U.S. Department of Energy
Hanford Site

20-SGD-0042 April 1, 2020

Mr. Mason Murphy, Interim Manager
Energy and Environmental Sciences Program
Confederated Tribes of the
Umatilla Indian Reservation
46411 Timine Way
Pendleton, Oregon 97801

Dear Mr. Murphy:

PROPOSED PLAN FOR INTERIM ACTION REMEDIATION OF THE 200-BP-5 AND 200-PO-1 OPERABLE UNITS, DOE/RL-2018-58, REVISION 0

The U.S. Department of Energy at Hanford (DOE), the Washington State Department of Ecology (Ecology), and the U.S. Environmental Protection Agency (EPA) are planning a cleanup decision for the 200-BP-5 and 200-PO-1 Operable Units on the Hanford Site, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act.

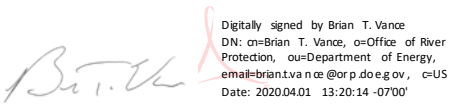
The 200-BP-5 and 200-PO-1 Groundwater Operable Units Feasibility Study for Interim Action, DOE/RL-2018-30, Revision 0, was submitted to Ecology and EPA (20-SGD-0029) on December 18, 2019. The Confederated Tribes of the Umatilla Indian Reservation was also provided a copy. The Proposed Plan for Interim Action Remediation of the 200-BP-5 and 200-PO-1 Operable Units, DOE/RL-2018-58, Revision 0, will be available for public comment May 4, 2020. Per our practice, we are providing your tribe an advance copy of the Proposed Plan 30 days in advance, for comment. We are working towards an interim cleanup decision, the Interim Record of Decision, during the 4th Quarter of Fiscal Year 2020.

Richland Operations Office
P.O. Box 550
Richland, Washington 99352

Office of River Protection
P.O. Box 450
Richland, Washington 99352

If you have any questions, please contact Greg Phillips, Tribal Affairs Program Manager, on (509) 372-0100.

Sincerely,



Brian T. Vance
Manager

SGD:NMJ

Attachment:
DOE/RL-2018-58, Revision 0

cc w/attach:
C. E. Cameron, EPA
C. S. Cearlock, CHPRC
D. R. Einan, EPA
N. M. Menard, Ecology
A. K. Smith, Ecology
K. R. Welsch, Ecology
Administrative Record (200-BP-5, 200-PO-1)
Environmental Portal

I

DOE/RL-2018-58
Revision 0

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

P.O. Box 550
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

DOE/RL-2018-58
Revision 0

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

Date Published
March 2020

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 6:36 am, Mar 31, 2020

Release Approval

Date

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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, Rev. 0

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

Public Comment Period
May 4 to
June 8, 2020

How You Can Participate:

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

Comment on this Proposed Plan by mail or email on or before June 8, 2020.

Paula Call, U.S. Department of Energy,
Richland Operations Office
P.O. Box 550, H5-20
Richland, WA 99352
Email: 200BP5PP@rl.gov

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

Inside this Plan

Introduction 1
Site Background 6
Site Characteristics 8
Scope and Role 13
Summary of Site Risks 13
Remedial Action Objectives 16
Summary of Remedial Alternatives 17
Evaluation of Remedial Alternatives 20
Preferred Remedial Alternative 25
Community Participation 27
Acronym List 28
Glossary 29
References/Bibliography 32

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-Party Agreement Agencies***[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).

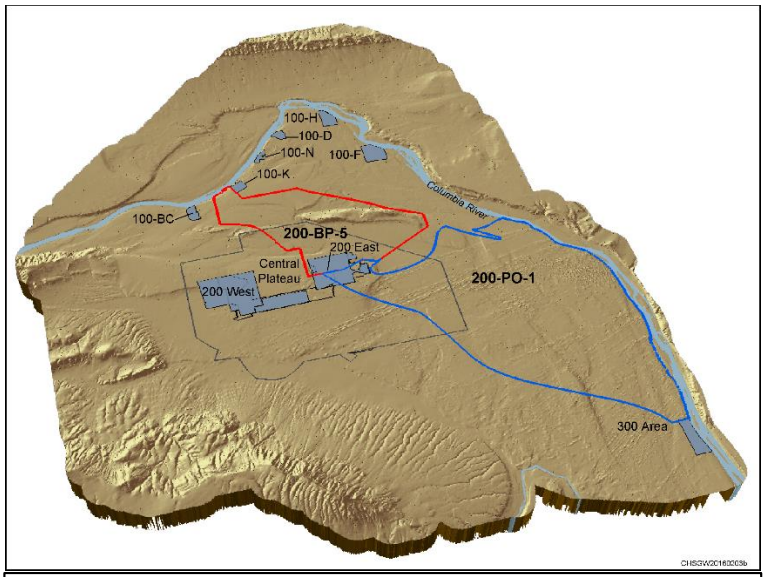


Figure 1. Location of the 200-BP-5 and 200-PO-1 Groundwater OUs at the Hanford Site

[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 and 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, an RI report has been prepared (DOE/RL-2009-127, *Remedial Investigation for the 200-BP-5 Groundwater Operable Unit*). For the 200-PO-l OU, an RI 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, ***Resource Conservation and Recovery Act*** **(RCRA)** Facility Investigation/Corrective Measures Study, or RCRA corrective action process.

Considering that the source investigations are not complete, the Tri-Party Agreement Agencies agree that the necessary information is not available to prepare an FS that supports a final (non-interim) ***Record of Decision (ROD)*** for the groundwater OUs. Therefore, the Tri-Party Agreement Agencies are pursuing an ***Interim Record of Decision (IROD)*** for the groundwater OUs to expedite the remediation of some groundwater contaminant plumes because they would pose a risk to human health and the environment if exposure were to occur, and coordinate with actions at C Farm. A final (non-interim) ROD for the 200 East Area groundwater OUs will be developed after contaminant sources are adequately characterized. This interim action would be consistent with and would not preclude or interfere with implementation of future remedial actions.

The 200-BP-5 RI, 200-PO-1 RI, and 200-PO-1 RI Addendum identified several contaminants in the groundwater with concentrations that exceed ***drinking water standards (DWS)***. Of these, uranium and technetium-99 warrant near-term interim action because they exhibit the following characteristics:

- The plumes are large and exhibit relatively high concentrations compared to DWS. The plumes constitute the majority of the mobile mass of uranium and technetium-99 in the 200-BP-5 and 200-PO-1 OUs.
- The B Complex[2] plume area, and the C Farm and A-AX Farms plume area contaminants are mobile, and the plumes are expanding downgradient from the source.
- 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***). Until the contributions of those overlying source areas to groundwater are adequately characterized and evaluated, they pose an uncertainty. This interim action addresses the existing groundwater plumes.
- The ***aquifer*** in the B Complex plume area, and C Farm and A-AX Farms plume area is highly ***transmissive***. Therefore, the targeted contaminant plumes are conducive to remediation by ***pump and treat (P&T)***.

In contrast to the B Complex, and C Farm and A-AX Farm plume areas, groundwater in the Gable Gap plume area is essentially stagnant, and contaminants in that plume, such as technetium-99, are not migrating. In addition, the Gable Gap technetium-99 plume does not have a continuing source. For these reasons, remediation of the Gable Gap technetium-99 plume does not have an immediate need for near-term action as seen for the B Complex and C Farm and A-AX Farm plume areas, outlined above. However, remediation of the Gable Gap plume area is included in one of the remedial alternatives (Alternative 3 – see below) as an optional efficiency measure while the 200 West P&T facility is operating for treatment of extracted groundwater.

