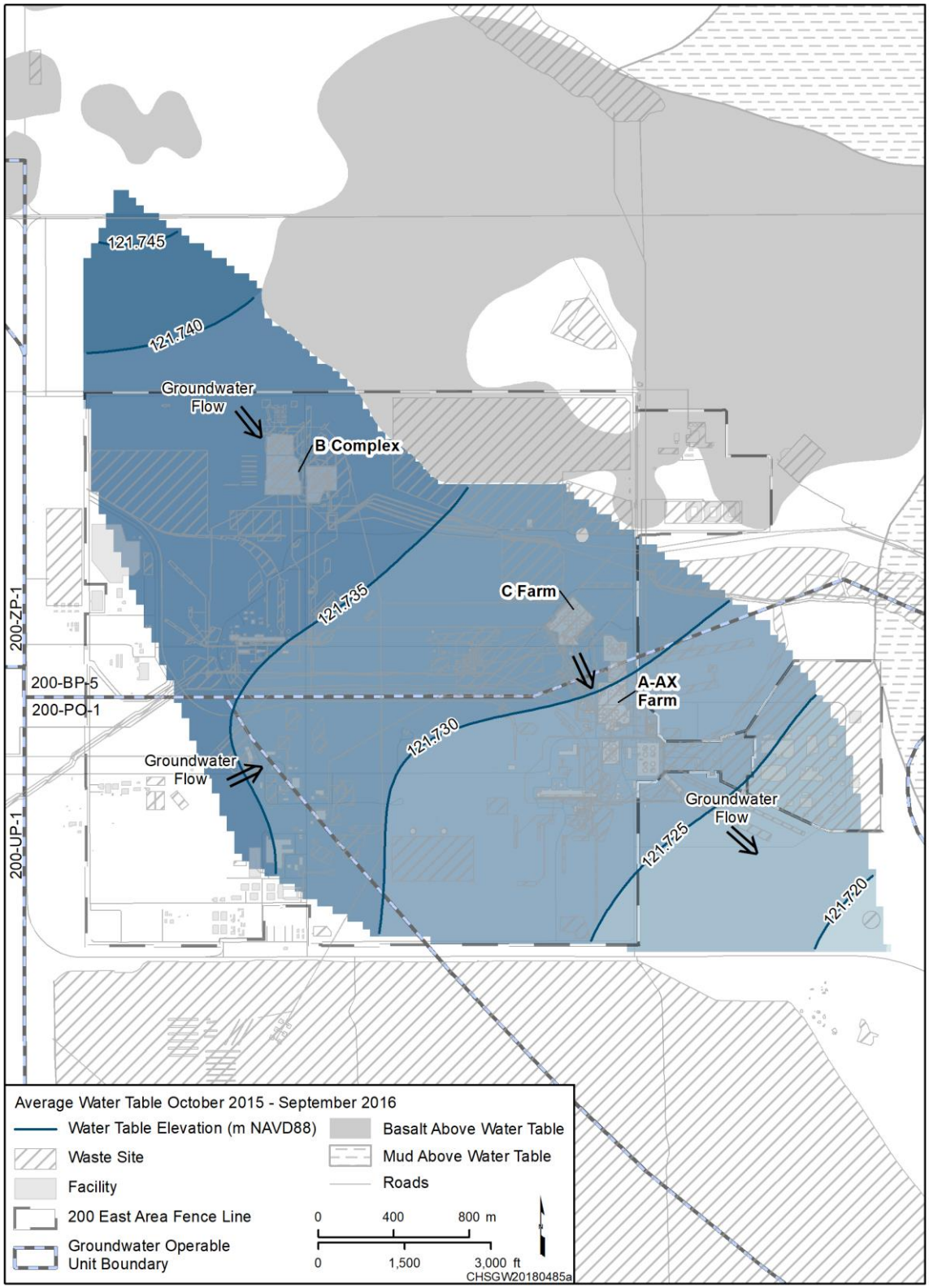
The principal structures overlying the 200-BP-5/200-PO-1 OUs in the Central Plateau include the B Plant, B Complex, PUREX Plant, C Farm, A-AX Farms, and roads (Figure 2). The B Complex consists of the B-BY-BX Farms and associated crib and trench disposal sites. The B-BY-BX Farms, C Farm, and A-AX Farms consist of a series of single-shell underground storage tanks used to store process waste. Current land use for the Central Plateau is industrial, and public access to the site is restricted. Land use in the 200 West and 200 East Areas will remain industrial for the foreseeable future because these areas will be used for ongoing waste management operations and infrastructure services.

Groundwater in the 200-BP-5/200-PO-1 OUs is not currently used, and site controls restrict its use except for limited research purposes, monitoring, and treatment. Many communities downstream of the Hanford Site draw water from the Columbia River for all or part of their domestic water supply. The city of Richland water intake is the closest to the Hanford Site. The city of Richland filters and treats water from the river and routinely monitors it prior to its distribution to ensure that the water meets federal DWSs (maximum contaminant levels), as required by the *Safe Drinking Water Act of 1974*.

Physical Features Influencing Remedy Selection

Groundwater conditions in the 200-BP-5/200-PO-1 OUs include unconfined, semiconfined, and confined aquifers. Groundwater contamination is largely within the uppermost unconfined aquifer associated with the suprabasalt sediment of the Ringold Formation, Cold Creek unit, and Hanford formation. Depths to the water table range from <1 m (3 ft) below ground surface near the Columbia River to 90 to 100 m (295 to 328 ft) below ground surface in the 200 East Area. The unconfined aquifer thickness in the B Complex target remediation area is interpreted to vary from <1 m (3 ft) north to >5 m (17ft) along the southern boundary. The unconfined aquifer thickness at WMA C is interpreted to vary from 9 to 16 m (30 to 55 ft). Finally, the aquifer thickness in the Gable Gap ranges from <2 m (<6 ft) along the edge of the Elephant basalt to over 40 m (<130 ft) in the central part of the Gable Gap.

Water table mounding from high-volume effluent disposal starting in the 1940s resulted in groundwater flowing in two general directions. Groundwater in the northwestern portion of the 200-BP-5 OU generally flowed northwest toward Gable Gap and north toward the Columbia River. Groundwater farther south in the 200-BP-5/200-PO-1 OUs flowed southeast toward the Columbia River. With the discontinuation of high-volume discharges in the early 1990s, the groundwater table began to decline, resulting a declining groundwater gradient. In 2011, a major groundwater flow change occurred within the unconfined aquifer south of Gable Mountain. The flow direction in the northwest portion of the 200-BP-5 OU changed 180 degrees (from northwest to southeast) due to water table declines in the 200 East Area. Since 2011, the groundwater flow across most of the 200 East Area has been south-southeast, representing its natural pre-operational flow direction (Figure 3).



Note: Modified from DOE/RL-2016-67, *Hanford Site Groundwater Monitoring Report for 2016*.

Figure 3. Average Groundwater Elevations and Flow Direction in the 200 East Area (2016)

Groundwater Contamination

The RIs identified groundwater contaminants near the 200 East Area of the 200-BP-5/200-PO-1 OUs at concentrations exceeding federal and state DWSs include uranium, technetium-99, cyanide, nitrate, iodine-129, tritium, and strontium-90 (Figure 4). Uranium and technetium-99 are the COCs targeted for cleanup, and the other contaminants above the DWS are identified as co-contaminants under the interim action. As discussed in the Introduction, the uranium and technetium-99 plume areas are targeted because of the following: (1) the plumes are large and exhibit high concentration compared to DWS; (2) the plumes are mobile and expanding downgradient from the source (B Complex, and C Farm and A-AX Farms plume areas); (3) the plume area is a highly transmissive aquifer; (4) the plumes have continuing sources (B Complex, and C Farm and A-AX Farms plume areas; Gable Gap plume area does not have continuing source).

The expected concentrations for uranium, technetium-99, and co-contaminants from extracted groundwater will be within the 200 West P&T capacity or feed acceptance criteria, and with the exception of tritium and I-129, the 200 West P&T will treat other collocated contaminants to achieve the effluent criteria identified in EPA et al., 2008, *Record of Decision, Hanford 200 Area 200-ZP-1 Superfund Site, Benton County, Washington* (hereinafter referred to as the 200-ZP-1 ROD).

