RECORD OF DECISION

HANFORD 100 AREA

SUPERFUND SITE

100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3

OPERABLE UNITS

July 2018

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PART I: DECLARATION OF THE RECORD OF DECISION

1.0 Site Name and Location

USDOE Hanford 100 Area

100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units

Benton County, Washington

EPA ID: #WA3890090076

2.0 Statement of Basis and Purpose

This decision document presents the Selected Remedy for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units (OUs), which are part of the Hanford Site, 100 Area, in Benton County, Washington. These five OUs are referred to collectively as the 100-D/H Area.

The Selected Remedy was chosen in accordance with the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), as amended by the *Superfund Amendments and Reauthorization Act of 1986* (SARA), and, to the extent practicable, the National Contingency Plan (NCP; 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan"). This decision is based on the Administrative Record (AR) file that contains the documents that form the basis for the Selected Remedy for these OUs.

The State of Washington, through the Washington State Department of Ecology (Ecology), concurs with the Selected Remedy. In accordance with Ecology et al., 1989, *Hanford Federal Facility Agreement and Consent Order* (also known as the Tri-Party Agreement [TPA]), Ecology will serve as the lead regulatory agency for the Selected Remedy for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs.

3.0 Assessment of the Site

The response actions selected in this record of decision (ROD) are necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants, or contaminants into the environment. Such a release or the threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment. Where no action is necessary at waste sites to protect public health or welfare or the environment, No Action is the Selected Remedy.

4.0 Description of Selected Remedy

4.1 Overall Site Cleanup Strategy

The River Corridor (100 and 300 Area National Priorities List [NPL] sites and the Central Plateau (200 Area NPL site) are the two main geographic areas for cleanup work on the Hanford Site. The River Corridor includes the former reactor operations and fuel fabrication areas adjacent to the Columbia River. The Central Plateau includes the former fuel-processing facilities and numerous waste disposal facilities. To facilitate cleanup, the River Corridor, which spans approximately 220 mi^2, was divided into six geographic areas by the U.S. Department of Energy (DOE). These six areas were selected to define manageable portions of the River Corridor that align with historical operations (e.g., uranium fuel rod preparation or reactor operations). The 100-D/H Area is the northernmost of the six River Corridor areas.

This ROD presents the selected final remedial actions for the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 source OUs to address soil contamination and for the 100-HR-3 groundwater OU to address groundwater contamination from the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 source OUs.

The sequence and timing of the remedial action to be conducted at these OUs will be specified in a work plan written by DOE to be submitted to Ecology for approval within 6 months after ROD approval. Ecology is the lead regulatory agency under the TPA for these Operable Units and will be responsible for regulatory oversight of the implementation of the Record of Decision. In-progress interim action remediation for these OUs under the 1999 ROD (EPA/ROD/R10-99/039, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington (100 Area Remaining Sites)*) and 1996 ROD (EPA/ROD/R10-96/134, *Record of Decision for the 100-HR-3 and 100-KR-4 Operable Units Interim Remedial Actions, Hanford Site, Benton County, Washington*) shall continue, except that the cleanup levels selected in this ROD shall be used immediately upon issuance of this ROD for in progress interim action remediation. All other aspects of the interim actions for these OUs shall continue to be performed in accordance with the existing approved remedial design/remedial action work plans (RD/RAWPs). When the new RD/RAWP for the remedies selected by this ROD is approved, that document will direct future remedial action and will replace all interim action RD/RAWP requirements.

4.2 Principal Threat Wastes at the Site

Principal threat waste is defined as source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. They include soil containing significant concentrations of highly toxic materials and surface or subsurface soil containing high concentrations of contaminants that are, or potentially are, mobile due to wind entrainment, volatilization, surface runoff, or sub-surface transport. Contaminated groundwater is generally not considered to be source material.

Principal threat wastes associated with the OUs that are the subject of this ROD, such as fuel fragments and concentrated liquid sodium dichromate, have been removed through earlier cleanup actions. No waste sites remain in these OUs with principal threat waste.

4.3 Major Components of the Selected Remedy

The Selected Remedy for 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs addresses all wastes sites in those OUs, which are identified in Table 1. The Selected Remedy for the 100-HR-3 OU addresses contaminated groundwater. A brief description of the major components of the Selected Remedy is provided below.

4.3.1 No Action

Table 1 identifies 150 waste sites where the Selected Remedy is No Action. There is no basis for action at these waste sites. The 100-D/H remedial investigation/feasibility study (RI/FS) (DOE/RL-2010-95, *Remedial Investigation/Feasibility Study for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units*) determined that these waste sites had no remaining contaminants at concentrations greater than established standards that define acceptable levels for unlimited use/unrestricted exposure (UU/UE) and those protective of groundwater and surface water.

4.3.2 Removal, Treatment, and Disposal of Contaminated Soil and Debris

Table 1 identifies 104 waste sites in the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs where the Selected Remedy is the Removal, Treatment (as needed) and Disposal (RTD) remedy. The RTD remedy requires contaminated soil and debris as deep as 4.6 m (15 ft) below ground surface (bgs) exceeding soil cleanup levels in Table 4 for human health protection, and soil and debris at any depth throughout the soil column with contamination exceeding cleanup levels in Table 5 for groundwater and surface water protection to be excavated using shallow and deep excavation technology, transported to the Environmental Restoration Disposal Facility (ERDF) or other U.S Environmental Protection Agency (EPA) approved facility, and treated as necessary to meet applicable land disposal restrictions (LDRs) and waste acceptance criteria prior to disposal. Once remediated, the sites will be backfilled with clean borrow material and contoured, and then native vegetation will be established.

4.3.3 Groundwater Pump and Treat

The Selected Remedy for the 100-HR-3 OU requires an expansion and optimization of the existing interim groundwater pump and treat remedy. Under the interim remedy, groundwater contaminated with hexavalent chromium (Cr(VI)) is extracted using wells and is transferred to a facility for treatment that uses an ion-exchange resin to treat for Cr(VI). The treated water is then returned to the aquifer through injection wells or other approved discharge. Pump and treat system expansion and optimization activities under the Selected Remedy will incorporate new wells and variable pumping rates to target Cr(VI) removal to reduce contamination level and hydraulic plume capture to prevent discharge to the Columbia River above state surface water quality standard. Total chromium, strontium-90 and nitrate are collocated with Cr(VI), and treatment of Cr(VI) groundwater contamination will result in attainment of cleanup levels for total chromium, but not for strontium-90 and nitrate. Under the Selected Remedy, the pump and treat system is to be expanded and optimized to achieve Table 6 cleanup levels for Cr(VI) and total chromium in 12 years upon implementation. Strontium-90 and nitrate contamination will be addressed by monitored natural attenuation (MNA).

4.3.4 Monitored Natural Attenuation

MNA relies on natural attenuation processes that include a variety of physical, chemical, or biological processes, which act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in groundwater. These in situ processes include biodegradation, dispersion, dilution, sorption, volatilization, radioactive decay, and chemical or biological stabilization, transformation, or destruction of contaminants. Waste site natural attenuation for radionuclides occurs through radioactive decay, with the time required to achieve cleanup levels dependent on radionuclide half-lives.

The Selected Remedy for the nitrate and strontium-90 contaminated groundwater is MNA, which will be achieved through radioactive decay, diffusion, and dispersion until groundwater cleanup levels in Table 6 are achieved. Nitrate cleanup levels will be met in approximately six years and strontium-90 cleanup levels will be met in approximately 44 years. The performance monitoring component includes installation of new wells, periodic sampling, laboratory analysis, and data evaluation to assess and confirm the natural attenuation processes, rates of attenuation, and overall protectiveness. Operations and maintenance (O&M) activities for this remedy include inspection, maintenance, and periodic replacement of monitoring wells.

4.3.5 Institutional Controls

Institutional controls (ICs) are used to protect the integrity of a response action and/or restrict exposure to contamination in soil and groundwater until such contamination is at levels that allow for UU/UE. Required ICs include excavation and use restrictions to prevent inadvertent exposure to contamination in soil and ICs to restrict groundwater use until cleanup levels are achieved. Excavation and use ICs are the Selected Remedy for a number of shallow and deep waste sites with radiological contamination exceeding

UU/UE levels. Those wastes sites are identified in Table 1 along with the year that radioactive decay of elements decreases to concentrations less than cleanup levels that are protective of UU/UE.

DOE shall be responsible for implementing, maintaining, reporting on, and enforcing ICs required under this ROD. Although the DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement or through other means, the DOE shall retain ultimate responsibility for remedy integrity. In the event that land is transferred out of federal ownership, deed restrictions (proprietary controls such as easements and covenants) are required that are legally enforceable against subsequent property owners.

4.3.6 Pipeline Capping and Institutional Controls

The Selected Remedy for the contamination in the 100-D-50:2 pipeline waste site is pipeline end-capping and ICs so as not to disturb a maternal bat colony. ICs for the 100-D-50:2 pipeline waste site that prevent entry or excavation will need to be maintained indefinitely. DOE shall be responsible for implementing, maintaining, reporting on, and enforcing ICs required under this ROD. Although the DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement or through other means, the DOE shall retain ultimate responsibility for remedy integrity. In the event that land is transferred out of federal ownership, deed restrictions (proprietary controls such as easements and covenants) are required that are legally enforceable against subsequent property owners.

Table 1. Waste Sites Addressed by this ROD

Technology/Approach	Waste Sites
No Action	**100-DR-1 OU (75 waste sites):** 100-D-1, 100-D-2, 100-D-10, 100-D-20, 100-D-21, 100-D-22, 100-D-24, 100-D-29, 100-D-3, 100-D-31:1, 100-D-31:10, 100-D-31:2, 100-D-31:3, 100-D-31:4, 100-D-31:5, 100-D-31:6, 100-D-31:7, 100-D-31:8, 100-D-31:9, 100-D-32, 100-D-4, 100-D-42, 100-D-45, 100-D-48:4, 100-D-49:3, 100-D-50:10, 100-D-50:3, 100-D-50:5, 100-D-56:1, 100-D-56:2, 100-D-59, 100-D-60, 100-D-61, 100-D-63, 100-D-67, 100-D-7, 100-D-70, 100-D-74, 100-D-75:3, 100-D-80:1, 100-D-82, 100-D-83:4, 100-D-84:1, 100-D-85:1, 100-D-86:2, 100-D-87, 100-D-88, 100-D-9, 100-D-90, 116-D-10, 116-D-2, 116-D-3, 116-D-4, 116-D-5, 116-D-6, 116-D-9, 116-DR-5, 118-D-6:2, 120-D-2, 126-D-2, 128-D-2, 130-D-1, 132-D-1, 132-D-2, 132-D-3, 132-D-4, 1607-D2:1, 1607-D2:2, 1607-D2:3, 1607-D2:4, 1607-D4, 1607-D5, 628-3, UPR-100-D-1, UPR-100-D-5
	100-DR-2 OU (25 waste sites): 100-D-12, 100-D-13, 100-D-15, 100-D-23, 100-D-28:1, 100-D-43, 100-D-47, 100-D-53, 100-D-54, 100-D-64, 100-D-68, 100-D-94, 116-DR-10, 116-DR-4, 116-DR-7, 116-DR-8, 118-D-1, 118-D-4, 118-D-5, 118-DR-1, 128-D-1, 132-DR-1, 132-DR-2, 1607-D1, 600-30
	100-HR-1 OU (36 waste sites): 100-H-10, 100-H-13, 100-H-17, 100-H-24, 100-H-28:1, 100-H-28:6, 100-H-28:8, 100-H-3, 100-H-30, 100-H-31, 100-H-33, 100-H-34, 100-H-35, 100-H-36, 100-H-4, 100-H-40, 100-H-41, 100-H-45, 100-H-49:2, 100-H-50, 100-H-51:4, 100-H-51:5, 100-H-53, 100-H-7, 100-H-8, 100-H-9, 116-H-2, 116-H-4, 116-H-9, 118-H-6:2, 118-H-6:4, 118-H-6:5, 132-H-1, 1607-H2, 1607-H3, 1607-H4
	100-HR-2 OU (14 waste sites): 100-H-2, 100-H-37, 118-H-1:2, 118-H-2, 118-H-3, 118-H-4, 118-H-5, 128-H-1, 128-H-2, 128-H-3, 132-H-2, 1607-H1, 600-151, 600-152
Removal, treatment, and disposal to cleanup levels	**100-DR-1 OU (45 waste sites):** 100-D-101, 100-D-102, 100-D-103, 100-D-104, 100-D-105, 100-D-107, 100-D-108, 100-D-109, 100-D-30, 100-D-31:11, 100-D-31:12, 100-D-50:1, 100-D-50:4, 100-D-50:6, 100-D-50:7, 100-D-50:8, 100-D-50:9, 100-D-52, 100-D-65, 100-D-66, 100-D-69, 100-D-71, 100-D-72, 100-D-73, 100-D-75:1, 100-D-75:2, 100-D-76, 100-D-8, 100-D-80:2, 100-D-81,

Table 1. Waste Sites Addressed by this ROD

Technology/Approach	Waste Sites
	100-D-83:1, 100-D-83:2, 100-D-83:3, 100-D-83:5, 100-D-84:2, 100-D-85:2, 100-D-86:1, 100-D-86:3, 100-D-96:1, 100-D-96:2, 100-D-97, 100-D-98:2, 100-D-98:3, 100-D-99, 1607-D2:5
	100-DR-2 OU (11 waste sites): 100-D-100, 100-D-106, 100-D-14, 100-D-62, 100-D-77, 100-D-78, 116-DR-3, 118-D-2:2, 118-D-3:2, 118-DR-2:2, 126-DR-1
	100-HR-1 OU (24 waste sites): 100-H-28:2, 100-H-28:3, 100-H-28:4, 100-H-28:5, 100-H-28:7, 100-H-38, 100-H-42, 100-H-43, 100-H-44, 100-H-46, 100-H-48, 100-H-49:1, 100-H-5, 100-H-51:1, 100-H-51:2, 100-H-51:3, 100-H-51:6, 100-H-52, 100-H-56, 100-H-57, 100-H-59:1, 100-H-59:2, 126-H-2, 132-H-3
	100-HR-2 OU (24 waste sites): 100-H-58, 600-380, 600-381, 600-382:1, 600-382:2, 600-382:3, 600-382:4, 600-382:5, 600-383:1, 600-383:10, 600-383:2, 600-383:3, 600-383:4, 600-383:5, 600-383:6, 600-383:7, 600-383:8, 600-383:9, 600-384:1, 600-384:2, 600-384:3, 600-384:4, 600-384:5, 600-385
Pipeline Capping, ICs for entry and excavation restrictions (This site is a maternal bat colony.)	**100-DR-1 OU (1 waste site):** 100-D-50:2
ICs (deep zone) [a] Excavation restrictions Waste sites with radiological contamination exceeding human health direct contact cleanup levels at a depth deeper than 4.6 m (15 ft) bgs	**100-DR-1 OU (21 waste sites):** 100-D-5 (2028) 100-D-6 (2028) 100-D-18 (2066) 100-D-19 (2042) 100-D-48:1(2093) 100-D-48:2 (2034) 100-D-48:3 (2028) 100-D-49:1 (2093) 100-D-49:2 (2117) 100-D-49:4 (2027) 116-D-1A (2203) 116-D-1B (2203) 116-D-7 (2125) 116-DR-1 & 2 (2148) 118-D-6:3 (2120) 118-D-6:4 (2143)[b] UPR-100-D-2 (2034) UPR-100-D-3 (2034) UPR-100-D-4 (2093) 116-DR-9/100-D-25 (2064)[b] **100-DR-2 OU (3 waste sites):** 100-D-46 (2203) 116-DR-6 (2048) 118-D-3:1 (2025) **100-HR-1 OU (11 waste sites):** 100-H-1 (2019) 100-H-11 (2108) 100-H-12 (2108) 100-H-14 (2108) 100-H-21 (2019) 100-H-22 (2019) 116-H-1 (2110) 116-H-3 (2056) 116-H-7 (2098) 118-H-6:3 (2108) 118-H-6:6 (2108)
ICs (shallow zone)[a] Residential use and excavation restrictions	**100-DR-1 OU (3 waste sites):** 116-DR-9/100-D-25 (2038)[b] 118-D-6:4 (2022)[b] **100-DR-2 OU (2 waste site):** 116-D-8 (2035) 118-D-2:1 (2019)

Table 1. Waste Sites Addressed by this ROD

Technology/Approach	Waste Sites	
Waste sites with radiological contamination exceeding human health direct contact cleanup levels at a depth less than 4.6 m (15 ft) bgs	**100-HR-1 OU (2 waste sites):** 116-H-5 (2016) 100-H-54 (2026)	**100-HR-2 OU (1 waste site):** 118-H-1:1 (2016)

a. The numbers in parentheses are the year that radioactive decay of elements decreases to concentrations less than cleanup levels that are protective of UU/UE.

b. These two waste sites (116-DR-9/100-D-25) are in the same location and have shallow and deep zone components, so they are addressed together in both the shallow zone and deep zone IC categories. Note that the shallow zone decay date differs from the deep zone date (2038 versus 2064) because of different radionuclide concentrations in the shallow zone compared to the deep zone. 118-D-6:4 is similarly identified for both shallow and deep ICs.

bgs = below ground surface
IC = institutional control
OU = operable unit
RTD = removal, treatment, and disposal
UU/UE = unlimited use/unrestricted exposure

5.0 Statutory Determinations

Under CERCLA Section 121 and the NCP Section 300.430(f)(5)(ii), the remedy must be protective of human health and the environment (HHE) and comply with applicable or relevant and appropriate requirements (ARARs) (unless a statutory waiver is justified), be cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous substances, pollutants, or contaminants as a principal element, and a bias against offsite disposal of untreated wastes.

The Selected Remedy for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs is protective of HHE, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The Selected Remedy also utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. The remedy for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility or volume of hazardous substances, pollutants or contaminants as a principal element through treatment) in part as treatment is required as part of the RTD remedy where it is needed to meet applicable LDR requirements and treatment is required to address Cr(VI) and total chromium in groundwater. DOE and EPA have determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at these OUs as the Selected Remedy provides the best balance of trade-offs in terms of the five balancing remedy selection criteria while also considering the statutory preference for treatment as a principal element.

Because the Selected Remedy will result in hazardous substances, pollutants or contaminants remaining onsite above levels that allow for UU/UE, a statutory review will be conducted within five years after initiation of remedial action to assure that human health and the environment are being protected by the remedial action being implemented. Five-year reviews will continue until hazardous substances no longer remain present above levels that allow for UU/UE. Three five year reviews have been completed for the Hanford Site (see Decision Summary Section 4). The protectiveness of the interim action decision for 100-D/H OUs has been evaluated in previous five-year reviews.

The preamble to the NCP (40 CFR 300) states that when noncontiguous facilities are reasonably close to one another and wastes at these sites are compatible for a selected treatment or disposal approach, CERCLA Section 104(d)(4), “Response Authorities,” allows the lead agency to treat these related facilities as one site for response purposes and, therefore, allows the lead agency to manage waste transferred between such noncontiguous facilities without having to obtain a permit. The 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs; ERDF; and the 200 Centralized Groundwater Waste Storage Area (CGWSA) in the 6265A Building are reasonably close to one another, and the wastes in these OUs are compatible for the selected disposal approach. Therefore, these facilities are considered to be a single site for response purposes.

6.0 ROD Data Certification Checklist

The information outlined in Table 2 is included in the Decision Summary (Part II) of this ROD. Additional information can be found in the AR.

Table 2. 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs ROD Data Certification Checklist

Information	Location in ROD
Contaminants of Concern (COCs) and their respective concentrations	Section 7
Baseline risk represented by the COCs	Section 7
Cleanup levels established for COCs and the basis for these levels	Tables 4, 5, 6
How source materials constituting principal threat wastes are addressed	Section 11
Current and reasonably anticipated future land use and current and potential future beneficial uses of groundwater	Section 6
Potential land and groundwater use that will be available at the site as a result of the Selected Remedy	Section 6
Estimated capital, annual operations and maintenance, and total present value costs, discount rate, and the number of years over which the remedy cost estimates are projected	Section 12.3
Key factors that led to selecting the remedy	Section 12.1

7.0 Authorizing Signatures

U.S. DOE Signature for the Record of Decision for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units at the USDOE Hanford 100 Area NPL Site. The Record of Decision is selected by the U.S. Department of Energy and the U.S. Environmental Protection Agency, with concurrence by the Washington State Department of Ecology.

Doug S. Shoop | 7/24/18

Doug Shoop
Manager, Richland Operations Office
U.S. Department of Energy

Date

U.S. EPA Signature for the Record of Decision for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units at the USDOE Hanford 100 Area NPL Site as selected by the U.S. Department of Energy and the U.S. Environmental Protection Agency, with concurrence by the Washington State Department of Ecology.

Andrew Wheeler
Acting Administrator
U.S. Environmental Protection Agency

7-30-2018
Date

State Signature for the Record of Decision for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units at the USDOE Hanford 100 Area NPL Site as selected by the U.S. Department of Energy and the U.S. Environmental Protection Agency, with concurrence by the Washington State Department of Ecology.

Alexandra K. Smith
Program Manager, Nuclear Waste Program
Washington State Department of Ecology

7/23/18
Date

PART II: DECISION SUMMARY

This Decision Summary provides a summary of the site characteristics, alternatives evaluated, and the analysis of those alternatives for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs at the Hanford Site. It also identifies the Selected Remedy for these OUs and explains how the remedies fulfill statutory and regulatory requirements. Although some of the information in the Decision Summary is similar to that in the Declaration, this section discusses the topics in more detail and provides the rationale for the "summary declarations." This section is based on the information that is available in the AR for these OUs.

1.0 Site Name, Location, and Brief Description

The Hanford Site is federally owned property located in south eastern Washington State, which is managed by the DOE. Hanford currently contains three listed NPL (40 CFR 300, Appendix B) sites. One of the NPL sites is the 100 Area (EPA ID#: WA3890090076) commonly referred to as the River Corridor portion of the Hanford Site. To facilitate cleanup, the River Corridor, which spans approximately 220 mi^2, was divided into six geographic areas by DOE. These six areas were selected to help define manageable portions of the River Corridor that align with historical operations (e.g., uranium fuel rod preparation or reactor operations).

The 100-D/H Area (Figure 1) encompasses approximately 20 km^2 (7.8 mi^2). The 100-D/H Area includes three deactivated nuclear reactors and support facilities that operated to produce plutonium from 1944 to 1967. Figure 2 shows the 105-D and 105-DR Reactors within the 100-D Area, and the 105-H Reactor within the 100-H Area. The area between the 100-D and 100-H Areas is undeveloped and is referred to as "the Horn."

Buildings (including the D, DR and H Reactors) are not part of the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs. Contaminated buildings are being removed in accord with CERCLA Removal Action Memoranda. This ROD addresses all five OUs within 100-D/H, but excludes the 100-OL-1 OU and the Columbia River. DOE is the lead agency responsible to perform the remedial actions, Ecology is the lead regulatory agency for 100-D/H, and EPA is the non-lead regulatory agency, per the TPA (Ecology et al., 1989).

2.0 Site History and Enforcement Activities

This section provides background information on past activities at the Hanford Site that have led to the current contamination at the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs. In addition, this section contains information on how CERCLA has been applied to the investigation and cleanup of these OUs.

2.1 Site Operational History

From 1943 to 1990, the primary mission of the Hanford site was the production of nuclear materials for national defense. Operations at the Hanford Site included nuclear fuel manufacturing, reactor operations, fuel reprocessing, chemical separation, plutonium and uranium recovery, processing of fission products, and waste partitioning. The 105-D, 105-DR and 105-H Reactors' primary mission was plutonium production. These water-cooled nuclear reactors, associated structures and processes that generated solid and liquid wastes were the primary sources of contamination. Solid waste was placed in unlined burial grounds. Liquid contaminants were released to the environment via retention basins, trenches, cribs, ditches, and through outfall piping to the Columbia River. The waste sites within the 100-D Reactor Area are included in the 100-DR-1 and 100-DR-2 OUs and the waste sites within the 100-H Reactor Area are included in the 100-HR-1 and 100-HR-2 OUs. Groundwater contamination from these source OUs is part of the 100-HR-3 OU. Waste sites generally originated from industrial production activities and include landfills, dump sites, surface debris, and unplanned releases.

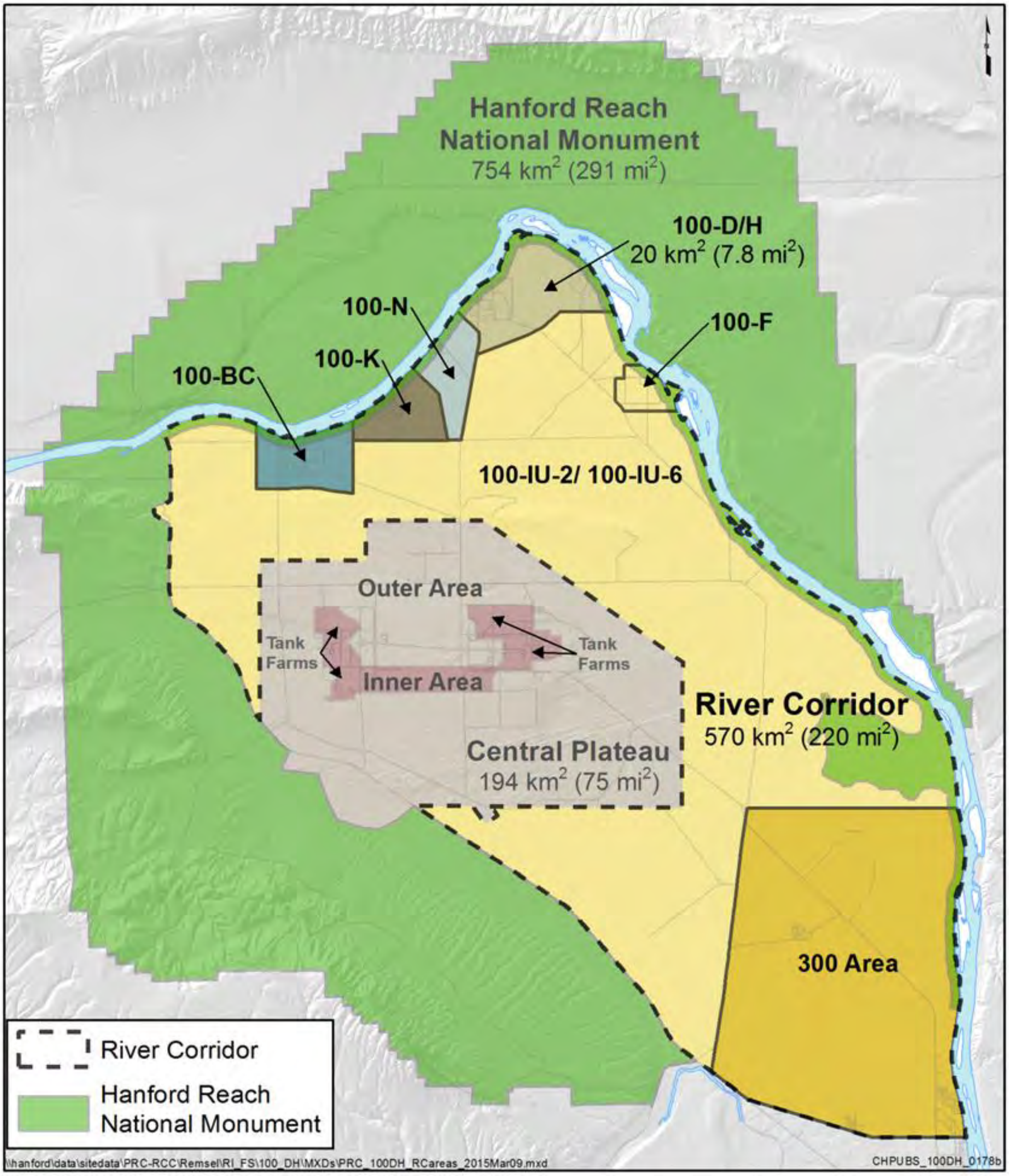


Figure 1. Hanford Site River Corridor

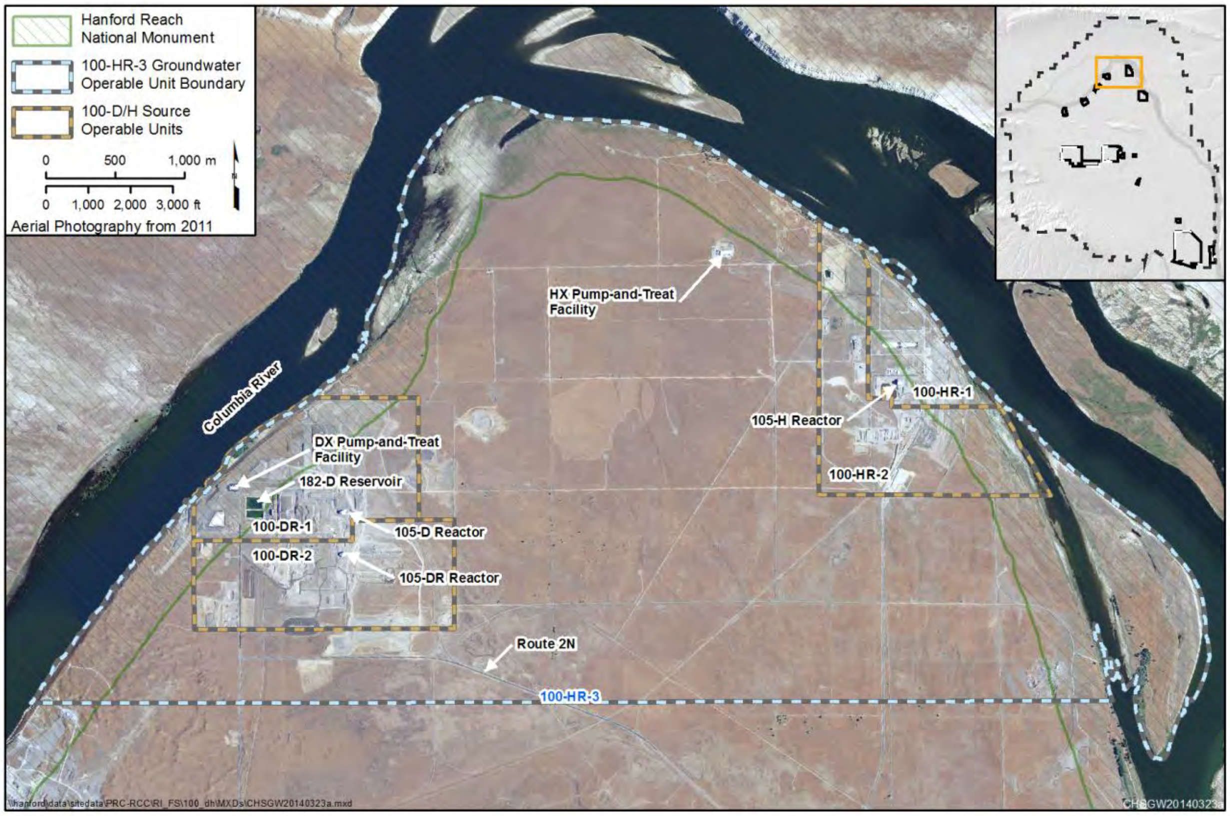


Figure 2. Features of the 100-D/H Area

2.2 Previous Investigations and Interim Actions

DOE has completed six field investigations within 100-D/H. These include four limited field investigations (LFIs), one *Resource Conservation and Recovery Act of 1976* (RCRA) facility investigation/corrective measures study, and one comprehensive RI/FS (100-D/H RI/FS report [DOE/RL-2010-95]).