Uranium and technetium-99 are the ***contaminants of concern (COCs)*** for this interim action, whereas the other groundwater contaminants exceeding DWS in the target remediation areas (e.g., tritium, I-129, nitrate, and cyanide) are identified as collocated or co-contaminants. While cleanup of co-contaminants is not the objective

[2] The B Complex consists of the B-BX-BY Farms and surrounding waste disposal facilities. The term "Farms" is used in this document to refer to single-shell tank farms used to store process waste.

of this interim action, co-contaminants in the target remediation areas for this interim action will be captured along with the COCs. Because this is a proposed interim action of limited scope that addresses two specific COCs in two or three 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 implemented. All contaminants identified in the three RI reports will be re-evaluated for inclusion in the final (non-interim) ROD.

The interim action alternatives developed and evaluated in DOE/RL-2018-30, Rev. 0, *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 uranium and technetium-99 contaminant plumes in the 200-BP-5 and 200-PO-1 OUs (Figure 2):

- B Complex plume area: uranium and technetium-99
- C Farm and A-AX Farms plume area: technetium-99
- Gable Gap plume area: technetium-99 (optional – see Summary of Remedial Alternatives, Alternative 3 below)

The two adjacent groundwater OUs, 200-BP-5 and 200-PO-1, were combined in this FS and Proposed Plan because they have similar contaminants and similar reasons for conducting interim remedial action, and because the C Farm and A-AX Farms plume area overlaps the boundary into both OUs.

A final ROD for these OUs will address contamination in groundwater and contributions from the vadose zone sources after the overlying source areas are adequately characterized. 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[3] in B Complex, C Farm and A-AX Farms, and Gable Gap plume areas, with ICs for groundwater

In the 200-BP-5 OU, groundwater contaminated with uranium and technetium-99 concentrations exceeding 10 times the DWS in the B Complex plume area is 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 of extracted water at the 200 West P&T, and injection of treated water in the 200 West Area. DOE/RL-2017-11, *Removal Action Work Plan for the 200-BP-5 Operable Unit Groundwater Extraction*, provides additional information on the 200-BP-5 OU removal action.

[3] While it is customary to consider alternatives comprising different remedial technologies, Alternatives 2 and 3 use the same technologies and differ only in scope. This is because it is well understood and demonstrated that P&T is the most viable approach for achieving contaminant cleanup levels in groundwater at the Hanford Site, such as that at the 200-BP-5 and 200-PO-1 OUs.

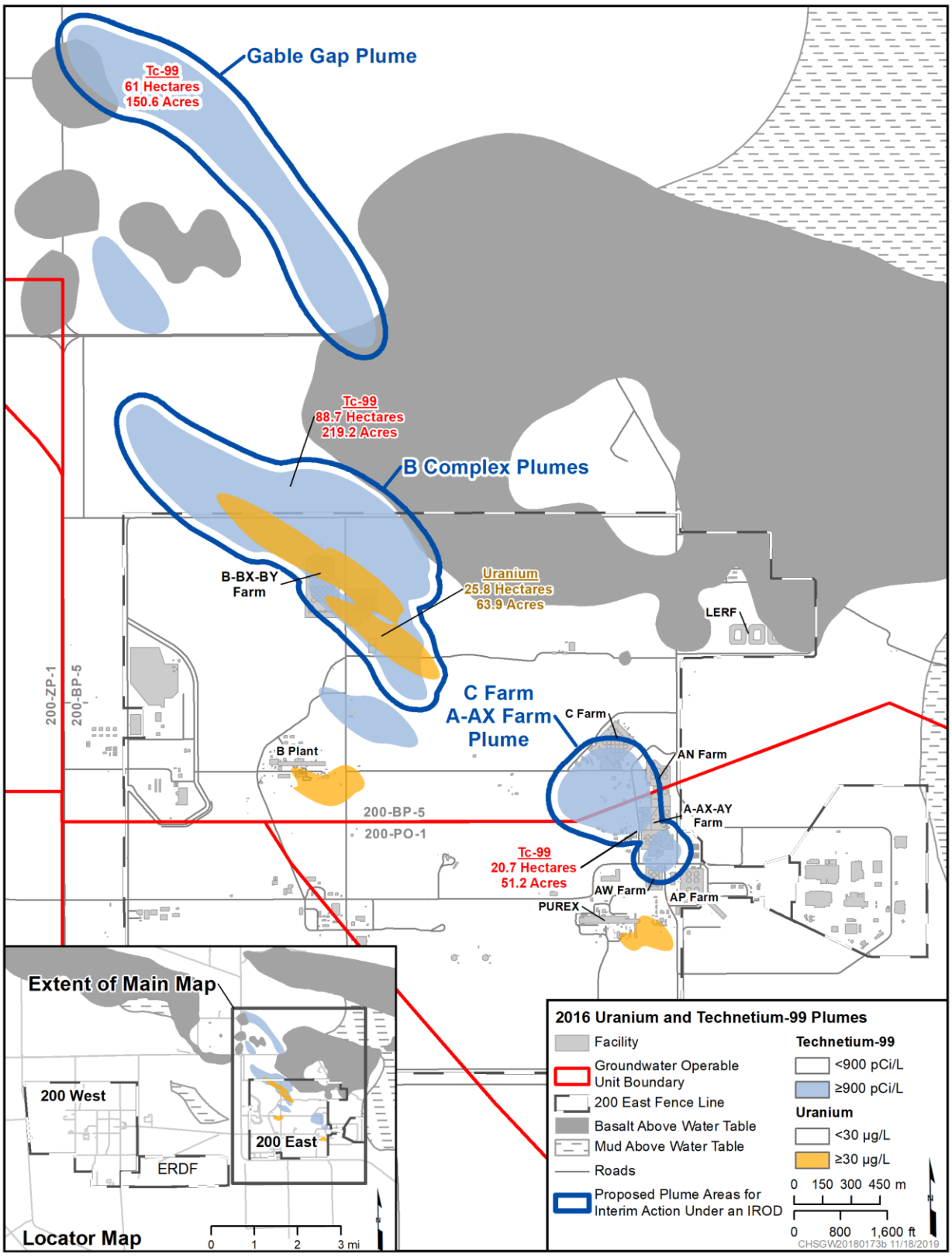


Figure 2. Uranium and Technetium-99 Plumes in the 200-BP-5 and 200-PO-1 OUs

Alternatives 2 and 3 incorporate the current B Complex P&T system under the removal action and change the groundwater cleanup level from 10 times the DWS to the DWS for both uranium and technetium-99 in the B Complex plume area. Alternatives 2 and 3 expand the P&T system in the B Complex plume area and add P&T in the C Farm and A-AX Farms plume area. Alternative 3 adds P&T in the Gable Gap plume area. The interim action cleanup levels for uranium and technetium-99 in the targeted areas addressed by the alternatives will meet DWS. Tribal Nations and public input on this Proposed Plan will help the Tri-Party Agreement Agencies select an alternative for interim action cleanup of the target uranium and technetium-99 contamination in the 200-BP-5 and 200-PO-1 OUs. Following consideration of Tribal Nations and public input on this Proposed Plan, an IROD will be prepared by EPA and Ecology. 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 and 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 and 200-PO-1 OU record index is available at https://pdw.hanford.gov/document/AR-03624.

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 and 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.