DOE anticipates that the future decision documents will address co-contaminants, and future contamination in groundwater from the vadose zone sources, after the overlying source OUs and WMAs are adequately characterized to determine COCs and future risk to groundwater.

Uranium and Technntium-99. Uranium and technetium-99 are fission products common to many of the nuclear fuel reprocessing waste streams. Figure 2 shows the uranium and technetium-99 groundwater plumes with concentrations exceeding the DWS for uranium (30 µg/L) and a DWS equivalent of 900 ***picocuries*** per liter (pCi/L)[2] for technetium-99.

Sources of uranium contamination to the groundwater OUs are the B Complex, B Plant, and PUREX Plant. The main uranium plume extending northwest and southeast from the B Complex is the focus of this interim action (Figure 2). Smaller, isolated uranium plumes occurring southeast of B Plant and southeast of the PUREX Plant are not within the scope of this interim action and will be addressed in future decision documents.

Sources of technetium-99 contamination to the groundwater OUs are the B Complex, C Farm, and A-AX Farms. Technetium-99 groundwater plumes occur below the B Complex, extending northwest and southeast; north of the B Complex, extending northwest to Gable Gap; and below C Farm, extending to the A-AX Farms (Figure 4).

Co-Contaminants. The co-contaminant plumes in the target remediation areas with concentrations exceeding DWSs (Figure 4) include cyanide, nitrate, iodine-129, and tritium.

[2] EPA has established a maximum contaminant level of 4 mrem/yr for beta particle and photon radioactivity from manmade radionuclides (e.g., technetium-99) in drinking water. The average concentration of technetium-99 at 4 mrem/yr is 900 pCi/L.

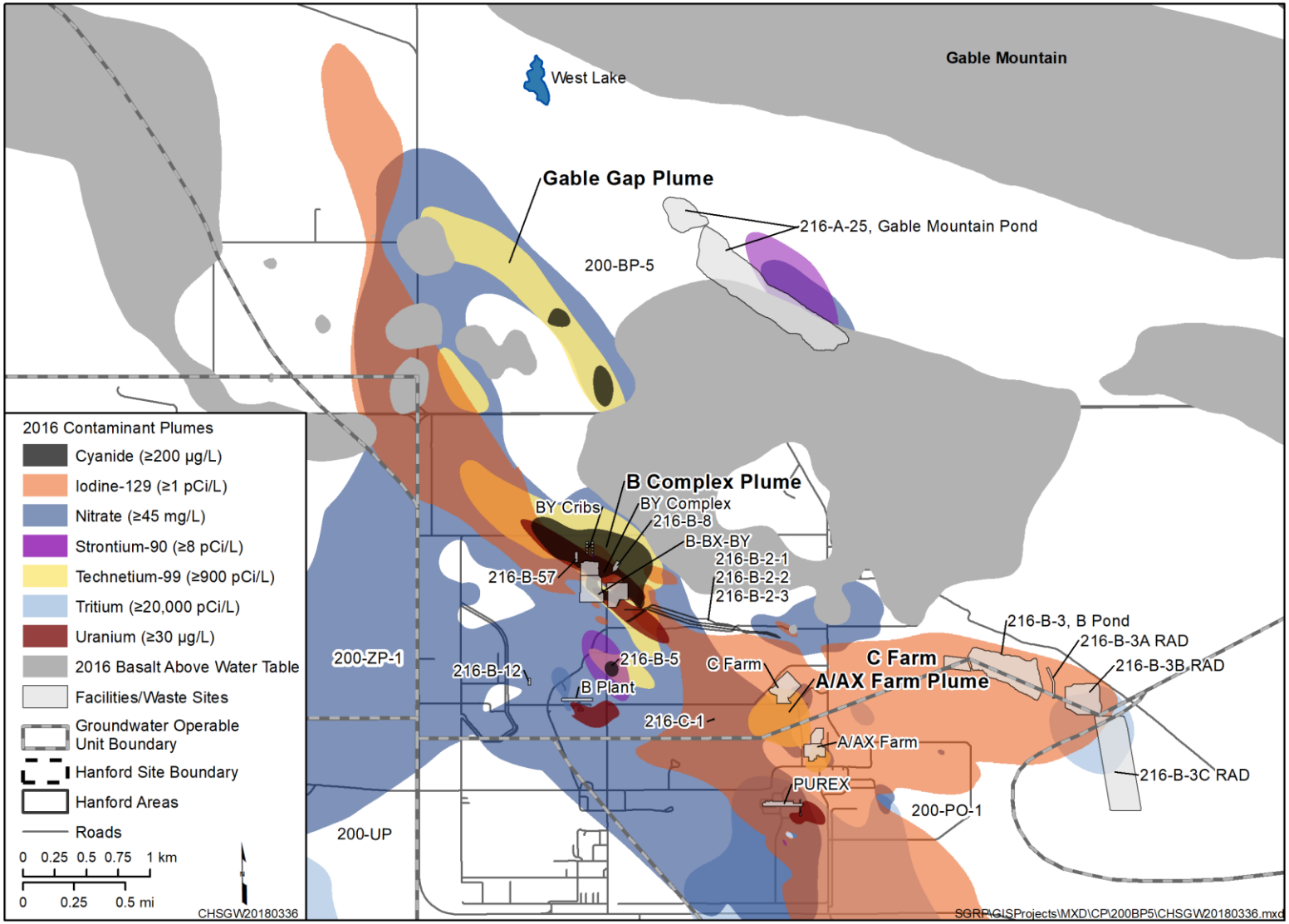
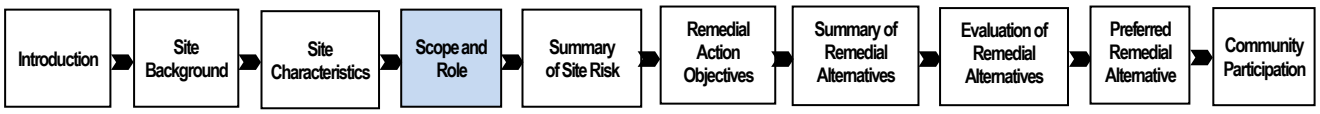


Figure 4. Groundwater Contaminant Plumes Exceeding DWSs near the 200 East Area Within the 200-BP-5/200-PO-1 OUs

Cyanide was a component of the scavenging process that removed cesium-137 and strontium-90 from waste solutions by adding ferrocyanide. Liquid waste associated with the scavenging process was disposed to the BY Cribs. The cyanide groundwater plume with concentrations exceeding the 200 µg/L DWS in the 200-BP-5 OU lies beneath the B Complex.

Nitrate originated primarily from nitric acid used for nuclear fuel reprocessing and ammonium solutions in liquids discharged to waste sites overlying the groundwater OUs. The nitrate plume with groundwater contamination exceeding the 45 mg/L DWS equivalent[3] is largely commingled with the uranium and technetium-99 groundwater plumes in the B Complex and Gable Gap areas of 200-BP-5 OU.

Iodine-129 was formed from the fission of uranium in nuclear reactors and is one of the fission products in waste from the separations processes in the 200 Areas that was discharged to the PUREX Cribs. Iodine-129 exceeding the 1 pCi/L DWS occurs as a plume underlying the B Complex, C Farm, and A-AX Farms, extending southeast from the 200 East Area.



Scope and Role

This Proposed Plan for interim action addresses specific plume areas with the 200-BP-5 and 200-PO-1 OUs that merit near-term action for the areas, and COCs identified below:

- 200-BP-5 Groundwater OU:
  - B Complex plume area: uranium and technetium-99
  - C Farm and A-AX Farms plume areas (plume spans the 200-BP-5/200-PO-1 OUs boundary): technetium-99
  - Gable Gap plume area: technetium-99 (optional as an efficiency measure while the 200 West P&T is operating; see “Remedial Action Objectives” section of this Proposed Plan)
- 200-PO-1 Groundwater OU:
  - C Farm and A-AX Farms plume areas (plume spans the 200-BP-5/200-PO-1 OUs boundary): technetium-99

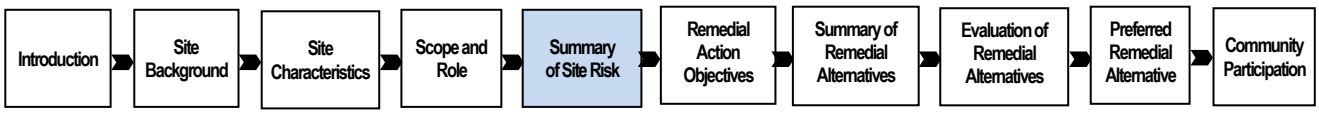
The role of the 200-BP-5/200-PO-1 OUs interim action in the scope of the Hanford Site cleanup strategy is discussed in the following section.