The results of the LFIs and RCRA investigation are presented in the following documents:

- DOE/RL-93-29, *Limited Field Investigation Report for the 100-DR-1 Operable Unit*
- DOE/RL-93-51, *Limited Field Investigation Report for the 100-HR-1 Operable Unit*
- DOE/RL-94-53, *Limited Field Investigation Report for the 100-HR-2 Operable Unit*
- DOE/RL-93-43, *Limited Field Investigation Report for the 100-HR-3 Operable Unit*
- Appendix D of DOE/RL-93-46, *RCRA Facility Investigation/Corrective Measures Study Work Plan for the 100-DR-2 Operable Unit, Hanford Site, Richland, Washington*

The LFIs provided an initial characterization of the nature and extent of contamination, identified contaminant concentrations in waste sites that were above human health direct contact risk levels, and determined that Cr(VI) in groundwater was above drinking water standards (DWSs) and was entering the Columbia River at concentrations considered toxic to aquatic organisms. Based on these findings and the associated qualitative risk assessments, interim actions were implemented at 100-D/H to remediate contaminated soil and to treat Cr(VI)-contaminated groundwater.

In 2008, DOE prepared DOE/RL-2008-46-ADD1, *Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan Addendum 1: 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units*, which summarized the current knowledge of contamination and identified the additional data needs to support final remedial decisions. The data needs were met by completing the RI/FS fieldwork in 2011. The results are documented in the 100-D/H RI/FS report (DOE/RL-2010-95).

The 100-D/H Area included 128 facilities, such as storage buildings, offices, retention basins, maintenance shops, process plants, an electric substation, storage tanks, pump stations, and outfall structures that were removed under separate decisions and are not addressed by this ROD.

Waste site remedial action began in 1995 under EPA/ROD/R10-95/126, *Interim Remedial Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington*. These interim actions consisted primarily of RTD, followed by backfill and revegetation. Specifically, contaminated material was excavated and transported to ERDF, located in the Hanford Site 200 Area. The contaminated materials were treated as necessary to meet applicable LDRs and disposed at ERDF. Subsequent interim action RODs, interim action ROD amendments, and explanation of significant differences (ESD) identified additional waste sites or changes to interim remedial actions. The waste site decisions include the following:

- **1995 –** EPA/ROD/R10-95/126, *Interim Remedial Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington*
- **1997 –** EPA/AMD/R10-97/044, *Amendment to the Interim Remedial Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington*
- **1999 –** EPA/ROD/R10-99/039, *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington (100 Area Remaining Sites)*
- **2000 –** EPA/ROD/R10-00/121, *Interim Remedial Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, and 100-KR-2 Operable Units, Hanford Site (100 Area Burial Grounds), Benton County, Washington*
- **2004 –** EPA et al., 2004, *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision*
- **2009 –** EPA et al., 2009a, *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision: Hanford Site, Benton County, Washington*

In addition to the CERCLA interim remedial actions, three RCRA treatment, storage, and disposal units within the 100-D/H area have undergone closure or closure with modifications, but are not part of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs. These closures were conducted under the following:

- **1991 –** DOE/RL-88-04, *183-H Solar Evaporation Basins Closure Postclosure Plan* (Release 3)
- **1997 –** DOE/RL-97-48, *183-H Solar Evaporation Basins Postclosure Plan*
- **1999 –** DOE/RL-92-71, *100-D Ponds Closure Plan*
- **2004 –** DOE/RL-90-25, *105-DR Large Sodium Fire Facility Closure Plan*

Groundwater remedial actions have been conducted under the following:

- **1996 –** EPA/ROD/R10-96/134, *Record of Decision for the 100-HR-3 and 100-KR-4 Operable Units Interim Remedial Actions, Hanford Site, Benton County, Washington*
- **1999 –** EPA/AMD/R10-00/122, *Interim Remedial Action Record of Decision Amendment for the 100-HR-3 Operable Unit, Hanford Site, Benton County, Washington*
- **2003 –** EPA/ESD/R10-03/606, *Explanation of Significant Difference for the 100-HR-3 Operable Unit, Hanford Site, Benton County, Washington*
- **2009 –** EPA et al., 2009b, *Explanation of Significant Differences for the 100-HR-3 and 100-KR-4 Operable Units Interim Action Record of Decision: Hanford Site, Benton County, Washington*
- **2010 –** 11-AMCP-0002, "Non-Significant Change for the 100-HR-3 and 100-KR-4 Operable Units Interim Action Record of Decision, Hanford Site, Washington, July 2010, Memo to File Regarding: Supplemental Actions for the In-Situ Reduction/Oxidation Manipulation Barrier Performance for the 100-HR-3 Groundwater Operable Unit Interim Remedy"

Groundwater remediation by extraction and treatment was initiated in 1997 under the interim action ROD (EPA/ROD/R10-96/134) with startup of the first pump and treat system, HR-3. The objective of the interim remediation was to remove Cr(VI) contamination from groundwater and address immediate threats to the Columbia River. A second pump and treat system, DR-5, began operating in 2004. Under the 2009 ESD (EPA et al., 2009b), these two initial pump and treat systems (DR-5 and HR-3) were expanded to include additional plume treatment capacity. As part of this expansion, two new ion-exchange treatment facilities were constructed, and most of the wells under the HR-3 and DR-5 systems were transitioned to the new HX and DX systems. The original treatment facilities for HR-3 and DR-5 stopped operating after this transition was complete. The DX and HX pump and treat systems have continued to operate within the 100-HR-3 OU under the interim action ROD. The treatment capacities have been increased, and numerous wells (injection, extraction, and monitoring) have been constructed.

An in situ redox manipulation barrier was installed as a new technology for treating Cr(VI)-contaminated groundwater in the 100-D Area under the 1999 interim action ROD amendment (EPA/AMD/R10-00/122) and the 2003 ESD (EPA/ESD/R10-03/606). In 2009, it was determined that breakthrough of Cr(VI) was occurring at the in situ redox manipulation barrier, and the barrier was not achieving the required level of performance. DOE, EPA, and Ecology (also known as the Tri-Parties) agreed that the DX pump and treat system would provide adequate protection of the river and barrier maintenance could be discontinued (11-AMCP-0002).

2.3 CERCLA Regulatory and Enforcement Activities

In July 1989, EPA placed the 100, 200, 300, and 1100 Areas of the Hanford Site on the NPL (40 CFR 300, Appendix B) pursuant to CERCLA. In anticipation of the NPL listing, DOE, EPA, and Ecology entered into the TPA (Ecology et al., 1989) in May 1989. This agreement established a procedural framework and schedule for developing, implementing, and monitoring CERCLA response actions on the Hanford Site. The 1100 Area NPL site was deleted from the NPL list on September 30, 1996.

In October 2006, EPA issued DOE a penalty for failure to conduct remediation activities at the 100-D-56 pipeline in accordance with applicable requirements in the CERCLA 100 Area Remedial Design Remedial Action Work Plan. A DOE contractor (Washington Closure Hanford [WCH]) conducted excavation actions, which caused the release of at least 30 gallons of liquids containing sodium dichromate to the soil, and failed to notify Ecology of significant spills. DOE took corrective actions and agreed to payment of stipulated penalties of $120,000.

3.0 Community Participation

This section describes how the public participation requirements of CERCLA and the NCP (40 CFR 300) were met in the remedy selection process.

The Tri-Parties developed a Community Relations Plan in April 1990 as part of the overall Hanford Site restoration process. The Community Relations Plan was updated and became the *Hanford Public Involvement Plan* in 2012. The plan is designed to promote public awareness of the investigations and public involvement in the decision-making process. Public participation was conducted in accordance with the Hanford Public Involvement Plan. Presentations were made to the Hanford Advisory Board River and Plateau Committee to inform and to receive feedback.

DOE and EPA formally notified the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Yakama Nation, Nez Perce, and Wanapum, of the upcoming planning for this cleanup decision and invited formal consultation in a letter dated January 28, 2016. The area tribes did not respond. DOE sent the proposed plan (DOE/RL-2011-111, *Proposed Plan for Remediation of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units*) to area tribes on July 26, 2016. On August 17, 2016, DOE, EPA and Washington State Department of Ecology project leads, experts and contractors held a workshop on the proposed plan and addressed concerns and questions. Representatives from the area tribes participated and all information requested was provided.

The 100-D/H RI/FS report (DOE/RL-2010-95) was placed in the Hanford AR on September 15, 2014, and the proposed plan (DOE/RL-2011-111) was placed in the Hanford AR on July 20, 2016. The notice of the public comment period and availability of these two documents and the AR for the remedy decision for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs was published in the *Tri-City Herald* on July 26, 2016. The public comment period was initially from July 26, 2016 to August 25, 2016, but it was extended to September 16, 2016 in response to requests for an extension. There was no request for a public meeting for this decision during the public comment period. Electronic listserve messages were sent to about 1,300 e-mail addresses, and about 2,000 US Postal Service cards were sent with a notice of the public comment period and availability of the documents. This information was also included in Hanford's public involvement calendar available on the internet.

The administrative record for this ROD is available at:
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0075856H.

and at:

ADMINISTRATIVE RECORD
U.S. Department of Energy
Administrative Record Center
2440 Stevens Center Place, Room 1101
Richland, WA

Information is also available at the Public Information Repositories specified below:

PUBLIC INFORMATION REPOSITORIES
(Contains limited documentation, but provides access to the online Administrative Record)

USDOE Public Reading Room
Washington State University, Tri-Cities
Consolidated Information Center, Room 101-L
2770 University Drive
Richland, WA 99352

University of Washington
Suzzallo Library
Government Publications Division
P.O. Box 352900
Seattle, WA 98195

Portland State University
Branford P. Millar Library
1875 SW Park Avenue
Portland, OR 97207

Gonzaga University
Foley Center Library
East 502 Boone Avenue
Spokane, WA 99258

Responses to the significant comments, criticisms and new data received during the public comment period are included in the Responsiveness Summary, which is Part III of this ROD.

4.0 Scope and Role of the Response Action

The process for characterization and remediation of waste sites at the Hanford Site is addressed by the TPA. The River Corridor (100 and 300 Area NPL [40 CFR 300, Appendix B] sites) and the Central Plateau (200 Area NPL site) are the two main geographic areas for cleanup work on the Hanford Site. The River Corridor includes the former reactor operations and fuel fabrication areas adjacent to the Columbia River. The Central Plateau includes the former fuel-processing facilities and numerous waste disposal facilities.

Under the TPA, dangerous waste treatment, storage and disposal (TSD) units subject to state dangerous waste closure requirements will be closed in accordance with dangerous waste rules, and non-TSD waste units and contamination (referred to as past practice units in the TPA) is to be addressed under CERCLA or under both CERCLA and state dangerous waste corrective action requirements. To facilitate cleanup, the River Corridor was divided into six geographic areas by DOE. These six areas were selected to define manageable portions of the River Corridor that align with historical operations (e.g., uranium fuel rod preparation or reactor operations). The past practice units in these areas have been further divided into OUs.

The Hanford Site cleanup consists of three major components: (1) River Corridor, (2) Central Plateau, and (3) Tank Waste. Within the overall strategy, the River Corridor includes the adjacent areas that extend from the 100 Areas and 300 Area to the Central Plateau. Cleanup of the River Corridor was generally prioritized above the Central Plateau since the early 1990s.

Within the River Corridor, the 100-D and 100-H areas are 2 of the 6 reactor areas that contain nine defueled plutonium production reactors. This 100-D/H ROD was preceded by RODs for the 300 Area and 100-F/100-IU-2 & 6 Areas. It will be followed by RODs for the 100-BC, 100-N and 100-K reactor areas.

For sites in the River Corridor, remedial action objectives (RAOs) include restoring contaminated groundwater (including the 100-HR-3 OU within this ROD) to DWSs wherever practicable, and achieving ambient water quality standards in the groundwater prior to it discharging into the Columbia River. River Corridor cleanup work also includes removing soil and debris with contaminant concentrations above cleanup levels, and sources of groundwater contamination (including within 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs) that pose an unacceptable risk to the Columbia

River. The removed contaminated soil will be treated as necessary and transported to the Central Plateau for final disposal. The intent is to shrink the footprint of active cleanup to within the 75 mi^2 area of the Central Plateau by removing excess facilities and remediating waste sites.

The Hanford cleanup strategy includes (1) treating and/or removing contamination that is close to the Columbia River to support current and reasonably anticipated future land uses, protect the environment, restore groundwater to beneficial use, and ensure the aquatic life in the Columbia River is protected; and (2) moving removed contaminated material to the Central Plateau or other EPA-approved disposal facility and treating it when required in accordance with CERCLA remedy requirements. This involves addressing contamination in soil, restoration of groundwater beneath the Hanford Site to DWSs and ensuring that aquatic life in the Columbia River is protected by achieving federal Ambient Water Quality Criteria and state Surface Water Quality Standards in areas where groundwater discharges to surface water.

This ROD addresses the risk from releases and potential releases in the following OUs:

- 100-DR-1 waste sites
- 100-DR-2 waste sites
- 100-HR-1 waste sites
- 100-HR-2 waste sites
- 100-HR-3 groundwater

The structures shown in Figure 2 are not included in these OUs and are not addressed by this ROD. They include 105-D, 105-DR, and 105-H Reactors; parts of the export water system infrastructure; the electrical substation; and multiple support buildings. Except for the three reactors, which are currently in safe storage, and the active facilities, most of these historical structures are to be or have been removed under existing removal action memoranda.

Most of the remediation activities conducted in the 100-D/H Area have been the result of CERCLA decisions, as listed below. Interim actions under CERCLA were initiated in the 100-D/H Area in 1995 for contaminated waste sites in 100-DR-1 and in 1999 for contaminated waste sites in 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs. The RODs, amendments to RODs, and associated ESDs for these OUs are summarized in Section 2.2.

Three action memoranda apply to building deactivation, decommissioning, decontamination, and demolition in the 100-D/H Area:

- 1998 – Ecology et al., 1998, *Action Memorandum 105-F and 105-DR Reactor Buildings and Ancillary Facilities*
- 2000 – Ecology and DOE, 2000, *Action Memorandum:105-D and 105-H Reactor Facilities and Ancillary Facilities*
- 2010 – DOE/RL-2010-22, *Action Memorandum for General Hanford Site Decommissioning Activities*

Three five-year review reports have been issued. CERCLA and the NCP (40 CFR 300) require that remedial actions that result in hazardous substances, pollutants or contaminants remaining at the site above levels that allow for UU/UE be reviewed at least every 5 years after initiation of the selected remedial action to ensure that human health and the environment are being protected by the remedial action being implemented. Three five-year reviews have been completed for the Hanford Site:

- 2001 – EPA, 2001, *USDOE Hanford Site First Five Year Review Report*
- 2006 – DOE/RL-2006-20, *The Second CERCLA Five-Year Review Report for the Hanford Site*
- 2012 – DOE/RL-2011-56, *Hanford Site Third CERCLA Five-Year Review Report*

5.0 Site Characteristics

The following sections provide information on the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OU site features, current land and groundwater uses, the nature and extent of contamination (including groundwater plumes exceeding cleanup levels in Table 6), and the conceptual site model (CSM) on contaminant migration and the potential contaminant receptors.

5.1 Site Features and Land and Groundwater Use

The 100-D/H Area is mostly comprised of undeveloped land (Figure 2). The 105-D, 105-DR, and 105-H Reactor buildings remain in interim safe storage, and there is no current plan to remove them under an existing removal action memorandum.

The 100-D/H Area is being used for waste management, environmental monitoring, waste site remediation, and conservation and restoration activities. Groundwater from the 100-HR-3 Groundwater OU will be restored to its beneficial use as a potential future drinking water source. The segment of the Columbia River adjacent to 100-D/H is used for a variety of recreational activities. The land adjacent to the Columbia River is part of the Hanford Reach National Monument (HRNM) and land use includes preservation and conservation. Tribal access and use is an anticipated future use, such as traditional gathering and ceremonies that are activities consistent with the conservation and preservation designations. The 100-D/H Area has a long history of use by area tribes. The Yakama, Umatilla, Nez Perce and Wanapum tribal cultural experts have provided information to the DOE-RL Cultural Resources Program regarding its religious and cultural significance, including information on numerous archaeological resources in the area and written and oral history. Area tribes have also stated that this stretch of the Columbia River is used for treaty-reserved activities including fishing.

The raw water supply for the 100 and 200 Areas is provided from the Columbia River through a series of pump houses, reservoirs, and pipelines. This water distribution system is known as the export water system. A part of this system, including the 181-D Pump House and the 182-D reservoir, is located in 100-D/H.

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's water uptake is the closest to the Hanford Site. The city of Richland filters and treats water from the river and routinely monitors it prior to its distribution to ensure that the water meets federal DWSs (maximum contaminant levels [MCLs]), as required by the *Safe Drinking Water Act*. No alternate water sources have been required for the City of Richland because of contamination resulting from Hanford operations.

5.1.1 Physical Features Impacting Remedy Selection

The 100-D/H topography is gently sloping, with elevations ranging from approximately 154 m (505 ft) above mean sea level along the western boundary of the 100-D Area to 115 m (377 ft) above mean sea level south of the 100-H Area along the river shoreline. The average elevation in 100-D/H is 135 m (443 ft). The topography on the east side of the 100-D Area slopes downward, so the ground surface across the Horn is several meters lower in elevation. The gently sloping topography and soil types are easily excavated. Other topographic changes occur along the shoreline where the riverbank slopes steeply downward, toward the Columbia River.

The thickness of the vadose zone in 100-D/H ranges from approximately 27 m (90 ft) in the 100-D Area to 1 m (3 ft) near the Columbia River in the 100-H Area. A shallow unconfined aquifer is found within sands and gravels beneath most of the 100-D Area and in sands and gravels beneath the 100-H Area. In the area of the Horn, the shallow unconfined aquifer is variably within sands and gravels and gravel-dominated material. Fine-grained materials define the base of the unconfined aquifer. This material, part of the Ringold Formation upper mud (RUM) unit, forms an aquitard that restricts groundwater flow. In 100-D/H, these fine-grained materials are not continuous at all locations. A confined to semiconfined aquifer is located in sandy water-bearing units in the RUM. The upper confined to semiconfined water-bearing unit varies from approximately 0.5 to 7 m (1.6 to 23 ft) thick (Figure 3).

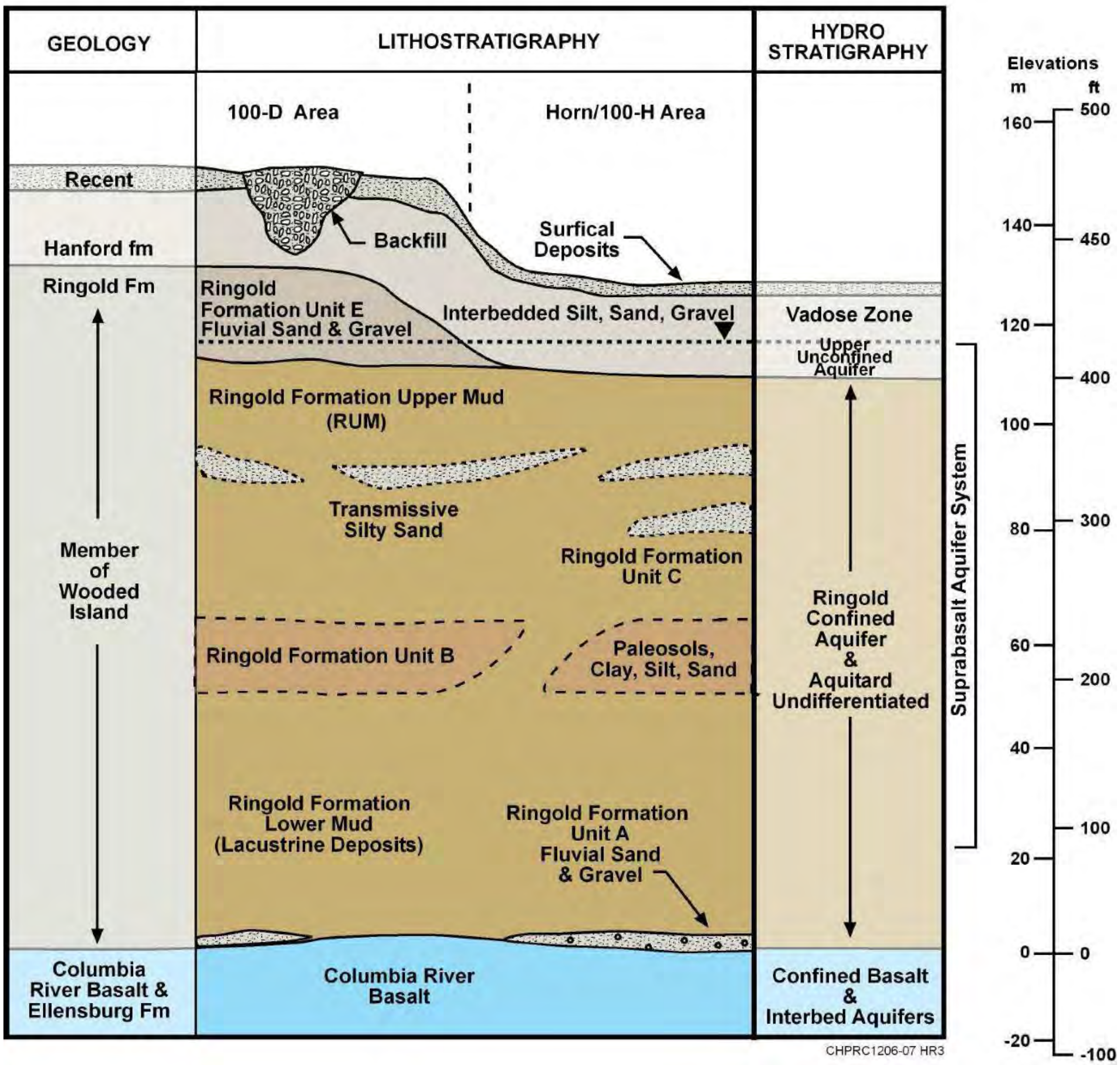
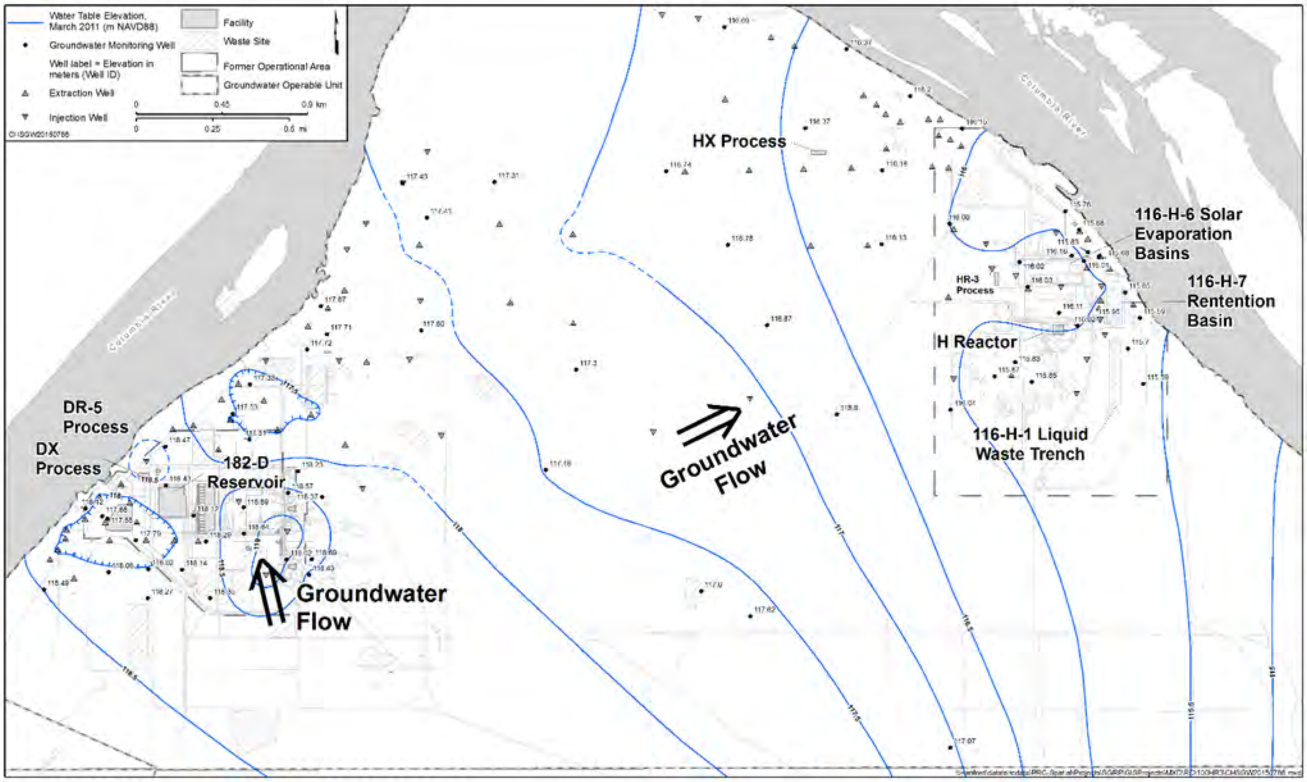


Figure 3. Stratigraphy and Hydrogeologic Units of 100-D/H

An important factor influencing remedy selection is the interaction of contaminated groundwater with the Columbia River. Groundwater and the Columbia River are hydraulically connected at 100-D/H, and the river level influences groundwater flow, especially near the river. Groundwater generally flows north in the 100-D Area, west to east beneath the Horn, and northeast in the 100-H Area, discharging to the Columbia River. Figure 4 presents the water table in March 2011, depicting typical groundwater flow direction.



Reference: NAVD88, *North American Vertical Datum of 1988*.

Figure 4. 100-D/H Water Table Map (March 2011)

Groundwater flow is not always directed toward the river, as the hydraulic gradients change direction in response to river stage. This interaction with the river not only affects groundwater flow patterns but also contaminant transport rates, groundwater geochemistry, contaminant concentrations, and attenuation rates.

Groundwater in the unconfined aquifer discharges to the Columbia River via upwelling through the riverbed and riverbank seeps (Figure 5). Because the river stage regularly fluctuates up and down, flow beneath the shoreline is back and forth over a limited distance, with river water intruding into the unconfined aquifer and mixing with groundwater during high river stage. When the river stage drops to a low elevation, riverbank seeps appear. High river stage is generally from May through August, and low river stage is generally from September through January, with transitional levels in other months. River-stage fluctuation affects the extraction of contaminated groundwater along the river. The rate of groundwater discharge from the Hanford Site unconfined and confined aquifers is very low compared to the flow of the river. Groundwater in the confined/semi-confined aquifer of the RUM is extracted in the near shore zone using the HX pump and treat system to mitigate potential discharges to the Columbia River in areas where contamination is found.

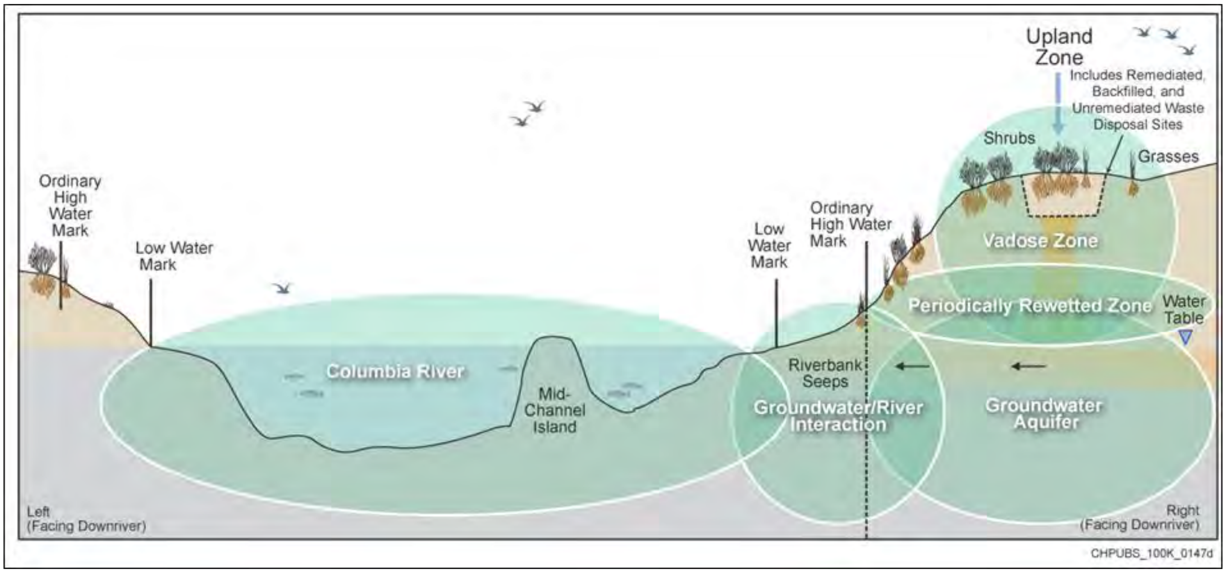


Figure 5. Groundwater and Surface Water Interactions at 100-D/H

The sands and gravels at 100-D/H provide a permeable media, which allows for efficient extraction of contaminated groundwater for treatment. This is true for both the unconfined aquifer and the water bearing units (confined/ semi-confined aquifer) within the RUM. This permeable media also allows efficient return of treated groundwater to the aquifer through wells or infiltration through the vadose zone.

5.2 Nature and Extent of Contamination

The following subsections discuss the nature and extent of contamination in the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs.

5.2.1 Sources of Contamination

The identified sources of contamination in the 100-D/H Area are categorized as primary and secondary sources. The primary sources of contamination in 100-D/H are from the historical operation of three water-cooled nuclear reactors, the structures and processes (e.g., sodium dichromate process) associated with reactor operations, and disposal of wastes to liquid waste disposal trenches and burial grounds.

Secondary sources consist of environmental media (e.g., soil, surface water, and groundwater) that were impacted by releases from primary sources. These media can retain sufficient levels of contaminants that can act as a reservoir for continuing releases to adjacent soil, surface water, groundwater, or air.