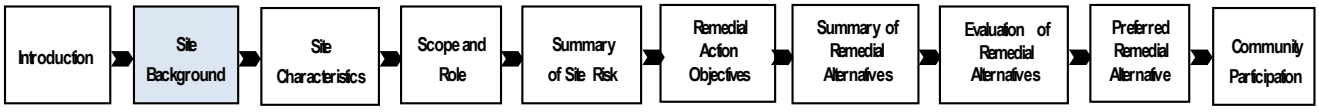
The preferred alternative meets the statutory requirements under CERCLA and the NCP (40 CFR 300) to select remedies that are protective of human health and the environment and comply with ***applicable or relevant and appropriate requirements (ARARs)***, are cost effective, and use permanent solutions 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(9)). 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, previous cleanup 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.
- **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.

From this point forward, 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 1,500 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 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 from the inception of plutonium-production activities in the 1940s until the 1990s. Liquid (e.g., cooling water and steam condensate) was discharged to open ditches and ponds, while low-level radiologically and chemically contaminated process waste was discharged to cribs and trenches. The liquid discharged to surface ponds (e.g., B Pond), cribs, and trenches was allowed to infiltrate into the soil. Mixed radioactive and hazardous 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 of contamination in the vadose zone that are 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 and the A/AX Farms overlying the 200-PO-1 OU.

Investigations

The RI reports were conducted for the 200-BP-5 and 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 an 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). These RI efforts focused on characterization of groundwater; continuing sources of contamination to groundwater from the vadose zone have not been adequately 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 amount of time required for existing groundwater contaminant concentrations to decrease to DWS is 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 area) in the 200-PO-1 OU. The RI reports for both groundwater OUs concluded that there is a basis for a remedial action and 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 DWS; (2) the Tri-Party Agreement Agencies decide to terminate the removal action; or (3) the removal action is superseded by a remedial action.

The Tri-Party Agreement Agencies recommendation to pursue an IROD for the 200-BP-5 and 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 and 200-PO-1 OUs is to expedite the remediation of some groundwater contaminant plumes and coordinate with actions at C Farm. This IROD would supersede the removal action discussed above.

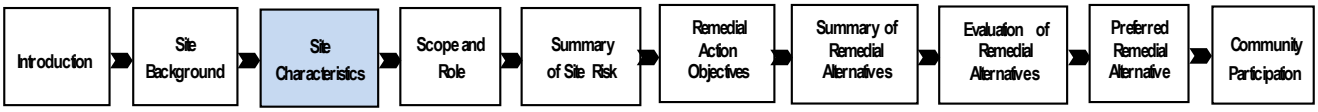
Previous Public Participation

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*, which supports previous cleanup decisions discussed above.

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 on the FS for interim action (DOE/RL-2018-30). These comments have been considered in the development of each of the documents.



Site Characteristics

This section presents information on surface features overlying the 200-BP-5 and 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 and 200-PO-1 OUs in the Central Plateau include B Plant, B Complex, PUREX Plant, C Farm, A-AX Farms, and roads (Figure 2). The B Complex consists of the B-BX-BY Farms and associated crib and trench disposal sites. The B-BX-BY Farms, C Farm, and A-AX Farms consist of a series of single-shell underground storage tanks used to store mixed radioactive and hazardous reprocessing 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 reasonably anticipated future land use because these areas will be used for ongoing waste management operations and infrastructure services.

Groundwater in the 200-BP-5 and 200-PO-1 OUs is not currently used as a drinking water source, 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 has the nearest water intake downstream from 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 DWS (maximum contaminant levels), as required by the *Safe Drinking Water Act of 1974*.

Physical Features Influencing Remedy Selection

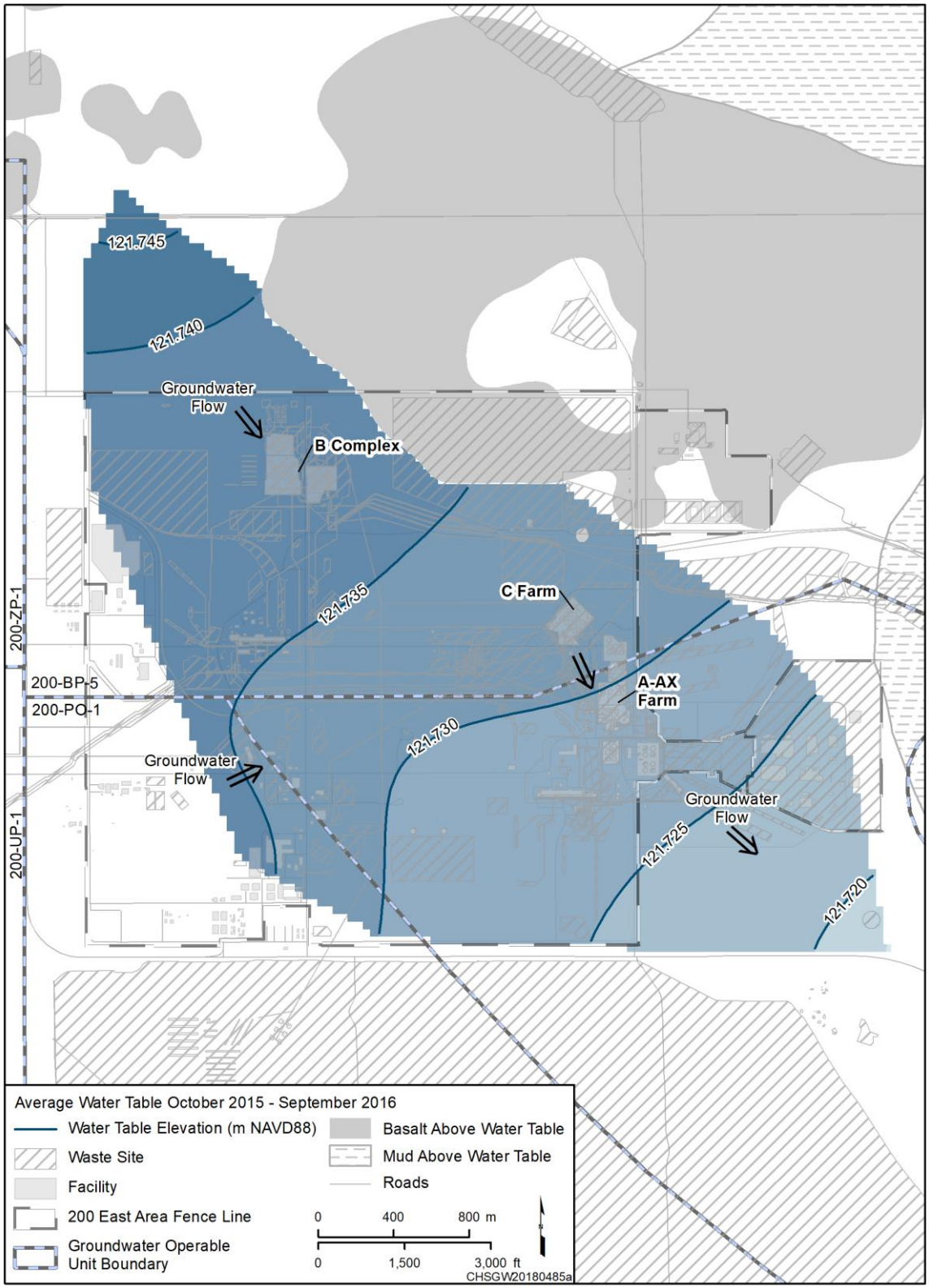
Groundwater conditions in the 200-BP-5 and 200-PO-1 OUs include unconfined, semiconfined, and confined aquifers. Groundwater contamination is largely within the uppermost unconfined aquifer associated with the suprabasalt sediment of the Ringold Formation, Cold Creek unit, and Hanford formation. Depths 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 (17 ft) along the southern boundary. The unconfined aquifer thickness in the C Farm and A-AX Farms plume area is interpreted to vary from 9 to 16 m (30 to 55 ft). The aquifer thickness in 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 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 and 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 in 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).