Hanford Site Overall Cleanup Strategy

This Proposed Plan is part of a cleanup strategy to complete remediation of the Hanford Site. The objective of the cleanup strategy is to ensure that cleanup actions address threats to human health and the environment in accordance with regulatory requirements.

[3] The EPA maximum contaminant level for nitrate is 10 mg/L expressed as nitrogen (N). This is equal to a nitrate concentration of approximately 45 mg/L when expressed as nitrate itself (NO_{3-}).

The intent of the Hanford Site cleanup strategy is to shrink the Hanford Site footprint to the Central Plateau. The strategy includes remediating waste sites and restoring groundwater to (1) be protective of human health and the environment, including the Columbia River; (2) restore groundwater to beneficial use wherever practicable; and (3) support reasonably anticipated future land uses. The Tri-Parties are pursuing an IROD for specific plume areas in the 200-BP-5/200-PO-1 groundwater OUs to expedite the remediation of some groundwater contaminant plumes and coordinate with actions at C Farm.



Summary of Site Risks

The BRA identifies and characterizes the actual and potential risks that a site poses to human health or the environment if no action were taken at the site. It provides the basis for taking a response action under CERLCA. Separate BRAs were performed for the 200-BP-5 and 200-PO-1 OUs, as required by the NCP (40 CFR 300), to characterize current and potential threats to human health and the environment and to provide information that can be used to develop and evaluate remedial alternatives. The BRA results are presented in the respective RI reports for the 200-BP-5 and 200-PO-1 OUs (DOE/RL-2009-127, *Remedial Investigation for the 200-BP-5 Groundwater Operable Unit*; DOE/RL-2009-85, *Remedial Investigation Report for the 200-PO-1 Groundwater Operable Unit*; and DOE/RL-2009-85 ADD1, *Remedial Investigation Report for the 200-PO-1 Groundwater Operable Unit*, Addendum 1) and are summarized in the following sections.

Groundwater-Use Assumptions

The NCP establishes an expectation to "…return useable ground waters to their beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site…" (40 CFR 300.430(a)(1)(iii)(F)). The Tri-Parties' goal for Hanford Site groundwater is to return groundwater to its beneficial use as a potential future drinking water source.

Groundwater in the 200-BP-5/200-PO-1 OUs is currently contaminated above DWSs, and groundwater-use ICs are implemented to protect human health. Groundwater use is restricted through site controls to limited research purposes and for monitoring and treatment.

Groundwater Human Health Risk Assessment

The BRA for the 200-BP-5/200-PO-1 OUs described in the RI reports (DOE/RL-2009-127, *Remedial Investigation for the 200-BP-5 Groundwater Operable Unit*; DOE/RL-2009-85 ADD1, *Remedial Investigation Report for the 200-PO-1 Groundwater Operable Unit*, Addendum 1) and summarized below, looked at risk with perspective of the entire OUs and used the EPA tap water (residential) scenario to calculate cumulative cancer risks for radionuclides and chemicals and cumulative noncancer hazards for chemicals. This scenario assumes that the groundwater is used as a tap water source for a 30-year period. Potential routes of exposure include ingestion, dermal contact, and inhalation of volatiles during household activities. ***Excess lifetime cancer risks (ELCRs)*** and noncancer ***hazard quotients (HQs)*** and ***hazard index (HI)*** values were calculated for the 200-BP-5 and 200-PO-1 OUs RI reports (DOE/RL-2009-127, *Remedial Investigation for the 200-BP-5 Groundwater Operable Unit*; DOE/RL-2009-85 ADD1, *Remedial Investigation Report for the 200-PO-1 Groundwater Operable Unit*, Addendum 1) based on ***exposure point concentrations (EPCs)***. ***Contaminants of potential concern (COPCs)*** were identified when the ELCR and/or noncancer HQs were greater than the acceptable risk thresholds identified in WAC 173-340, Model Toxics Control Act—Cleanup" (also known as the ***Model Toxics Control Act [MTCA]***) and the NCP (40 CFR 300), or when a significant contribution to

adverse human health effects was identified. The NCP identifies cumulative ELCR < 1 in 1,000,000 (1×10^{-6}) as acceptable risk. Risks between 1 in 10,000 (1×10^{-4}) to 10^{-6} are generally referred to as an "acceptable risk range"; risks $>10^{-4}$ are considered unacceptable. For noncarcinogenic effects, the NCP and MTCA define the acceptable target HI as ≤1. The HI may exceed 1 even if all of the individual HQs are <1. In this case, the chemicals may be segregated by similar mechanisms of toxicity and toxicological effects. Separate HI values may then be derived based on mechanism and effect.

The COPCs associated with the specific plume areas in the FS for interim action were identified when the following risk thresholds were met or exceeded:

- Cumulative cancer risk for chemicals was >1 in 100,000 (1×10^{-5}), or when the HI for chemicals was >1
- Cumulative cancer risk for radiological analytes was >1 in 10,000

In addition to the groundwater BRA, all individual groundwater measurements were compared to DWS groundwater cleanup levels (WAC 173-340-720, "Groundwater Cleanup Standards") based on a target risk level of 1×10^{-6} or an HQ of 1.

The RI reports for the 200-BP-5/200-PO-1 OUs provide sufficient BRA information for the specific plume areas targeted for this interim action. The 200-BP-5 OU RI report (DOE/RL-2009-127, *Remedial Investigation for the 200-BP-5 Groundwater Operable Unit*) identified 15 groundwater COPCs: arsenic, cesium-137, cobalt-60, cyanide, fluoride, hexavalent chromium, gross alpha, iodine-129, nitrate, plutonium-239/240, strontium-90, sulfate, technetium-99, tritium, and uranium; while the 200-PO-1 OU RI addendum (DOE/RL-2009-85 ADD1, *Remedial Investigation Report for the 200-PO-1 Groundwater Operable Unit*, Addendum 1) identified eight groundwater COPCs: gross alpha, iodine-129, nitrate, strontium-90, sulfate, technetium-99, tritium, and uranium. The COPCs with the broadest distribution in groundwater are iodine-129, nitrate, technetium-99, and uranium. Cyanide, tritium, strontium-90, and sulfate concentrations exceeding DWSs are limited to areas beneath and adjacent to the overlying source waste site (of these, sulfate exceeds only the secondary DWS and was developed for esthetic considerations [e.g., taste, odor, or color]). The other COPCs are even more limited in distribution, with detections limited to a few wells below source waste sites. Gross alpha is an indicator parameter of plutonium-239/240 and uranium, and its activity is elevated at some monitoring wells.

As discussed in the Introduction, the uranium and technetium-99 plume areas are targeted because of the following: (1) the plumes are large and exhibit high concentration compared to DWS; (2) the plumes are mobile and expanding downgradient from the source (B Complex, and C Farm and A-AX Farms plume areas); (3) the plume area is a highly transmissive aquifer; (4) the plumes have continuing sources (B Complex, and C Farm and A-AX Farms plume areas; Gable Gap plume area does not have continuing source). Table 1 summarizes the cancer risks for technetium-99 and the noncancer HQs for uranium associated with exposure areas defined in the BRAs. Table 1 also illustrates how the BRA exposure areas align with the target remediation areas for this interim action. Cancer risks $>1\times10^{-4}$ or HQs >1 indicate that remedial action is warranted. As shown in Table 1, cancer risks associated with technetium-99 are $>1\times10^{-4}$ in the B Complex plume area, C Farm and A-AX Farms plume areas, and Gable Gap plume area (WMA B-BX-BY Farms, and WMA C Farm exposure areas), and the HQ for uranium is >1 in the B Complex plume areas (WMA B-BY-BY Farms exposure area). The cancer risk for technetium-99 in the WMA A-AX Farms exposure area is within the CERCLA target risk range of 1×10^{-4} and 1×10^{-6}; however, this is included in the target remediation area for this interim action because the C Farm and A-AX Farms plume areas have merged together. The HQs for uranium are <1 in all target areas except for the B Complex plume area.