Historical releases of various liquid and solid waste resulted in contamination of the vadose zone and underlying groundwater. Contaminated groundwater migrated downgradient toward the Columbia River and entered the river through surface seeps and springs. Direct interaction of groundwater with surface water in the river's hyporheic zone also has occurred.

5.2.2 Waste Site (Soil) Contamination

The primary sources of contamination in 100-D/H were three water-cooled nuclear reactors (105-D, 105-DR, and 105-H), and the structures (for example, fuel storage basins, burial grounds) and processes (for example, sodium dichromate process) associated with reactor operations. Reactor cooling water, obtained from the Columbia River, was conditioned before passing through the reactor. The conditioning process included solids removal and addition of sodium dichromate for corrosion protection.

Contaminants potentially introduced into the cooling water as it passed through the reactor consisted of fuel materials, fission and activation products, and residual Cr(VI). Liquid wastes were disposed in basins, cribs, trenches, and ponds. The liquid waste discharged to the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OU waste sites contained metals, anions, radionuclides, and organic chemicals. The largest volume of waste from reactor operations was cooling water discharges containing Cr(VI) and radionuclides. The 118-D-3 and 118-D-4 Burial Grounds were the primary disposal sites for radioactive solid wastes at 100-D. The primary disposal site for radioactive solid waste from the 105-H Reactor was the 118-H-1 Burial Ground. Solid wastes consisted of sludge, reactor components, and various other contaminated items and were disposed in burial grounds at depths up to 8 m (25 ft) bgs. Waste generated from reactor operations was contaminated with radionuclides, hazardous chemicals, or both. For soil, the Vadose Zone Model for the River Corridor Model Version 1.0, implemented in the Subsurface Transport Over Multiple Phases (STOMP) computer model, and following the agency-concurred graded approach for development of soil screening levels and preliminary remediation goals, was used to evaluate waste site contaminant concentrations. This modeling approach provides for one-dimensional fate and transport modeling to determine the maximum soil concentration that can remain in place, for a given future infiltration scenario, without resulting in exceedances of groundwater protection levels in the future. Specific details on concentrations, depth, and mobility are included in the 100-D/H RI/FS report (DOE/RL-2010-95). Key contaminants driving waste site cleanup included Cr(VI), strontium-90, and cesium-137.

5.2.3 Groundwater Contamination

Contaminants from waste sites and facilities were transported through the vadose zone, into the periodically rewetted zone (PRZ), and then into the groundwater. For groundwater, the 100 Area Groundwater Model Version 3, implemented in MODFLOW-2000-MST and MT3DMS-MST, was used to evaluate baseline and remedial alternatives for groundwater contamination. The contaminant conditions were modeled into the future under the different alternatives to evaluate alternative performance. Less mobile contaminants tend to stay bound to soil particles in the vadose zone and PRZ, while more mobile contaminants tend to move through the vadose zone and PRZ into the groundwater due to driving forces (during reactor operations discharges and under natural rainfall conditions). As groundwater elevations rise and fall across the PRZ due to Columbia River stage changes, contaminants that are more mobile have the potential to leach into the groundwater. This includes contaminated soil in the PRZ, which is the lower portion of the vadose zone that is contacted by groundwater during periods of high groundwater elevation. Mobile contaminants such as nitrate and Cr(VI) have migrated through the vadose zone to the groundwater.

Groundwater contaminants include total chromium, Cr(VI), strontium-90, and nitrate. Figure 6 presents the groundwater contaminant of concern (COC) plumes identified by concentrations greater than a DWS or state surface water quality standard. Cr(VI) contamination in groundwater is associated with reactor cooling water discharges to the cooling water retention basins and trenches, and unplanned releases of concentrated solutions in product transfer areas. Sodium dichromate handling and cooling water discharge locations, which were the sources of Cr(VI), are identified in the 100-D/H RI/FS report (DOE/RL-2010-95). The total chromium, strontium-90, and nitrate contaminant plumes are generally collocated within the boundaries of the Cr(VI) plumes or are within the boundaries of current pump and treat system. The plume discussions in the 100-D/H RI/FS report identify the sources, concentrations, and plume characteristics.

Cr(VI). Cr(VI) in the 100-HR-3 OU exceeds the 10 µg/L Washington State surface water quality standard over an area of approximately 7.73 km2 (2.98 mi2) (DOE/RL-2011-118). DOE used the state surface water quality standard of 10 µg/L as a screening level to assess the potential for Cr(VI) to reach the river at concentrations greater than the state surface water quality standard. Concentrations were also compared to the Model Toxics Control Act (MTCA) (WAC 173-340, "Model Toxics Control Act—Cleanup") Method B groundwater cleanup level of 48 µg/L. Concentrations of Cr(VI) ranged from 2 to 69,700 µg/L for the data used in the RI/FS evaluation. With startup of the DX pump and treat system, which was installed to expand treatment of the Cr(VI) plume in the 100-D Area, the highest concentrations have declined and in 2014 were less than 4,000 µg/L. Because the plume exceeds the 10 µg/L state surface water quality standard, the pump and treat systems intercept and treat contaminated groundwater prior to it reaching the river. Cr(VI) has also been observed in the confined to semiconfined aquifer at the 100-H Area and is also intercepted there prior to reaching the river at concentrations above the 10 µg/L state surface water quality standard by the HX pump and treat system.

Total Chromium. Total chromium is collocated with Cr(VI), and treatment of Cr(VI) groundwater contamination will result in attainment of cleanup levels for total chromium. Total chromium in groundwater is primarily present as Cr(VI). Treatment of Cr(VI) groundwater contamination will result in attaining cleanup levels for total chromium in less time than Cr(VI), since the total chromium cleanup levels are greater than the Cr(VI) cleanup levels. Both the MTCA (WAC 173-340) Method B groundwater cleanup level of 48 µg/L and the state surface water quality standard (10 µg/L) for Cr(VI) are less than the respective DWS (100 µg/L) and ambient water quality criteria (65 µg/L) for total chromium.

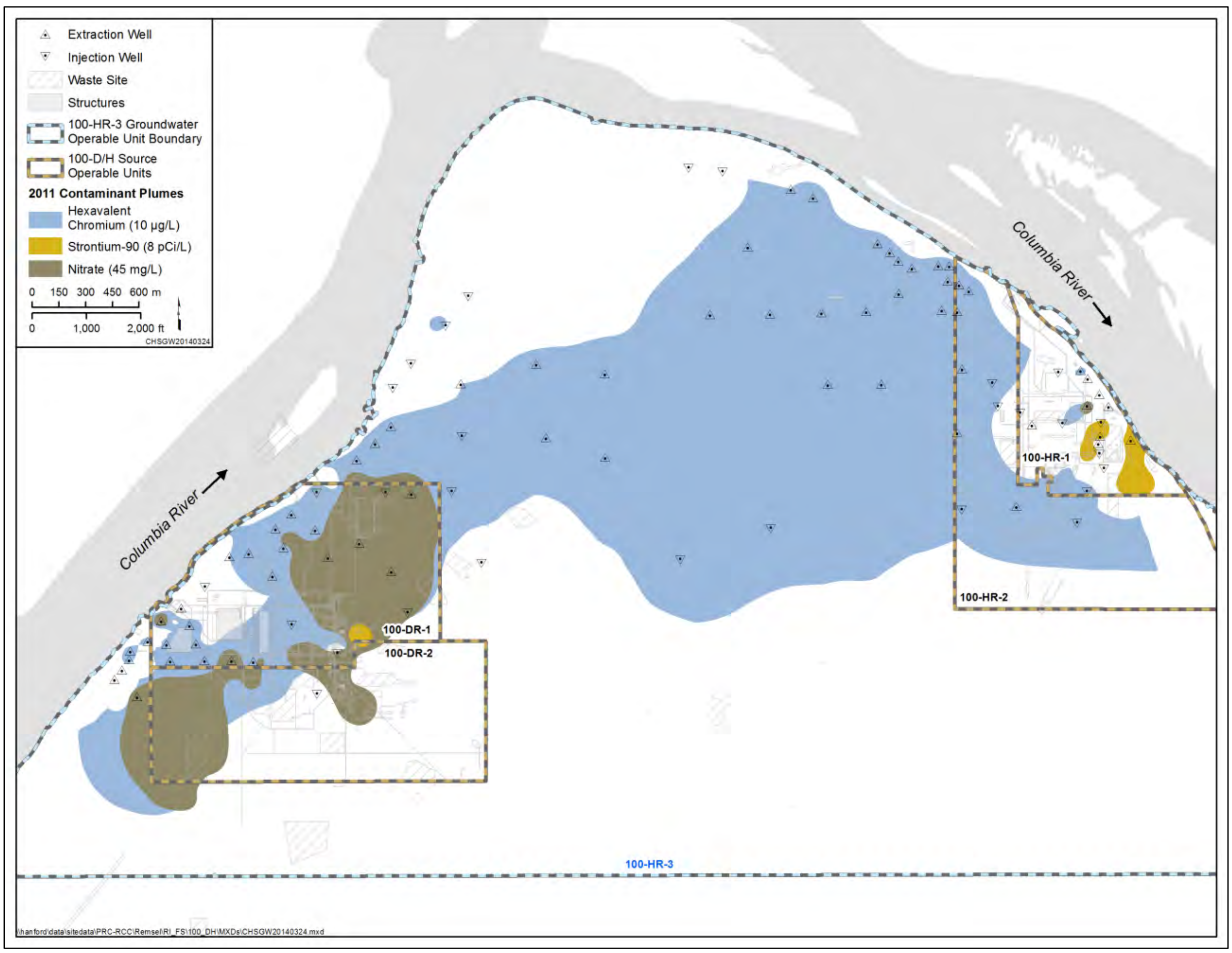


Figure 6. Groundwater Contaminant Plumes in the 100-HR-3 OU (2011)

Nitrate. Nitrate contamination of groundwater in the 100-HR-3 OU is greater than the 45 mg/L (NO_3)[1] DWS primarily in the 100-D Area and a small area in 100-H, encompassing an area of approximately 0.34 km^2 (0.13 mi^2). The primary source of nitrate in 100-D/H is nitric acid used during reactor operations as a decontamination solution. Concentrations of nitrate ranged from 1.81 to 107 mg/L in data evaluated for the RI/FS.

Strontium 90. Leaks from the cooling water retention basins, as well as the intentional discharges of contaminated cooling water to the disposal trenches, account for most of the observed strontium 90 contamination in groundwater. Concentrations of strontium 90 in groundwater above the 8 pCi/L DWS are present in an area of 0.12 km^2 (0.05 mi^2). Concentrations of strontium 90 range from 1.1 to 110 pCi/L in data evaluated for the RI/FS. The observed concentrations were less than the lowest risk based concentration for aquatic or riparian animals for strontium 90, which is 278 pCi/L for riparian animals. The risk based numbers for fish and aquatic invertebrates are much higher.

5.3 Conceptual Site Model

A CSM documents current and potential future site conditions and illustrates site conditions including contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human and ecological receptors. Figure 7 presents elements of the CSM for 100-D/H.

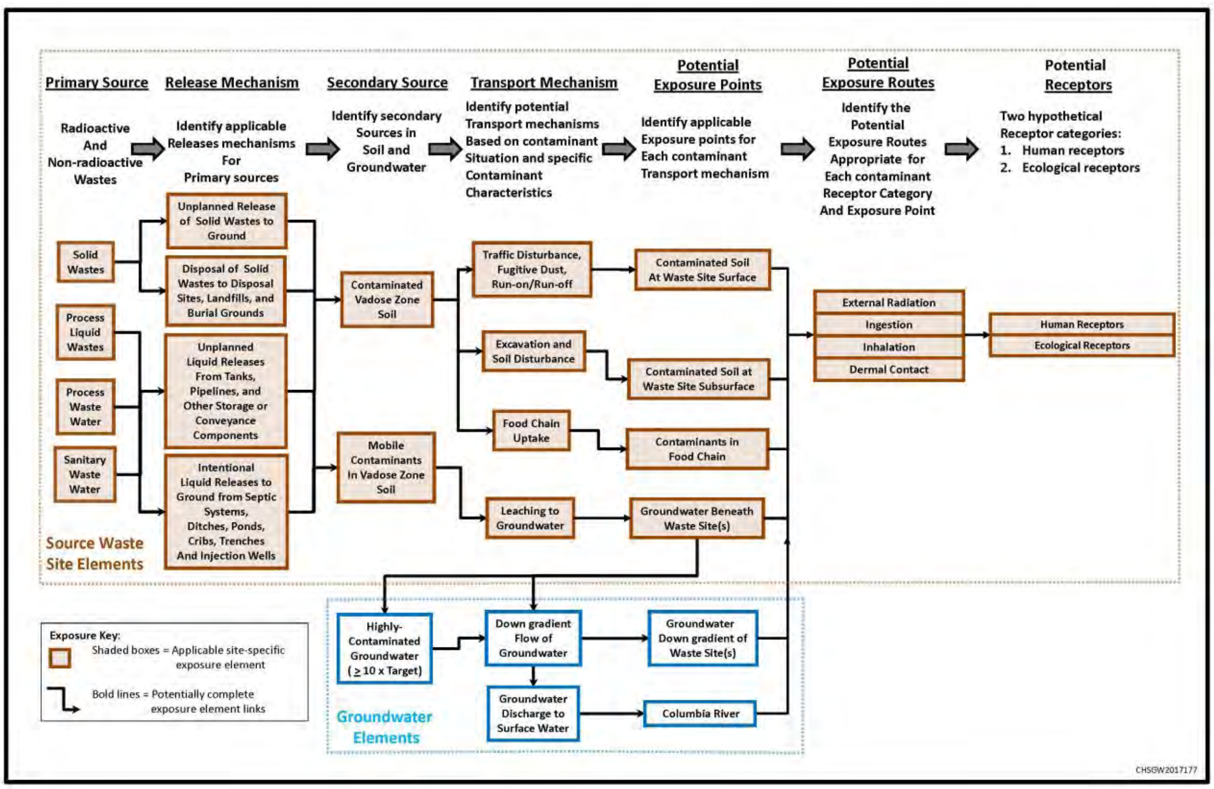


Figure 7. Conceptual Site Model for Soil and Groundwater within the 100-D/H Source OUs

Current and reasonably anticipated land and water uses are described in detail in Section 6.

[1] The EPA maximum contaminant level under the *Safe Drinking Water Act* for nitrate is 10 mg/L or 10 ppm. The 10 mg/L standard expressed as nitrogen (N) is equivalent to 45 mg/L expressed as nitrate.

Sources of contamination in 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs include unintentional and intentional releases, disposal by burial of solid waste materials and disposal through release of large volumes of liquid effluent to the vadose zone during reactor operations. Large volume liquid releases resulted in accelerated transport of contaminants to deeper portions of the vadose zone and the unconfined aquifer in 100-D/H. Plume migration patterns, as estimated by modeling, indicate a diminishing footprint of the Cr(VI) plume because of pump and treat operations.

Exposure pathways to contaminants for HHE are covered in detail in Chapters 6 and 7 of the 100-D/H RI/FS report (DOE/RL-2010-95) and include direct contact with contaminants in soil, excavation of soil, and leaching of contaminants to groundwater and subsequent exposure to groundwater through extraction or transport to surface water. Scenarios of how humans, plant, animal, bird, or invertebrate species might come into contact with contaminants and be affected were evaluated.

6.0 Current and Potential Future Land and Water Uses

This section discusses the current and reasonably anticipated future land uses at the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2, OUs, as well as the current use and future beneficial use of the 100-HR-3 groundwater located beneath these OUs. Land use forms part of the basis for exposure assessment assumptions and risk characterization conclusions.

6.1 Current Onsite and Surrounding Land Use

Land use in the 100-D/H Area is currently controlled by DOE, with the U.S. Fish and Wildlife Service (USFWS) managing the HRNM (USFWS, 2008, *Hanford Reach National Monument: Final Comprehensive Conservation Plan and Environmental Impact Statement, Adams, Benton, Grant and Franklin Counties, Washington*). DOE and the USFWS manage this federally owned land to protect natural and cultural resources while cleanup activities are being conducted. The 100-D/H Area is mostly comprised of undeveloped land. The D, DR and H Reactors remain in interim safe storage. The raw water supply for the 100 and 200 Areas is provided from the Columbia River through a series of pump houses, reservoirs, and pipelines. This water distribution system is known as the water export system. Parts of this system, including the 181-D Pump House and the 182-D reservoir, are located in 100-D/H.

The 100-D/H Area is being used for waste management, environmental monitoring, waste site remediation, and conservation and restoration activities. The segment of the Columbia River adjacent to 100-D/H is used for a variety of recreational activities. The land adjacent to the Columbia River is part of the HRNM and land use includes preservation and conservation. The land use further away, beyond the Hanford boundaries contains irrigated agriculture and to the south and east are the cities of Richland, West Richland, Kennewick, and Pasco.

The D/H area is shrub steppe habitat, home to a variety of birds, mammals and insects. There is a manmade structure that has become habitat for a maternal bat colony.

6.2 Anticipated Future Land Use

In June 2000, the HRNM was established within the boundaries of the Hanford Site. Clinton, 2000, *Establishment of the Hanford Reach National Monument*, mandates preservation of the natural and cultural resources within the HRNM and specifically included the possibility of adding lands to the HRNM as they are remediated. DOE's reasonably anticipated future use of the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs is conservation and preservation. As described in DOE/EIS-0222-F, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, and DOE/EIS-0222-SA-01, *Supplement Analysis, Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, the area is reserved for the management, protection, and preservation of archaeological, cultural, ecological, and natural resources. Limited public access would be consistent with resource preservation. EPA and Ecology believe that other uses, including residential use, are reasonably anticipated future land use for these areas. The residential based cleanup levels, identified in this ROD, also allow for conservation and preservation uses.

6.3 Current Ground and Surface Water Uses

Groundwater from the 100-HR-3 OU is currently contaminated above DWSs, and withdrawal for uses other than the pump and treat system, research purposes, and monitoring is prohibited by the interim action ROD (EPA/ROD/R10-96/134), and by DOE/RL-2001-41, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions and RCRA Corrective Actions*. Under current site use conditions and controls, the only complete human exposure pathway to groundwater in 100-HR-3 is the potential for limited exposure to groundwater from intermittent seeps along the Columbia River or during remediation, research and monitoring activities. 100-HR-3 groundwater is not being used for drinking water.

The Columbia River is the second largest river in the contiguous United States in terms of total flow and is the dominant surface-water body on the Hanford Site. The Columbia River is the principal source of drinking water for the Tri-Cities and the Hanford Site. In addition, the river is used regionally for irrigation and recreation, which includes fishing, hunting, boating, water skiing, diving, and swimming.

6.4 Potential Future Groundwater Beneficial Uses

The NCP (40 CFR 300.430(a)(1)(iii)(F)) 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." Washington state regulations contain a similar expectation.

Given the nature of the groundwater in 100-HR-3, potential beneficial groundwater uses include drinking water, irrigation and industrial uses. Drinking water use includes other domestic uses such as bathing and cooking. The Tri-Party agencies' goal for Hanford groundwater is consistent with the NCP.

6.5 Expected Timeframes for Beneficial Groundwater Use

Groundwater is not currently used as a drinking water source and there are no plans for using it as a drinking water source for at least the next 40 to 50 years it will take to achieve DWSs throughout the 100-HR-3 OU under the Selected Remedy. The Selected Remedy will achieve groundwater cleanup levels in 12 years for Cr(VI) and total chromium, in 6 years for nitrate, and in 44 years for strontium-90.

6.6 Location of Anticipated Groundwater Use in Relation to Contamination

Groundwater use, other than as part of groundwater monitoring, research, and pump and treat systems in contaminated areas, is not anticipated for at least the next 40 to 50 years. Raw Columbia River water from the export water system is the current and long term anticipated water source for the 100-D/H Area.

7.0 Summary of Site Risks

This section of the ROD summarizes the site risks associated with the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs, as identified in the baseline risk assessment, and in components of other risk assessments discussed in the RI/FS. This section of the ROD includes information on the human health risk assessments and ecological risk assessment and states the basis for taking action at these OUs.

7.1 Summary of Human Health Risk Assessment

The baseline risk assessment estimates what risks the contamination at the 100-D/H Area poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the human health risk assessment.

7.1.1 Identification of Contaminants of Concern

Contaminants of potential concern (COPCs) were initially identified by evaluating the history of operations in the 100-D/H Area and by analysis of soil and groundwater samples over time. From the initial list of COPCs, COCs were identified during site characterization and risk assessment. The COCs driving the need for remedial action in the soil and groundwater are identified in Table 3 based on this comprehensive review.

Table 3. Selected COCs for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs

Soil Radionuclides	Soil Nonradionuclides		Groundwater Radionuclides	Groundwater Nonradionuclides
Cesium-137 Cobalt-60 Europium-152 Europium-154 Nickel-63 Strontium-90	Antimony Arsenic Barium Cadmium Total chromium Hexavalent chromium Copper Lead Mercury Nickel Silver Zinc	Aroclor 1016 Aroclor 1221 Aroclor 1232 Aroclor 1242 Aroclor 1248 Aroclor 1254 Aroclor 1260 Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene Dibenz(a,h)anthracene Indeno(1,2,3 cd)pyrene Pyrene	Strontium-90	Total chromium Hexavalent chromium Nitrate

7.1.2 Human Health Exposure Assessment

For purposes of evaluating risk, establishing a basis for action, and developing cleanup levels, EPA, DOE, and Ecology agreed to evaluate risk based on the residential exposure scenarios. Residential human exposure scenarios were evaluated in the River Corridor Baseline Risk Assessment (RCBRA) (DOE/RL-2007-21, *River Corridor Baseline Risk Assessment, Volume II: Human Health Risk Assessment*), the Columbia River Component (CRC) (DOE/RL-2010-117, *Columbia River Component Risk Assessment*; *Volume II: Baseline Human Health Risk Assessment*) risk assessment, and the baseline human health risk assessment in the 100-D/H RI/FS report (DOE/RL-2010-95). In addition to the residential exposure scenario, the 100-D/H RI/FS report also includes human health risk estimates based on a National Monument worker, casual recreational user, and Tribal exposure scenarios.

The assessment of risk from exposure to chemicals assessment used Washington State's MTCA cleanup levels (WAC 173-340) for unrestricted use to identify unacceptable risk. For assessing risks from chemicals in soil, MTCA Method B (WAC 173-340-740, "Unrestricted Land Use Soil Cleanup Standards") levels were used. MTCA provides chemical-specific standards that define acceptable risk levels based on reasonable maximum exposure scenarios. For direct contact, these MTCA-based cleanup levels are based on a six-year exposure of a child through incidental soil ingestion, but are not based on consumption of site-derived food. For the inhalation pathway, the MTCA Standard Method B cleanup levels are based on exposure of adults and children from inhalation of vapors and dust in ambient air. The residential scenario used to assess risk described above assumed potential exposure to the top 4.6 m (15 ft) of soil as part of the reasonable maximum exposure scenario.

For assessing residential risk from radionuclides in soil, the residential scenario that was used assumes that exposure to soil within the top 4.6 m (15 ft) occurs over a 30-year period. That scenario was evaluated as follows. A residence is established on the waste site and the resident receives exposure from direct contact with the soil from the waste site and through the food chain. This includes potential exposure through external radiation, incidental soil ingestion, and inhalation of ambient dust particulates. The food chain pathway includes exposure from consumption of fruits and vegetables grown in a backyard garden and consumption of meat (beef and poultry) and milk from livestock raised in a pasture. Uptake of contamination into crops and livestock is assumed to occur from contamination present in soil. Contaminants in soil are transported through the soil column, into the underlying groundwater, and to a hypothetical down gradient well located at the waste site boundary that is used for drinking water consumption, irrigation of crops and watering livestock and consumption of fish raised in a pond of water drawn from a well down gradient of the waste site. An additional risk evaluation was performed for groundwater use based on the assumption that the only exposure was through use of groundwater as a drinking water source (which includes other domestic uses such as bathing and cooking). The cancer risk limit for soil radionuclides used in the risk assessment was 1×10^{-4} excess upper bound lifetime cancer risk to an individual or 15 mrem/year for isotopes where that is more conservative.

The exposure pathways and duration in the MTCA (WAC 173-340) unrestricted scenario used to evaluate risk for chemical soil contaminants are less conservative than the default residential scenario in EPA guidance. However, EPA guidance allows the use of site-specific scenarios for assessing risk and setting cleanup levels. The MTCA unrestricted scenario is single pathway, the more conservative of the ingestion or inhalation pathways. The EPA default residential scenario uses multiple pathways, which is the sum of ingestion, inhalation and dermal pathways. The MTCA duration is six years for ingestion and is thirty years for inhalation. The EPA duration is 30 years for all pathways. The MTCA cancer risk limit for individual chemicals in soil is 1×10^{-6}. The MTCA multi-contaminant total cancer risk limit is 1×10^{-5}. Although MTCA is less conservative with respect to the risk scenarios, the acceptable MTCA risk limits are at the conservative end of the NCP cancer risk range, which is 1×10^{-4} to 1×10^{-6}. MTCA uses the same hazard index of one limit as EPA for non-cancer toxic effects.

Human health risk from exposure to groundwater was evaluated through risk calculations and comparison to federal and state drinking water or cleanup standards. For assessing human health risks from radionuclides and chemicals in groundwater, the methodology identified in EPA's tap water scenario was used (residential drinking water source in EPA's "Regional Screening Levels for Chemical Contaminants at Superfund Sites"). The approach used assumes that the groundwater is used as a tap water source for a 30 year period. Potential routes of exposure include ingestion, dermal contact and inhalation of volatiles during household activities. Groundwater concentrations were also compared to existing federal and state drinking water or cleanup standards.

7.1.3 Human Health Toxicity and Risk Characterization

All of the waste sites in the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 source OUs that were remediated under Interim RODs with closeout verification data as of November 2012 from the shallow vadose zone from 0 to 4.6 m (0 to 15 ft) bgs were evaluated in the RI risk assessment. Only six sites (116-DR-9/100-D-25, 116-D-8, 116-H-5, 118-D-6:4, and 118-H-1:1) had residual radionuclide contamination that resulted in excess lifetime cancer risk (ELCR) greater than 1×10^{-4} based on the residential exposure scenario. These sites will decay to a total ELCR of less than 1.0×10^{-4} by years 2038, 2035, 2016, 2022, and 2016, respectively. All other previously remediated waste sites with closeout verification data as of November 2012 report a total ELCR for non-radiological chemical contamination less than the MTCA (WAC 173-340-708(5), “Human Health Risk Assessment Procedures”) total risk threshold of 1×10^{-5}, individual chemical contaminant risk threshold of 1×10^{-6}, and have a hazard index of less than one for the residential exposure scenario.

The residential risk assessment scenario considered direct exposure to contamination within the upper vadose zone 4.6 m (0 to 15 ft) bgs. In the risk assessment, closeout verification data from all previously remediated waste sites excavated into the deep vadose zone were evaluated to identify where exposure to residual contamination could present a potential risk from an inadvertent exposure through deep excavation activities. Thirty-five remediated waste sites in the 100-DR-1, 100-DR-2, and 100-HR-1 OUs (100-D-5,100-D-6, 100-D-18, 100-D-19, 100-D-48:1, 100-D-48:2, 100-D-48:3, 100-D-49:1, 100-D-49:2, 100-D-49:4, 116-D-1A, 116-D-1B, 116-D-7, 116-DR-1&2, 118-D-6:3, 118-D-6:4, UPR-100-D-2, UPR-100-D-3, UPR-100-D-4, 116-DR-9, 100-D-25, 100-D-46, 116-DR-6, 118-D-3:1, 100-H-1, 100-H-11, 100-H-12, 100-H-14, 100-H-21, 100-H-22, 116-H-1, 116-H-3, 116-H-7, 118-H-6:3, and 118-H-6:6) contained residual radionuclide contamination at depths greater than 4.6 m (15 ft) bgs that would result in an ELCR greater than 1×10^{-4} based on residential exposure should the contamination deeper than 15 feet be brought to the surface through excavation activities in sufficient quantities to allow exposures through the residential scenario, including food chain pathway exposures. Radionuclides associated with historical waste disposal contribute a majority of the ELCR and include cesium-137, cobalt-60, europium-152, europium-154, nickel-63, and strontium-90.

For waste sites that had not been remediated as of December 2012, a review of available characterization data, waste site history or processes, and contamination and risk information for analogous waste in remediated sites was used to assess risk. Although only some of these sites had sample data, this comprehensive review of information was used to assess risk.

Between December 2012 and December 2015, interim remediation was completed at an additional 101 waste sites in the 100-D/H source OUs. The results of the waste site data evaluation (CHPRC-02895, *Evaluation of Remaining Site Verification Packages Approved after Transmittal of the Rev. 0 Remedial Investigation/Feasibility Study for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units, DOE/RL-2010-95*) indicate that radionuclides will result in an ELCR greater than 1×10^{-4} based on the residential exposure scenario at shallow zone waste sites 118-D-2:1 and 100-H-54, and deep zone waste site 118-D-3:1. These sites will decay to a total ELCR of less than 1×10^{-4} by years 2019, 2026, and 2025 respectively.

All of the previously remediated waste sites in the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs were also evaluated as potential sources for groundwater and surface water contamination using closeout verification data. The Cr(VI) surface water standard (10 µg/L) was used to determine if unacceptable risk to surface water exists, as groundwater discharges to the Columbia River and the surface water standard is lower than the risk standards for drinking water and other residential uses.

Groundwater was evaluated as a potential drinking water source through a comparison of the exposure point concentration (EPC) for each contaminant against the lowest applicable standard or MTCA risk-based concentration, including federal and state DWSs and MTCA-based groundwater cleanup levels. EPCs were calculated using ProUCL statistical software.

Groundwater COCs are total chromium, Cr(VI), nitrate, and strontium-90. The groundwater Cr(VI) plumes are the southern and northern plumes in the 100-D Area, and the Horn and 100-H Area plumes in the eastern portion of the 100-D/H Area. The total chromium, strontium-90, and nitrate contaminant plumes are generally collocated within the boundaries of the Cr(VI) plumes or are within the boundaries of current pump and treat system containment. The groundwater within 100-HR-3 contains total chromium at concentrations greater than the federal DWS of 100 µg/L, nitrate at concentrations greater than the DWS of 45,000 µg/L, strontium-90 at concentrations greater than the DWS of 8 pCi/L and Cr(VI) concentrations greater than the MTCA Method B groundwater cleanup level of 48 µg/L.

Contaminant concentrations in the groundwater were also compared to surface water standards for protection of aquatic organisms because groundwater discharges to the Columbia River. This comparison included state surface water quality standards for fresh water and federal ambient water quality criteria. The groundwater within the 100-HR-3 Groundwater OU contains Cr(VI) concentrations greater than the WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington," freshwater state surface water quality standard of 10 µg/L.