Groundwater Contamination

The RI reports identified groundwater contaminants near the 200 East Area of the 200-BP-5 and 200-PO-1 OUs with concentrations exceeding federal and state DWS, including uranium, technetium-99, cyanide, nitrate, iodine-129, tritium, and strontium-90 (Figure 4) (further discussion of contaminants is provided in the Summary of Site Risks section). Uranium and technetium-99 are the COCs targeted for cleanup under this interim action. Other contaminants with concentrations above the DWS in the three target remediation areas 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 concentrations 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 at the B Complex and C Farm and A-AX Farms plume areas (however, the Gable Gap plume area does not have a 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. Extracted groundwater generated by this interim action will be treated at the existing 200 West P&T facility so that the treated effluent will meet the current effluent quality requirements.



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)

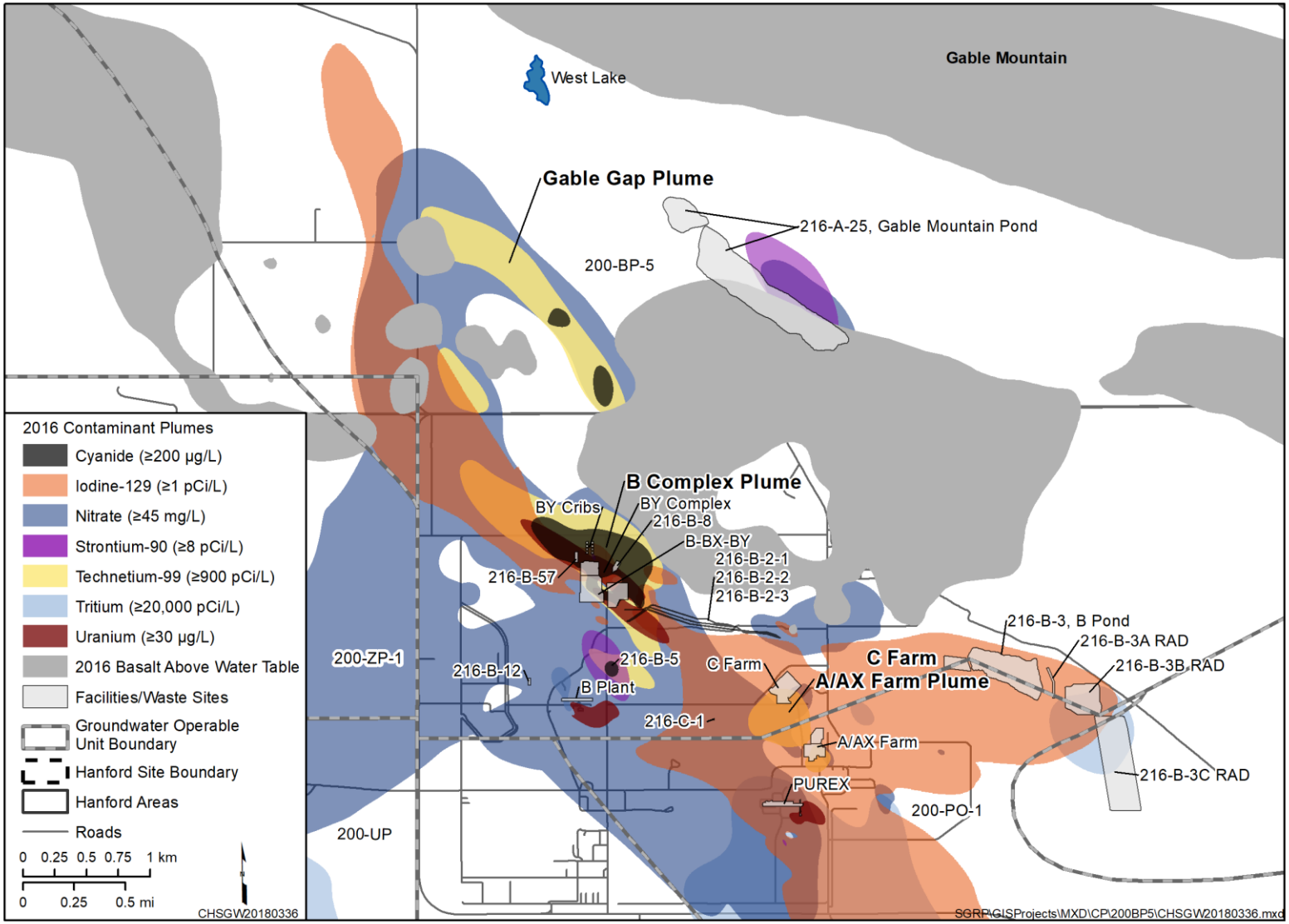


Figure 4. Groundwater Contaminant Plumes Exceeding DWS near the 200 East Area Within the 200-BP-5 and 200-PO-1 OUs

Uranium and Technetium-99. Uranium and technetium-99 are 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 of 30 µg/L for uranium and the DWS equivalent of 900 ***picocuries*** per liter (pCi/L)[4] 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 the uranium remediation portion 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 (1) below the B Complex, extending northwest and southeast; (2) north of the B Complex, extending northwest to Gable Gap; and (3) below C Farm, extending southeast to the A-AX Farms (Figure 4).

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

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[5] is largely commingled with the uranium and technetium-99 groundwater plumes in the B Complex and Gable Gap areas of the 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.

Tritium was a product of reactor enrichment and was disposed to the cribs in the 200 East Area as liquid waste water from various processes including decladding operations, process condensate, and in-tank solidification. The highest tritium concentrations were associated with process condensate, where the tritiated water was evaporated either within the separation plants or within the single-shell tanks. In the 200 East Area, tritium concentrations exceed the 20,000 pCi/L DWS underlying the B Complex and underlying the PUREX Cribs.

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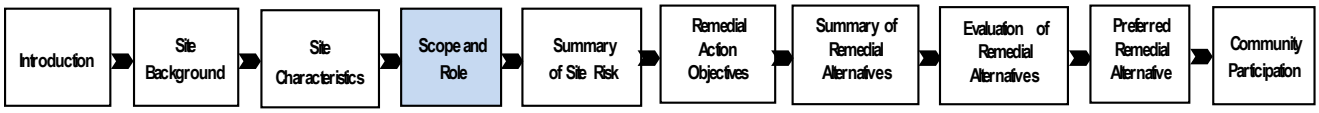
[4] EPA has established a maximum contaminant level of 4 millirems (mrem)/yr for beta particle and photon radioactivity from manmade radionuclides, such as technetium-99, in drinking water. The average concentration of technetium-99 at 4 mrem/yr is 900 pCi/L.

[5] 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^-).



Scope and Role

This Proposed Plan for interim action addresses specific COC plume areas within the 200-BP-5 and 200-PO-1 OUs that merit near-term action:

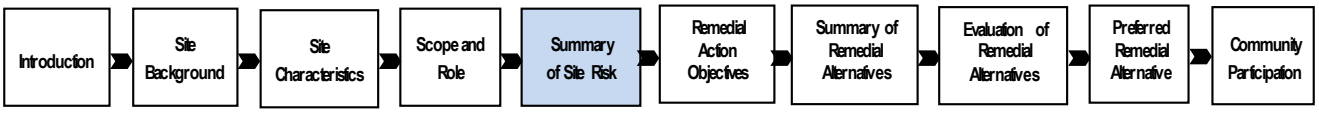
- B Complex plume area: uranium and technetium-99
- C Farm and A-AX Farms plume area: technetium-99
- Gable Gap plume area: technetium-99 (optional – see Summary of Remedial Alternatives, Alternative 3 below)

The role of the 200-BP-5 and 200-PO-1 OU 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.