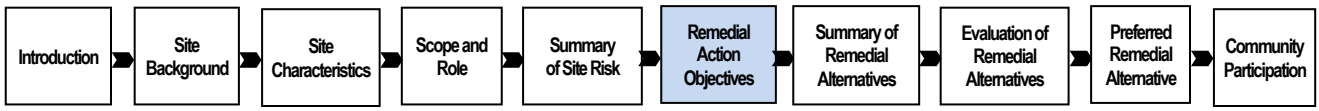
COCs and COPCs will be further defined for the 200-BP-5/200-PO-1 OUs in future decision documents after the overlying source OUs and WMAs are adequately characterized.

Table 1. Summary of Technetium-99 and Uranium Risk Results from the Tap Water (Residential) Exposure Scenario for the 200-BP-5/200-PO-1 Groundwater OUs

Exposure Area from Baseline Risk Assessments	Target Remediation Areas for the Interim Action	Cancer Risk for Tc-99	Hazard Quotient for Uranium
200-BP-5 Groundwater OU			
WMA B-BX-BY Farms	B Complex uranium and Tc-99 plume areas Gable Gap Tc-99 plume area	6.0×10^{-4}	4.2
WMA C Farm	C Farm and A-AX Farms Tc-99 plume areas	3.1×10^{-4}	0.43
200-PO-1 Groundwater OU			
WMA A-AX Farms*	C Farm and A-AX Farms Tc-99 plume areas	6.8×10^{-5}	0.041

*The cancer risk for technetium-99 in the WMA A-AX Farms exposure area is within the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* target risk range of 1×10^{-4} and 1×10^{-6}. However, this is included in the target remediation area for this interim action because the C Farm and A-AX Farms plume areas have merged together.

OU = operable unit
WMA = waste management area



Remedial Action Objectives

The RAOs describe what a proposed remedial action is expected to accomplish. RAOs generally include information on the media, COCs, potential exposure pathways, and remediation goals. The two RAOs developed for the 200-BP-5/200-PO-1 OUs interim action are as follows:

- **RAO #1:** Capture and remove the target COCs (uranium and technetium-99) from the target plumes sufficient to reach DWSs within a reasonable timeframe.
- **RAO #2:** Gather additional information from remedy performance monitoring and groundwater sampling in the areas addressed by the interim action in the 200-BP-5/200-PO-1 OUs to support a future (noninterim) decision.

While routine groundwater monitoring is not part of the interim action, this monitoring will continue pursuant to the existing 200-BP-5 and 200-PO-1 OU sampling and analysis plans and any future sampling and analysis plan revisions.

Preliminary Remediation Goals

Preliminary remediation goals (PRGs) establish acceptable exposure levels for specific contaminants based on the media and exposure scenario. During the interim action FS process (DOE/RL-2018-30), PRGs were used to support remedial technology screening and to assess the effectiveness of the remedial alternatives in meeting the RAOs and interim action objectives. Table 2 identifies the PRGs that represent the cleanup levels to be achieved by each of the alternatives (except the No Action alternative). Table 2 identifies the target COCs. The PRGs for the COCs apply to concentrations in groundwater when the interim action is complete. If injection of treated water is required in the Gable Gap plume area, the treated water would meet applicable requirements as identified in the interim RD/RAWP.

Table 2. 200-BP-5/200-PO-1 OU PRGs for COCs

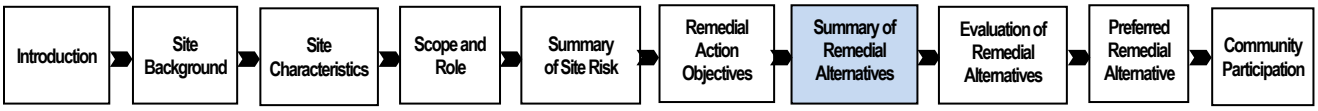
Target COCs for the Interim Action	Units	Exposure Point Concentrations[a]		Federal DWS[b]	MTCA Method B Preliminary Remediation Goal		200-BP-5 and 200-PO-1 PRGs[c]
		200-BP-5 OU	200-PO-1 OU		Noncarcinogens at HQ = 1	Carcinogens at 1×10^{-5} Risk Level	
Uranium	µg/L	422	26	30	48	—	30
Technetium-99	pCi/L	11,391	1,291	900	—	—	900

a. Exposure point concentration is a conservative estimate of the average chemical concentration in an environmental medium (e.g., groundwater) and is normally calculated as the 95% upper confidence limit of the arithmetic mean. Values for the 200-BP-5 OU are based on the maximum EPCs from Appendix G, Tables G-11 through G-22 in DOE/RL-2009-127, *Remedial Investigation for the 200-BP-5 Groundwater Operable Unit*. Values for the 200-PO-1 OU are based on the maximum EPCs from Appendix E, Tables E-11 through E-17 in DOE/RL-2009-85 ADD1, *Remedial Investigation Report for the 200-PO-1 Groundwater Operable Unit*, Addendum 1.

b. Federal DWS from 40 CFR 141, "National Primary Drinking Water Regulations," with technetium-99 value from EPA 816-F-00-002, *Implementation Guidance for Radionuclides*. Includes values derived from the maximum contaminant level for beta particle/photon emitters of 4 mrem/yr.

c. The final cleanup levels achieved at the conclusion of the remedial action will correspond to an excess lifetime cancer risk of $<1\times10^{-5}$ and a hazard index of <1.

COC = contaminant of concern
DWS = drinking water standard
EPC = exposure point concentration
HQ = hazard quotient
MTCA = *Model Toxics Control Act*
OU = operable unit
PRG = preliminary remediation goal



Summary of Remedial Alternatives

Remedial alternatives for the 200-BP-5/200-PO-1 OUs interim action were developed in the FS for interim action (DOE/RL-2018-30) based on the RAOs, interim action objectives, PRGs, and technology screening results. The alternatives that were developed and evaluated in the 200-BP-5/200-PO-1 OUs FS were as follows:

- Alternative 1 – No Action
- Alternative 2 – P&T at B Complex plume area, and C Farm and A-AX Farms plume areas, with ICs for Groundwater
- Alternative 3 – P&T at B Complex plume area, C Farm and A-AX Farms plume areas, and Gable Gap plume area, with ICs for Groundwater

Contaminant Fate and Transport Modeling

Fate and transport modeling was performed to simulate and predict contaminant movement in the groundwater using existing groundwater uranium and technetium-99 plume geometries defined in DOE/RL-2018-66, *Hanford Site Groundwater Monitoring Report for 2017*, to assess remediation timeframes for this interim action. The modeling is described in the 200-BP-5/200-PO-1 OUs FS for interim action (Chapter 5 and Appendix A of DOE/RL-2018-30) and was limited to 50 years to support decision making because this is an IROD. Contaminant transport in groundwater was modeled to predict the timeframes to achieve cleanup for the purpose of comparing the remedial alternatives. Cleanup times cited herein are based on fate and transport modeling simulations and assume no continuing contaminant source. The predicted cleanup times are rounded up to the nearest 5 years to obtain the durations used for the remedial alternatives and do not include potential continuing sources of groundwater contamination from the overlying vadose zone. The duration of operations may be extended if vadose zone contamination continues to contribute to groundwater contamination exceeding cleanup levels.

Groundwater contaminant sources will be addressed by ongoing source OU investigations. After contaminant sources are adequately characterized, a final (non-interim) ROD for the 200 East Area groundwater OUs will be developed to address additional groundwater remediation needs.