The risk assessment included evaluation of groundwater contamination using the EPA tap water scenario. Both cancer and non-cancer risk were calculated for ingestion and dermal contact as well as inhalation of volatile contaminants during household activities. Based on the results of the groundwater risk evaluation, concentrations of total chromium, Cr(VI), nitrate, and strontium-90 exceeded risk thresholds for carcinogenic (10^{-4} ELCR) and/or non-carcinogenic (hazard index greater than 1) risk and were identified as COCs.

7.1.4 Uncertainties

Uncertainties in the risk assessment arise due to multiple factors. Uncertainty reflects limitations in knowledge, which means that simplifying assumptions must be made to quantify health risks. Uncertainties are associated with sampling and analysis, sampling design, calculated EPCs, actual exposure verses exposure scenarios, fate and transport models, toxicity assumptions and risk characterization.

A significant uncertainty in the risk assessment is related to backfill. The risk assessment for waste sites in the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 source OUs that had completed interim remediation did not consider the risk reduction resulting from backfill placed over residual contamination. Post excavation confirmatory sample data collected from the bottom and sides of the excavation to depths as great as 4.6 m (15 ft) bgs was used in the risk assessment as if ground surface contained contamination at that concentration. Clean backfill reduces actual risk.

For many waste sites, characterization data has been collected using both a statistical sampling design and a focused sampling design, which uses samples that have been taken in areas anticipated to be the most contaminated. When both statistical and focused samples exist for an analyte at a waste site, risk could be overestimated due to sample bias. Focused samples in areas expected to have contamination tend to have higher values than statistical samples more representative of an area. During interim action remediation, statistical samples were used in a comparison to cleanup levels; for some sites, focused samples were collected and compared with cleanup levels. These uncertainties apply to both the human health and the ecological risk assessments.

7.2 Summary of Ecological Risk Assessment

The RCBRA (DOE/RL-2007-21, *River Corridor Baseline Risk Assessment, Volume I: Ecological Risk Assessment*) and the 100-D/H RI/FS report some exceedances of ecological risk thresholds at the 100-D/H Area interim remediated waste sites. The 100-D/H RI/FS used information from the RCBRA and other sources to evaluate the risk to populations and communities of ecological receptors, and it was concluded that there was no ecological risk at remediated waste sites within the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 source OUs. From this evaluation that considered the nature and extent of contamination, including consideration of the size of these waste sites compared to large areas of uncontaminated land surrounding each of the waste sites, a conclusion was drawn that there is no ecological risk at the population and community level. Based on consideration of ecological populations and communities, there is no basis for action at remaining 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 waste sites.

The RCBRA and CRC (DOE/RL-2010-117, *Columbia River Component Risk Assessment, Volume I: Screening-Level Ecological Risk Assessment*) evaluated potential ecological risks present in the riparian, near-shore, and river areas in the 100-D/H Area. The 100-D/H RI/FS (DOE/RL-2010-95) used information from these risk assessments and from other sources to evaluate risk to populations and communities of ecological receptors. The 100-D/H RI/FS evaluated contaminants present in these environments and pathways where Hanford Site operations have or may have released contaminants to the riparian, near-shore, and river environments. This included an evaluation of releases or potential releases of radionuclides, metals, and nitrate into the Columbia River from groundwater. Total chromium and Cr(VI) in groundwater within the riverbed gravels are considered contaminants of ecological concern to the 100-D/H near-shore area. The CRC concluded that groundwater actions taken in the 100 Areas OUs would address these COCs. No contaminants of ecological concern were identified in the riparian soil above risk thresholds. Although the state surface water quality standards and federal AWQC are exceeded, no risk was identified in the river.

The Hanford Reach of the Columbia River contains three species listed as threatened or endangered under the federal *Endangered Species Act of 1973*. These include the upper Columbia River spring-run Chinook salmon and steelhead, and the bull trout. The spring-run Chinook salmon do not spawn in the Hanford Reach, but use it as a migration corridor. Steelhead spawning has been observed in the Hanford Reach. The bull trout is not considered a resident species and is rarely observed in the Hanford Reach. The 100-HR-3 OU contains four groundwater COCs: Cr(VI), total chromium, nitrate, and strontium-90. The Columbia River rapidly dilutes groundwater contaminants to low concentrations, so the primary concern for ecological risk to aquatic biota is from exposure to contaminated pore water. Contaminated groundwater from the 100-HR-3 OU will have no effect on these fish species. This conclusion of no effect is because current and predicted future concentrations of COCs in groundwater and pore water do not exceed toxicity thresholds for steelhead near known spawning areas. Groundwater upwelling occurs during the low-flow seasons that do not overlap with the time frame when early life stages of steelhead are present in river gravels within their established spawning areas (redds).

7.3 Basis for Action

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants, or contaminants into the environment. Such a release or the threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment. However, no action is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment from wastes sites identified in Table 1 as No Action sites.

The risk assessment for waste sites in the 100-D/H RI/FS report (DOE/RL-2010-95) relied on a comprehensive review of all available data for each waste site, including field data, radiological surveys, process history, analogous site information, personal interviews, engineering drawings and as-builts, and any other information identified during the development of the report. Interim remediation data collected up to November 2012, including closeout verification documentation, was included in the risk assessment. Waste sites were determined to either have no remaining contaminants at concentrations greater than established standards that define acceptable levels of exposure, therefore, no further remedial action is necessary or that there are risks above established standards that define acceptable levels of exposure (Tables 4 and 5), thus providing a basis for action.

Waste sites that have not been remediated were evaluated based on process history, sample data and analogous experience from sites already interim remediated. These waste sites were determined to pose an unacceptable risk to HHE from direct exposure, providing the basis for remedial action. COCs for these sites are presented in Table 3.

Based on the results of the groundwater risk evaluation, concentrations of nitrate, total chromium, and strontium-90 are present at levels that exceed DWSs and are identified as COCs. Cr(VI) is present at levels that exceed the state surface water quality standard (WAC 173-201A) and 48 μg/L human health risk-based concentration (WAC 173-340-720, "Groundwater Cleanup Standards") in groundwater in the upland areas and is also identified as a COC. Contamination in the groundwater is determined to pose an unacceptable risk to HHE.

8.0 Remedial Action Objectives

RAOs provide a general description of cleanup goals. These goals typically provide the basis for development of the remedial alternatives, provide a basis for evaluating the cleanup options, and provide an understanding of how the identified risks will be addressed by the response action. RAOs also facilitate the five-year review determination of protectiveness.

8.1 Specific Remedial Action Objectives

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, taking into account the current and reasonably anticipated future land use. The RAOs for the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs are based on a residential use scenario. The RAOs for the 100-HR-3 OU reflect the potential use of groundwater as a drinking water source. The RAOs for the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs are RAOs 3 through 6. The RAOs for the 100-HR-3 OUs are RAOs 1, 2, and 7. The RAOs are as follows:

- **RAO 1:** Prevent unacceptable risk to human health from ingestion of and incidental exposure to groundwater containing contaminant concentrations above federal and state standards and risk-based thresholds.

- **RAO 2:** Prevent unacceptable risk to human health and ecological receptors from groundwater discharges to surface water containing contaminant concentrations above federal and state standards and risk-based thresholds.

- **RAO 3:** Prevent unacceptable risk from contaminants migrating and/or leaching through soil that will result in groundwater concentrations that exceed standards and risk-based thresholds for protection of surface water and groundwater.

- **RAO 4:** Prevent unacceptable risk to human health and ecological receptors from exposure to the upper 4.6 m (15 ft) of soil, structures, and debris contaminated with non-radiological constituents at concentrations above the unrestricted land-use standards for human health (provided in MTCA Method B [WAC 173-340]) or soil contaminant levels protective of ecological receptors.

- **RAO 5:** Prevent unacceptable risk to human health and ecological receptors from exposure to the upper 4.6 m (15 ft) of soil, structures, and debris contaminated with radiological constituents. For human health and ecological receptors:
  - Prevent exposure to radiological constituents at concentrations at or above a dose rate limit that causes an ELCR threshold of 1×10^{-6} to 1×10^{-4} above background for the residential exposure scenario.
  - Prevent ecological receptors based on a dose rate limit of 0.1 rad/day for terrestrial wildlife populations.
- **RAO 6:** Manage direct exposure to contaminated soils deeper than 4.6 m (15 ft) to prevent an unacceptable risk to human health and the environment.
- **RAO 7:** Restore groundwater in 100-HR-3 to cleanup levels, which include DWSs, within a time frame that is reasonable given the particular circumstances of the site.

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

8.2 Cleanup Levels

Cleanup levels are the specific endpoint contaminant concentrations that have been developed for each media and/or exposure pathway, that provide protection of HHE and comply with ARARs.

Soil cleanup levels for 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 were developed based on human health cleanup levels (Table 4) as well as groundwater and surface water protection (Table 5). These cleanup levels apply to soil and debris. The direct contact cleanup levels for radionuclides were set at the lower of the risk-based level of 1×10^{-4} ELCR or 15 mrem/year radiation dose, which was also used in the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 interim actions. For europium-152, europium-154, and cobalt-60, the 15 mrem/year radiation dose that was used for the interim actions was retained as the cleanup level since the 1×10^{-4} ELCR level was higher. The cleanup levels as indicated in Table 4 for these radionuclides are 3.3, 3.0, and 1.4 pCi/g respectively. The calculated 1×10^{-4} ELCR levels were 81, 3.7, 4.4, and 3.1 pCi/g respectively. Direct contact cleanup levels for non-radionuclides are based on current state standards (MTCA standards at WAC 173-340-740) for unrestricted use using a hazard index of one and an ELCR of 1×10^{-6}.

Soil cleanup levels for the protection of groundwater and surface water were calculated based on site-specific data and specific parameters using STOMP with a one-dimensional model for all contaminants (Table 5). The geologic differences between the 100-D and 100-H Areas result in different groundwater protection cleanup levels. For highly mobile contaminants (retardation coefficient <2), the model assumes the entire vadose zone from ground surface to groundwater is contaminated. For less mobile contaminants (retardation coefficient ≥2), the model assumes the top 70 percent is contaminated and the bottom 30 percent is not contaminated. Since cleanup levels are based on a residential scenario, a groundwater recharge rate of approximately 72 mm per year was used representing an irrigated condition. A soil cleanup level for groundwater or surface water protection was not selected for some contaminants because the model indicated the contaminants will not reach groundwater within 1,000 years at concentrations above the cleanup levels in Table 5.

The cleanup levels for contaminated soil in the top 4.6 m (15 ft) are the more protective (whichever is the lowest value) of the human health cleanup level (Table 4) or the groundwater and surface water protection cleanup level (Table 5). For contaminated soil at depths deeper than 4.6 m (15 ft) bgs, cleanup levels are the levels protective of groundwater and surface water.

Groundwater cleanup levels (upland and at groundwater discharge to surface water) for 100-HR-3 are based on site-specific data, current federal DWSs, state surface water quality standards (WAC 173-201A), and risk-based concentrations (WAC 173-340-720) (Table 6).

Table 4. Soil Cleanup Levels for Protection of Human Health

Media: Soil and Debris Site Area: 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs			
Contaminant	**Units**	**Cleanup Level (≤4.6 m [15 ft] bgs)**	**Basis for Cleanup Level**
Radionuclides			
Cesium-137	pCi/g	4.4	Direct contact residential scenario
Cobalt-60	pCi/g	1.4	Residential remedial action cleanup level*
Europium-152	pCi/g	3.3	Residential remedial action cleanup level*
Europium-154	pCi/g	3.0	Residential remedial action cleanup level*
Nickel-63	pCi/g	608	Direct contact residential scenario
Strontium-90	pCi/g	2.3	Direct contact residential scenario
Chemicals			
Antimony	mg/kg	32	Direct contact, MTCA Method B
Arsenic	mg/kg	20	WAC 173-340-900, Table 740-1, MTCA Method A
Barium	mg/kg	16,000	Direct contact, MTCA Method B
Cadmium	mg/kg	80	Direct contact, MTCA Method B
Total chromium	mg/kg	120,000	Direct contact, MTCA Method B
Hexavalent chromium	mg/kg	240	Direct contact, MTCA Method B
Copper	mg/kg	3,200	Direct contact, MTCA Method B
Lead	mg/kg	250	WAC 173-340-900, Table 740-1, MTCA Method A
Mercury	mg/kg	24	Direct contact, MTCA Method B
Nickel	mg/kg	1,600	Direct contact, MTCA Method B
Silver	mg/kg	400	Direct contact, MTCA Method B
Zinc	mg/kg	24,000	Direct contact, MTCA Method B
Aroclor 1016	mg/kg	5.6	Direct contact, MTCA Method B
Aroclor 1221	mg/kg	0.19	Inhalation, MTCA Method B
Aroclor 1232	mg/kg	0.19	Inhalation, MTCA Method B
Aroclor 1242	mg/kg	0.50	Direct contact, MTCA Method B
Aroclor 1248	mg/kg	0.50	Direct contact, MTCA Method B

Table 4. Soil Cleanup Levels for Protection of Human Health

Media: Soil and Debris Site Area: 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs			
Contaminant	**Units**	**Cleanup Level (≤4.6 m [15 ft] bgs)**	**Basis for Cleanup Level**
Aroclor 1254	mg/kg	0.50	Direct contact, MTCA Method B
Aroclor 1260	mg/kg	0.50	Direct contact, MTCA Method B
Benzo(a)pyrene	mg/kg	0.14	Direct contact, MTCA Method B
Benzo(b)fluoranthene	mg/kg	1.4	Direct contact, MTCA Method B
Benzo(k)fluoranthene	mg/kg	1.4	Direct contact, MTCA Method B
Chrysene	mg/kg	14	Direct contact, MTCA Method B
Dibenz(a,h)anthracene	mg/kg	1.4	Direct contact, MTCA Method B
Indeno(1,2,3-cd)pyrene	mg/kg	1.4	Direct contact, MTCA Method B
Pyrene	mg/kg	1.4	Direct contact, MTCA Method B

* Based on 15mrem / year cleanup level used in the Interim Records of Decision that are more stringent / protective than the $1x10^{-4}$ levels

MTCA = "Model Toxics Control Act—Cleanup" (WAC 173-340), Methods A and B (Soil Cleanup Levels for Unrestricted Land Use)

bgs = below ground surface

Waste sites that contain multiple contaminants will meet cumulative risk limits of 10-4 for radionuclides, 10-5 for chemicals, and a hazard index of 1.

Table 5. Soil Cleanup Levels for Protection of Groundwater and Surface Water

Contaminant	**Soil Cleanup Levels for Protection of Groundwater and Surface Water (Ground Surface to Water Table)[a]**	
	100-D	**100-H**
Radionuclides $\left(\frac{pCi}{g}\right)$		
Cesium-137	—	—
Cobalt-60	—	—
Europium-152	—	—
Europium-154	—	—
Nickel-63	—	>1,000,000
Strontium-90	29,400	157,000
Chemicals $\left(\frac{mg}{kg}\right)$		
Antimony	—	5,590
Arsenic[b]	246	20

Table 5. Soil Cleanup Levels for Protection of Groundwater and Surface Water

Contaminant	Soil Cleanup Levels for Protection of Groundwater and Surface Water (Ground Surface to Water Table)[a]	
	100-D	100-H
Barium	389,000	389,000
Cadmium	1.3	15
Total chromium	—	—
Hexavalent chromium[b]	2.0	2.0
Copper	4,030	1,920
Lead	—	—
Mercury	—	17
Nickel	—	150,000
Silver	18	191
Zinc	—	225,000
Aroclor 1016	—	260
Aroclor 1221	0.099	1.0
Aroclor 1232	0.099	1.0
Aroclor 1242	—	77
Aroclor 1248	—	72
Aroclor 1254	—	591
Aroclor 1260	—	—
Benzo(a)pyrene	—	—
Benzo(b)fluoranthene	—	—
Benzo(k)fluoranthene	—	—
Chrysene	—	—
Dibenz(a,h)anthracene	—	—
Indeno(1,2,3-cd)pyrene	—	—
Pyrene	—	389,000

a. Soil cleanup levels protective of groundwater and protective of surface water are provided on a unit-length basis. To apply these soil cleanup levels, divide the listed value by a representative length across the waste site decision unit in the general direction of groundwater flow to obtain the cleanup value for evaluation use. (Note that this scaling is not applicable to soil cleanup levels for arsenic and Cr(VI), the cleanup levels for these two analytes are in units of mg/kg.)

b. This value is not scaled by the representative waste site decision unit dimension in the general direction of groundwater flow.

Table 6. Cleanup Levels for 100-HR-3 Groundwater

COC	Units	Cleanup Level	Basis for Cleanup Level
Hexavalent chromium[a]	µg/L	10/48	WAC 173-201A/WAC 173-340-720
Total chromium[b]	µg/L	65/100	40 CFR 131/DWS
Nitrate[c]	µg/L	45,000	DWS
Strontium-90	pCi/L	8	DWS

Note: DWSs are from 40 CFR 141, "National Primary Drinking Water Regulations."

40 CFR 131, "Water Quality Standards."

WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington."

WAC 173-340-720, "Model Toxics Control Act–Cleanup," "Groundwater Cleanup Standards."

a. Cleanup levels for hexavalent chromium are 10 µg/L where groundwater discharges to surface water and 48 µg/L in the upland groundwater.

b. Cleanup levels for total chromium are 65 µg/L where groundwater discharges to surface water and 100 µg/L in the upland groundwater.

c. Nitrate may be expressed as nitrate-nitrogen (NO_3-N) or as nitrate (NO_3). The DWSs for NO_3-N and NO_3 are 10,000 and 45,000 µg/L, respectively.

COC = contaminant of concern

DWS = drinking water standard

9.0 Description of Alternatives

This section describes the remedial alternatives that were developed for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs that were evaluated in the 100-D/H RI/FS report (DOE/RL-2010-95). That evaluation included the use of interim remediated waste site data through November 2012. Since that time, under interim remedial actions, waste sites have been remediated, and groundwater has continued to be treated to remove Cr(VI). The alternatives and associated costs reflect the OU status and information available in 2012. The major components of the alternatives evaluated are as follows:

- Alternative 1: No Action.
- Alternative 2: RTD, ICs, Pipeline Capping with ICs, and No Action for waste sites; Pump and Treat, Additional Groundwater Wells, Biological Treatment, and MNA with ICs for groundwater.
- Alternative 3: RTD, ICs, Pipeline Capping with ICs, and No Action for waste sites; Increased Capacity Pump and Treat, Additional Groundwater Wells, and MNA with ICs for groundwater.
- Alternative 4: RTD, ICs, and No Action for waste sites; Pump and Treat, Additional Groundwater Wells, and MNA with ICs for groundwater.

The following subsections provide general descriptions, distinguishing features and expected outcomes of each of the alternatives evaluated in the 100-D/H RI/FS report (DOE/RL-2010-95).

9.1 Description of Remedy Components

9.1.1 Alternative 1: No Action

Estimated capital cost: $0

Estimated annual O&M cost: $0

Estimated present value (discounted): $0

Estimated time to achieve cleanup levels for waste sites: Cleanup levels would not be met for sites other than no action waste sites in Table 1 and other sites remediated under the interim ROD that upon further review prove to have met cleanup levels.

Estimated time to achieve cleanup levels for groundwater: Cr(VI) and total chromium would not be met; 60 years for nitrate, and 63 years for strontium-90 pursuant to natural attenuation processes.

Consideration of a No Action alternative is a requirement of the NCP (40 CFR 300.430(e)(6)). The No Action alternative is included to provide a baseline for comparison against the other alternatives. Under the No Action alternative, no additional remedial action would be taken to address potential threats to HHE posed by the contamination. All existing actions would cease, including ICs and groundwater monitoring under interim RODs. Remaining waste site contamination above cleanup levels would not be addressed. Without further remedial action, fate and transport model predictions for groundwater indicate that Cr(VI) contamination does not attenuate to concentrations less than cleanup levels within the modeling period of 75 years. Nitrate contamination attenuates to a concentration less than the DWS within 60 years. Strontium-90 contamination attenuates to a concentration less than the DWS within 63 years. The No Action alternative would not remediate the waste sites with contamination exceeding cleanup levels and as a result, these waste sites would have contamination that is not protective of HHE.

9.1.2 Alternative 2: RTD, ICs, Pipeline Capping with ICs and No Action for Waste Sites; Pump and Treat, Additional Groundwater Wells, Biological Treatment, and MNA with ICs for Groundwater

Estimated capital cost: $88 million

Estimated O&M cost: $343 million

Estimated present value (discounted): $333 million

Estimated time to achieve cleanup levels for waste sites: 25 years

Estimated time to achieve cleanup levels for groundwater: 25 years for Cr(VI) and total chromium, 13 years for nitrate, and 56 years for strontium 90

RTD*:* Alternative 2 uses RTD at waste sites in Table 1 listed under the RTD technology/approach. Contaminated soil and debris are excavated as needed to meet cleanup levels using shallow and deep excavation technology, transported to ERDF, and treated as necessary to meet LDRs prior to disposal. The estimated volume of contaminated material for removal is 133,000 m^3 (174,000 yd^3). The remediated sites will be backfilled with clean borrow material and contoured, and native vegetation will be established.

Waste sites selected for the RTD remedy component which were remediated under interim actions prior to issuance of this ROD will be evaluated to determine if these waste sites meet the cleanup levels in Tables 4 and 5. This evaluation will be consistent with the evaluation that was conducted and reported in the 100-D/H RI/FS report (DOE/RL-2010-95). Waste sites with contamination exceeding cleanup levels in Tables 4 and 5 will be required to complete the RTD remedy. All RTD waste sites are required to remove, treat and dispose of contaminated soil and debris, backfill, contour and replant native vegetation as described above. ICs are required to be established and maintained as necessary to prevent exposure until levels protective of UU/UE are achieved, and EPA or Ecology authorizes the removal of restrictions.

RTD of waste sites is anticipated to be completed within 5 years, with the exception of waste site 100-H-58. The contaminated power poles (waste site 100-H-58) provide electrical power to the HX pump and treat facility and will be remediated after 100-HR-3 groundwater remediation is complete.

ICs are mechanisms to control uses of land, facilities, and environmental media to prevent unacceptable HHE exposure to residual contaminants that could pose risks above levels deemed protective. ICs generally include non-engineered restrictions on activities and access to land, groundwater, surface water, waste sites, waste disposal areas, and other areas or media that may contain hazardous substances. Common types of ICs include procedural restrictions for access, warning notices, permits, easements, deed notifications, leases and contracts, and land use controls controlling excavation in areas where contamination remains that exceeds residential direct contact cleanup levels. ICs will be employed at RTD waste sites until levels protective of UU/UE are achieved.

***Institutional Controls** for shallow and deep waste sites:* Alternative 2 uses ICs for eight waste sites with shallow radionuclide contamination (depth less than 4.6 m [15 ft] bgs) and 35 waste sites with deep radionuclide contamination (depth more than 4.6 m [15 ft] bgs) identified in Table 7.

Radioactive contamination transformation, reduction and destruction at waste sites occurs through radioactive decay, with the time required to achieve cleanup levels dependent on radionuclide half-lives. Residential use and excavation IC restrictions would be implemented for the shallow IC waste sites and excavation restrictions would be implemented at deep IC waste sites (contamination deeper than 4.6 m [15 ft] bgs).

***Pipeline Capping with ICs**:* Alternative 2 caps the ends of pipes to contain contamination at waste site 100-D-50:2 and applies ICs preventing entry and excavation at this waste site, as identified in Table 7 below.

No Action: Alternative 2 includes no action for the 150 waste sites listed under no action in Table 1. Evaluation of these waste sites in the RI/FS report determined that interim actions at these waste sites have already reduced contamination to levels protective of UU/UE.

Institutional Controls: For Alternative 2, drilling and excavation restrictions apply at waste sites until cleanup levels protective of UU/UE are achieved, and EPA or Ecology authorizes the removal of restrictions. The waste sites for which ICs is the Alternative 2 remedy are identified in Table 7. The expected year that ICs can be removed based on radiological decay is indicated after the site number in parentheses. The concentrations of radionuclide COCs at these sites are protective of groundwater.

Table 7. Alternatives 2 and 3 —Institutional Controls Waste Sites

Risk Driver	Institutional Controls
Waste sites with radiological contamination exceeding human health direct contact cleanup levels at a depth less than 4.6 m (15 ft) bgs	Residential use and excavation restrictions: 100-D-25/116-DR-9 (2038)[a] 118-D-6:4 (2022)[b] 116-D-8 (2035) 116-H-5 (2016) 118-H-1:1 (2016) 118-D-2:1 (2019) 100-H-54 (2026)

Table 7. Alternatives 2 and 3 —Institutional Controls Waste Sites

Risk Driver	Institutional Controls
Waste sites with deep (greater than 4.6 m [15 ft] bgs) radiological contamination exceeding human health direct contact cleanup levels[c]	Excavation Restrictions: 118-D-3:1 (2025) 100-D-5 (2028) 100-D-6 (2028) 100-D-18 (2066) 100-D-19 (2042) 100-D-48:1(2093) 100-D-48:2 (2034) 100-D-48:3 (2028) 100-D-49:1 (2093) 100-D-49:2 (2117) 100-D-49:4 (2027) 116-D-1A (2203) 116-D-1B (2203) 116-D-7 (2125) 116-DR-1 & 2 (2148) 118-D-6:3 (2120) 118-D-6:4 (2143)[b] UPR-100-D-2 (2034) UPR-100-D-3 (2034) UPR-100-D-4 (2093) 100-D-46 (2203) 116-DR-6 (2048) 100-D-25/116-DR-9 (2064)[a] 100-H-1 (2019) 100-H-11 (2108) 100-H-12 (2108) 100-H-14 (2108) 100-H-21 (2019) 100-H-22 (2019) 116-H-1 (2110) 116-H-3 (2056) 116-H-7 (2098) 118-H-6:3 (2108) 118-H-6:6 (2108)
Waste site with pipe scale contamination exceeding acceptable levels of risk	Entry and excavation restrictions: 100-D-50:2

a. These sites are in the same location and have shallow and deep components, so they are addressed together in both the shallow and deep zone institutional control categories. Note that the shallow zone decay date differs from the deep zone decay date because of different radionuclide concentration in the shallow zone compared to the deep zone.

b. 118-D-6:4 has both a shallow zone and deep zone institutional control.

c. These sites have contamination at depth where human exposure is not expected and at concentrations that will not cause exceedances of cleanup levels in groundwater or surface water. Institutional controls would be applied to prevent contaminated material beyond 4.6 m (15 ft) bgs from being brought to the surface or otherwise encountered from drilling or excavation.

ICs were chosen for these waste sites under Alternative 2 because the benefits of contaminant removal do not outweigh the risk to workers and additional costs and allowing the residual soil contamination to remain in place will not result in exposure because ICs will prevent excavation or drilling that might bring these contaminants to the surface.

Pump and Treat, Additional Groundwater Wells, Biological Treatment: Under Alternative 2, groundwater contaminated with Cr(VI) is extracted from the aquifer using extraction wells and transferred to a facility for treatment. The treated water is then either returned to the aquifer using injection wells, or other approved discharge.

Alternative 2 expands and optimizes the existing pump and treat systems. At the end of 2014, the interim remedial action pump and treat systems included approximately 90 wells and two treatment facilities with a combined capacity of 5,300 L/min (1,400 gal/min) and ex situ ion exchange resin treatment specific to Cr(VI) removal. Alternative 2 involves installing approximately 30 new wells and optimizing the pump and treat systems with bioremediation technology (biological injection). The biological injection introduces a carbon source (e.g., cheese whey or sodium lactate) that provides a medium for biological growth. The biological growth produces a chemically reducing environment that promotes conversion of Cr(VI) to the less toxic and less mobile trivalent chromium. The biological injection system includes a mixing facility and closed-loop injection wells and extraction wells. The pump and treat capacity and number of wells will be defined through the RD/RAWP to meet the 25 year timeframe to achieve the cleanup levels for Cr(VI) and total chromium identified above. Cleanup of total chromium will be achieved through treatment of Cr(VI).

***MNA with ICs** for groundwater:* Alternative 2 relies upon MNA processes to reduce strontium-90 and nitrate contaminant concentrations in groundwater to cleanup levels.

MNA relies on natural attenuation processes that include a variety of physical, chemical, or biological processes, which, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume (TMV), or concentration of contaminants in soil or groundwater. These in situ processes include biodegradation; dispersion; dilution; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants.

Reduction of strontium-90 is through radioactive decay. Strontium-90 has a radioactive half-life of 28.8 years. There will also be ancillary reduction of nitrate and strontium-90 contamination through dispersion and diffusion created through co-extraction and injection (or discharge) associated with the pump and treat system. Nitrate and strontium-90 will be co-extracted with the Cr(VI) and will meet the cleanup standards upon reinjection by dilution that will occur in the pump and treat system. Nitrate will also be reduced through dispersion and diffusion unrelated to the pump and treat actions. Nitrate and strontium-90 will be monitored to confirm natural attenuation.

The MNA evaluation in the RI/FS used a multiple lines-of-evidence approach, described in OSWER Directive 9200.4-17P, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*, that considered the occurrence, mechanisms, rates, and expected performance of natural attenuation processes in site conditions. Key elements of the overall evaluation included demonstrating the following:

1. Effective source control and performance monitoring
2. A clear and meaningful trend of decreasing contaminant mass and/or concentration over time at appropriate monitoring or sampling points

3. Directly or indirectly, the type(s) of natural attenuation processes that are active at the site, and the rate at which such processes will reduce contaminant concentrations to required levels
4. The contamination condition does not currently present an actual risk to human or ecological receptors

As indicated above, interim remedial actions have been implemented at known source areas that have contributed to groundwater COC plumes at 100-D/H. This is particularly important to supporting selection of MNA for groundwater. The expected efficacy of source area remedial alternatives at 100-D/H was considered in the overall assessment of MNA for groundwater plume remediation.

The groundwater contaminant plumes are generally well defined for 100-D/H, and current ICs (for example, prohibitions against use of groundwater as a source of drinking water) prevent current exposure to human receptors. Existing groundwater pump and treat systems operating at 100-D/H are exerting groundwater capture forces that have reduced the discharge of contaminated groundwater into the Columbia River. This reduction in discharge mitigates exposure to ecological receptors and downstream human receptors.

Estimated timeframes for Alternative 2 to achieve cleanup levels are identified above. Timeframes are reasonable when compared to the other alternatives and are within a timeframe where ICs can be used to prevent exposure. ICs would be established and maintained to prevent exposure to contaminated groundwater until cleanup levels shown in Table 6 are achieved.

O&M activities for the Alternative 2 groundwater remedies include inspection, maintenance, and periodic replacement of monitoring wells; routine and preventive maintenance and replacement of pump and treat system parts at the end of their design life for groundwater pump and treat components; and operations and performance monitoring. A geostatistical analysis will be conducted to determine the optimum spatial distribution for the performance monitoring network. The performance monitoring component includes installation of new wells, periodic sampling, laboratory analysis, and data evaluation to assess the natural attenuation processes, rates of attenuation, and overall protectiveness.