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.



Summary of Site Risks

Baseline risk assessments identify and characterize the actual and potential risks that a site poses to human health or the environment if no action were taken at the site. They provide the basis for a response action under CERCLA. 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-Party Agreement Agencies' 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 and 200-PO-1 OUs is currently contaminated above DWS, and groundwater use is restricted through site controls to limited research purposes and for monitoring and treatment.

Groundwater Human Health Risk Assessment

The BRAs for the 200-BP-5 and 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) 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 26-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. Thus, the threshold for determining if a contaminant warrants evaluation of remedial alternatives is 1×10^{-4} for cancer risks or an HI >1 for noncancer hazards. If the contaminant exceeds these thresholds, contaminants in waters must be remediated to the acceptable target risk level, which is 1×10^{-6} for carcinogens or an HQ of ≤1 for noncarcinogens.

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 and 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, and sulfate concentrations exceeding DWS within the target remediation areas are largely limited to areas beneath and emanating from the overlying source waste sites. Of these, sulfate exceeds only the secondary DWS and was developed for esthetic considerations (e.g., taste, odor, or color) rather than for protection of human health. The other COPCs are even more limited in distribution, with detection above DWS limited to one or 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 above the MCL.

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 concentrations 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; and (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 area, and Gable Gap plume area (evaluated in the BRA as part of the WMA B-BX-BY Farms exposure area), and the HQ for uranium is >1 in the B Complex plume area (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} to 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 and 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 and 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; and Gable Gap Tc-99 plume area	6.0×10^{-4}	4.2
WMA C Farm	C Farm and A-AX Farms Tc-99 plume area	3.1×10^{-4}	0.43
200-PO-1 Groundwater OU			
WMA A-AX Farms*	C Farm and A-AX Farms Tc-99 plume area	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 three RAOs developed for the 200-BP-5 and 200-PO-1 OU interim action are as follows:

- **RAO #1:** Capture and remove the target COCs (uranium and technetium-99) from selected groundwater plumes, thereby preventing further migration.
- **RAO #2:** Reduce concentrations of target COCs in selected groundwater plumes to DWS, supporting restoration to beneficial use.
- **RAO #3:** Prevent exposure and protect human health until compliance with DWS for the target COCs is attained.

As discussed in the Scope and Role section, the target plume areas for this interim action focus on two or three select areas and two target COCs as shown in Figure 2.

While routine groundwater monitoring of COCs and COPCs as identified in the 200-BP-5 and 200-PO-1 OU sampling and analysis plans (SAPs) is not part of the interim action, this monitoring will continue pursuant to the existing SAPs and any future SAP 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. Table 2 identifies the PRGs that represent the cleanup levels to be achieved by each of the alternatives (except the No Action alternative). The PRGs for the COCs apply to concentrations in groundwater when the interim action is complete. For remedial alternatives involving groundwater P&T (i.e., Alternatives 2 and 3; see Summary of Remedial Alternatives section), treated groundwater will meet the current effluent quality requirements for the 200 West P&T facility. 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 remedial design/remedial action work plan (RD/RAWP).

Table 2. 200-BP-5 and 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,

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

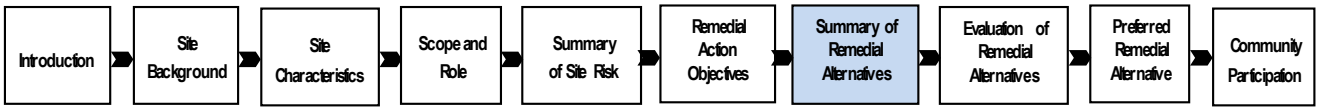
Target COCs for the Interim Action	Units	Exposure Point Concentrations[a]		Federal DWS[b]	MTCA Method B Preliminary Remediation Goal		200-BP-5 and 200-PO-1 PRGs[c]
		200-BP-5 OU	200-PO-1 OU		Noncarcinogens at HQ = 1	Carcinogens at 1×10^{-5} Risk Level	

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 $<1\times10^{-6}$ 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 and 200-PO-1 OU interim action were developed in the FS for interim action (DOE/RL-2018-30) based on the RAOs, PRGs, and technology screening results. The alternatives that were developed and evaluated in the 200-BP-5 and 200-PO-1 OU 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 area, with ICs for Groundwater
- Alternative 3 – P&T at B Complex plume area, C Farm and A-AX Farms plume area, 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 and 200-PO-1 OU FS for interim action (Chapter 5 and Appendix A of DOE/RL-2018-30). 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 using ***95% upper confidence limit (95% UCL)*** concentrations, and assuming no continuing contaminant source. The predicted cleanup times are rounded 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

P&T 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 (see Figure 5) and to support the detailed individual and comparative evaluations for each alternative. Cost details are provided in the 200-BP-5 and 200-PO-1 OU 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 response activities (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 area would require more than 65 years to attenuate to concentrations less than DWS, and that the technetium-99 plume in the Gable Gap plume area is predicted to take 800 years for concentrations to attenuate below the DWS. The No Action 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 Area, with ICs for Groundwater

Alternative 2 includes up to 25 years of P&T to capture and remove uranium and technetium-99 from groundwater in the B Complex plume area, and up to 10 years of P&T to capture and remove technetium-99 from groundwater in the C Farm and A-AX Farms plume area.[6] The duration of P&T operations may be extended if vadose zone contamination continues to contribute to groundwater contamination exceeding cleanup levels. This alternative also includes ICs to prevent exposure to contaminated groundwater until cleanup levels are achieved. This alternative does not include

Alternative 2

Estimated capital cost: *$17 million*

Estimated O&M and periodic cost: *$118 million*

Estimated total present value (discounted): *$124 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 area: *10 years*

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

[6] Although fate and transport modeling projects a cleanup time of 28 years for uranium in the B Complex plume area 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 using a more refined model with a smaller grid size and by optimizing groundwater extraction pumping rates during the interim action.

treatment of the Gable Gap plume area. Technetium-99 in the Gable Gap plume area is estimated to take 800 years for concentrations to attenuate below the DWS. A final ROD would address groundwater contamination in the Gable Gap plume area if Alternative 3 is not selected in the IROD.

The groundwater extraction system under Alternative 2 assumes two existing[7] 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 379 L/min (100 gal/min), respectively. The total Alternative 2 pumping rate is approximately 1,136 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 via the two existing cross-site pipelines. The extracted groundwater associated with this alternative would be treated for removal of uranium and technetium-99 in a new ion exchange (IX) system constructed at the 200 West P&T. After IX treatment, this water would be injected with other 200 West P&T effluent. Prior to injection the combined effluent will meet the current effluent quality requirements for the 200 West P&T.

The Alternative 2 effluent flow would be injected into the underlying 200 West Area aquifer. The existing injection system would be expanded to include three new ***injection wells*** to accommodate the increased flow rate. Final design details will be identified in the interim RD/RAWP, if selected. Impacts to the 200 West Area aquifer from this additional injection flow are expected to be minimal.