Description of Alternatives

This section describes the three remedial alternatives and the distinguishing features of each alternative. These descriptions were used to assess each alternative's performance against the CERCLA criteria and to support the detailed individual and comparative evaluations for each alternative. Cost details are provided in the 200-BP-5/200-PO-1 OUs FS for interim action (Chapter 6 and Appendix B of DOE/RL-2018-30).

Alternative 1 – No Action

Consideration of a No Action alternative is a requirement of the NCP (40 CFR 300.430(e)(6)) and is included to provide a baseline for comparison against the other alternatives. Under the No Action alternative, no active remedial action would be taken to address potential threats to human health and the environment posed by the groundwater COCs. For the No Action alternative, it is assumed that all site remedial activities and interim actions (e.g., P&T currently being performed as a removal action at the B Complex plume area) would be discontinued and ICs would also be suspended.

Fate and transport model simulations performed for the 200-BP 5-OU RI (DOE/RL-2009-127, *Remedial Investigation for the 200-BP-5 Groundwater Operable Unit*) indicate that under the No Action alternative, uranium contamination in the B Complex plume would require more than 65 years to attenuate to concentrations less than DWSs. Modeling performed for the 200-BP-5 OU RI (DOE/RL-2009-127) indicated that the technetium-99 plume in the Gable Gap plume area might take 800 years for concentrations to attenuate below the DWS. This alternative does not meet the threshold criterion of protecting human health and the environment; therefore, it was not considered further.

Alternative 2 – P&T at B Complex Plume Area, and C Farm and A-AX Farms Plume Areas, with ICs for Groundwater

Alternative 2 includes up to 25 years of P&T to capture and remove uranium and technetium-99 from groundwater beneath the B Complex plume area, and up to 10 years of P&T to capture and remove technetium-99 from groundwater beneath the C Farm and A-AX Farms plume areas.[4] The duration of operations may be extended if vadose zone contamination continues to contribute to groundwater contamination exceeding cleanup levels. Technetium-99 in the Gable Gap plume area might take 800 years for concentrations to attenuate below the DWS. This alternative also includes ICs to prevent exposure to contaminated groundwater until PRGs are achieved. A final ROD may address groundwater contamination in the Gable Gap plume areas.

Alternative 2

Estimated capital cost: *$24 million*

Estimated O&M and periodic cost: *$190 million*

Estimated total present value (discounted): *$200 million*

Estimated time to achieve groundwater PRG, B Complex uranium and technetium-99 plume areas: *25 years*

Estimated time to achieve groundwater PRG, C Farm and A-AX Farms techneium-99 plume area: *10 years*

Note: The Gable Gap technetium-99 plume area is not addressed by Alternative 2.

The groundwater extraction system under Alternative 2 assumes two existing and one new ***extraction well*** in the B Complex area, and three new extraction wells in the C Farm and A-AX Farms area. The total extraction rates in the B Complex and the C Farm and A-AX Farms plume areas are estimated to be approximately 757 L/min (200 gal/min) and 378 L/min (100 gal/min), respectively. The total Alternative 2 pumping rate is approximately 1,140 L/min (300 gal/min). Final design details will be identified in the interim RD/RAWP.

Extracted groundwater is conveyed from the extraction wells to the existing 200 West P&T for treatment. Treated groundwater will achieve the effluent criteria for the 200 West P&T identified in the 200-ZP-1 OU ROD (EPA et al., 2008). Extracted groundwater from the B Complex plume area is segregated from the C Farm and A-AX Farms plume area groundwater (i.e., conveyed to the 200 West P&T in a separate pipeline) because the B Complex plume area groundwater requires treatment for uranium, whereas the C Farm and A-AX Farms plume area groundwater does not. Treatment of the additional groundwater generated under this alternative would increase total flows to approximately 1,140 L/min (300 gal/min) and would require expansion of the radiological treatment system at the 200 West P&T by adding a new (third) technetium-99 ion exchange (IX) train.

[4] Although fate and transport modeling projects a cleanup time of 28 years for uranium in the B Complex plume under Alternative 2 assuming no continuing source, it is expected that it may be possible to reduce the cleanup time to 25 years or less by optimizing extraction well placement during remedial design and groundwater extraction pumping rates during the interim action.

A new (third) air stripper system would also be added to the 200 West P&T to accommodate the additional flow generated by Alternative 2.[5] The additional air stripper system, including a granular activated carbon tank, is needed to increase the treatment capacity of the 200 West P&T to accommodate the additional treatment needs from the 200-BP-5/200-PO-1 OUs.

After treatment, the Alternative 2 effluent flow would be injected into the 200 West Area. The existing injection system assumes expansion to include three new ***injection wells*** to accommodate the increased flow rate. Final design details will be identified in the interim RD/RAWP.

Additional elements of Alternative 2 include P&T system operations and maintenance (O&M), installation of new groundwater monitoring wells, and performance monitoring.

Alternative 3 – P&T at B Complex Plume Area, C Farm and A-AX Farms Plume Areas, and Gable Gap Plume Area, with ICs for Groundwater

Alternative 3 is similar to Alternative 2 but adds P&T for the Gable Gap target plume area. This alternative includes up to 25 years of P&T to capture and remove uranium and technetium-99 from groundwater beneath the B Complex plume area, and up to 10 years of P&T to capture and remove technetium-99 from groundwater beneath the C Farm and A-AX Farms plume areas, and the Gable Gap remediation target areas. This alternative also includes ICs to prevent exposure to contaminated groundwater until PRGs are achieved.

Alternative 3

Estimated capital cost: *$38 million*

Estimated O&M and periodic cost: *$224 million*

Estimated present value (discounted): *$245 million*

Estimated time to achieve groundwater PRG, B Complex uranium and technetium-99 plume areas: *25 years*

Estimated time to achieve groundwater PRG, C Farm and A-AX Farms technetium-99 plume areas: *10 years*

Estimated time to achieve groundwater PRG, Gable Gap technetium-99 plume area: *10 years*

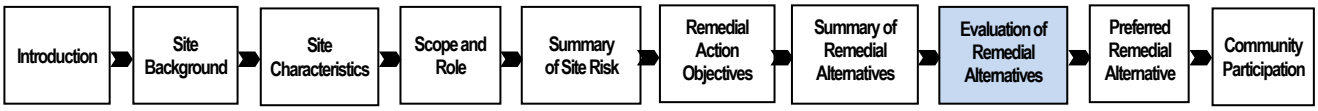
The groundwater extraction system for Alternative 3 assumes two existing and one new extraction well in the B Complex plume area, three new extraction wells in the C Farm and A-AX Farms plume areas, and one new extraction well in the Gable Gap plume area. The total extraction rates in the B Complex plume area, C Farm and A-AX Farms plume areas, and Gable Gap plume area are approximately 757 L/min (200 gal/min), 379 L/min (100 gal/min), and 379 L/min (100 gal/min), respectively. The total extraction pumping rate for Alternative 3 is approximately 1,510 L/min (400 gal/min). Final design details will be identified in the interim RD/RAWP.

Extracted groundwater is conveyed to the existing 200 West P&T for treatment. Treated groundwater will achieve the effluent criteria for the 200 West P&T identified in the 200-ZP-1 OU ROD (EPA et al., 2008). Extracted groundwater from the B Complex plume area is segregated from the combined C Farm and A-AX Farms plume areas, and Gable Gap plume area groundwater (i.e., conveyed to the 200 West P&T in a separate pipeline) because the B Complex plume area groundwater requires treatment for uranium, whereas groundwater from the other areas does not. As with Alternative 2, treatment of the additional groundwater generated under Alternative 3 would require expansion of the 200 West P&T by adding a new (third) technetium-99 IX train and a new (third) air stripper system, including a granular activated carbon tank.

[5] A portion of the groundwater currently treated at the 200 West P&T only requires treatment for carbon tetrachloride, a volatile organic compound that is removed by air stripping. Therefore, constructing a new air stripping system would allow the groundwater to be conveyed directly to the new air stripper, thereby freeing up capacity in the other treatment units at the 200 West P&T that could be used to treat new groundwater from the 200-BP-5/200-PO-1 OUs.