DOE must control well drilling through excavation permits and restrict groundwater use until such time as the groundwater achieves levels protective of UU/UE. Groundwater use would be restricted through ICs to limited research purposes and for monitoring and treatment, as approved by EPA or Ecology.

9.1.3 Alternative 3: RTD, ICs, Pipeline Capping with ICs, and No Action for waste sites; Increased Capacity Pump and Treat, Additional Groundwater Wells, and MNA with ICs for groundwater

Estimated capital cost: $188 million
Estimated O&M cost: $234 million
Estimated present value (discounted): $375 million
Estimated time to achieve cleanup levels for waste sites: 25 years
Estimated time to achieve cleanup levels for groundwater: 12 years for Cr(VI) and total chromium, 6 years for nitrate, and 44 years for strontium-90

RTD, ICs, Pipeline Capping with ICs, and No Action*:* Alternative 3 is the same as Alternative 2 for all waste sites.

Increased Capacity Pump and Treat, Additional Groundwater Wells: Under Alternative 3, groundwater contaminated with Cr(VI) is extracted from the aquifer using extraction wells and transferred to a facility for ex situ ion exchange resin treatment. The treated water is then either returned to the aquifer using injection wells, or other approved discharge. Treatment is specific to Cr(VI) removal.

Alternative 3 expands the existing pump and treat systems. At the end of 2014 the interim remedial action pump and treat systems included approximately 90 wells and two treatment facilities with a combined capacity of 5,300 L/min (1,400 gal/min) and ion exchange for Cr(VI) treatment. Alternative 3 adds up to an additional 5,400 L/min (1,425 gal/min) treatment capacity and an estimated 80 new extraction and injection wells. The pump and treat capacity and number of wells will be defined through the RD/RAWP. The Alternative 3 expanded pump and treat system must be designed to achieve cleanup levels for Cr(VI) within 12 years, which distinguishes it from Alternative 2 where Cr(VI) cleanup levels are to be achieved within 25 years. Cleanup of total chromium will be achieved through treatment of Cr(VI).

O&M activities for this remedy include inspection, maintenance, and periodic replacement of monitoring wells; routine and preventive maintenance and replacement of pump and treat system parts at the end of their design life for groundwater pump and treat components; and operations and performance monitoring. A geostatistical analysis will be conducted to determine the optimum spatial distribution for the performance monitoring network. The performance monitoring component includes installation of new wells, periodic sampling, laboratory analysis, and data evaluation to assess the natural attenuation processes, rates of attenuation, and overall protectiveness.

DOE must control well drilling through excavation permits and shall restrict groundwater use until such time as the groundwater achieves levels protective of UU/UE. Groundwater use would be restricted through ICs to limited research purposes and for monitoring and treatment, as approved by EPA or Ecology.

MNA with ICs *for groundwater*: Alternative 3 remedy components are the same as Alternative 2 for MNA with ICs. However, due to the increased pump and treat capacity and additional groundwater wells, there is an increase in ancillary dispersion and diffusion with Alternative 3 relative to Alternative 2. The result is that nitrate and strontium-90 concentrations will be reduced to cleanup standards sooner than under Alternative 2. Nitrate and strontium-90 co-extracted through the pump and treat system will be below their cleanup standards upon reinjection by dilution that will occur in the pump and treat system. They will be monitored to confirm natural attenuation. The MNA component was evaluated in the RI/FS using a multiple lines-of-evidence approach as described in Alternative 2.

Estimated timeframes to achieve cleanup levels are identified above. Timeframes for Alternative 3 are the shortest of all groundwater alternatives. ICs would be established and maintained to prevent exposure to contaminated groundwater until cleanup levels shown in Table 6 are achieved.

O&M activities for this remedy include inspection, maintenance, and periodic replacement of monitoring well and operations and performance monitoring. A geostatistical analysis will be conducted to determine the optimum spatial distribution for the performance monitoring network. The performance monitoring component includes installation of new wells, periodic sampling, laboratory analysis, and data evaluation to assess the natural attenuation processes, rates of attenuation, and overall protectiveness.

DOE must control well drilling through excavation permits and shall restrict groundwater use until such time as the groundwater achieves levels protective of UU/UE. Groundwater use would be restricted through ICs to limited research purposes and for monitoring and treatment, as approved by EPA or Ecology.

9.1.4 *Alternative 4: RTD, ICs, and No Action for waste sites; Pump and Treat, Additional Groundwater Wells, and MNA with ICs for groundwater*

Estimated capital cost: $106 million

Estimated O&M cost: $510 million

Estimated present value (discounted): $430 million

Estimated time to achieve cleanup levels for waste sites: 5 years

Estimated time to achieve cleanup levels for groundwater: 39 years for Cr(VI) and total chromium, 13 years for nitrate, and 56 years for strontium 90

RTD*:* Alternative 4 uses RTD in the same manner as Alternatives 2 and 3 except Alternative 4 uses RTD rather than ICs for the following six shallow zone waste sites with radionuclide contamination: 116-DR-9/100-D-25, 118-D-6:4, 116-D-8, 118-D-2:1, and 100-H-54. RTD is also used at the 100-D-50:2 waste site where Alternatives 2 and 3 use pipeline end-capping with ICs.

The estimated volume of removed material is 184,000 m^3 (241,000 $yd^{3)}$ for waste sites subject to RTD, which is an additional 51,000 m^3 (67,000 yd^3) greater than Alternatives 2 and 3. The RTD approach for Alternative 4 is the same as for Alternatives 2 and 3; contaminated soil and debris are excavated as needed to meet cleanup levels using shallow and deep excavation technology, transported to ERDF, and treated as necessary to meet LDRs prior to disposal at the facility. The remediated sites will be backfilled with clean borrow material and contoured, and native vegetation will be established. ICs are required to be established and maintained as necessary to prevent exposure until levels protective of UU/UE are achieved, and EPA or Ecology authorizes the removal of restrictions.

Under Alternative 4, waste sites selected for the RTD remedy that have been remediated under interim actions prior to issuance of this ROD will be evaluated to determine if these waste sites meet the cleanup levels in tables 4 and 5. This evaluation will be consistent with the evaluation that was conducted and reported in the 100-D/H RI/FS report (DOE/RL-2010-95). All waste sites are required to excavate, treat and dispose of contaminated soil and debris, backfill, contour and replant native vegetation as described above. The estimated timeframe to achieve cleanup levels is identified above.

Institutional Controls *for deep waste sites*: Alternative 4 uses ICs for 35 waste sites with deep radionuclide contamination (depth more than 4.6 m [15 ft] bgs) shown in Table 8.

Radioactive contamination transformation, reduction and destruction at waste sites occurs through radioactive decay, with the time required to achieve cleanup levels dependent on radionuclide half-lives. Excavation restrictions would be implemented at waste sites with ICs. The estimated timeframes until radioactive decay has reduced residual radionuclide contaminants to concentration protective of UU/UE are identified in Table 8.

No Action: Alternative 4 includes no action for the 150 waste sites listed under No Action in Table 1. Evaluation in the RI/FS report determined that the interim actions at these waste sites have reduced contamination to levels protective of UU/UE.

Institutional Controls: Alternative 4 requires ICs during the period before completion of the remedial action and following remedial action implementation. For Alternative 4, drilling and excavation restrictions apply at waste sites until cleanup levels protective of UU/UE are achieved, and EPA or Ecology authorizes the removal of restrictions. The waste sites in Alternative 4 for which ICs is the remedy are identified in Table 8, with the expected year that ICs can be removed based on radiological decay indicated after the site number in parentheses. The concentrations of radionuclide COCs at these sites are protective of groundwater.

Table 8. Alternative 4 —Institutional Controls Waste Sites

Risk Driver	Institutional Controls
Waste sites with radiological contamination exceeding human health direct contact cleanup levels at a depth less than 4.6 m (15 ft) bgs	Residential use and excavation restrictions: 116-H-5 (2016) 118-H-1:1 (2016)
Waste sites with deep (greater than 4.6 m [15 ft] bgs) radiological contamination exceeding human health direct contact cleanup levels.*	Excavation Restrictions: 118-D-3:1 (2025) 100-D-5 (2028) 100-D-6 (2028) 100-D-18 (2066) 100-D-19 (2042) 100-D-25 (2064) 100-D-48:1(2093) 100-D-48:2 (2034) 100-D-48:3 (2028) 100-D-49:1 (2093) 100-D-49:2 (2117) 100-D-49:4 (2027) 116-D-1A (2203) 116-D-1B (2203) 116-D-7 (2125) 116-D-8 (2035) 116-DR-1 & 2 (2148) 116-DR-9 (2064) 118-D-2:1 118-D-6:3 (2120) 118-D-6:4 (2143) UPR-100-D-2 (2034) UPR-100-D-3 (2034) UPR-100-D-4 (2093) 100-D-46 (2203) 116-DR-6 (2048) 100-D-25 (2064) 100-H-1 (2019) 100-H-11 (2108) 100-H-12 (2108) 100-H-14 (2108) 100-H-21 (2019) 100-H-22 (2019) 100-H-54 (2026) 116-H-1 (2110) 116-H-3 (2056) 116-H-7 (2098) 118-H-6:3 (2108) 118-H-6:6 (2108)

* These sites have contamination at depth where human exposure is not expected and at concentrations that will not cause exceedances of cleanup levels in groundwater or surface water. Institutional controls would be applied to prevent contaminated material beyond 4.6 m (15 ft) bgs from being brought to the surface or otherwise encountered from drilling or excavation.

Pump and Treat, Additional Groundwater Wells: Under Alternative 4, groundwater contaminated with Cr(VI) is extracted from the aquifer using extraction wells, transferred to a facility for ex situ ion exchange resin treatment. The treated water is then either returned to the aquifer using injection wells, or other approved discharge. Treatment is specific to Cr(VI) removal.

Alternative 4 expands the existing pump and treat systems. At the end of 2014, the interim remedial action pump and treat systems included approximately 90 wells and two treatment facilities with a combined capacity of 5,300 L/min (1,400 gal/min) and ion exchange for Cr(VI) treatment. Alternative 4 adds approximately 30 new extraction and injection wells. The pump and treat capacity and number of wells will be defined through the RD/RAWP to meet the estimated timeframe to achieve the cleanup level within 39 years. Cleanup of total chromium will be achieved through treatment of Cr(VI).

***MNA with ICs** for groundwater*: Alternative 4 relies upon MNA processes to reduce strontium-90 and nitrate contaminant concentrations in groundwater.

MNA relies on natural attenuation processes that include a variety of physical, chemical, or biological processes, which, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume (TMV), or concentration of contaminants in soil or groundwater. These in situ processes include biodegradation; dispersion; dilution; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants.

Reduction of strontium-90 is through radioactive decay. Strontium-90 has a radioactive half-life of 28.8 years. Under Alternative 4, ancillary reduction of nitrate and strontium-90 contamination will occur through dispersion and diffusion created through co-extraction and injection (or discharge) associated with the pump and treat system. Nitrate and strontium-90 will be co-extracted with the Cr(VI) and will meet cleanup standards upon reinjection by dilution that will occur in the pump and treat system. Nitrate will also be reduced through dispersion and diffusion unrelated to the pump and treat. Nitrate and strontium-90 will be monitored to confirm natural attenuation.

The MNA component was evaluated in the RI/FS using a multiple lines-of-evidence approach as described in Alternative 2.

Interim remedial actions have been implemented, at known source areas that have contributed to groundwater COC plumes at 100-D/H. This is particularly important to supporting selection of MNA for groundwater. The expected efficacy of source area remedial alternatives at 100-D/H under Alternative 4 was considered in the overall assessment of MNA for groundwater plume remediation.

Estimated timeframes to achieve cleanup levels are identified above. Timeframes are reasonable when compared to the other alternatives and is within a timeframe where ICs can be used to prevent exposure. ICs would be established and maintained to prevent exposure to contaminated groundwater until cleanup levels shown in Table 6 are achieved.

O&M activities for the Alternative 4 groundwater remedy include inspection, maintenance, and periodic replacement of monitoring wells; routine and preventive maintenance and replacement of pump and treat system parts at the end of their design life for groundwater pump and treat component; and operations and performance monitoring. A geostatistical analysis will be conducted to determine the optimum spatial distribution for the performance monitoring network. The performance monitoring component includes installation of new wells, periodic sampling, laboratory analysis, and data evaluation to assess the natural attenuation processes, rates of attenuation, and overall protectiveness.

DOE must control well drilling through excavation permits and restrict groundwater use until such time as the groundwater achieves levels protective of UU/UE. Groundwater use would be restricted through ICs to limited research purposes and for monitoring and treatment, as approved by EPA or Ecology.

9.2 Common Elements of Alternatives 2, 3, and 4

Remedial action alternatives developed for 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs have some components in common.

Remove Treat Dispose. RTD, which is used to eliminate the presence of contamination in soil above cleanup levels, consists of excavating waste site structures and vadose zone soil where contaminant concentrations are above cleanup levels (including those protective of groundwater) using shallow and deep excavation technology.

Excavation using best practices, which includes appropriately sloped sidewalls based on the type of the material being removed, benching, shoring, and proper placement of the stockpiled material according to Occupational Safety and Health Administration standards and suppression of dust during excavation to ensure that contaminants are not spread by wind and do not drive mobile contamination toward groundwater.

Excavated material is transported for disposal to ERDF as long as the material meets disposal criteria. Hazardous or mixed waste is treated to meet LDRs before disposal at ERDF or an EPA approved offsite location.

Verification sampling is conducted following excavation to demonstrate that soil remaining in the excavated area does not exceed the cleanup levels.

The remediated waste sites are backfilled with clean borrow material and contoured to blend the excavation with the surrounding ground surface. Sources for backfill material include local borrow pits and any excavated material determined to be clean (verified as clean by meeting cleanup levels). Sites are revegetated with native plant species.

RTD of waste sites is anticipated to be completed within 5 years, with the exception of waste site 100-H-58. The contaminated power poles (waste site 100-H-58) provide electrical power to the HX pump and treat facility and will be remediated after 100-HR-3 groundwater remediation is complete.

Groundwater Pump and Treat. Groundwater contaminated with Cr(VI) is extracted from the aquifer using wells and is transferred to a facility for treatment. Treatment is specific to Cr(VI) removal and uses an ion-exchange resin. The treated water is then either returned to the aquifer through injection wells or other approved discharge. The number of wells and treatment system capacity varies for Alternatives 2, 3, and 4.

During Cr(VI) pump and treat operations, strontium 90 and nitrate-contaminated groundwater will be coincidentally co-extracted with Cr(VI) contaminated groundwater and will meet cleanup standards upon reinjection due to dispersion and mixing that occurs in the extraction and treatment system.

Institutional Controls. Alternatives 2, 3, and 4 require ICs during the period before completion of the remedial action and following remedial action implementation where cleanup levels protective of UU/UE will not be achieved. Exposure to contamination deeper than 4.6 m (15 ft) bgs is not anticipated. Where contamination deeper than 4.6 m (15 ft) bgs exceeds the residential use cleanup levels, ICs are required to ensure that future activities do not bring this contamination to the surface or otherwise result in exposure to contaminant concentrations above standards for UU/UE. ICs are used to control access to residual contamination in soil and groundwater above standards for UU/UE. DOE will be responsible for implementing, maintaining, reporting on and enforcing ICs. Although the DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement or through other means, the DOE shall retain ultimate responsibility for remedy integrity. In the event that land is transferred out of federal ownership, appropriate provisions will be included in transfer terms or conveyance documents to maintain effective ICs (such as easements and covenants). ICs to support achievement of the RAOs are the following:

- Signage and access control to waste sites
- Maintenance and operation of an excavation permit program for protection of environmental and cultural resources and site workers
- Administrative controls limiting groundwater access and use where groundwater is above cleanup levels
- In the event that land is transferred out of federal ownership, deed restrictions (proprietary controls such as easements and covenants) are required that are legally enforceable against subsequent property owners
- Control drilling and excavation in areas where contamination is left deeper than 4.6 m (15 ft) bgs that exceeds levels protective of HHE
- Control residential use, entry and excavation in areas where contamination is left at depth less than 4.6 m (15 ft) bgs that exceeds levels protective of HHE

ICs will be maintained until cleanup levels are achieved, the concentrations of hazardous substances, pollutants and contaminants are at levels to allow for UU/UE, and EPA or Ecology authorizes the removal of restrictions.

Alternatives 2, 3, and 4 rely on ICs for some of the waste sites. ICs will be maintained at these waste sites until radioactive decay achieves cleanup levels protective of UU/UE. The time frames for which UU/UE will be achieved are in Table 1.

Monitored Natural Attenuation. MNA relies on natural attenuation processes, which include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, TMV, or concentration of contaminants in soil or groundwater. These in situ processes include biodegradation; dispersion; dilution; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants.

Alternatives 2, 3, and 4 include MNA for nitrate and strontium-90 in groundwater. Natural attenuation processes, including diffusion and dispersion of nitrate and radioactive decay of strontium-90, will be monitored to confirm natural attenuation.

Groundwater Monitoring. Groundwater contaminant plumes are monitored to measure performance of the pump and treat systems, contaminant attenuation rates, and to evaluate the effectiveness of MNA and protectiveness of the remedy. Monitoring results are evaluated to identify if system modifications are needed to improve remedy effectiveness and to identify when the remedy achieves cleanup levels. Monitoring continues until groundwater achieves cleanup requirements.

100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2, and 100-HR-3 – Transition from Interim to Final Action. Interim actions shall continue to be performed in accord with the existing RD/RAWPs, except that RTD shall meet the cleanup levels specified in this ROD. DOE shall develop, and submit for Ecology approval, a new RD/RAWP, along with accompanying TPA milestone change package(s) for this ROD prepared in accordance with the Tri Party Agreement. When the new RD/RAWP is approved, that document will direct future remedial actions at the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs.

9.3 Expected Outcomes of Each Alternative

The 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs would be cleaned up under Alternatives 2-4 to achieve residential cleanup standards for unrestricted use for waste sites identified for RTD in Table 1. Soil cleanup levels for Alternative 2 will be achieved in 25 years, Alternative 3 will be achieved in 25 years, and Alternative 4 will be achieved in 5 years.

Available uses of 100-HR-3 groundwater will be unrestricted use upon achieving cleanup levels. For Alternative 2, groundwater cleanup levels for Cr(VI) and total chromium will be met in approximately 25 years, nitrate cleanup levels will be met in approximately 13 years, and strontium-90 cleanup levels will be met in approximately 56 years. For Alternative 3, groundwater cleanup work needs to be designed to meet cleanup levels for Cr(VI) and total chromium in 12 years, nitrate cleanup levels will be met in approximately 6 years, and strontium-90 cleanup levels will be met in approximately 44 years. For Alternative 4, groundwater cleanup levels for Cr(VI) and total chromium will be met in approximately 39 years, nitrate cleanup levels will be met in approximately 13 years, and strontium-90 cleanup levels will be met in approximately 56 years.

10.0 Comparative Analysis of Alternatives

This section of the ROD summarizes the comparative analysis of alternatives presented in the respective feasibility study portion of the 100-D/H RI/FS report (DOE/RL-2010-95) and as updated in the proposed plan (DOE/RL-2011-111) for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs. The major objective of the analysis was to evaluate the relative performance of the alternatives with respect to the nine CERCLA evaluation criteria, as described in the NCP (40 CFR 300.430(f)(5)(i)), so the advantages and disadvantages of each alternative are clearly understood. The nine CERCLA evaluation criteria are as follows:

- Overall protection of HHE
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of TMV through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

The first two criteria, overall protection and compliance with ARARs, are defined under CERCLA as "threshold criteria." Threshold criteria must be met for an alternative to be eligible for selection. The next five criteria are defined as "primary balancing criteria." These criteria are used to weigh major trade-offs among alternatives. The last two criteria, state acceptance and community acceptance, are defined as "modifying criteria." In the final comparison of alternatives used to select a remedy, both balancing criteria and modifying criteria are considered for alternatives that satisfy threshold criteria. Alternative 1 (No Action for all wastes and the groundwater) fails the "threshold criteria," so information regarding the performance of this alternative with respect to the "primary balancing criteria" is not included. The comparative evaluation is summarized in Table 9.

Table 9. Evaluation of Remedial Alternatives

Alternatives	Threshold Criteria		Balancing Criteria				
	Overall Protection of Human Health and the Environment	**Compliance with ARARs**	**Long-Term Effectiveness and Permanence**	**Reduction in Toxicity, Mobility, or Volume through Treatment**	**Short-Term Effectiveness**	**Implementability**	**Cost (Present Value in $ Millions)***
1 – No Action	No	N/A	N/A	N/A	N/A	N/A	N/A
2 – RTD, ICs, Pipeline Capping with ICs, and No Action for Waste Sites; and Pump and Treat, Additional Groundwater Wells, Biological Treatment, and MNA with ICs for Groundwater	Yes	Yes	★★☆	★★★	★★☆	★☆☆	Waste sites $66 Groundwater $267 **Total: $333**
3 – RTD, ICs, Pipeline Capping with ICs, and No Action for Waste Sites; and Increased Capacity Pump and Treat, Additional Groundwater Wells, and MNA with ICs for Groundwater	Yes	Yes	★★☆	★★★	★★★	★★☆	Waste sites $67 Groundwater $308 **Total: $375**
4 – RTD, ICs, and No Action for Waste Sites; and Pump and Treat, Additional Groundwater Wells, and MNA with ICs for Groundwater	Yes	Yes	★★☆	★★★	★☆☆	★★☆	Waste sites $75 Groundwater $355 **Total: $430**

Note: The comparative evaluation metrics are defined as follows:

★★★ = Expected to perform very well against the criteria with fewer disadvantages or uncertainties.

★★☆ = Expected to perform moderately well with some disadvantages or uncertainties.

★☆☆ = Expected to perform less well with more disadvantages or uncertainty when compared to the other alternatives.

* Detailed cost estimates are presented in Appendix J of DOE/RL-2010-95, *Remedial Investigation/Feasibility Study for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units*. Cost estimates reflect an expected accuracy of +50% to -30%.

ARAR = applicable or relevant and appropriate requirement
IC = institutional control
MNA = monitored natural attenuation
N/A = not applicable
RTD = removal, treatment, and disposal

10.1 Overall Protection of Human Health and the Environment

Overall protection of HHE addresses whether each alternative provides adequate protection of HHE by considering how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, and/or ICs.

Alternative 1 (No Action) proposes no remediation of waste sites or contaminated groundwater and no ICs. This alternative is not protective of HHE.

Alternatives 2, 3, and 4 are protective of HHE. They address the risks in each of the OUs and will achieve cleanup levels within a reasonable time frame. Each of these alternatives includes waste sites identified for No Action which are currently protective of HHE (Table 1). Pump and treat and MNA remedies for groundwater are projected to achieve cleanup levels for Cr(VI) and total chromium within 25, 12, and 39 years from the start of implementation for Alternatives 2, 3, and 4, respectively. Cleanup levels for all groundwater COCs are projected to be achieved within 56, 44, and 56 years for Alternatives 2, 3, and 4, respectively. Unacceptable risks are also prevented or controlled through implementation of ICs restricting use until cleanup levels are achieved.

For waste sites, RTD, ICs, and pipeline end-capping effectively controls or prevents unacceptable risks to human and ecological receptors. It also addresses soil-to-groundwater and surface water risks through physical removal of contaminated soil as necessary to protect groundwater and surface water. Unacceptable risks are also prevented or controlled through implementation of ICs until the waste sites meet UU/UE criteria.

10.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA and the NCP (40 CFR 300.430(f)(1)(ii)(B)) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations, which are collectively referred to as ARARs, unless such ARARs are waived under CERCLA Section 121(d)(4). Compliance with ARARs addresses whether a remedy will meet all of the ARARs or provide a basis for invoking a waiver.

Alternative 1 (No Action) does not require action and therefore ARARs are not implicated.

Alternatives 2, 3, and 4 comply with ARARs and meet this threshold criterion. ARARs are not implicated for the no action component of Alternatives 2, 3 and 4 because no action is required. The remedial actions and treatment systems proposed under these alternatives would be designed to meet ARARs. For groundwater, proposed remedies will achieve DWS and state surface water quality standard ARARs in a reasonable time frame considering the particular circumstances.

10.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence criterion evaluates the expected residual risk and the ability of a remedy to maintain reliable protection of HHE over time, once cleanup levels have been met. Alternatives that are more effective in the long-term are more permanent. The evaluation considers (1) the magnitude of the residual risk, and (2) the adequacy and reliability of controls.

For the waste sites, Alternatives 2, 3, and 4 each provide very good long-term effectiveness and permanence under RTD because COC-contaminated soil and debris exceeding cleanup levels are removed and transported to ERDF. One pipeline is end-capped under Alternatives 2 and 3 and will require long-term ICs to be protective, although the reliability of the ICs to be used is high and the residual risk is low. The pipeline being capped is located in an underground tunnel that is an established maternal bat colony, and RTD would adversely affect the habitat. Alternatives 2 and 3 use ICs for

radiological contamination at depths less than 4.6 m (15 ft) bgs for eight waste sites rather than RTD. Alternative 4 uses ICs for radiological contamination at depths less than 4.6 m (15 ft) bgs for two waste sites rather than RTD. All three alternatives require ICs until cleanup levels are met.
Alternatives 2, 3, and 4 all use ICs for 35 deep waste sites with radiological contamination at depths greater than 4.6 m (15 ft) bgs until radioactive decay has reduced residual radionuclide contaminants to concentration protective of UU/UE.

All three of the alternatives provide good long-term effectiveness and permanence for waste sites because, other than the pipelines that will be end-capped and IC waste sites, the contaminated soil and debris exceeding cleanup levels will be removed to ERDF. Alternatives 2 and 3 may be rated slightly lower, as the pipeline end-capping at one waste site will need an IC long term to maintain protectiveness, and Alternative 4 uses RTD for six shallow radiologically contaminated waste sites that Alternatives 2 and 3 address with ICs. The estimated time frames to achieve cleanup levels for all but the pipeline waste site are 25 years for Alternatives 2 and 3, and 5 years for Alternative 4.

The alternatives for groundwater treatment are comparable and are rated high in long-term effectiveness and permanence. The alternatives use a combination of both active treatment and MNA that permanently reduces COC concentrations over different time frames. Table 10 presents the estimated remedial action time frames for groundwater cleanup. At the end of the remedial action time frame, the COC concentrations under each of the alternatives will be reduced to levels that are protective of HHE.

10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

The reduction of TMV through treatment criterion assesses the anticipated performance of the treatment technologies that may be included as part of a remedial action.

Alternatives 2, 3, and 4 are comparable in the reduction of TMV through treatment in remediation of waste sites. Additional RTD of deep radiological sites under Alternative 4 does not result in any additional waste treatment. Reduction of TMV through treatment as part of the RTD remedy component is limited to treatment required to meet applicable LDR requirements for disposal of excavated soil and material at ERDF. The ICs and pipeline end-capping components of Alternatives 2, 3, and 4 do not involve any reduction of TMV through active treatment.

Alternatives 2, 3, and 4 treat the same mass of groundwater contaminants in removing Cr(VI) through pump and treat where ion exchange treatment removes Cr(VI) from the extracted groundwater. When the ion exchange resin capacity is reached, the resin will be changed out with fresh resin. Removal of Cr(VI) is not reversible since the spent resin loaded with Cr(VI) will be disposed of as solid waste at ERDF or another EPA-approved disposal facility. For Alternative 2 reduction of TMV by treatment is also achieved through biological reduction (bioinjection) converting Cr(VI) to less toxic Cr(III). Alternatives 2, 3, and 4 were all rated very good for this criterion because of their use of treatment to address Cr(VI).

10.5 Short-Term Effectiveness

Short-term effectiveness considers the amount of time it will take for the remedy to effectively protect HHE at the site. It also includes evaluation of any adverse effects that the remedy may pose to the community, workers, and the environment during the construction and implementation phases of the remedy.

Alternative 4 achieves the shallow waste site cleanup levels faster than Alternatives 2 or 3 (5 years as opposed to 25 years) because it uses RTD for six shallow zone waste sites with radionuclide contamination as opposed to Alternatives 2 and 3 which use ICs to address the six waste sites. The volume of RTD material is greater for Alternative 4 than Alternatives 2 and 3, given the six additional

RTD waste sites. This results in some additional potential risk during material handling and from excavation sidewall instability associated with the additional waste sites. However, the short-term adverse effects to workers can be mitigated through health and safety programs, and risks to the community are low because of the remote location of the waste sites.

Table 10. Comparison of Remedial Action Time Frame Estimates for the 100-HR-3 Groundwater Operable Unit

COC	Cleanup Level	Alternative 1 – No Action	Alternative 2 – RTD, ICs, Pipeline Capping with ICs, and No Action for Waste Sites; and Pump and Treat, Additional Groundwater Wells, Biological Treatment, and MNA with ICs for Groundwater	Alternative 3 – RTD, ICs, Pipeline Capping with ICs, and No Action for Waste Sites; and Increased Capacity Pump and Treat, Additional Groundwater Wells, and MNA with ICs for Groundwater	Alternative 4 – RTD, ICs, and No Action for Waste Sites; and Pump and Treat, Additional Groundwater Wells, and MNA with ICs for Groundwater
Cr(VI)	10 µg/L*	Not achieved	25 years	12 years	39 years
Cr(VI)	48 µg/L*	Not achieved	11 years	6 years	11 years
Nitrate	45,000 µg/L	60 years	13 years	6 years	13 years
Strontium-90	8 pCi/L	63 years	56 years	44 years	56 years

Notes: The remedial action time frame estimates are based on modeling as presented in DOE/RL-2010-95, *Remedial Investigation/Feasibility Study for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units*. Total chromium in groundwater is primarily present as Cr(VI), so the remediation time frames are reflective of Cr(VI). Treatment of Cr(VI) groundwater contamination will result in attaining cleanup levels for total chromium in less time than Cr(VI), since the total chromium cleanup levels are greater than the Cr(VI) cleanup levels.

"Not achieved" indicates that COC concentrations in groundwater exceeded the cleanup level at the end of the 75-year modeling period.

*Cleanup levels for Cr(VI) are 10 µg/L where groundwater discharges to surface water and 48 µg/L in the upland groundwater.

COC = contaminant of concern
Cr(VI) = hexavalent chromium
IC = institutional control
MNA = monitored natural attenuation
RTD = removal, treatment, and disposal

Alternatives 2, 3 and 4 are otherwise the same as to short term effectiveness. Except as identified above, all three alternatives use ICs for waste sites with radionuclide contamination at depths less than 4.6 m (15 ft) bgs until cleanup levels are met. ICs for residential use and excavation restrictions address the risk to human health until cleanup levels are achieved. Alternatives 2, 3, and 4 also all use ICs for 35 deep waste sites with radiological contamination at depths greater than 4.6 m (15 ft) bgs until radioactive decay has reduced residual radionuclide contaminants to concentration protective of UU/UE. ICs for drilling and excavation address the risk by preventing contaminated material below 4.6 m (15 ft) bgs from being brought to the surface or otherwise encountered from drilling or excavation, except as approved by EPA or Ecology.