Other 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 Area, and Gable Gap Plume Area, with ICs for Groundwater

Alternative 3 is similar to Alternative 2 but adds P&T for the Gable Gap plume area. P&T in the Gable Gap plume area is included in Alternative 3 as an optional efficiency measure while the 200 West P&T facility is operating. The Gable Gap plume area has no continuing source and the technetium-99 plume is not expanding (i.e., it is stagnant).

This alternative includes up to 25 years of P&T to capture and remove uranium and technetium-99 from groundwater in the B Complex plume area, and up to 10 years of P&T to capture and remove technetium-99 from groundwater in the C Farm and A-AX Farms plume area and the Gable Gap plume area. This alternative also includes ICs to prevent exposure to contaminated groundwater until cleanup levels are achieved.

Alternative 3

Estimated capital cost: *$29 million*

Estimated O&M and periodic cost: *$140 million*

Estimated present value (discounted): *$159 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 area: *10 years*

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

Note: This alternative includes P&T of the Gable Gap plume area as an efficiency measure while the 200 West P&T facility is operating.

[7] Alternatives 2 and 3 supersede and incorporate the current B Complex P&T system under the removal action as part of the larger P&T systems under the two alternatives.

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 area, and one new extraction well in the Gable Gap plume area. The total extraction rates in the B Complex, C Farm and A-AX Farms, and Gable Gap plume areas 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 1,515 L/min (400 gal/min). If selected, final design details will be identified in the interim RD/RAWP.

Extracted groundwater is conveyed to the existing 200 West P&T for treatment via the two existing cross-site pipelines. As in Alternative 2, the extracted groundwater associated with Alternative 3 would be treated for removal of uranium and technetium-99 in a new IX system constructed at the 200 West P&T. After IX treatment, this water would be injected with other 200 West P&T effluent. The combined effluent will comply with the current effluent quality criteria for the 200 West P&T.

After treatment, approximately 1,136 L/min (300 gal/min) of the Alternative 3 effluent flow would be injected in the 200 West Area, as in Alternative 2, while the remaining approximately 379 L/min (100 gal/min) of the Alternative 3 effluent flow would be injected in the Gable Gap plume area to create the hydraulic gradient needed to move the water toward the extraction well (because the plume is stagnant). Injection in the 200 West Area assumes a combination of the existing injection wells and three new injection wells to accommodate the additional flow. The flow injected into the 200 West Area would be the same as in Alternative 2, and impacts to the 200 West Area aquifer from this additional injection flow are expected to be minimal. Injection in the Gable Gap plume area would require a new transfer station, a new effluent cross-site pipeline, and two new injection wells. Injection of treated water in the Gable Gap plume area would meet applicable requirements. Final design details will also be identified in the interim RD/RAWP, if selected.

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

Introduction | Site Background | Site Characteristics | Scope and Role | Summary of Site Risk | Remedial Action Objectives | Summary of Remedial Alternatives | Evaluation of Remedial Alternatives | Preferred Remedial Alternative | Community Participation

Evaluation of Remedial Alternatives

As part of the FS for interim action, the Tri-Party Agreement Agencies 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-Party Agreement Agencies 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 and 200-PO-1 OU 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-Party Agreement Agencies 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.

CERCLA Evaluation Criteria

THRESHOLD CRITERIA

Threshold criteria mean that only those remedial alternatives that provide adequate protection of human health and the environment and comply with ARARs are eligible for selection:

1. **Overall Protection of Human Health and the Environment** is the primary objective of the remedial action and determines whether an alternative provides adequate overall protection of human health and the environment. This criterion must be met for all remedial actions.

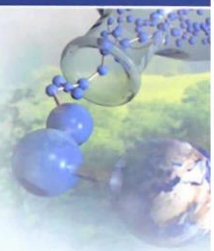
2. **Compliance with Applicable or Relevant and Appropriate Requirements** addresses whether an alternative meets federal and state statutes or provides grounds for a waiver. This criterion must be met for a remedial alternative to be eligible for consideration.

BALANCING CRITERIA

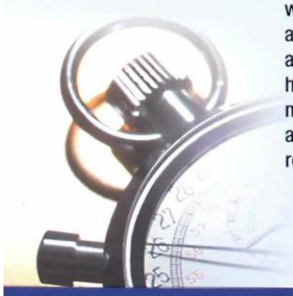
Balancing criteria help describe technical and cost trade-offs among the various remedial alternatives:

3. **Long-Term Effectiveness and Permanence** refers to the ability of a remedy to protect human health and the environment over time, after remedial action objectives have been met.

4. **Reduction of Toxicity, Mobility, or Volume through Treatment** means the alternative is evaluated for its ability to reduce the toxicity, mobility, and volume of the hazards at a site.



5. **Short-Term Effectiveness** refers to an evaluation of the speed with which the remedy can be successful and also takes into consideration any adverse impacts on human health and the environment that may result during the construction and implementation phase of the remedial action.



6. **Implementability** refers to the technical and administrative feasibility of a remedial action, including the availability of materials and services needed to implement the selection.

7. **Cost** refers to an evaluation of the costs of each alternative.

MODIFYING CRITERIA

Modifying criteria can only be considered after public comment is received on the proposed remedy:

8. **State Acceptance** indicates whether the state concurs with, opposes, or has no comment on the proposed remedial action.

9. **Community Acceptance** assesses the public response to the proposed remedial action. Although public comment is an important part of the decision-making process, EPA is required by law to balance community concerns with the above criteria.

Figure 5. CERCLA Evaluation Criteria Under the NCP

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

Threshold Criteria

Overall Protection of Human Health and the Environment. The NCP requires consideration of a No Action alternative, which serves as a baseline for comparing other remedial alternatives. 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 on developing ARARs. 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 (No Action) does not require action and, therefore, ARARs are not implicated. Alternatives 2 and 3 would comply with ARARs.

Section 3.2 of the FS for Interim Action (DOE/RL-2018-30) contains a detailed discussion on how the ARARs evaluation process is conducted through the remedial action process in accordance with the NCP (40 CFR 300.430[f][1][ii][B][2]). Table 3-1 in the FS for Interim Action report lists all of the potential federal and Washington State ARARs for these remedial actions. The ARARs will be finalized as part of the IROD.

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 residual risk 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 area, Alternatives 2 and 3 provide comparable long-term effectiveness and permanence. However, the duration of P&T operations in the B Complex 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 address principal threats.

Table 3. Comparative Evaluation of Remedial Alternatives

Criterion	Alternative 1 – No Action	Alternative 2 – P&T at B Complex Plume Area and C Farm and A-AX Farms Plume Area	Alternative 3 – P&T at B Complex, C Farm and A-AX Farms, and Gable Gap Plume Areas
Threshold Criteria			
Protects human health and the environment	No	Yes	Yes
Complies with applicable or relevant and appropriate requirements	No	Yes	Yes
Balancing Criteria			
Long-term effectiveness and permanence	Not evaluated	Alternative 3 provides greater reduction in the magnitude of residual risk than Alternative 2, because it mitigates the risk associated with technetium-99 in the Gable Gap plume area, whereas Alternative 2 does not. Uncertainties associated with continuing sources and residual co-contaminants are the same between Alternatives 2 and 3 (there is no known continuing source in Gable Gap).	
Reduction of toxicity, mobility, or volume through treatment	Not evaluated	Alternative 3 achieves greater reduction of toxicity, mobility, or volume than Alternative 2, because it remediates the contaminant mass and contaminated groundwater volume in Gable Gap, whereas Alternative 2 does not. However, the incremental amount of technetium-99 activity removed by Alternative 3, compared to Alternative 2, is predicted to be only 0.8 Ci.	
Short-term effectiveness	Not evaluated	Alternative 3 yields shorter predicted cleanup times for uranium (6 years shorter) and, to a lesser degree, technetium-99 (2 years shorter) in the B Complex area (due to the beneficial hydraulic effect of injection in the Gable Gap area). Alternative 2 has lower risks for site workers and environmental impacts (such as habitat destruction) than Alternative 3, because of its smaller scope (e.g., less new infrastructure construction, less area involved, more confined to the 200 East Area, less operating equipment, less water conveyed and treated).	
Implementability	Not evaluated	Alternatives 2 and 3 are both implementable. Both use proven technologies that are widely used at the Hanford Site. Technical and administrative issues are likely to be minimal. Due to its greater complexity, Alternative 3 poses a higher potential for difficulties, uncertainties, and technical problems associated with construction and operation. Implementation of Alternatives 2 and 3 would not preclude or interfere with future additional remedial actions, if necessary.	
Cost			
Total present value cost	$0	$124,000,000	$159,000,000
Total present value cost range:			
−30%	$0	$87,000,000	$111,000,000
+50%	$0	$186,000,000	$238,000,000
Modifying Criteria			
State and community acceptance	To be evaluated following issuance of the Proposed Plan.		