After treatment, the Alternative 3 effluent would be injected in the Gable Gap plume area and 200 West Area. A new transfer station would be used to return approximately 379 L/min (100 gal/min) of treated effluent to Gable Gap plume area for injection assuming two new injection wells to provide a hydraulic gradient to move the water toward the extraction well (because the area is stagnant). Injection of treated water in the Gable Gap plume area would meet applicable requirements as identified in the interim RD/RAWP. Injection in the 200 West Area assumes a combination of the existing injection wells and three new injection wells to accommodate the additional Alternative 3 flow rate. Final design details will be identified in the interim RD/RAWP.

As with Alternative 2, additional elements of Alternative 3 are P&T system O&M, installation of new groundwater monitoring wells, and performance monitoring.



Evaluation of Remedial Alternatives

As part of the FS for interim action, EPA and DOE evaluated each remedial alternative against the CERCLA threshold and balancing criteria provided in the NCP (40 CFR 300.430(e)(9)). Following this evaluation, the Tri-Parties and DOE performed a comparative analysis to assess the overall performance of each alternative. Figure 5 presents the nine CERCLA evaluation criteria; additional CERCLA subcriteria are provided in the 200-BP-5/200-PO-1 OUs FS for interim action (Table 6-1 of DOE/RL-2018-30) and are discussed briefly in the following sections. The nine criteria are categorized into three groups: threshold criteria, balancing criteria, and modifying criteria.

A remedial alternative must satisfy the two threshold criteria to be considered a viable alternative: (1) overall protection of human health and the environment, and (2) compliance with ARARs. The five balancing criteria allow for a comparison of major tradeoffs among the alternatives. The modifying criteria, Washington State acceptance and community acceptance, cannot be fully considered until after Tribal Nations and public comments are received on this Proposed Plan. After completion of the formal public comment period, the Tri-Parties will consider the comments received before DOE and EPA issue an IROD specifying the selected interim action alternative. The modifying criteria are important considerations in the final evaluation of the remedial alternatives.

Figure 5. CERCLA Evaluation Criteria

The following sections summarize the comparative evaluation of alternatives that was used to identify the preferred alternative presented in this Proposed Plan. Detailed information on the individual and comparative analysis of alternatives is provided in the 200-BP-5/200-PO-1 OUs FS for interim action (DOE/RL-2018-30). Table 3 summarizes the comparative evaluation.

Threshold Criteria

Overall Protection of Human Health and the Environment. Alternative 1 (No Action) proposes no remediation for groundwater. This alternative is not protective of human health and the environment and, therefore, was not carried forward in the FS for detailed and comparative evaluation for groundwater that poses unacceptable risk to human health or the environment.

Alternatives 2 and 3 are protective of human health and the environment, would achieve PRGs by capture and removing contaminants until a final ROD is in place, and meet this threshold criterion. ICs would be used to prevent exposure to contaminated groundwater until PRGs are met.

Compliance with ARARs. The ARAR identification process is based on CERCLA and the NCP (40 CFR 300), with consideration of guidance. The lead and non-lead agencies identify requirements that are applicable or relevant and appropriate to the release or remedial action at a CERCLA site (40 CFR 300.400(g)). Alternative 1 does not require action and, therefore, ARARs are not implicated. Alternatives 2 and 3 would comply with ARARs.

Balancing Criteria

Long-Term Effectiveness and Permanence. This criterion evaluates the risk remaining after the interim action objectives have been met. The evaluation considers (1) the magnitude of the residual risk at the conclusion of remedial activities, and (2) the adequacy and reliability of controls that may be required to manage treatment residuals or untreated waste.

Alternative 3 provides greater reduction of groundwater exceeding DWSs by remediating technetium-99 in the Gable Gap plume area, whereas Alternative 2 does not address Gable Gap groundwater. Within the B Complex plume area, and C Farm and A-AX Farms plume areas, Alternatives 2 and 3 provide comparable long-term effectiveness and permanence. However, the duration of operations in the B Complex plume area, and C Farm and A-AX Farms plume areas are uncertain and may be extended if vadose zone contamination continues to contribute to groundwater contamination exceeding cleanup levels.

Reduction of Toxicity, Mobility, or Volume through Treatment. This criterion assesses the degree to which alternatives use recycling or treatment that reduces the TMV, including how treatment is used to treat principal threats.

Alternative 3 results in greater TMV reduction in terms of plume area and contaminated groundwater volume remediated because it addresses technetium-99 in the Gable Gap plume area, whereas Alternative 2 does not. However, the duration of operations in the B Complex plume area, and C Farm and A-AX Farms plume areas may be extended if vadose zone contamination continues to contribute to groundwater contamination exceeding cleanup levels. Although true destruction of elements such as uranium and technetium-99 through treatment is not possible, removal from the aquifer via groundwater extraction, treatment of extracted groundwater by IX, and placement of spent IX resin in a secure disposal facility is effectively permanent and irreversible.

Table 3. Comparative Evaluation of Remedial Alternatives

Alternative	Estimated Time to Achieve Groundwater PRG[a]	Threshold Criteria		Balancing Criteria				
		Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in TMV Through Treatment	Short-Term Effectiveness	Implementability	Cost (Present Value) (in Millions $)[b]
1 – No Action	>50	No	N/A	NE	NE	NE	NE	$0
2 – P&T at B Complex plume area, and C Farm and A-AX Farms plume areas, with ICs for Groundwater	25	Yes	Yes	★★★☆	★★★☆	★★★☆	★★★☆	$200
3 – P&T at B Complex plume area, C Farm and A-AX Farms plume areas, and Gable Gap plume area, with ICs for Groundwater	25	Yes	Yes	★★★★	★★★★	★★★☆	★★☆☆	$245

Notes: Final alternative ratings are pending review and finalization of DOE/RL-2018-30, *200-BP-5 and 200-PO-1 Operable Units Feasibility Study for Interim Action*.

The comparative evaluation metrics are defined as follows:

★★★★ = Performs superior against the CERCLA balancing criterion with no disadvantages or uncertainties.

★★★☆ = Performs well against the CERCLA balancing criterion with minimal disadvantages or uncertainties.

★★☆☆ = Performs fair against the CERCLA balancing criterion but with some disadvantages or uncertainties.

★☆☆☆ = Performs poor against the CERCLA balancing criterion with more disadvantages or uncertainties.

a. Fate and transport modeling predicts slightly shorter cleanup times for uranium and technetium-99 in the B Complex for Alternative 3 compared to Alternative 2, even though the two alternatives have identical P&T configurations in the B Complex area. The difference in predicted cleanup times is due to the hydrologic influence on the B Complex area of groundwater extraction and injection in the Gable Gap area under Alternative 3.

b. Detailed cost estimates are presented in Appendix B of the feasibility study for interim action (DOE/RL-2018-30). Cost estimates reflect an expected accuracy of +50% to -30%.

Table 3. Comparative Evaluation of Remedial Alternatives

Alternative	Estimated Time to Achieve Groundwater PRG[a]	Threshold Criteria		Balancing Criteria				
		Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in TMV Through Treatment	Short-Term Effectiveness	Implementability	Cost (Present Value) (in Millions $)[b]

ARAR = applicable or relevant and appropriate requirement
CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
IC = institutional control
N/A = not applicable
NE = not evaluated
OU = operable unit
P&T = pump and treat
PRG = preliminary remediation goals
TMV = toxicity, mobility, or volume

Short-Term Effectiveness. This criterion assesses the estimated timeframe to achieve PRGs and the potential adverse effects that each alternative may pose to the workers and the environment during the remedy construction and implementation phases.

Alternatives 2 and 3 perform similarly well with respect to the short-term effectiveness criterion. Alternative 3 involves additional remediation for the Gable Gap plume area, which leads to greater potential for impacts to workers and the environment due to remediation system construction and operation. Because of this remediation, Alternative 3 achieves cleanup levels in 10 years for technetium-99 in the Gable Gap area. Alternative 2 does not address remediation of the Gable Gap plume area, which is predicted to take approximately 800 years to achieve the cleanup levels. Alternative 3 is also predicted (by fate and transport modeling) to result in a slightly shorter time to achieve the uranium PRG in the B Complex plume area than Alternative 2. These two factors (cleanup time and potential impacts) are considered to be offsetting, resulting in equal ranking of Alternatives 2 and 3 for this criterion.