For groundwater, Alternative 3 provides a higher level of short-term effectiveness when compared to Alternatives 2 and 4. Modeling estimates indicate that groundwater cleanup levels will be achieved sooner for all COCs under Alternative 3 compared to Alternatives 2 and 4 (Table 10) because of the increased pump and treat capacity relative to the other alternatives. The additional short-term adverse effects to workers of the larger Alternative 3 pump and treat system during well installation and system operations can be mitigated through health and safety programs, and risks to the community are low because of the remote location. The increased number of wells for Alternative 3 in comparison to Alternatives 2 and 4 results in an increased adverse environmental effect caused by ground disturbance of ecological habitat to build roads and drilling pads for the additional wells. For all three of these alternatives, risks to workers are controlled and minimized using established health and safety and engineering measures and personal protective equipment.

Based on the shortest period to achieve groundwater cleanup levels and the ability to mitigate worker, public, and environmental effects during construction and implementation, Alternative 3 was the highest rated for this criterion. Alternative 2 was rated better than Alternative 4 based on a shorter time to achieve groundwater Cr(VI) cleanup levels.

10.6 Implementability

The criterion of implementability is used to compare the technical and administrative feasibility of the remedial alternatives from design through construction and operation. Factors considered include the availability of materials and services needed to implement the remedy components.

For waste sites, RTD is a common and proven remedial action used at the Hanford Site that presents minimal technical and administrative difficulties. Conventional equipment and vendors for implementation are readily available. ERDF is a proven, reliable, and readily accessible disposal facility that meets technical and design requirements for disposal of hazardous waste. ICs for waste site remediation have also been used extensively. Alternatives 2, 3, and 4 are all rated very good for waste site implementability. ICs are a readily implementable remedy as is pipeline end-capping.

Alternative 4 was rated the lowest for waste site implementability based on the use of RTD rather than ICs for 6 shallow zone radiological waste sites and the end-capped pipeline under Alternatives 2 and 3. While RTD is readily implementable, ICs are easier to implement.

Alternatives 3 and 4 perform better than Alternative 2 under this criterion for groundwater remediation. All rely on pump and treat for Cr(VI), which is readily implemented and has been previously used at the Hanford Site. All materials and services needed to implement the pump and treat remedy are readily available, including for the larger system required under Alternative 3. Alternative 2 uses bioinjection as a component of the groundwater treatment. Bioinjection has been proven and implemented at other sites, but it may require specialized biological reagents and will require design testing for implementation at the 100-HR-3 OU. Alternatives 2, 3, and 4 each rely on MNA for nitrate and strontium-90 groundwater remediation.

Installation of 30 additional wells under Alternatives 2 and 4 for groundwater treatment is more easily implemented in comparison to the installation of 80 wells for Alternative 3. Alternative 3 is rated higher for implementability than Alternative 2 for groundwater because of the uncertainties associated with biological injection under Alternative 2.

10.7 Cost

The costs for the alternatives are lowest for Alternative 2 and highest for Alternative 4. Estimated design, construction, O&M, and decommissioning costs were developed for each alternative. The O&M costs were estimated based on the alternative-specific remedial time frames. The total present value costs are $333 million for Alternative 2, $375 million for Alternative 3, and $430 million for Alternative 4. These cost estimates are within the -30 to +50 percent range of accuracy recommended in EPA/540/G-89/004, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA.*

10.8 State Acceptance

The Washington State Department of Ecology has concurred with the Selected Remedy identified in this ROD.

Ecology is identified as the lead regulatory agency in the HFFACO for remedial actions at the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs. Under Washington's *Resource Conservation and Recovery Act of 1976* (RCRA)-authorized Hazardous Waste Management Act (HWMA) and Dangerous Waste Regulations, Ecology has asserted corrective action jurisdiction over the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs concurrent with DOE and EPA's exercise of authority under the Comprehensive Environmental Response Conservation, and Liability Act of 1980 (CERCLA). However, under the Hanford Facility Dangerous Waste Permit (Site-wide Permit), Ecology allows for work under other cleanup authorities or programs to be used to satisfy corrective action requirements, provided such work protects human health and the environment: Site-wide Permit Condition II.Y.2. Ecology specifically accepts work under the Tri-Party Agreement and the CERCLA program as satisfying corrective action requirements, subject to certain reservations (Site-wide Permit Condition II.Y.2.a). These reservations include a qualification that "a final decision about satisfaction of corrective action requirements will be made in the context of issuance of a final ROD," Sitewide Permit Condition II.Y.2.a.ii.

In addition to jurisdiction asserted under the permit, certain HWMA corrective action requirements are "applicable or relevant and appropriate requirements" (ARARs) under CERCLA. Ecology has evaluated protection of human health and the environment by considering how the selected remedy will address state corrective action requirements under the Washington Administrative Code (WAC) 173-303-64620(4). This regulation provides that corrective action must, at a minimum, be consistent with certain provisions of Washington's Model Toxics Control Act (MTCA) regulations. Ecology concludes that the selected remedy is consistent with the requirements as stated.

Periodic review of cleanup actions is listed as a corrective action requirement at WAC 173-303-64620(4)(e). The corrective action requirement for consistency with the WAC 173-340-420 requirements for periodic review can be satisfied by the CERCLA requirement for 5-year review of CERCLA RODs.

This ROD does not set precedents for other RODs, as every CERCLA decision must be evaluated on its own merit.

10.9 Community Acceptance

Numerous comments were received on the proposed plan (DOE/RL-2011-111). Tribes and members of the public voiced concerns over the proposed Alternative 3, including the length of ICs for waste sites and MNA time frame for groundwater cleanup. The concerns were largely based on a desire for a more active and expedited remedy and generally preferred additional RTD of deep waste sites and active treatment for strontium-90 and nitrate in groundwater. Other concerns were that ICs will not be sufficient or effective enough to prevent future human exposure to contaminants. The Tribe's and public's comments, along with the agency responses, are included in the Responsiveness Summary in Part III of this ROD.

11.0 Principal Threat Waste

Principal threat waste are source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. They include soil containing significant concentrations of highly toxic materials and surface or subsurface soil containing high concentrations of contaminants that are, or potentially are, mobile due to wind entrainment, volatilization, surface runoff, or subsurface transport. Contaminated groundwater is generally not considered to be source material.

Principal threat wastes associated with the OUs that are the subject of this ROD, such as fuel fragments and concentrated liquid sodium dichromate, and highly Cr(VI) contaminated soil and debris have been removed through earlier cleanup actions. No waste remains in the source OUs with highly toxic or highly mobile contaminants that cannot be reliably contained or that would present a significant risk to human health or the environment should exposure occur. The contamination that remains in source OU can be reliably contained and would present only a low risk should exposure occur.

12.0 Selected Remedy

This ROD presents the selected final remedy for the Hanford Site 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs, 100 Area, Benton County, Washington. The remedy was selected, in accordance with CERCLA, as amended by SARA, and to the extent practicable, the NCP. This decision is based on the information contained in the AR, which includes the public comments on the proposed plan for these OUs (DOE/RL-2011-111). The Selected Remedy for these OUs is Alternative 3 with modifications.

Alternative 3 in the proposed plan (DOE/RL-2011-111) included an MNA remedy for waste sites with shallow and deep radiological contamination. The RI/FS evaluated ICs, but did not identify or evaluate monitoring components that are needed to select an MNA remedy. Therefore, ICs rather than MNA is the remedy for the waste sites with shallow and deep radiological contamination. ICs will be required to be in place at these waste sites until levels allowing for UU/UE are met. Table 1 identifies the date by which radioactive decay to those levels is expected based on sampling done after interim remedial actions and known radioactive decay rates.

The following subsections provide a summary of the rationale for the Selected Remedy, the description of the Selected Remedy, the summary of estimated remedy costs, and expected outcomes of the Selected Remedy.

12.1 Summary of the Rationale for the Selected Remedy

The Selected Remedy (Alternative 3 in the proposed plan [DOE/RL-2011-111], as modified) is as follows: RTD (104 waste sites), ICs (8 shallow and 35 deep waste sites), Pipeline Capping with ICs (1 waste site), and No Action (150 waste sites); and Increased Capacity Pump and Treat, Additional Groundwater Wells, and MNA with ICs for groundwater.

The Selected Remedy is protective of HHE and achieves substantial risk reduction through RTD of waste sites and groundwater pump and treat, pipeline end-capping, and MNA of groundwater. The Selected Remedy also prevents exposure to contamination that would pose unacceptable risk through imposition of ICs until cleanup levels are met. The Selected Remedy includes no action for waste sites that the RI/FS has demonstrated meet UU/UE standards.

The Selected Remedy also satisfies ARARs, and compared to the other alternatives, provides the best balance of tradeoffs under the balancing and modifying criteria.

Waste Sites/Contaminated Soil

The Selected Remedy uses RTD to achieve cleanup levels identified in Tables 4 and 5, for waste sites listed for RTD in Table 1. ICs are the Selected Remedy where radionuclide contamination deeper than 4.6 m (15 ft) bgs exceeds the residential cleanup levels and where radionuclide contamination less than 4.6 m (15 ft) bgs exceeds cleanup levels, but will decay to cleanup levels within 25 years. ICs are required to ensure that future activities do not bring this contamination to the surface or otherwise result in exposure to contaminant concentrations that exceed cleanup levels. The Selected Remedy includes No Action for 150 waste sites where it has been confirmed that they meet UU/UE standards. One waste site has pipelines that will be end-capped, leaving contamination in place with ICs to restrict entry and excavation in order not to unduly disturb a maternal bat colony.

RTD is accomplished using standard construction practices for shallow and deep excavation. Well established practices will be used for secure transport of materials to ERDF, for treatment as necessary to meet any LDRs, and for disposal of the material at ERDF. The Selected Remedy will meet all of the RAOs applicable to wastes sites (RAOs #3, #4, #5, and #6). ICs will be implemented under the Selected Remedy and maintained to prevent exposure until waste sites meet UU/UE standards and EPA or Ecology authorizes the removal of restrictions. The excavation restriction IC for deep and shallow zone waste sites meets RAO #6 to prevent unacceptable risk by managing direct exposure until UU/UE levels are reached through radioactive decay. Table 1 lists all of the waste sites in the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs and identifies how each would be specifically addressed under the Selected Remedy.

Alternatives 2, 3, and 4 provide good long term effectiveness and permanence for waste sites (other than the pipelines that would be end-capped under Alternatives 2 and 3 and radiological wastes sites for which the Selected Remedy are ICs) because the contaminated soil and debris exceeding cleanup levels are removed to ERDF. Alternatives 2 and 3 may be rated slightly lower than Alternative 4. Alternative 4 calls for RTD for the pipeline waste site rather than pipeline end-capping and ICs, and for RTD for additional shallow zone waste sites with radionuclide contamination rather than ICs.

Alternatives 2, 3, and 4 are comparable in the reduction of TMV through treatment, as RTD is the primary technology implemented for waste sites for all three alternatives.

Alternative 4 achieves the shallow waste site RAOs faster than Alternatives 2 or 3 (5 years as opposed to 25 years) because it uses RTD for additional shallow zone waste sites with radionuclide contamination as opposed to ICs. The volume of RTD materials is greater for Alternative 4 than Alternatives 2 and 3, which is anticipated to have some potentially higher adverse effects during construction and implementation. However, it is expected that those effects can be readily mitigated.

Alternatives 2, 3, and 4 waste site remedies are all rated very good for implementability, with Alternative 4 rated lower because ICs and end-capping the pipeline are easier to implement than RTD.

The estimated costs to remediate the waste sites under Alternatives 2 and 3 are the same, but lower than Alternative 4.

Alternative 4 performs best regarding community acceptance for waste sites given the preference for RTD rather than ICs, as expressed by many of the commenters. Modifications to Alternative 4 recommended by commenters included RTD of the deep zone waste sites with radionuclide contamination.

Groundwater

The Selected Remedy for groundwater is readily implementable, provides reduction in TMV through treatment, and is rated higher than the other alternatives evaluated because it achieves cleanup levels sooner. The Selected Remedy meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing criteria.

The Selected Remedy achieves substantial risk reduction for groundwater by using pump and treat and MNA as remedial technologies. These methods provide the mechanisms to restore groundwater to the cleanup levels identified in Table 6 and meet the applicable RAOs for groundwater (RAOs #1, #2, and #7). Implementation includes the installation of wells and facilities for extraction, treatment, injection and monitoring. The pump and treat system will be designed to reduce concentrations of Cr(VI) to meet cleanup levels in 12 years after implementation.

Alternatives 2, 3, and 4 for groundwater treatment are comparable and provide good long-term effectiveness and permanence. The alternatives use a combination of both active treatment and MNA that permanently reduces COC concentrations over different time frames.

Alternatives 2, 3, and 4 treat the same mass of chromium in groundwater. Alternatives 3 and 4 use pump and treat, while Alternative 2 uses pump and treat and biological treatment. Alternatives 2, 3, and 4 were all rated very good and are comparable in the reduction of TMV through treatment.

Alternative 3 provides a higher level of short term effectiveness when compared to Alternatives 2 and 4. Modeling estimates indicate that groundwater cleanup levels will be achieved sooner for all COCs under Alternative 3 compared to Alternatives 2 and 4 because of the increased pump and treat capacity relative to the other alternatives.

Implementability of Alternatives 3 and 4 was rated higher than Alternative 2 for groundwater remediation. Both rely on pump and treat for Cr(VI), which is readily implemented and has been previously used at the Hanford Site. Alternative 2 uses bioremediation, which is a proven technology, but the bioinjections will require additional design and operational adjustments for implementation.

The estimated cost to remediate the 100-HR-3 Groundwater OU under Alternative 3 is greater than Alternative 2 but lower than Alternative 4.

Alternative 3 performed best in terms of community acceptance. Commenters expressed support for Alternative 3 for groundwater remediation, as this alternative provides a robust system that achieves cleanup levels within the shortest time frames. Commenters also expressed an interest in adding treatment technologies for COCs other than Cr(VI).

The Selected Remedy meets the threshold criteria and provides the best balance of tradeoffs as compared to the other alternatives with respect to the balancing and modifying criteria. The Selected Remedy satisfies CERCLA Section 121(b) to: (1) be protective of HHE; (2) comply with ARARs (or justify a waiver); (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.

12.2 Detailed Description of the Selected Remedy

The Selected Remedy may change somewhat as a result of the remedial design and construction process. Any changes to the remedy described in the ROD will be documented using a technical memorandum in the AR, an ESD, or a ROD amendment, in accordance with the NCP.

12.2.1 RTD at Waste Sites for 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2

RTD of 104 waste sites identified in Table 1 to achieve RAOs and cleanup levels will be conducted as follows: (a) RTD the soil and debris with COCs exceeding cleanup levels identified in Table 4 as deep as 4.6 m (15 ft) bgs to protect human health and ecological receptors from direct exposure to contaminants, (b) RTD the soil and debris below 4.6 m (15 ft) bgs with COCs exceeding cleanup levels in Table 5 for groundwater and river protection and (c) the excavated waste sites will be backfilled with clean borrow material and contoured to blend with the surrounding ground surface, after which native vegetation will be established. Contaminated soil and debris with concentrations above the cleanup levels will be excavated from the waste sites using shallow and deep excavation technology, treated as necessary to meet applicable LDRs and disposal facility requirements and sent to ERDF, which is considered onsite, or another facility approved by EPA or Ecology. The Selected Remedy for the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs requires treatment of RTD waste as necessary to meet applicable LDRs and the waste acceptance criteria of the disposal facility and as necessary to reduce air releases and worker exposure during excavation and waste management.

All remediated waste sites with closeout verification data as of November 2012 from the shallow vadose zone from 0 to 4.6 m (0 to 15 ft) bgs in the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 source OUs were fully evaluated in the RI risk assessment. Between December 2012 and December 2015, interim remediation was completed at 101 waste sites in the 100-D/H source OUs. The results of the waste site data evaluation (CHPRC-02895 *Evaluation of Remaining Site Verification Packages Approved after Transmittal of the Rev. 0 Remedial Investigation/Feasibility Study for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units, DOE/RL-2010-95*) conducted in 2016 indicate that contaminant concentrations at 99 of the 101 waste sites will likely not exceed the cleanup levels in Tables 4 and 5 of this ROD. Although the preliminary data evaluation indicates these 99 waste sites may not require RTD to meet cleanup levels, additional evaluation of these waste sites consistent with the evaluation conducted in the RI Risk Assessment will occur after issuance of this ROD. Table 1 identifies the waste sites for which the Selected Remedy is RTD. RTD is required unless the waste site meets cleanup levels in Tables 4 and 5.

12.2.2 Pipeline Capping, Institutional Controls at Waste Site in 100-DR-1

Capping the end of the pipes in the 100-D-50:2 waste site is required, along with ICs to restrict entry and restrict excavation that will need to be maintained indefinitely.

12.2.3 Institutional Controls (deep zone) at Waste Sites in 100-DR-1, 100-DR-2, and 100-HR-1

Institutional Controls Component Unique to ICs (deep zone) at waste sites in 100-DR-1, 100-DR-2, and 100-HR-1

ICs in the form of excavation restrictions are required for the 35 ICs (deep zone) waste sites identified in Table 1 and shown on Figures 9 and 10 to control access to residual contamination in soil below 4.6 m (15 ft) bgs that is above standards for UU/UE. Exposure to contamination deeper than 4.6 m (15 ft) bgs is not anticipated, however, ICs restricting excavation are required to ensure future activities do not bring contamination to the surface or otherwise result in exposure to contaminant concentrations that are above standards for UU/UE. These ICs will be maintained until the concentrations of hazardous substances are at such levels to allow for UU/UE and EPA or Ecology authorizes the removal of restrictions.

12.2.4 Institutional Controls (shallow zone) at waste sites in 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2

Institutional Controls Component Unique to ICs (shallow zone) at waste sites in 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2

ICs to control access, use, and to restrict excavation are required for the 8 shallow zone radiologically contaminated waste sites identified in Table 1 and shown on Figures 9 and 10 that exceed cleanup levels. The ICs to control access to residual contamination in soil above 4.6 m (15 ft) bgs and restricting excavation are required to ensure future activities do not bring contamination to the surface or otherwise result in exposure to contaminant concentrations that exceed the cleanup levels identified in Table 4. These ICs will be maintained until cleanup levels are achieved and the concentrations of hazardous substances are at such levels to allow for UU/UE and EPA or Ecology authorizes the removal of restrictions.

12.2.5 Pump and Treat System for 100-HR-3

The Selected Remedy requires an expansion and optimization of the existing pump and treat system designed to reduce concentrations of Cr(VI) and total chromium to meet cleanup levels in Table 6 within 12 years after implementation and hydraulic plume capture to reduce contamination levels and prevent discharge to the Columbia River above state surface water quality standards. Total chromium, strontium-90 and nitrate are collocated with Cr(VI). Nitrate and strontium-90 will be co-extracted with the Cr(VI) during pump and treat. Cr(VI), total chromium, nitrate and strontium-90 will meet cleanup standards in Table 6 upon reinjection.

O&M activities for this remedy include inspection, maintenance, and periodic replacement of monitoring wells; routine and preventive maintenance and replacement of pump and treat system parts at the end of their design life for groundwater pump and treat components; and operations and performance monitoring. A geostatistical analysis will be conducted to determine the optimum spatial distribution for the performance monitoring network. The performance monitoring component includes installation of new wells, periodic sampling, laboratory analysis, and data evaluation to assess the natural attenuation processes, rates of attenuation, and overall protectiveness.

DOE must control well drilling through excavation permits and shall restrict groundwater use until such time as the groundwater achieves levels protective of UU/UE. Groundwater use would be restricted through ICs to limited research purposes and for monitoring and treatment, as approved by EPA or Ecology.

12.2.6 MNA for 100-HR-3

MNA will be used for nitrate and strontium-90 in the 100-HR-3 OU to reduce groundwater contamination to concentrations less than the cleanup levels shown in Table 6. The primary natural attenuation processes for nitrate and strontium-90 present in 100-HR-3 include biodegradation and abiotic degradation, radioactive decay, dispersion, and sorption. The required performance monitoring component includes installation of new wells, periodic sampling, laboratory analysis, and data evaluation needed to assess and confirm the natural attenuation processes, rates of attenuation consistent with natural attenuation model estimates, and overall protectiveness. The MNA processes are expected to achieve cleanup standards for nitrate in 6 years and strontium-90 in 44 years. The monitoring will continue until cleanup levels are achieved.

O&M activities for this remedy include inspection, maintenance, and periodic replacement of monitoring wells, and operations and performance monitoring. A geostatistical analysis will be conducted to determine the optimum spatial distribution for the performance monitoring network. The performance monitoring component includes installation of new wells, periodic sampling, laboratory analysis, and data evaluation to assess the natural attenuation processes, rates of attenuation, and overall protectiveness.

DOE must control well drilling through excavation permits and shall restrict groundwater use until such time as the groundwater achieves levels protective of UU/UE. Groundwater use would be restricted through ICs to limited research purposes and for monitoring and treatment, as approved by EPA or Ecology.

12.2.7 Institutional Controls Component Unique to 100-HR-3

The following IC performance objectives are required to be met as part of this remedial action for 100-HR-3. Land-use controls will be maintained until cleanup levels are achieved and the concentrations of hazardous substances are at such levels to allow for UU/UE and EPA or Ecology authorizes the removal of restrictions. ICs to be implemented by DOE to support achievement of the RAOs include the following:

- DOE shall employ and maintain a permit program limiting 100-HR-3 groundwater access and use to research purposes and for monitoring and treatment in areas where groundwater is above cleanup levels (Figure 8).
- Prevent access or use of the groundwater for drinking water purposes until cleanup levels are met (Figure 8).

12.2.8 Institutional Controls Component Common to All OUs

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

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

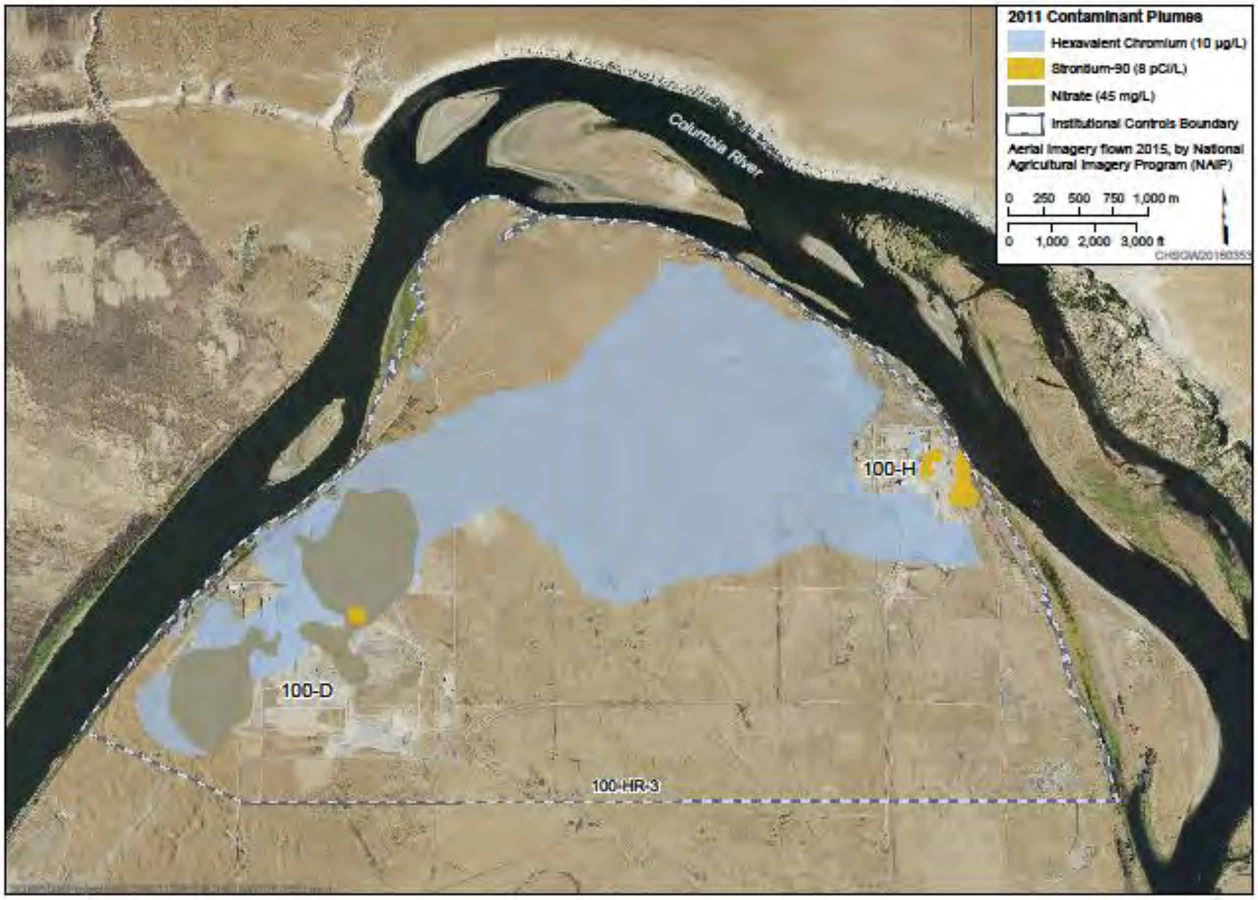


Figure 8. 100-HR-3 OU IC Boundary

The following IC performance objectives are required to be met as part of this remedial action. Land-use controls will be maintained until cleanup levels are achieved and the concentrations of hazardous substances are at such levels to allow for UU/UE and EPA or Ecology authorizes the removal of restrictions. Figure 8 shows the IC boundaries for 100-HR-3. Figure 9 shows the IC boundaries for waste sites in the 100-DR-1 and 100-DR-2 OUs, and Figure 10 shows the IC boundaries for waste sites in the 100-HR-1 and 100-HR-2 OUs. ICs to be implemented by DOE to support achievement of the RAOs include the following:

- In the event that land is transferred out of federal ownership, deed restrictions (proprietary controls such as easements and covenants) are required that are legally enforceable against subsequent property owners.
- In the event of any unauthorized access (e.g. trespassing), DOE shall report such incidents to the Benton County Sheriff's Office for investigation and evaluation of possible prosecution.
- Activities that would disrupt or lessen the performance of any component of the remedies are prohibited.
- Signage and access control to waste sites with contamination above cleanup levels will be provided.
- Maintain the integrity of any current or future remedial or monitoring system such as monitoring wells.

- Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities, and playgrounds until cleanup levels are met.
- DOE shall employ and maintain an excavation permit program for protection of human health against unacceptable exposure, and protection of environmental and cultural resources.
- The DOE shall report on the effectiveness of ICs for all OUs that are the subject of this ROD in an annual report as required by the approved updated Sitewide Institutional Controls Plan, or on an alternative reporting frequency specified by the lead regulatory agency.

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

12.2.9 Land Use Control Boundary

The land use control boundary for the 100-DR-1 and 100-DR-2 OUs is shown on Figure 9. The land use control boundary for the 100-HR-1 and 100-HR-2 OUs is shown on Figure 10. Figure 8 shows the IC boundaries for 100-HR-3.

12.2.10 Groundwater Performance Monitoring for 100-HR-3

Groundwater performance monitoring will be integrated into the sampling and analysis portion of the RD/RAWP. Sampling will be sufficient to document changes in contaminant plumes for all groundwater COCs. As part of monitoring the lateral extents of plumes, groundwater will be monitored in the near vicinity of the Columbia River throughout 100-HR-3 to ensure the lateral extent of the plumes are defined. Monitoring will continue until COCs have met cleanup levels and are expected to continue to meet cleanup levels and EPA or Ecology approves termination of the monitoring. Groundwater monitoring will be performed to evaluate the effectiveness of the selected 100-HR-3 remedy to achieve cleanup levels. The monitoring will be for groundwater COCs (Cr(VI), total chromium, nitrate, and strontium-90).

Miscellaneous solid waste generated by groundwater monitoring activities may be transferred to the CGWSA and accumulated or stored there before being transferred to ERDF or another facility approved by EPA or Ecology, where it will be treated as necessary to meet applicable LDRs and disposal facility requirements and disposed.