P&T = pump and treat

Alternative 3 results in greater TMV reduction in terms of contaminant mass and contaminated groundwater volume remediated because it addresses technetium-99 in the Gable Gap plume area, whereas Alternative 2 does not. However, the incremental amount of technetium-99 removed by Alternative 3 via treatment, compared to Alternative 2, is predicted to be only 0.8 Ci, compared to the 6.4 and 3.0 Ci predicted to be removed from the B Complex and C Farm and A-AX Farm areas, respectively, under both alternatives[8]. Although true destruction of elements such as uranium and technetium-99 through treatment is not possible, removal from the aquifer is possible via groundwater extraction, treatment of extracted groundwater by IX, and placement of spent IX resin in an engineered disposal facility.

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.

Alternative 3 is predicted to result in a shorter cleanup time than Alternative 2 for uranium (22 versus 28 years), and, to a lesser extent, technetium-99 (5 versus 7 years) in the B Complex plume area, assuming no continuing source, due to the beneficial hydraulic effect of injection in the Gable Gap area. Predicted cleanup times for technetium-99 in the C Farm and A-AX Farms plume area are the same for the two alternatives. However, the duration of P&T operations in the B Complex 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 3 achieves cleanup levels in 10 years for technetium-99 in the Gable Gap area, whereas Alternative 2 does not address remediation of the Gable Gap plume area.

Alternative 3 involves additional remediation for the Gable Gap plume area, which leads to greater potential for impacts to workers and the environment, such as habitat destruction, than Alternative 2 due to more extensive remediation system construction and operation.

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 mature technologies that are well-proven, readily available, and widely used at the Hanford Site. Technical and administrative impediments to implementation of either alternative are considered minimal. Due to the greater complexity of Alternative 3, including a new cross-site pipeline, transfer station, and need to pump water across long pipe runs, it may pose more difficulties, uncertainties, and likelihood of technical problems associated with construction and operation than Alternative 2.

Cost. The estimated ***total present value*** cost of Alternative 2 ($124 million) is $35 million less than the estimated total present value cost of Alternative 3 ($159 million). Thus, on a total net value cost basis, the estimated cost of Alternative 3 is approximately 28% 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*.

[8] Alternative 3 is predicted to result in an estimated reduction in technetium-99 of 1.2 Ci in the Gable Gap plume area. This predicted reduction includes that removed via groundwater extraction and treatment, and the reduction in concentrations below DWS due to natural attenuation mechanisms (e.g., advection, dilution/dispersion). Alternative 2 is predicted to result in a reduction in technetium-99 of 0.4 Ci in the Gable Gap plume area, all of which is due to natural attenuation (no treatment). The difference in predicted Tc-99 removal between Alternative 3 and Alternative 2, approximately 0.8 Ci, is the incremental amount removed by Alternative 3 via treatment. For comparison, the amount of technetium-99 activity removal predicted for the B Complex and the C Farm and A-AX Farms plumes under Alternatives 2 and 3 are 6.4 Ci and 3.0 Ci, respectively.

The original basis for considering P&T for the Gable Gap plume under Alternative 3 was as an efficiency measure, to allow groundwater extracted from the Gable Gap area to be treated at the 200 West P&T facility while it is operating. The objective was to determine the incremental cost and effort of adding P&T in Gable Gap to the interim remedial activities planned for the B Complex and C Farm and A-AX Farms plume areas. The incremental cost and effort associated with Alternative 3 beyond that identified in Alternative 2, outweighs the efficiency that would be realized by remediating the Gable Gap plume area in the near-term while the 200 West P&T facility is operating, and it is possible that the P&T facility could be operated longer if needed. The estimated additional contaminant mass/activity achieved for this incremental cost, by Alternative 3 compared to Alternative 2, is only about 0.8 Ci. The Gable Gap plume has no continuing source and is relatively stable. Consequently, remediation of the Gable Gap plume area as part of this interim action may not be warranted; however, it would be addressed as part of a future (e.g., final) remedial action.

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.

Introduction | Site Background | Site Characteristics | Scope and Role | Summary of Site Risk | Remedial Action Objectives | Summary of Remedial Alternatives | Evaluation of Remedial Alternatives | Preferred Remedial Alternative | Community Participation

Preferred Remedial Alternative

Under this interim remedial action, the preferred alternative is Alternative 2 – P&T in the B Complex plume area, and C Farm and A-AX Farms plume area, 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 balancing 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. The duration of P&T operations in the B Complex 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 the objective of 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 capturing and removing contaminants to prevent migration and by maintaining ICs to prevent exposure to groundwater until DWS are achieved or a final ROD is in place. Implementation includes construction of additional extraction wells, treatment facility upgrades, construction of new injection wells and pipelines, and transfer station modifications. 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 area 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. If selected, 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 and the C Farm and A-AX Farms plume areas. Alternative 3 offers advantages with respect to these criteria because it addresses the Gable Gap technetium-99 plume area, whereas

Alternative 2 does not. However, the incremental amount of contaminant mass removed by Alternative 3, compared to Alternative 2, does not justify the incremental cost. Without remedial action, the technetium-99 in the Gable Gap plume area would take 800 years to reach cleanup levels; however, a future (e.g., final) remedial action will address this contamination. Fate and transport modeling indicates that the Gable Gap technetium-99 plume will not expand nor migrate under Alternative 2, and there is no continuing source of technetium-99 in that area.

Alternatives 2 and 3 are both implementable, in terms of technical and administrative feasibility.