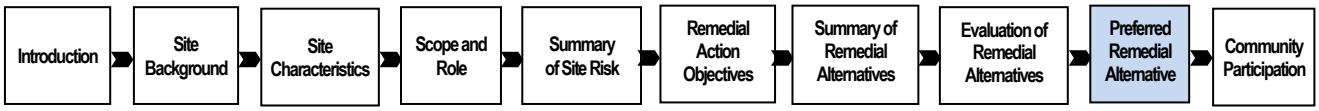
Implementability. This criterion is used to compare the technical and administrative feasibility of the remedial alternatives. This includes the ease of implementing the remedy in terms of construction and operation, as well as the availability of services and materials required to implement the alternative.

Both Alternatives 2 and 3 use technologies that are well-proven, readily available, and widely used at the Hanford Site. Alternative 3 received a lower ranking against the implementability criterion because of the additional wells, pipelines, and transfer (pump) stations required.

Cost. The estimated total present value cost of Alternative 2 ($200 million) is $45 million less than the estimated total present value cost of Alternative 3 ($245 million). Thus, on a total net value cost basis, the estimated cost of Alternative 3 is approximately 23% higher than the cost of Alternative 2. These cost estimates are for comparison purposes and are prepared to meet the -30 to +50% range of accuracy recommended in EPA/540/G-89/004, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*.

Modifying Criteria

State, community, and Tribal Nations input received to date has been considered in the development of this Proposed Plan. Modifying criteria will be fully evaluated in the IROD after considering comments from the Tribal Nations and the public on this Proposed Plan and assessing any state concerns. In the final balancing of tradeoffs between alternatives upon which the interim action remedy selection is based, modifying criteria and balancing criteria are both important.



Preferred Remedial Alternative

Under this interim remedial action, the preferred alternative is Alternative 2 – P&T in B Complex plume area, and C Farm and A-AX Farms plume areas, with ICs for Groundwater. This alternative is recommended because it achieves protection of human health and the environment, satisfies ARARs within a reasonable timeframe, and compared to the other alternatives, provides the best balance of tradeoffs under the modifying criteria. Alternative 2 addresses uranium and technetium-99 contamination in the 200 East Area, whereas Alternative 3 addresses those plumes plus the technetium-99 plume in Gable Gap plume area. However, the duration of operations in the B Complex plume area, and C Farm and A-AX Farms plume areas may be extended if vadose zone contamination continues to contribute to groundwater contamination exceeding cleanup levels.

Alternative 2 satisfies plume reduction for groundwater by using P&T as the remedial technology. This method provides the mechanisms to restore groundwater to the PRGs identified in Table 2 and meets the applicable RAOs by capture and removing contaminants until a final ROD is in place. Implementation includes construction of additional extraction wells; treatment facility upgrades; and construction of new injection wells, pipelines, and pumping facilities. The P&T system will be designed to reduce concentrations of uranium and technetium-99 to meet PRGs in 25 years in the B Complex and the technetium-99 PRG in 10 years at the C Farm and A-AX Farms plume areas after implementation assuming no vadose zone contaminant contributions. If vadose zone contamination continues to contribute to groundwater contamination exceeding cleanup levels, the duration of operations may need to be extended. Final design details will be identified in the interim RD/RAWP.

Alternative 2 provides comparable levels of long-term effectiveness and reduction in TMV through treatment as Alternative 3 in the B Complex plume area, and the C Farm and A-AX Farms plume areas. Alternative 3 was rated slightly higher with respect to these criteria because it addresses the Gable Gap technetium-99 plume area, whereas Alternative 2 does not. Without remedial action, the technetium-99 in the Gable Gap plume area will take 800 years to reach cleanup levels. A final ROD will likely address this contamination. Fate and transport modeling indicates that the Gable Gap technetium-99 plume area would not expand nor migrate under Alternative 2, and there is no continuing source of technetium-99 in that area.

Alternative 2 is readily implementable, and it was rated higher than Alternative 3 for implementability because Alternative 3 requires additional pipelines, wells, and transfer stations in comparison to Alternative 2.

Alternatives 2 and 3 perform similarly with respect to the short-term effectiveness criterion for the B Complex plume area, and the C Farm and A-AX Farms plume areas. Alternative 3 involves a larger remediation footprint, leading to slightly greater potential for impacts to workers and the environment due to its greater amount of construction, operating equipment, and groundwater volume conveyed and treated.

DOE believes that Alternative 2 meets the threshold criteria and provides the best balance of tradeoffs among the three alternatives with respect to the balancing criteria. DOE expects the preferred alternative to satisfy the following statutory requirements of CERCLA Section 121(b), “Cleanup Standards,” “General Rules”: (1) be protective of human health and the environment, (2) comply with ARARs, (3) be cost effective, (4) use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and (5) satisfy the preference for treatment as a principal element, or explain why the preference for treatment will not be met.

The preferred alternative could be modified or another alternative selected through consideration of state acceptance and public comments on this Proposed Plan. After consideration of the input received during the public comment period, a CERCLA IROD will be issued, which will identify the selected remedy. A responsiveness summary containing agency responses to comments received during the public comment period will be made available with issuance of the IROD.

Remediation of Gable Gap was not selected at this time because (1) the plume is not an expanding, (2) there is no continuing source, (3) there is no current exposure, and (4) it is an additional cost that would take away from other remedial priorities. The description and components of the Gable Gap remedy may be useful for a future remedial decision.

In addition, DOE anticipates that a final ROD may address future contamination in groundwater from the vadose zone sources after the overlying source OUs and WMAs are adequately characterized to determine future risk to groundwater.

Community Participation

Public input is a key element in DOE's decision-making process. The Tribal Nations and the public are encouraged to read and provide comments on the alternatives presented in this Proposed Plan, including the preferred alternative.

The Administrative Record for this proposed remedial action decision is available for review at http://pdw.hanford.gov/arpir/. Printed copies of this Proposed Plan for interim action and the 200-BP-5/200-PO-1 OUs FS for interim action (DOE/RL-2018-30) are available at the repositories listed to the right.

The comment period for this Proposed Plan extends from <mon day> through <mon day, year>. Comments on the preferred alternatives, other alternatives, or any element of this Proposed Plan or support information will be accepted through <mon day, year>. Please send comments to the following:

Mail: Richard Buel
U.S. Department of Energy, Richland Operations Office
P.O. Box 550, MSIN A7-75
Richland, WA 99352
Email: TBD

To request a meeting in your area, please contact Nina Menard at 509-372-7941 no later than <mon day, year>.

After the public comment period, DOE and EPA will consider the comments received regarding this Proposed Plan and the information gathered during the comment period.

Hanford Public Information Repository Locations

Administrative Record and Public Information Repository
2440 Stevens Center Place
Room 1101, Richland, WA 99352
Phone: (509) 376-2530
Website: http://pdw.hanford.gov/arpir/

Portland
Portland State University
Branford P. Millar Library
1875 SW Park Avenue
Portland, OR 97207-1151
Phone: (503) 725-4542
Map: http://www.pdx.edu/map.html

Seattle
University of Washington
Suzzallo Library
Government Publications Department
P.O. Box 352900
Seattle, WA 98195-2900
Phone: (206) 543-5597
Map: http://tinyurl.com/m8ebj

Richland
Washington State University, Tri-Cities
Consolidated Information Center
Room 101-L, 2770 University Drive
Richland, WA 99352
Phone: (509) 375-3308
Map: http://reading-room.labworks.org/Directions.aspx

Spokane
Gonzaga University
Foley Center Library
East 502 Boone Ave.
Spokane, WA 99258
Phone: (509) 313-6110
Map: http://tinyurl.com/2c6bpm

Acronym List

ARAR	applicable or relevant and appropriate requirement
BRA	baseline risk assessment
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
COC	contaminant of concern
COPC	contaminant of potential concern
DOE	U.S. Department of Energy
DWS	drinking water standard
Ecology	Washington State Department of Ecology
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
FS	feasibility study
HI	hazard index
HQ	hazard quotient
IC	institutional control
IROD	Interim Record of Decision
IX	ion exchange
MTCA	Model Toxics Control Act
NCP	National Contingency Plan
O&M	operations and maintenance
OU	operable unit
P&T	pump and treat
PRG	preliminary remediation goal
PUREX	Plutonium-Uranium Extraction (Plant)
RAO	remedial action objective
RCRA	*Resource Conservation and Recovery Act of 1976*
RD/RAWP	remedial design/removal action work plan
RI	remedial investigation
ROD	Record of Decision

TMV	toxicity, mobility, or volume
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
Tri-Parties	U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology
WMA	waste management area

Glossary

Administrative Record: Collection of information (including reports, public comments, and correspondence) that contains the documents that form the basis for selection of a response action. A list of locations where the Administrative Record is available appears in the "Community Participation" section of this Proposed Plan.