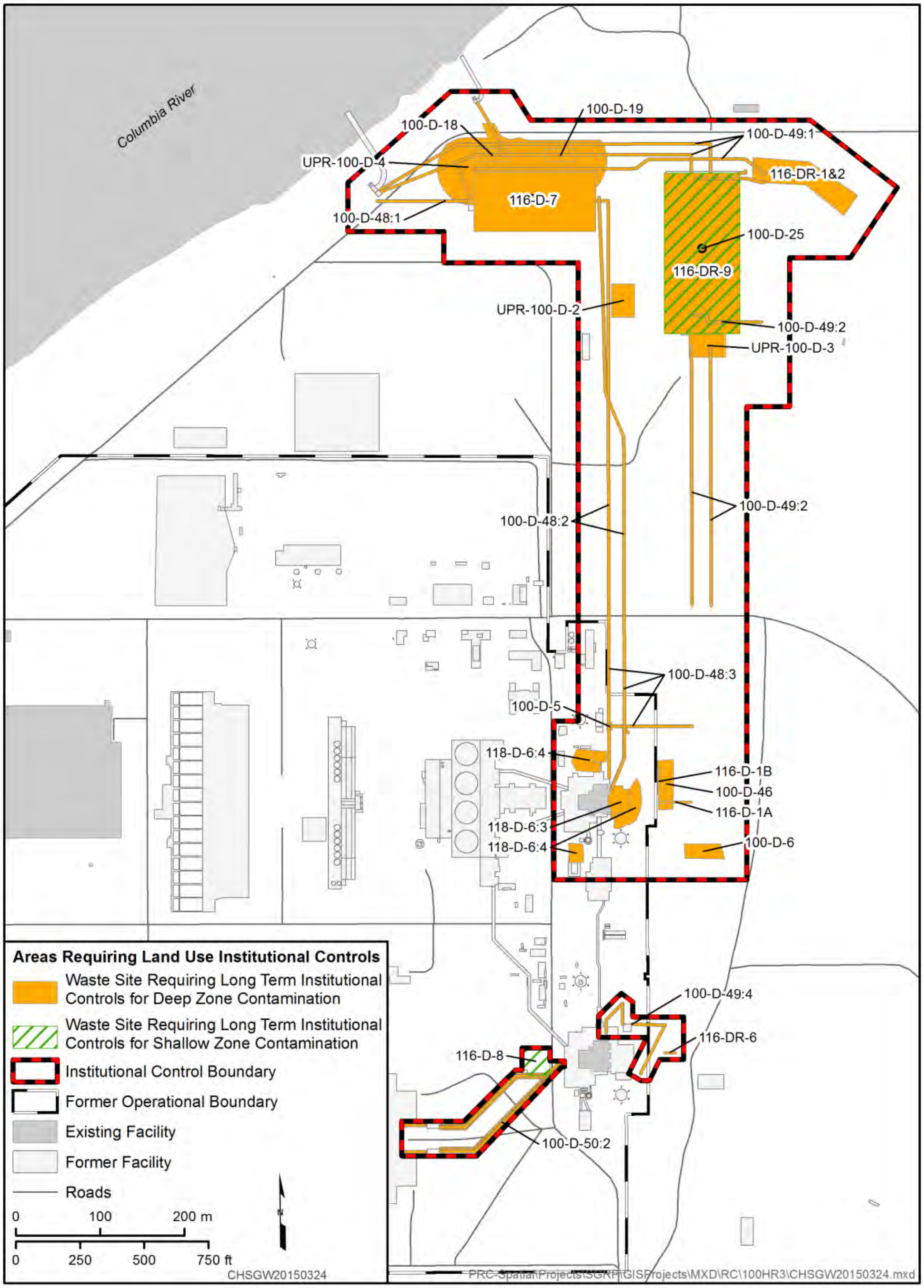


Figure 9. 100-DR-1 and 100-DR-2 OUs ICs Boundary

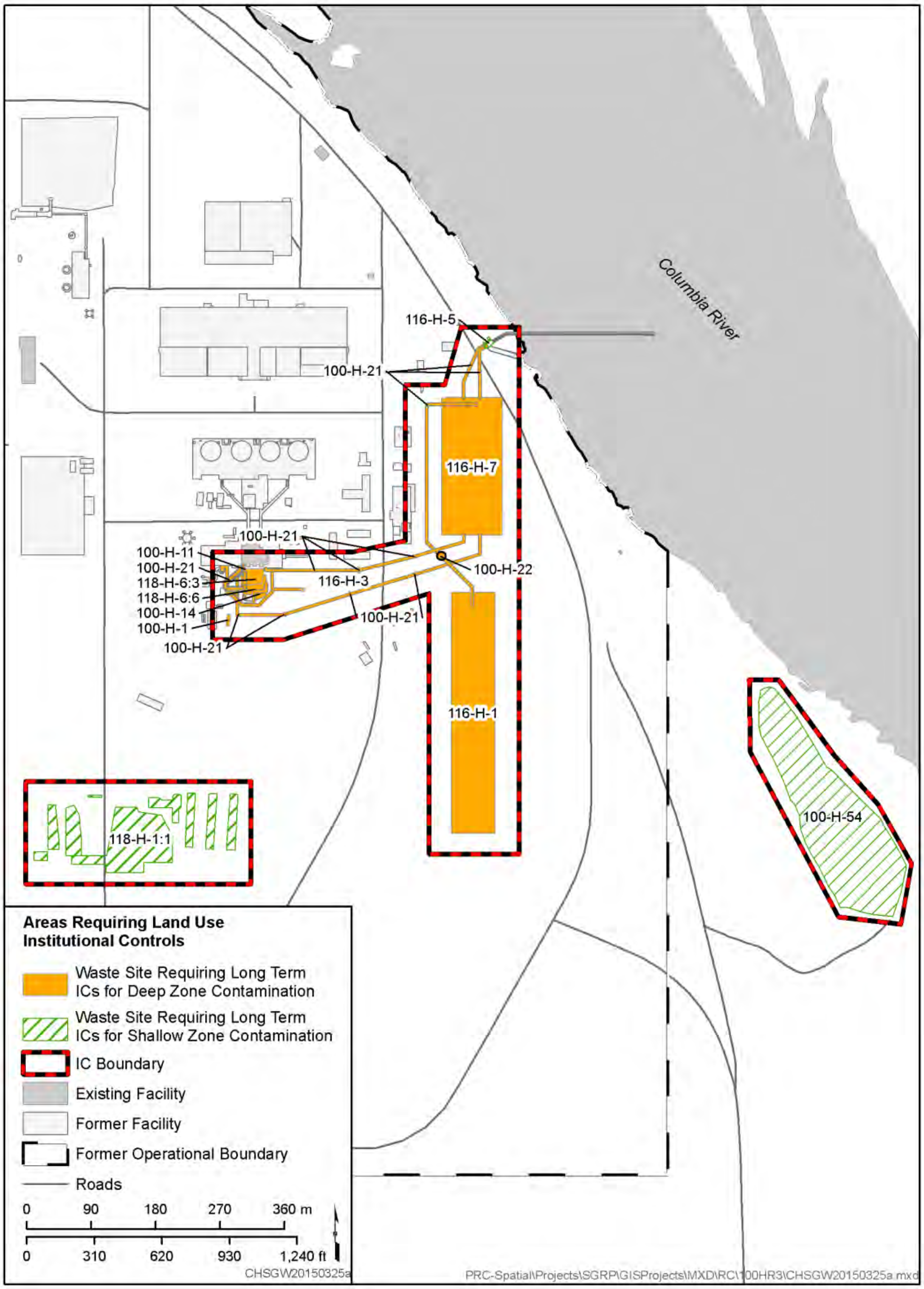


Figure 10. 100-HR-1 and 100-HR-2 OUs ICs Boundary

12.2.11 Transition from Interim to Final Action for 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs

In-progress interim action shall use the cleanup levels in this ROD immediately upon issuance of this ROD. All other aspects of the interim actions shall continue to be performed in accord with the existing RD/RAWPs. DOE shall develop, and submit for Ecology approval, a new RD/RAWP to implement the ROD, prepared in accordance with the TPA (Ecology et al., 1989). When the new RD/RAWP is approved, that document will direct future remedial actions and will replace all interim action ROD work plan requirements.

12.3 Summary of the Estimated Remedy Costs

The cost summary for the Selected Remedy is shown in Table 11. The net present worth value (discounted) represents the dollars that would need to be set aside today, at the defined interest rate, to ensure that funds would be available in the future as they are needed to implement the selected remedial action alternative. Present worth costs were estimated using the real discount rate published in Appendix C of OMB Circular No. A-94, 2011, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs" (effective through January 2013). Based on this guidance and the duration of 23 years for waste site alternatives 2 and 3, a discount rate of 1.8% was used. A discount rate was not used for waste site alternative 4 as the duration is only 1 year. Also, based on this guidance, and durations of 31 years for groundwater alternative 2 and 45 years for groundwater alternative 4, a real discount rate of 1.1% was used. For groundwater alternative 3 with duration of 18 years, a real discount rate of 0.7% was used in groundwater alternative cost estimate present value calculations. The costs for maintaining this ROD's share of site wide programmatic ICs and 5-year reviews costs are included with the cost estimates. Programmatic ICs costs were allocated between CERCLA and non-CERCLA site activities. At the time of the cost estimate there were 22 CERCLA RODs, so each ROD was allocated an equal portion of the CERCLA programmatic ICs costs. The total non-discounted cost for the ICs for 150 years is estimated to be $26,000,000 for each ROD. The total discounted cost for the ICs at Hanford is estimated at $10,000,000 for each ROD. The total non-discounted cost for the 5-year reviews for 150 years is estimated to be $630,000 per ROD. The total discounted cost for the 5-year reviews for 150 years is estimated to be $190,000 per ROD. Costs estimates are within +50 to -30 percent accuracy expectation.

Table 11. Selected Remedy—Cost Estimates (in Millions)

Waste Site Treatment	Capital	$56.2
	Total O&M	$25.7
	Total Periodic[a]	$0.8
	Total Nondiscounted	$82.7
	Net Present Value	$66.7
Groundwater Treatment	Capital	$131.9
	Total O&M	$93.6
	Total Periodic[a]	$113.5
	Total Nondiscounted	$339.0
	Net Present Value	$308.4
Total Nondiscounted Cost of Selected Remedy	$421.7	

Table 11. Selected Remedy—Cost Estimates (in Millions)

Total Net Present Value (Discounted) of Selected Remedy	$375.1

a. Periodic costs include O&M or construction activities, including costs to replace an installed remedy or components of an installed remedy, and services that are not included in initial capital costs or annual O&M costs. Periodic costs may be one-time costs or costs that recur at intervals over the life of the remedy.

O&M = operations and maintenance

12.4 Expected Outcomes of the Selected Remedy

Final cleanup levels and the basis for the cleanup levels are provided above in Table 4, Table 5, and Table 6. The waste sites in the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs for which No Action is the selected remedy allow for residential land use as cleanup levels have been achieved. The waste sites for which RTD is the selected remedy will support residential land use when remedial action is completed. Uses, except at the 100-D-50:2 waste site where the pipelines will be end-capped and at waste sites for which ICs is the selected remedy, will be restricted to prevent exposure to contamination exceeding cleanup levels. In all areas, if contamination below 4.6 m (15 ft) bgs exceeds the direct contact surface cleanup level for that area, land use will be limited to prevent direct exposure to the deep contamination in accord with the ICs. In shallow waste sites for which the Selected Remedy is ICs, radioactive decay is expected to result in UU/UE in the next 25 years. IC's will be in place until levels protective of UU/UE are reached. The waste sites will not pose an unacceptable ecological risk.

Groundwater use in the 100-HR-3 OU will be restricted to prevent use as drinking water where contamination is above cleanup levels. The remedy will achieve groundwater cleanup levels in 12 years for Cr(VI) and total chromium, 6 years for nitrate, and 44 years for strontium 90. Groundwater will be returned to its beneficial use as a potential future drinking water source in approximately 44 years.

13.0 Statutory Determinations

Under CERCLA Section 121 and the NCP (40 CFR 300.430(f)(5)(ii)), the remedy must be protective of HHE, comply with ARARs (unless a statutory waiver is justified), be cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous substances, pollutants, or contaminants as a principal element, and a bias against offsite disposal of untreated wastes.

CERCLA Section 121(c) and the NCP (40 CFR 300.430(f)(4)(ii)) requires review, at least every five years, to determine if adequate protection of HHE is being maintained in those instances where remedial actions result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for UU/UE.

The preamble to the NCP states that when noncontiguous facilities are reasonably close to one another and wastes at these sites are compatible for a selected treatment or disposal approach, CERCLA Section 104(d)(4) allows the lead agency to treat these related facilities as one site for response purposes and, therefore, allows the lead agency to manage waste transferred between such noncontiguous facilities without having to obtain a permit. The 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs, CGWSA and ERDF are reasonably close to one another, and the wastes are compatible for the selected disposal approach. Therefore, these OUs and ERDF are considered to be a single site for response purposes.

The following subsections discuss how the Selected Remedy for these OUs meets the statutory requirements.

13.1 Protection of Human Health and the Environment

The Selected Remedy (Alternative 3) for remediation of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs will be protective of HHE through removal of contaminated soil and debris, pump and treat, MNA to achieve cleanup levels in groundwater, long-term groundwater performance monitoring, and ICs. Cleanup levels for RTD waste sites and for groundwater are set at levels that reduce risk to the acceptable risk range and comply with ARARs. Risk levels expected post cleanup will achieve EPA's acceptable cancer risk range of 10^{-4} to 10^{-6} and non-cancer HI of 1 or less. All waste that is removed will be treated as necessary to meet waste acceptance criteria for disposal. Some waste to be removed will be treated in-situ prior to removal where necessary to protect workers or to manage airborne emissions. ICs apply to prevent exposure to contamination in the soil and groundwater that exceeds levels protective of HHE. Alternative 3 includes the selection of No Action for waste sites that already meet UU/UE standards.

13.2 Compliance with ARARs

The NCP (40 CFR 300.430(f)(5)(ii)(B) and (C)) requires that a ROD describe the federal and state ARARs that the Selected Remedy will attain and any ARARs the remedy will not meet, the waiver invoked, and the justification for any waivers. All federal and state ARARs will be met upon completion of the Selected Remedy, and no ARARs are being waived.

The ARARs are the substantive provisions of any promulgated federal environmental or more stringent state environmental or facility siting standard, requirement, criteria, or limitation that is determined to be legally applicable or relevant and appropriate for a CERCLA site or action. Applicable requirements are 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 (40 CFR 300.5, "Definitions"). Relevant and appropriate requirements are 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 legally "applicable" to circumstances at a particular CERCLA site, address problems or situations sufficiently similar to those encountered at the site that their use is well-suited (40 CFR 300.5). A list of the federal and state ARARS that are to be complied with by the Selected Remedy is provided in Table 12. Only the substantive requirements, standards, criteria or limitations must be met for onsite remedial action.

Table 12. Federal and Washington State ARARs for the Selected Remedies

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
Groundwater			
Safe Drinking Water Act of 1974 **(Public Law 93-523, as amended; 42 USC 300f, et seq.); "National Primary Drinking Water Regulations" (40 CFR 141)**			
"Maximum Contaminant Levels for Inorganic Contaminants" (40 CFR 141.62) "Maximum Contaminant Level Goals for Inorganic Contaminants" (40 CFR 141.51(b))	Establishes MCLs and nonzero MCLGs for drinking water. The standards/goals are designed to protect human health from adverse effects of inorganic contaminants in the drinking water.	These levels regulate the concentrations of contaminants in public drinking water supplies and are considered relevant and appropriate for groundwater and for surface water used potentially for drinking water. Although 100-HR-3 groundwater is not currently used for drinking water, it is a potential drinking water source and discharges into the Columbia River, which is used for drinking water.	100-HR-3. To be met through remediation by Pump and Treat, MNA and source control measures.
"Maximum Contaminant Levels for Radionuclides" (40 CFR 141.66)	Establishes MCLs for drinking water. The standards are designed to protect human health from the adverse effects of radionuclides in the drinking water.	These levels regulate the concentrations of contaminants in public drinking water supplies and are considered relevant and appropriate for groundwater and for surface water used potentially for drinking water. Although 100-HR-3 groundwater is not currently used for drinking water, it is a potential drinking water source and discharges into the Columbia River, which is used for drinking water.	100-HR-3. To be met through MNA and source control measures.
"Hazardous Waste Cleanup—Model Toxics Control Act" (RCW 70.105D, as amended); "Model Toxics Control Act—Cleanup" (WAC 173-340)			
"Potable Groundwater Defined" (WAC 173-340-720(2)) "Method B Cleanup Levels for Potable Ground Water" (WAC 173-340-720(4)(b)(i-iii)(A)&(B)) "Adjustments to Cleanup Levels" (WAC 173-340-720(7)) "Points of Compliance" (WAC 173-340-720(8)) "Compliance Monitoring" (WAC 173-340-720(9)(b-f))	Groundwater shall be classified as potable unless exclusion criteria are met. These groundwater cleanup requirements are ARARs where they are more stringent than federal MCL ARARs. Adjustments to CULs are made in accordance with WAC 173-340-720(7). Points of compliance are established throughout 100-HR-3. Groundwater sample analysis shall be conducted on unfiltered samples unless a filtered sample is shown to be more representative.	Groundwater in 100-HR-3 contains contaminants that require remediation Although groundwater is not currently used for drinking water, it is a potential drinking water source and discharges into the Columbia River, which is used for drinking water.	100-HR-3. The groundwater cleanup levels for chemicals are calculated using the more stringent of those defined in WAC 173-340-720(4)(b). In this case, Method B equations (720-1 and 720-2) for non-carcinogens and carcinogens, respectively, will be used. The remedy will comply with the standards using Pump and Treat, MNA and source control measures, with the 100-HR-3 points of compliance being throughout the 100-HR-3 aquifer.
"Water Well Construction" (RCW 18.104, as amended); "Minimum Standards for Construction and Maintenance of Wells" (WAC 173-160)			
"How Shall Each Water Well Be Planned and Constructed?" (WAC 173-160-161)	Identifies well planning and construction requirements. Water wells must not be a conduit for contamination and be constructed to yield the necessary quantity of water.	Wells are used for treatment and monitoring of groundwater.	100-HR-3. The selected remedy will comply by constructing water wells that meet these standards.
"What Are the Requirements for Preserving the Natural Barriers to Ground Water Movement Between Aquifers?" (WAC 173-160-181)	Identifies the requirements for preserving natural barriers to groundwater movement between aquifers.	Wells are used for treatment and monitoring of groundwater.	100-HR-3. The selected remedy will comply by constructing water wells that meet these standards.

Table 12. Federal and Washington State ARARs for the Selected Remedies

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"What Are the Minimum Standards for Resource Protection Wells and Geotechnical Soil Borings?" (WAC 173-160-400)	Identifies the minimum standards for resource protection wells and geotechnical soil borings.	Wells are used for treatment and monitoring of groundwater.	100-HR-3. The selected remedy will comply by constructing water wells that meet these standards.
"What Are the General Construction Requirements for Resource Protection Wells?" (WAC 173-160-420)	Identifies the general construction requirements for resource protection wells.	Wells are used for treatment and monitoring of groundwater.	100-HR-3. The selected remedy will comply by, constructing water wells that meet these standards.
"What Are the Minimum Casing Standards?" (WAC 173-160-430)	Identifies the minimum casing standards.	Wells are used for treatment and monitoring of groundwater.	100-HR-3. The selected remedy will comply by constructing water wells that meet these standards.
"What Are the Equipment Cleaning Standards?" (WAC 173-160-440)	Identifies the equipment cleaning standards for construction and maintenance of wells.	Wells are used for treatment and monitoring of groundwater.	100-HR-3. The selected remedy will comply by constructing wells that meet these standards.
"What Are the Well Sealing Requirements?" (WAC 173-160-450)	Identifies the well sealing requirements for resource protection wells.	Wells are used for treatment and monitoring of groundwater.	100-HR-3. The selected remedy will comply by constructing wells that meet these standards.
"What Is the Decommissioning Process for Resource Protection Wells?" (WAC 173-160-460)	Identifies the decommissioning process for resource protection wells.	Wells are used for treatment and monitoring of groundwater.	100-HR-3. The selected remedy will comply by decommissioning wells to and borings to meet these standards.
Surface Water			
***Clean Water Act of 1972* (Public Law 107-303, as amended; 33 USC 1251, et seq.), Section 303c; "Water Quality Standards" (40 CFR 131)**			
"Toxics Criteria for Those States Not Complying with Clean Water Act" (40 CFR 131.36(b)(1) as applied to Washington, 40 CFR 131.36(d)(14))	Establishes numeric water quality criteria for priority toxic pollutants for the protection of human health and aquatic organisms which supersede criteria adopted by the state, except where the state criteria are more stringent than the federal criteria.	Groundwater from 100-HR-3 that discharges into the Columbia River contains priority toxic pollutants that require remediation to meet toxics criteria standards.	100-HR-3. These standards apply where groundwater discharges to the river. The selected remedy will comply through Pump and Treat, MNA, infiltration control and source control measures.
"Water Pollution Control" (RCW 90.48, as amended); "Underground Injection Control Program" (WAC 173-218)			
"UIC Well Classification Including Allowed and Prohibited Wells" (WAC 173-218-040)	Establishes criteria and standards for an underground injection control program.	Groundwater in 100-HR-3 contains contaminants that require remediation; treated groundwater may be discharged through underground injection wells.	100-HR-3. Groundwater remedial activities involve underground injection which will satisfy substantive requirements.
"Water Pollution Control" (RCW 90.48, as amended); "Water Quality Standards for Surface Waters of the State of Washington" (WAC 173-201A)			
"Toxic Substances" (WAC 173-201A-240(5))	Establishes chemical water quality standards for surface waters of the State of Washington for protection of aquatic life.	Groundwater in 100-HR-3 contains contaminants that require remediation and discharges into the Columbia River.	100-HR-3. These standards apply where groundwater discharges to the river. The selected remedy will comply through Pump and Treat and source control measures

Table 12. Federal and Washington State ARARs for the Selected Remedies

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
Soil and Vadose Zone			
"Hazardous Waste Cleanup—Model Toxics Control Act" (RCW 70.105D, as amended); "Model Toxics Control Act—Cleanup" (WAC 173-340)			
"Unrestricted Land Use Soil Cleanup Standards" (WAC 173-340-740(3)) Unrestricted Land Use Soil Cleanup Standards, Adjustments to Cleanup Levels" (WAC 173-340-740(5)) Unrestricted Land Use Soil Cleanup Standards, Point of Compliance" (WAC 173-340-740(6)) "Unrestricted Land Use Soil Cleanup Standards, Compliance Monitoring" (WAC 173-340-740(7)(a)-(b))	Requires that soil cleanup levels result in no significant adverse effects on terrestrial ecological receptors. Requires human health protection from both groundwater contaminated due to leaching and direct soil contact. Total excess cancer risk may not exceed $1x10^{-6}$ or a non-cancer hazard index of 1 for chemical contaminants. Soil points of compliance for groundwater protection are throughout the site and for human health via direct contact from the ground surface to fifteen feet below ground surface. Soil cleanup levels apply to the less than 2mm size fraction of dry samples, and also larger size fractions if it is reasonable to expect that larger soil particles could be reduced to 2 mm or less during current or future site use and the reduction could cause an increase in the concentrations of hazardous substances in the soil.	Soil in 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 contains contaminants that require remediation to meet Method B soil cleanup levels calculated based on an unrestricted land use.	100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2. The selected remedy will comply through RTD of contaminants that exceed the standards and end pipe capping with IC's at one site. Table 4 includes soil cleanup levels to protect direct exposure that meet the risk and hazard requirements. Table 5 includes soil cleanup levels for the protection of groundwater and surface water due to leaching from soil contamination.
"Deriving Soil Concentrations for Groundwater Protection" (WAC 173-340-747(3) through (8))	Establishes soil concentrations that will not cause contamination of groundwater at levels that exceed the groundwater cleanup levels established under "Groundwater Cleanup Standards" (WAC 173-340-720).	Soil in 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 contains contaminants that require remediation to ensure protection of groundwater. Although 100-HR-3 groundwater is not currently used for drinking water, it is a potential drinking water source. Groundwater discharges into the Columbia River, which is used for drinking water.	100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs. The selected remedy will comply through RTD of contaminants that exceed the standards. Table 5 includes soil cleanup levels to protect groundwater and surface water due to leaching from soil contamination.
Air			
"Washington Clean Air Act" (Chapter 70.94 RCW, as amended); "General Regulations for Air Pollution Sources" (WAC 173-400)			
"General Standards for Maximum Emissions" (WAC 173-400-040)	All sources and emission units are required to meet the general emission standards unless a specific source standard is available. General standards apply to visible emissions, fallout, fugitive emissions, odors, emissions detrimental to persons and property, sulfur dioxide, concealment and masking, and fugitive dust.	Soil remedial action at 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs provides the potential for emissions subject to these standards because selected remedial action could result in emissions of regulated air pollutants.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3 OUs. Remedial actions that have the potential to release air emissions will meet standards.

Table 12. Federal and Washington State ARARs for the Selected Remedies

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"Emission Standards for Sources Emitting Hazardous Air Pollutants" (WAC 173-400-075)	Establishes emission standards for hazardous air pollutants. Adopts, by reference, "National Emission Standards for Hazardous Air Pollutants" (NESHAP [40 CFR 61]) and appendices.	100 -DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 and 100-HR-3 OUs contain hazardous pollutants that could become airborne.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3. Remedial actions will be designed and performed in compliance with the standards.
"Washington Clean Air Act" (Chapter 70.94 RCW, as amended); "Controls for New Sources of Toxic Air Pollutants" (WAC 173-460)			
"Control Technology Requirements" (WAC 173-460-060) "Table of ASIL, SQER and de Minimis Emission Values" (WAC 173-460-150)	Shall not establish, operate or cause to be established or operated any new or modified toxic air pollutant source which is likely to increase TAP emissions without installing and operating BACT. Non-process fugitive emissions activities are exempt for the requirement to apply BACT. Requires compliance with the limits for air pollutants including carcinogens and noncarcinogens listed in "Table of ASIL, SQER and de Minimis Emission Values" (WAC 173-460-150).	Hazardous contaminants detected in soil and/or 100-HR-3 groundwater include constituents that would constitute toxic air pollutants if released to the air.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3. Remediation activities with the potential to emit toxic air emissions identified in this standard will comply.
"Washington Clean Air Act" (Chapter 70.94 RCW, as amended); "Ambient Air Quality Standards and Emission Limits for Radionuclides" (WAC 173-480)			
"Ambient Standard" (WAC 173-480-040)	Requires that emissions of radionuclides in the air shall not cause a maximum effective dose equivalent of more than 10 mRem/year to the whole body to any member of the public. Per "Applicability" (WAC 173-480-020), the ambient standard applies to the entire state. Measurements may be made at all points up to property lines of point, area and fugitive emission sources.	Hazardous contaminants detected in soil and groundwater at 100-D/H include radionuclides that could be emitted to ambient air during remedial actions.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3. Remediation activities (e.g., RTD) that have the potential to emit radionuclides above maximum acceptable levels will be controlled to meet standards.
"General Standards for Maximum Permissible Emissions" (WAC 173-480-050)	At a minimum, all emission units shall make every reasonable effort to maintain radioactive materials in effluents to unrestricted areas ALARA; control equipment at sites operating under ALARA shall be defined as reasonably available control technology and as low as reasonably achievable control technology.	The potential for fugitive and diffuse emissions because of excavation and related activities will require efforts to minimize those emissions.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3. Remediation activities (e.g., RTD,) that have the potential to emit radionuclides to residential areas will meet standards.
"Emission Monitoring and Compliance Procedures" (WAC 173-480-070(2))	Compliance is determined by calculating the dose to members of the public at the point of maximum annual air concentration in an unrestricted area where any member of the public may be located.	Hazardous contaminants detected in 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3 include radionuclides that could be emitted to unrestricted areas during remedial actions.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3. Remediation activities (e.g., RTD,) that have the potential to emit radionuclides to unrestricted areas will meet standards.

Table 12. Federal and Washington State ARARs for the Selected Remedies

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"Emission Standards for New and Modified Emission Units" (WAC 173-480-060)	Requires that construction, installation, or establishment of new air emission control units use best available radionuclide control technology.	Hazardous contaminants detected 100-D/H includes radionuclides that could be emitted from air emission control units during remedial actions.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3. Remediation activities (e.g., RTD,) that require air pollution control measures and/or equipment and have the potential to emit radionuclides to the ambient air will meet standards.
"Nuclear Energy and Radiation" (RCW 70.98, as amended); "Radiation Protection—Air Emissions" (WAC 246-247)			
"National Standards Adopted by Reference for Sources of Radionuclide Emissions" (WAC 246 247 035(1)(a)(i) and (ii) Adopts by reference provisions of "General Provisions" 40 CFR 61Subpart A, "Radionuclides other than Radon" 40 CFR 61 Subpart H	Requires the owner or operator of each stationary source of hazardous air pollutants subject to a national emission standard for a hazardous air pollutant to determine compliance with numerical emission limits in accordance with emission tests established in NESHAP "Emission Tests and Waiver of Emission Tests" (40 CFR 61.13) or as otherwise specified in an individual subpart. Compliance with design, equipment, work practice, or operational standards shall be determined as specified in the individual subpart. Also, maintain and operate the source, including associated equipment for air pollution control, in a manner consistent with good air pollution control practice for minimizing emissions.	Remedial actions in 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 OUs and 100-HR-3 have the potential to emit hazardous air pollutants.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 OUs and 100-HR-3. Remedial actions involve stationary sources that provide a potential to emit regulated hazardous air pollutants (e.g., decontamination stations, or waste removal or storage activities). Associated design, equipment, work practice and/or air emissions controls will be maintained and operated to meet these standards.
"Radiation Protection, Air Emissions, General Standards" (WAC 246-247-040(2) (3) (4))	Requires that emissions be controlled to ensure substantive portions of ALARA based and best available controls standards are not exceeded.	Hazardous contaminants that would be subject to radionuclide air emission standards and resultant requirements have the potential to be detected in, and emitted from, structures, components, debris, soil, or groundwater involved in the remedial actions in 100 D/H.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3. Remedial actions will use BARCT or ALARACT as required to meet this standard.
"Monitoring, Testing and Quality Assurance" (WAC 246-247-075(2), (4); (8)-(14))	Establishes the monitoring, testing, and quality assurance substantive requirements for radioactive air emissions. Emissions from nonpoint and fugitive sources of airborne radioactive material will be measured.	Hazardous radionuclide contaminants in 100 D/H waste sites that would be subject to radionuclide air emission standards and resultant requirements have the potential to be detected in, and emitted from, structures, components, debris, soil, or groundwater involved in the remedial actions.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3. OUs. Monitoring, testing and quality assurance requirements will be defined and followed to meet this standard.

Table 12. Federal and Washington State ARARs for the Selected Remedies

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
***Clean Air Act of 1990* and amendments; "Standards of Performance for New Stationary Sources" (40 CFR 60) and "National Emission Standards for Hazardous Air Pollutants for Source Categories" (40 CFR 63)**			
40 CFR 60 Subpart IIII—Standards of Performance for Stationary Compression Ignition Internal Combustion Engines 40 CFR 60 Subpart JJJJ--Standards of Performance for Stationary Spark Ignition Internal Combustion Engine 40 CFR 63 Subpart ZZZZ - National Emission Standard for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines	The requirements for stationary engines changed May 3, 2013 to include timers, maintenance plans, and meeting monitoring requirements. Includes requirements for operating stationary engines. Emission standards are met by operating/maintaining the engine per manufacturer's instructions, recording the hours of operation, and maintaining records of maintenance.	This applies to all stationary engines, except motor vehicle or non-road engines and existing emergency engines.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3 OUs may use a covered stationary engine to support remedial activities in which case the substantive requirements will be met.
***Clean Air Act of 1990* and amendments; "National Emission Standard for Asbestos" (40 CFR 61, Subpart M),**			
"Applicability" (40 CFR 61.140) "Standard for Demolition and Renovation" (40 CFR 61.145)	Defines regulated ACM and regulated removal and handling requirements. Includes substantive sampling, inspection, handling, and disposal requirements for regulated sources having the potential to emit asbestos. Specifically, no visible emissions are allowed during handling, packaging, and transport of ACM.	Encountering ACM on pipelines or buried asbestos within the 100-DR-1, 100-DR-2, 100-HR-1 and 100-HR-2 OUs is possible during remediation activities.	100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs. Site investigation, remediation activities and associated handling, packaging, transportation and disposal of ACM will meet standards.
Standard for Waste Disposal for Manufacturing, Fabricating, Demolition, Renovation, and Spraying Operations (40 CFR 61.150)	Includes substantive requirements for the removal and disposal of asbestos from demolition and renovation activities.	Pipelines, other debris and soil contain ACM.	100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs. Site remediation activities and associated handling, packaging, transportation and disposal of ACM will meet standards.
Solid Wastes			
***Toxic Substances Control Act of 1976* (Public Law 107-377, as amended; 15 USC Section 2605, et seq.); "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions" (40 CFR 761)**			
"Applicability," "PCB Waste" (40 CFR 761.50(b)1, 2, 3, and 7) "Applicability," "Storage for Disposal" (40 CFR 761.50(c))	Establishes substantive PCB requirements for the storage and disposal of PCB wastes including liquid PCB wastes, PCB items, PCB remediation waste, PCB bulk product wastes, and PCB/radioactive wastes at concentrations greater than 50 ppm.	Remediation is expected to generate PCB and PCB/radioactive waste.	100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs. Management and disposal of remediation waste with PCBs will meet standards.