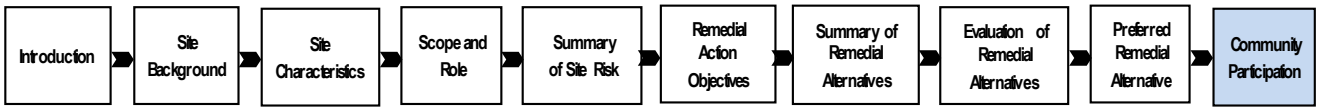
With respect to the short-term effectiveness, Alternative 3 is predicted to take less time than Alternative 2 to remediate uranium (6 years less) and technetium-99 (2 years less) in the B Complex plume area, whereas the cleanup times for technetium-99 in the C Farm and A-AX Farms plume area would be the same. The remediation timeframe in either of those areas could be extended, if needed, to account for contaminants released from the continuing sources. Alternative 3 involves a larger remediation footprint, leading to greater potential for impacts to workers and the environment (e.g., habitat destruction) 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 as a result of 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 (Alternative 3) is not preferred at this time because (1) the plume is not expanding; (2) there is no continuing contaminant source; (3) there is no current exposure; (4) although it would result in a lower magnitude of residual risk and provide greater removal of toxicity, mobility, or volume through treatment, the predicted incremental amount of technetium-99 that would be removed from the Gable Gap plume area does not justify the incremental cost difference between the two alternatives; (5) Alternative 3 would increase the potential for impacts to the environment and workers; and (6) the incremental cost of Alternative 3 compared to Alternative 2 outweighs the potential efficiency of remediating the Gable Gap plume in the near-term while the 200 West P&T facility is operating (and operation could be extended if needed). Because the Gable Gap technetium-99 plume is stagnant, there would be no increase in risk if remediation of the Gable Gap plume area were left for a future (e.g., final) remedial action. The description and components of the Gable Gap remedy may be useful for a future remedial decision.

In addition, a final ROD would address future contamination in groundwater from the vadose zone sources after the overlying source areas are adequately characterized to determine future risk to groundwater.



Community Participation

Public input is a key element in the 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 and 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 May 4, 2020 through June 8, 2020. Comments on the preferred alternatives, other alternatives, or any element of this Proposed Plan or support information will be accepted through June 8, 2020. Please send comments to the following:

Mail: Jennifer Colborn
U.S. Department of Energy, Richland Operations Office
P.O. Box 550, MSIN H6-60
Richland, WA 99352

Email: 200BP5PP@rl.gov

To request a meeting in your area, please contact Jenifer Colborn at 509-376-5840 by May 22, 2020.

After the public comment period, the Tri-Party Agreement Agencies will consider the comments received regarding this Proposed Plan and the information gathered during the comment period and issue a Responsiveness Summary together with the IROD.

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

95% UCL	95 percent upper confidence limit
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(s)
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
SAP	sampling and analysis plan
TMV	toxicity, mobility, or volume
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
Tri-Party Agreement Agencies	U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology
WMA	waste management area

Glossary

95% Upper Confidence Limit (95% UCL): A term used to estimate the exposure point concentrations for contaminants. The calculation of this value provides 95% confidence that the mean concentration will be lower than the 95% UCL.

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.

Aquifer: One or more strata of rock or sediment that is saturated and sufficiently permeable to yield economically significant quantities of water to wells or springs. An aquifer includes any geologic material that is currently used or could be used as a source of water (for drinking or other purposes).

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.

Capital costs: Expenditures required to construct a remedial action. They are exclusive of costs required to operate or maintain the 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(s) (DWS): The maximum allowable concentration of a chemical or radionuclide constituent in drinking water that is protective of human health. The DWS, 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): Non-engineered 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: A no action alternative is required to be considered as a baseline under CERCLA in evaluating other remedial alternatives . No active remedial measures would be implemented and risk levels would be reduced through radioactive decay or other natural processes.

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 CERCLA 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.

Operations and maintenance (O&M): Post-construction costs necessary to ensure continued effectiveness of a remedial action. Includes both short-term O&M and long-term O&M costs. Most O&M costs are estimated on an annual basis.

Periodic costs: Capital or O&M costs that occur only once every few years or only once during the entire project timeframe. Because of their periodic nature, these costs are usually considered separately in the estimating process from initial capital or annual O&M costs.

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.

***Resource Conservation and Recovery Act* (RCRA):** It is the federal law that regulates the management of hazardous waste, non-hazardous wastes, medical wastes, and underground storage tanks.

Total present value: The total present value of a future investment or payment that is calculated using a particular discount or interest rate. Total present value is the amount of money, which, if invested in the current year, would be sufficient to cover all the costs over time associated with a project.

Transmissive: Transmissivity (T) is the capacity of an aquifer to transmit, or convey, water horizontally. It is mathematically defined as T = Kb, where K = hydraulic conductivity and b is aquifer thickness (vertically).

Tri-Party Agreement Agencies: Three agencies are comprised of DOE, EPA, and Ecology.

Tri-Party Agreement: The Tri-Party Agreement Agencies 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.

References/Bibliography

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol22/xml/CFR-2010-title40-vol22-part141.xml.

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol27/xml/CFR-2010-title40-vol27-part300.xml.

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

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and *Superfund Amendments and Reauthorization Act of 1986*, 42 USC 9601, et seq. Available at: https://www.gpo.gov/fdsys/pkg/USCODE-2011-title42/pdf/USCODE-2011-title42-chap103.pdf.

Section 117(a), "Public Participation," "Proposed Plan."

Section 121(b), "Cleanup Standards," "General Rules."

DOE, EPA, and Ecology, 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*, U.S. Department of Energy, Richland Operations Office, U.S. Environmental Protection Agency, and Washington State Department of Ecology, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/pdf.cfm?accession=0065119H.

DOE/RL-2009-85, 2012, *Remedial Investigation Report for the 200-PO-1 Groundwater Operable Unit*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/pdf.cfm?accession=0091415.

DOE/RL-2009-85 ADD1, 2018, *Remedial Investigation Report for the 200-PO-1 Groundwater Operable Unit*, Addendum 1, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/pdf.cfm?accession=0064654H.

DOE/RL-2009-127, 2018, *Remedial Investigation for the 200-BP-5 Groundwater Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/pdf.cfm?accession=0064655H.

DOE/RL-2015-26, 2016, *Engineering Evaluation/Cost Analysis for the 200-BP-5 Operable Unit Groundwater Extraction*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/pdf.cfm?accession=0077225H.

DOE/RL-2016-41, 2016, *Action Memorandum for 200-BP-5 Operable Unit Groundwater Extraction*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/pdf.cfm?accession=0073242H.

DOE/RL-2016-67, 2017, *Hanford Site Groundwater Monitoring Report for 2016*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/pdf.cfm?accession=0068229H.

DOE/RL-2017-11, 2018, *Removal Action Work Plan for the 200-BP-5 Operable Unit Groundwater Extraction*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/pdf.cfm?accession=0065869H.

DOE/RL-2018-30, 2019, *200-BP-5 and 200-PO-1 Operable Units Feasibility Study for Interim Action*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/pdf.cfm?accession=0064072H.

DOE/RL-2018-66, 2018, *Hanford Site Groundwater Monitoring Report for 2017*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/pdf.cfm?accession=0064709H.

DOE/RL-2019-48, 2020, *Administrative Record Index for the 2020 Hanford Site 200 Area Record of Decision for Interim Action for the 200-BP-5 and 200-PO-1 Groundwater Operable Untis*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: https://pdw.hanford.gov/document/AR-03624.

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.

EPA/540/G-89/004, 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, Interim Final, OSWER Directive 9355.3-01, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: https://rais.ornl.gov/documents/GUIDANCE.PDF.

EPA 816-F-00-002, 2002, *Implementation Guidance for Radionuclides*, Office of Ground Water and Drinking Water, U.S. Environmental Protection Agency, Washington, D.C. Available at: https://www.epa.gov/sites/production/files/2015-09/documents/2009_04_16_radionuclides_guide_radionuclides_stateimplementation.pdf.

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.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq. Available at: https://www.gpo.gov/fdsys/pkg/STATUTE-90/pdf/STATUTE-90-Pg2795.pdf.

Safe Drinking Water Act of 1974, 42 USC 300f et seq., Pub. L. 93-523, as amended. Available at: https://www.gpo.gov/fdsys/pkg/STATUTE-88/pdf/STATUTE-88-Pg1660-2.pdf.

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.

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