Applicable or relevant and appropriate requirements (ARARs): "Applicable requirements" mean those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable. "Relevant and appropriate requirements" mean those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

Baseline risk assessment (BRA): A study to characterize the current and potential threats to human health and the environment if no remedial action is taken at the site. It is also used to help establish acceptable exposure levels for use in developing remedial alternatives and to determine the need, or basis, for action.

***Code of Federal Regulations* (CFR):** The codification of the general and permanent rules published in the *Federal Register* by the executive departments and agencies of the federal government. It is divided into 50 titles that represent broad areas subject to federal regulation. Each volume of the CFR is updated once each calendar year.

***Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA):** Also known as the *Superfund Act*, CERCLA is the federal law that establishes a program to identify, evaluate, and remediate sites where hazardous substances, pollutants, or contaminants have been released (e.g., leaked, spilled, or dumped) to the environment or where there is a substantial threat of such a release.

Contaminant of concern (COC): Radionuclides and chemicals that exceed risk threshold values and are addressed by cleanup actions at the site.

Contaminant of potential concern (COPC): Hazardous substances, pollutants, or contaminants that have been found, or are likely to be present, that could potentially represent risk to human health and the environment. The effects depend upon the amount of the contaminant present, the toxicity of the contaminant, and the way the contaminant is or might be contacted. COPCs are evaluated to develop a list of contaminants that should be considered for remediation and to screen out contaminants that are unlikely to be a threat to human health and the environment.

Drinking water standard (DWS): The maximum allowable concentration of a chemical or radionuclide constituent in drinking water that is protective of human health. The DWSs, described in 40 CFR 141, "National Primary Drinking Water Regulations," are also known as maximum contaminant levels.

Excess lifetime cancer risk (ELCR): Potential carcinogenic effects that are characterized by estimating the additional (excess) probability of cancer incidence in a population of individuals for a specific lifetime from projected contamination intakes (and exposures) and chemical-specific dose response data (i.e., slope factors).

Exposure point concentration (EPC): The value that represents a conservative estimate of the chemical concentration available from a particular medium (e.g., soil or groundwater) or route of exposure (e.g., ingestion or inhalation).

Extraction well: A well designed to pump groundwater from the aquifer to the surface.

Feasibility study (FS): A study to develop and evaluate options for remedial action.

Groundwater: Water in a saturated zone or geologic stratum beneath the land surface or beneath a surface water body.

Hazard index (HI): The sum of more than one HQ for multiple substances and/or multiple exposure pathways. The HI is calculated separately for chronic, subchronic, and shorter duration exposures. Potential noncarcinogenic (systemic) effects are characterized by comparing projected intakes of chemicals to toxicity values (i.e., reference doses). The numerical risk or HQ estimates that result are a ratio. The ratio of the intake over the reference dose (HI) is compared to unity (1.0). If the HQ is <1, then the systemic effects are assumed not to be of concern; if the HQ is >1, then the systemic effects are assumed to be of concern. The HI is the sum of the HQs. The HI is calculated by summing HQs for each chemical across all exposure routes.

Hazard quotient (HQ): The ratio of the potential exposure to a substance and the level at which no adverse effects are expected. If the HQ is calculated to be <1, then no adverse health effects are expected as a result of exposure.

Injection well: A groundwater well designed to inject water into an aquifer.

Institutional control (IC): Nonengineered instruments such as administrative and legal controls that help to minimize the potential for exposure to contamination and/or to protect the integrity of a response action.

Interim action: Implemented before a final remedy selection designed to address risks to human health and the environment.

Model Toxics Control Act (MTCA): MTCA (RCW 70.105D, "Hazardous Waste Cleanup – Model Toxics Control Act" [also known as the *Washington Hazardous Waste Management Act*]), provides Washington State's standards and statutory requirements for addressing releases and threats of releases of hazardous substances into the environment. The standards and requirements established to implement MTCA are published in WAC 173-340, "Model Toxics Control Act—Cleanup."

"National Oil and Hazardous Substances Pollution Contingency Plan" (NCP): The NCP (40 CFR 300) provides the organizational structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants.

No action: Sites that can be released for unrestricted land use because they pose no unacceptable risk to human health and the environment. A no action alternative is required to be considered under CERCLA in making a remedial action selection.

Operable unit (OU): A discrete portion of the Hanford Site, as identified in Section 3.3 of Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*. An OU at the Hanford Site is a group of land disposal sites and/or contaminated groundwater grouped together for the purposes of performing an RI/FS and subsequent cleanup actions. The primary criteria for placement of a site into an OU include geographic proximity, similarity of waste characteristics and site type, and the possibility for economies of scale.

Picocurie (pCi): A unit of radioactivity equivalent to 1×10^{-12} Ci or 0.037 disintegrations per second.

Preferred alternative: The remedial action proposed after evaluating a range of viable alternatives. The preferred alternative must be protective of human health and the environment.

Preliminary remediation goal (PRG): PRGs are established during the FS, are based on readily available information (e.g., chemical specific ARARs or other reliable information), and are modified as additional information becomes available during the RI/FS process.

Proposed Plan: A document that briefly describes the remedial alternatives analyzed, proposes a preferred remedial action alternative, and summarizes the information relied upon to select the preferred alternative. The Proposed Plan provides the public with an opportunity to comment on the preferred alternative, as well as the other alternatives under consideration.

Pump and treat (P&T): The extraction of contaminated groundwater and treatment of contaminants with one or more of an assortment of technologies.

Record of Decision (ROD), or Interim Record of Decision (IROD): The CERCLA document used to select the method of remedial action to be implemented at a site after the FS/Proposed Plan process has been completed. An IROD is a ROD for an interim action.

Remedial action: An action performed to reduce potential harm to human health and the environment from radioactive or hazardous substances.

Remedial action objective (RAO): Specifies the contaminants and media of concern, potential exposure pathways, and remediation goals.

Remedial investigation (RI): A process to determine the nature and extent of the problem presented by releases or threats of releases of hazardous substances, including gathering sufficient information to determine the necessity for remedial action and to support evaluation of remedial alternatives.

Responsiveness summary: A summary that is made available with the IROD and contains the significant public comments received on the Proposed Plan and responses.

Remedial Design/Remedial Action Work Plan (RD/RAWP): A document that describes the remedy will be designed, installed, and operated to meet the RAOs identified in the IROD.

Tri-Parties: Three agencies are comprised of DOE, EPA, and Ecology.

Tri-Party Agreement: The Tri-Parties signed Ecology et al., 1989a, *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement), on May 15, 1989. The general purposes of the agreement are as follows: to ensure that environmental impacts are thoroughly investigated and appropriate response actions are taken as necessary to protect human health and the environment; to provide a framework for the permitting of treatment, storage, and disposal units; to ensure compliance with the *Resource Conservation and Recovery Act of 1976* (RCRA) and RCW 70.105D (*Washington Hazardous Waste Management Act*) for treatment, storage, and disposal units; to establish a procedural framework and schedule for developing, prioritizing, implementing,

and monitoring appropriate response actions at the Hanford Site in accordance with CERCLA, the NCP (40 CFR 300), Superfund guidance and policy, and RCRA guidance and policy; and to facilitate cooperation, exchange of information, and coordinate participation of the parties in such actions.

Vadose zone: The unsaturated soil between the land surface and the groundwater.

Waste management area (WMA): A group of tanks and associated components (ancillary equipment and miscellaneous small tank structures) grouped into farms that have been geographically grouped for regulatory purposes into WMAs.

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