Table 12. Federal and Washington State ARARs for the Selected Remedies

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"Disposal Requirements," "PCB Liquids" (40 CFR 761.60(a)) "Disposal Requirements," "PCB Articles" (40 CFR 761.60(b)) "Disposal Requirements," "PCB Containers" (40 CFR 761.60(c))	Establishes substantive requirements applicable to the handling and disposal of PCB liquids, PCB articles, and PCB containers.	PCB liquids, articles, and/or containers may be encountered and/or generated during the remedial actions for 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2.	100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2. Standards will be met for PCB liquids, articles and debris handling, storage and disposal.
"PCB Remediation Waste" (40 CFR 761.61)	Provides substantive cleanup and disposal options for PCB remediation waste based on the concentration at which PCBs are found.	PCB remediation wastes may be encountered and/or generated during the remedial actions for 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2.	100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2. Standards will be met for PCB remediation wastes
Solid Wastes			
"Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities" (40 CFR 264)			
"Staging Piles" (WAC 173-303-64690)	Establishes the substantive requirements for staging and accumulation of remediation waste during remedial operations.	Remediation wastes may be generated and accumulated during remedial actions at 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2.	100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2. Standards will be met for remediation waste.
"Hazardous Waste Management" (RCW 70.105, as amended); "Dangerous Waste Regulations" (WAC 173-303)			
"Identifying Solid Waste" (WAC 173-303-016) "Recycling Processes Involving Solid Waste" (WAC 173-303-017)	Identifies those materials that are and are not solid wastes and identifies those materials that are and are not solid wastes when recycled.	Solid wastes will be generated during 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 remedial actions which will be subject to solid waste and dangerous waste designation requirements.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3. Standards will be met for remediation activities
"Designation of Dangerous Waste" (WAC 173-303-070)	Establishes the substantive method for determining if a solid waste is a dangerous waste (or an extremely hazardous waste).	Dangerous/hazardous waste will be generated during 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 remedial actions.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3. Standards will be met for remediation (including waste treatment) activities that generate wastes.
"Requirements for Universal Waste" (WAC 173-303-077)	Identifies certain batteries, mercury-containing equipment and lamps as exempt from regulation under WAC 173-303-140 and WAC 173-303-170 through 173-303-9906 (excluding WAC 173-303-960). These wastes are subject to regulation under WAC 173-303-573, "Land Disposal Restrictions" (WAC 173-303-140) and WAC 173-303-170 through 173-303-9907 (excluding WAC 173-303-960, "Special Powers and Authorities of the Department"). These wastes are subject to regulation under "Standards for Universal Waste Management" (WAC 173-303-573).	Waste sites in 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 may contain universal wastes.	100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2. Remediation activities will meet standards for universal wastes.

Table 12. Federal and Washington State ARARs for the Selected Remedies

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"Recycled, Reclaimed, and Recovered Wastes" (WAC 173-303-120) "Recycled, Reclaimed, and Recovered Wastes" (WAC 173-303-120(3)) "Recycled, Reclaimed, and Recovered Wastes" (WAC 173-303-120(5))	Defines the requirements for the recycling of materials that are solid and dangerous waste. Specifically, "Recycled, Reclaimed, and Recovered Wastes" (WAC 173-303-120[3]) provides for the management of certain recyclable materials, including spent refrigerants, antifreeze, and lead acid batteries. "Recycled, Reclaimed, and Recovered Wastes" (WAC 173-303-120[5]) provides for the recycling of used oil.	Wastes that can be recycled, reclaimed or recovered have the potential to be generated during 100-D/H remedial actions.	100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2. Recycling of wastes subject to these requirements will be done in a manner that satisfies standards.
"Land Disposal Restrictions" (WAC 173-303-140)	Establishes treatment requirements and disposal prohibitions for land disposal of dangerous waste and incorporates the federal land disposal restrictions (40 CFR 268).	Remediation may generate waste subject to land disposal restrictions.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3. Wastes subject to these requirements will be treated as required and disposed in a manner that satisfies standards.
"Requirements for Generators of Dangerous Waste" (WAC 173-303-170)	Establishes the requirements for dangerous waste generators. "Requirements for Generators of Dangerous Waste" (WAC 173-303-170[3]) which includes the substantive provisions of "Accumulating Dangerous Waste On-Site" (WAC 173-303-200) by reference.	100-D/H remedial actions may generate dangerous wastes.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3. Remediation wastes (e.g., contaminated soil, personnel protective gear, treatment chemicals) may be dangerous waste, and will be managed in accord with these requirements.
"Accumulating Dangerous Waste On-Site" (WAC 173-303-200)	Establishes the requirements for accumulating wastes onsite. "Accumulating Dangerous Waste On-Site" (WAC 173-303-200) further includes certain substantive standards from "Use and Management of Containers (WAC 173-303-630) and "Tank Systems" (WAC 173-303-640) by reference.	100-D/H remedial actions may generate dangerous wastes.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3. Remediation wastes (e.g., contaminated soil, personnel protective gear, treatment chemicals) may be dangerous waste, and accumulations of such will be in accord with these requirements.
"Use and Management of Containers" (WAC 173-303-630), "General Requirements" (WAC 173-303-280(6)) "Closure" (WAC 173-303-610(2), (4) and (5))	Establishes requirements for dangerous waste facilities that store containers of dangerous waste.	Remedial actions may involve management of dangerous waste in containers that are subject to this standard.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3. Investigation and remedial actions that produce or manage containers of dangerous waste will be managed to meet standards.

Table 12. Federal and Washington State ARARs for the Selected Remedies

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
"Corrective Action Dangerous Waste Regulation Requirements" (WAC 173-303-64620(4))	Requires corrective action to be "consistent with" specified sections of Model Toxics Control Act.	The substantive portions of this regulation establish minimum requirements for HWMA corrective action.	For waste sites within 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs.
"Solid Waste Management—Reduction and Recycling" (RCW 70.95, as amended); "Solid Waste Handling Standards" (WAC 173-350)			
"Owner Responsibilities for Solid Waste (WAC 173-350-025) "Performance Standards" (WAC 173-350-040) "On-Site Storage, Collection and Transportation Standards" (WAC 173-350-300) "Remedial Action" (WAC 173-350-900)	Establishes minimum functional performance standards for the proper handling and disposal of solid waste, not otherwise excluded. Provides requirements for the proper handling of solid waste materials originating from residences, commercial, agricultural and industrial operations, and other sources, and identifies those functions necessary to ensure effective solid waste handling programs at both the state and local level.	Covered solid waste will be generated during implementation of remedial actions.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3. Remedial actions that generate covered solid waste will meet standards.
Historical and Archeological Resources			
***National Historic Preservation Act of 1966* (Public Law 89-665, as amended, 16 USC 470, et seq.)**			
"Protection of Historic Properties" (36 CFR 800)	Requires federal agencies to consider the impacts of their undertaking on cultural properties through identification and evaluation. Potential project adverse effects are to be avoided or mitigated. Need to take actions as necessary to minimize harm to any National Historic Landmarks and historic properties.	Cultural and historic sites have been identified within 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2.	100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2. Historical and cultural reviews have identified cultural and historic sites. Additional reviews will locate remedial action areas where existing reviews are insufficient. For any discoveries, appropriate actions will be taken to meet standards.
***Protection and Enhancement of the Cultural Environment* (Executive Order 11593)**			
"National Historic Landmarks Program" (36 CFR 65)	These regulations set forth the criteria for establishing national significance. Requires that federal agencies shall, to the maximum extent possible, undertake planning and actions as may be necessary to minimize harm to landmarks.	Cultural and historic sites have been identified within 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3. Remedial actions shall comply with this standard.
***Native American Graves Protection and Repatriation Act of 1990* (Public Law 101-601, as amended, 25 USC 3001, et seq.); "Native American Graves Protection and Repatriation Regulations" (43 CFR 10)**			
"Native American Graves Protection and Repatriation Regulations" (43 CFR 10)	Establishes federal agency responsibility for discovery, protection and appropriate disposition of human remains, associated and unassociated funerary objects, sacred objects, and items of cultural patrimony.	Native American archaeological, cultural, and historic sites have been identified within 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2; Native American remains and associated objects have the potential to be present.	100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3. Remedial activities will be conducted to identify, protect and provide for appropriate disposition of covered human remains, objects and items. Native American Tribal consultation will be conducted in the event of discovery.

Table 12. Federal and Washington State ARARs for the Selected Remedies

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application
Archeological and Historic Preservation Act of 1974 **(Public Law 93-291, as amended; 16 USC 469a-1 through 469a-2(d))**			
"Applicant Requirements" 16 USC 469a-1 through 469a-2(d)	Requires that Federal projects do not cause the loss of archaeological or historic data. This act mandates preservation of the data; it does not require protection of the actual waste site or facility.	Archaeological and historic sites have been identified within, 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2.	100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2. Remediation activities will prevent irreparable loss of significant scientific, prehistoric or archeological data, the data will be preserved.
Natural and Ecological Resources			
Endangered Species Act of 1973 **(Public Law 93-205, as amended; 7 USC Section 136; 16 USC Ch. 1531, et seq.)**			
"Endangered Species Act of 1973", as Amended 16 U.S.C. §§ 1531-1544, specifically Sections 7 and 9(a). 50 CFR Part 17 (listings, prohibitions) 50 CFR Part 402 ,50 CFR Parts 222-224 (endangered and threatened marine species), 50 CFR 226.212 (critical habitat for Northwest salmon and steelhead)	Prohibits actions by federal agencies that are likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of habitat critical to them. Also prohibits the taking of any endangered species.	100-HR-3 groundwater discharges into the Hanford Reach of the Columbia River which contains the Upper Columbia River spring-run Chinook salmon and the steelhead which are endangered. The spring-run Chinook salmon do not spawn in the Hanford Reach but use it as a migration corridor. Steelhead spawning has been observed in the Hanford Reach. The bull trout is listed as a threatened species but is not considered a resident species and is rarely observed in the Hanford Reach.	100-HR-3. Remediation actions will be managed to avoid jeopardy and/or adversely affect a listed species or critical habitat.
Migratory Bird Treaty Act of 1918 **(16 USC 703-712; Ch. 128; July 13, 1918; 40 Stat. 755), as amended**			
Migratory Bird Treaty Act of 1918 (16 USC 703-712) 50 CFR Parts 10 and 21	Protects all migratory bird species and prevents "take" of protected migratory birds, their young, or their eggs." Federal agencies are required to avoid or minimize impacts to migratory bird resources, restore or enhance their habitat and prevent or abate its detrimental alteration.	Migratory birds utilize 100 D/H.	100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2. Remedial actions will require mitigation measures to deter nesting by migratory birds on, around or within remedial action site and methods to identify and protect occupied bird nests in a manner that complies with requirements.
"Powers and Duties," "Habitat Buffer Zone for Bald Eagles—Rules" (RCW 77.12.655); "Permanent Regulations," "Bald Eagle Protection Rules" (WAC 232-12-292)			
"Bald and Golden Eagle Protection Act" (16 USC § 668, 50 CFR Part 22)	Protects eagle habitat to maintain eagle populations so the species is not classified as threatened, endangered, or sensitive in Washington State.	Bald eagles nest, feed, and overwinter along the shores of the Columbia River.	100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2. Remedial actions will be performed in a way to protect bald eagle habitat.

Table 12. Federal and Washington State ARARs for the Selected Remedies

Regulatory Citation	Description of Regulatory Requirement	Rationale for Including	Application

ACM = asbestos-containing material
ALARA = as low as reasonably achievable
ALARACT = as low as reasonably achievable control technology
BACT (BARCT) = best available (radionuclide) control technology
CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
HHE = human health and the environment
HWMA = Hazardous Waste Management Act
MCL = maximum contaminant level
MCLG = maximum contaminant level goal
MNA = monitored natural attenuation
NRC = U.S. Nuclear Regulatory Commission
PCB = polychlorinated biphenyl
RTD = removal, treatment, and disposal

13.3 Cost Effectiveness

The Selected Remedy is cost-effective. In making the determination of cost effectiveness, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness" (NCP [40 CFR 300.430(f)(1)(ii)(D)]). This determination was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of HHE and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost-effectiveness. The overall effectiveness of Alternatives 2, 3, and 4 was determined to be proportional to their respective costs.

The estimated present worth cost of the Selected Remedy is $375 million. The Selected Remedy for groundwater will provide an overall level of protection comparable to Alternatives 2 and 4 at the same (Alternative 4) or lower cost (Alternative 2). The additional cost for biological treatment of the groundwater plumes in Alternative 2 does not provide a significant increase in protection of HHE since both of these alternatives rely on MNA to address nitrate and strontium-90 contamination with timeframes similar to the Selected Remedy for groundwater. There is greater uncertainty with the cost estimated for Alternative 2. The Selected Remedy for the waste sites will provide an overall level of protection the same as Alternative 2. Alternative 4 employs RTD for 6 additional sites, but at a significant additional cost. Alternative 3 is fully protective. It employs ICs until such time UU/UE levels are achieved through radioactive decay.

13.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

This determination looks at whether the Selected Remedy provides the best balance of trade-offs among the alternatives with respect to the balancing criteria set forth in the NCP (40 CFR 300.430(f)(1)(i)(B)), such that it represents the maximum extent to which permanence and treatment can be practicably utilized. The NCP (40 CFR 300.430(f)(1)(ii)(E)) provides that the balancing shall emphasize the factors of "long-term effectiveness" and "reduction of toxicity, mobility or volume through treatment," and shall consider the preference for treatment and bias against offsite disposal or untreated waste. The modifying criteria were also considered in making this determination.

Contaminated soil resulting from waste sites using RTD will be treated to reduce toxicity and mobility when necessary to meet applicable LDRs or the waste acceptance criteria of the disposal facility. Treatment may be in-situ or during excavation as needed to control worker exposure. RTD is a permanent solution that includes treatment for some of the waste. The selection of ICs and pipeline end-capping for one waste site does not provide permanent solutions and does not involve the use of treatment technologies. Pipeline end-capping and ICs are being employed to avoid disturbing a maternal bat colony. ICs are the Selected Remedy for a number of shallow waste sites with radiological contamination that will decay below cleanup levels naturally within 25 years without the complications and cost of excavations. The IC remedy for deep waste sites with radiological contamination ensures unexpected excavations at those depths do not occur in a manner that would expose humans to contamination that poses unacceptable risks. The radiological contamination at the deep waste sites will also decay below levels protective of UU/UE, but it will take significantly longer in some cases.

Treatment of groundwater via pump and treat with ion exchange resin removes a significant mass of Cr(VI) permanently from the groundwater. Pump and treat using ion exchange resin is not an innovative technology.

MNA uses natural attenuation processes that permanently reduce COC concentrations over time.

DOE and EPA have determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site. Of those alternatives that are protective of HHE and comply with ARARs, DOE and EPA have determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against offsite treatment and disposal and considering State and community acceptance.

13.5 Preference for Treatment as a Principal Element

Principal threat waste is defined as source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. They include soil containing significant concentrations of highly toxic materials and surface or subsurface soil containing high concentrations of contaminants that are, or potentially are, mobile due to wind entrainment, volatilization, surface runoff, or sub-surface transport. Contaminated groundwater is generally not considered to be source material.

The NCP states that “EPA expects to use treatment to address the principal threats posed by a site, wherever practicable” (40 CFR 300.430(a)(1)(iii)(A)). Principal threat wastes associated with these OUs, such as fuel fragments and concentrated liquid sodium dichromate, have been removed through earlier cleanup actions. No waste sites remain in the source OUs with principal threat waste.

The Selected Remedy for the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs requires treatment of RTD waste as necessary to meet applicable LDRs and the waste acceptance criteria of the disposal facility and as necessary to reduce air releases and worker exposure during excavation and waste management. The Selected Remedy for the 100-HR-3 OU uses an effective pump and treat remedy and natural attenuation processes that permanently reduces COC concentrations in groundwater over time. The statutory preference for treatment as a principal element is only met in part and only in groundwater during the active phase of pump and treat activity and for wastes that must be treated before they can be land disposed. However, no principal threat waste remains and the Selected Remedy is protective of

HHE, satisfies ARARs, and provides the best balance of trade-offs in terms of the five balancing criteria, while also considering State and community acceptance.

13.6 Five-Year Review Requirements

A review, in accordance with CERCLA Section 121(c) and the NCP (40 CFR 300.430(f)(4)(ii)), is required at a minimum every five years if a remedy is selected that results in hazardous substances, pollutants or contaminants remaining at the site above levels that allow for UU/UE. Since the Selected Remedy will result in contamination remaining above levels that allow for UU/UE, DOE will conduct five-year reviews in accordance with CERCLA Section 121(c) and the NCP. Reviews will begin no later than five years after the initiation of the remedial action to help ensure the Selected Remedy is protective of HHE.

14.0 Documentation of Significant Changes

The proposed plan (DOE/RL-2011-111) identified Alternative 3 as the preferred alternative. Comments received from the state of Oregon supported moving some waste sites from No Action to RTD. Review of the AR confirmed insufficient information was available at the time the Proposed Plan was issued to select the No Action remedy for waste sites 100-D-108, 100-D-109, and 100-H-38. As part of the Selected Remedy, these waste sites were moved from the No Action to RTD remedy.

The review of information in the AR also indicated that waste site 118-D-6:4, identified as a deep ICs waste site, also needed to be added to the shallow IC remedy. In addition, consistent with footnote b in Table 6 in the proposed plan (DOE/RL-2011-111), waste sites that were identified as RTD were added to the shallow IC remedy (118-D-2:1 and 100-H-54), and to the deep IC remedy (118-D-3:1). Table 1 reflects these changes.

Consistent with the alternatives analysis presented in the RI/FS, the MNA and ICs remedy for waste sites with shallow and deep radiological contamination in the proposed plan (DOE/RL-2011-111, Alternatives 2 through 4) has been replaced with just ICs. That change is reflected in the alternative analysis presented above. MNA is not part of the Selected Remedy for those radiological waste sites (identified in Table 1 as IC waste sites). The remedy will be ICs until such time as radioactive decay results in levels protective of UU/UE (see dates shown in Table 1). The RI/FS report (DOE/RL-2010-95) and proposed plan did not identify or evaluate monitoring components that are needed to select an MNA remedy as monitoring is not needed to confirm known and well established radiological decay rates.

PART III: RESPONSIVENESS SUMMARY

1.0 Introduction

This responsiveness summary was prepared in accordance with the requirements of Section 117(b), "Public Participation," of CERCLA, as amended. The purpose of this responsiveness summary is to summarize and respond to significant public comments, criticisms, and new information submitted during the public comment period on the proposed plan (DOE/RL-2011-111).

2.0 Community Involvement

Public involvement is important to the DOE, EPA, and Ecology. Stakeholders and the public are expected to be included in the decision-making process at Hanford. The Hanford public involvement team engaged stakeholders and the public throughout the CERCLA process for selecting this remedy.

A formal public comment period on the proposed plan (DOE/RL-2011-1110, originally scheduled to run from July 26, 2016, through August 26, 2016, was extended through September 16, 2016, in response to requests from stakeholders. The comment period for the proposed plan was publicized in the *Tri-City Herald* on July 25, 2016. A fact sheet was mailed to the Hanford mailing list and sent electronically on the Hanford Listserv on July 26, 2016, with information on how to access the proposed plan and AR, with links to key technical documents provided.

Individuals and the Yakama, CTUIR, and Oregon sent written comments through the mail or electronically.

3.0 Comments and Responses

Comments were received from both individuals and groups covering a range of topics and varying perspectives. The public comments were separated and grouped into the following categories:

- Alternatives – Cost, Evaluation, Selection
- Land Management and Land Use
- Contaminant Identification and Cleanup Levels
- Risk Assessment/Modeling Approach
- Tribal Comments
- Additional Comments

Appendix A provides all the public comments received on the proposed plan (DOE/RL-2011-111) and identifies which of the above categories of the responsiveness summary addresses the comments. A summary of public comments received and agency responses is provided below.

Alternatives – Cost, Evaluation, Selection

Alternative Costs

Commenters requested clarification that the costs in the Proposed Plan for each alternative have been verified and are inclusive of Institutional Controls (ICs) beyond the anticipated cleanup timeframes as well as potential maintenance costs should the remedy take longer. Clarification was requested for the site transitions to long-term stewardship and whether this would incur additional cost to the selected remedy. A specific comment requested clarification on whether potential IC costs referenced in a footnote in Table 9-4 (of the 100-D/H RI/FS Report [DOE/RL-2010-95]) are included in the ROD.

Response: Yes, it has been verified that the cost estimates for the alternatives include maintenance of ICs and operations and maintenance costs, which capture monitoring and evaluation of the remedial actions until contaminant concentrations protective of unlimited use/unrestricted entry (UU/UE) are achieved. Costs estimates do not include costs beyond the well supported anticipated cleanup timeframe. The remedial design/remedial action work plan (RD/RAWP) will further define monitoring and evaluation activities that are identified in the ROD. The transition to long-term stewardship has minimal or no impact to the costs of the remedy. The calculation of long-term IC costs for the waste sites is based on maintaining this ROD's share of site wide programmatic ICs and 5-year reviews costs. At the time of the cost estimate there were 22 CERCLA RODs, so each ROD was allocated an equal portion of the CERCLA programmatic ICs costs. The cost for ICs is described in Section 12.3 of the ROD. The IC costs referenced in the footnote in Table 9-4 (of the 100-D/H RI/FS Report) have been verified and are included in the ROD cost estimate. EPA guidance indicates that the cost estimate in a ROD should be within an accuracy of -30% and +50%. The 100-D/H RI/FS Report (Appendix J) includes a cost estimate with details on the design, construction, operations and maintenance, and decommissioning costs.

Contingent Remedy

Comments indicated concern that the groundwater remedy could fail or natural attenuation may not be achieved. Commenters requested descriptions for a contingent remedy.

Response: CERCLA and the NCP do not require contingent remedies. There are no contingent remedies in this ROD. There is a high level of confidence that these remedies will be effective. Groundwater pump and treat has been used successfully for Cr(VI) contaminated groundwater in 100-HR-3 since 1997. Decreasing concentration trends indicate MNA processes are effectively reducing nitrate and strontium-90 groundwater contamination. CERCLA requires a 5-year review of the protectiveness of the remedial decision described in the ROD. Remedies found not to be functioning as intended will be studied to determine if additional actions are needed.

Deep Vadose Zone Contamination Remaining in Place

Commenters expressed desire to not leave soil contamination in the deep vadose zone, but rather consider an alternative of Removal Treatment and Disposal (RTD) for these waste sites. Commenters advised DOE to consider strategic removal of concentrated mass of isotopes in the deep vadose zone before adopting long-term ICs. Concerns were expressed that contaminants have the potential to migrate to groundwater and the Columbia River, or receptors may be exposed through excavation or by soil being brought to the surface. Commenters expressed concern for effectively maintaining an alternative consisting of MNA and ICs over long periods of time, particularly in the River Corridor where there is interest in different land use. There were additional comments that the cost of ICs over time would be greater than the short term remedy of soil removal.

The deep vadose zone waste sites listed in Table 6 of the Proposed Plan were cited as those sites needing a different alternative. The 118-D-3:1 waste site was specifically cited as one that commenters felt needed further RTD to address specific contaminants, including nickel-63.

Response: The strategic removal of contaminants in the deep vadose zone was done during interim actions at waste sites to remove contaminants impacting groundwater. Deep removals were considered during the RI/FS process, but as a result of contaminant removal done under the Interim ROD, none of the deep vadose zone waste sites have mobile chemical or radionuclide contamination at concentrations that would reach groundwater or surface water at levels that would exceed levels protective of groundwater and surface water. The incremental increase of IC costs over time are considerably less than the cost of RTD of these waste sites. RTD of these waste sites will have minimal impact to IC costs for groundwater. ICs that restrict use at deep waste sites with concentrations of contaminants that exceed UU/UE will ensure that receptors will not be exposed through excavation or by soil being brought to the surface. As stated in Section 9.2 of the ROD, DOE will be responsible for implementing, maintaining, reporting on, and enforcing ICs. Although the DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the DOE shall retain ultimate responsibility for remedy integrity.

RTD would address deep soil contamination, but was not selected as the preferred alternative. The cost to conduct deep RTD of these sites was evaluated in the FS and is significantly greater than the cost of the selected remedy.

ICs are an effective remedy for the deep waste site with radioactive contamination that will be reduced through radioactive decay, which is an irreversible process that proceeds at an invariable rate (as compared to biological or chemical attenuation processes). At Hanford, the Tri-Parties have taken advantage of radioactive decay for relatively immobile isotopes that have relatively short half-lives (e.g., 30 years or less), such as those in the deep waste sites. CERCLA requires a review of the protectiveness of the remedial decision described in the ROD including the ICs every 5 years. These reviews will ensure the MNA and IC remedies are regularly evaluated and maintained to ensure protectiveness of current and reasonably anticipated future land use.

ICs are necessary because some contamination will remain in place that will not allow for unlimited use of the land and unrestricted exposure. For the deep vadose zone contamination remaining in place, the soil ICs apply to the deep waste site areas with soil contamination that would exceed acceptable exposure levels in Table 4 of the ROD if brought to the surface. There was a misconception that there were high levels of nickel-63 remaining at waste site 118-D-3. Waste site 118-D-3:1 did have elevated residual nickel-63, but the highest concentration under the interim action calculations was 515 pCi/g, which was less than the Human Health (HH) preliminary remediation goal (PRG) of 608 pCi/g. The calculated cumulative HH carcinogenic radiological risk was $1.39E^{-4}$ for the waste site 118-D-3:1 deep zone. RTD was not selected because there is no pathway, all individual COCs do meet cleanup levels, and the time frame to meet UU/UE is relatively short. Deep excavation is not expected as part of residential use or any other reasonably anticipated future land use. No change in the remedy is required as the waste site is listed as requiring a deep zone IC based on cumulative risk from multiple contaminants. Based on well-established radiological decay rates, it is expected that ICs will be needed until 2025 when contaminant levels allowing for UU/UE will be reached.

Institutional Controls Performance

Commenters expressed that the Proposed Plan does not indicate the types of ICs that will be applied to waste sites or which contaminants of concern (COCs) are responsible for the need for ICs. Additionally, concern was expressed over the use of ICs rather than an alternative like RTD, as well as the belief that the cost summaries do not adequately quantify the cost of performance monitoring for the alternative. Commenters expressed concern over the time frame needed for cleanup.

Response: The ROD identifies the waste sites for which ICs are necessary because of radionuclide contamination, including cesium-137, cobalt-60, europium-152, europium-154, and strontium-90. Figures 8, 9, and 10 illustrate the IC boundaries and Table 1 identifies the waste sites. None of these IC sites have mobile chemical or radionuclide contamination at concentrations that exceed levels protective of groundwater or surface water, so none of these will have impacts on groundwater or surface water. The ICs for waste sites were listed in Table 6 of the Proposed Plan and include restrictions for entry, excavation, and residential use.

The remedies selected for both waste sites and groundwater include RTD and groundwater pump and treat. Much of the cleanup conducted under both the interim and selected final remedial action for contaminated soil will be source removal through RTD, which includes treatment, where necessary, to meet land disposal restriction requirements. ICs are included in the selected remedy to provide protectiveness until UU/UE is achieved. The evaluation of alternatives for radiologically contaminated shallow zone waste sites concluded that there was no additional protectiveness from RTD as there are ICs to restrict exposure during the relatively short decay time frame.

The ROD identifies operations and maintenance costs which capture monitoring and evaluation of the ROD over time. IC costs are included in the cost estimates. EPA guidance identifies that the cost estimate in a ROD should be within an accuracy of -30% and +50%. The RD/RAWP will further define monitoring and evaluation activities that are identified in the ROD. Design, operation maintenance, and other detailed specifications are not required or appropriate in a ROD. CERCLA guidance identifies that this level of detail be presented in the RD/RAWP.

Groundwater ICs are part of the selected remedy in some areas of the 100-HR-3 OU because groundwater remains contaminated above cleanup levels. Withdrawal for uses other than research purposes, treatment, and monitoring is currently prohibited by DOE. The selected remedy for the 100-HR-3 OU requires restrictions on use of groundwater until the cleanup levels are met, expected to be as long as 44 years. These restrictions prevent the installation of public and private groundwater wells. Protective cleanup levels will be met through pump and treat and MNA, and long-term monitoring will be ongoing to assess and ensure the performance of the selected remedy. When cleanup levels are met, the selected remedies will restore groundwater to its highest beneficial use as a potential future drinking water source.

ICs are required to be maintained as long as necessary for the selected remedy to be protective. As contamination will remain above levels that allow for UU/UE, CERCLA requires that the selected remedy be reviewed no less often than every five years to ensure that human health and the environment are being protected by the remedial action. If a remedy is found to be not protective, then additional evaluations and changes to the remedy would be considered.

Regarding the timeline, the Tri-Parties understand public concerns about ICs. ICs are required before, during and after the active phase of remedial action implementation where ICs are needed to protect human health and the environment. ICs are used to control access to residual contamination in soil and groundwater above standards for UU/UE. DOE shall be responsible for implementing, maintaining, reporting on and enforcing ICs. Although the DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement or through other means, the DOE shall retain ultimate responsibility for remedy integrity and ICs. In the event that land is transferred out of federal ownership, deed restrictions (proprietary controls such as easements and covenants) are required that are legally enforceable against subsequent property owners. The Tri-Parties will continue oversight of ICs for the foreseeable future.

Most of Hanford's shoreline has been designated as a national monument. There is also a Manhattan Project National Historic Park presence for the B Reactor and other locations at Hanford. The reactors are identified in a NEPA ROD as possibly being removed 75 years from that ROD, but there is no final CERCLA ROD for the reactors. In addition, several groups, including the Hanford Natural Resource Trustee Council, have identified the habitat value of this area as very high, being one of the last contiguous shrub-steppe habitats in Washington and therefore worth preserving. Residential development and unrestricted well drilling is highly unlikely for the foreseeable future.

New Alternative

Commenters requested a combination of Alternatives 3 and 4 with the pump and treat remedy from Alternative 3 and the additional shallow waste site RTD from Alternative 4 (including the waste site with the maternal bat colony). Commenters desired an alternative with less reliance on MNA. The CTUIR asked to combine alternatives and work to cleanup waste sites quicker.

Response: The selected remedies meet the CERCLA remedy selection threshold criteria and provide the best balance of tradeoffs among the other alternatives with respect to the balancing criteria. The alternatives analysis evaluated the RTD of shallow waste sites. Selection of the RTD remedy instead of the selected IC remedy for the shallow sites is not warranted because the radiological contamination will decay within a relatively short time frame and ICs will restrict exposure during the decay time frame to UU/UE levels. RTD of the bat colony would destroy valued habitat, which has been important to Natural Resource Trustees in the past.

Reactor Concerns

Commenters expressed that the Proposed Plan did not identify all sources of Principle Threat Waste because the Proposed Plan excludes the 100-D/H reactors. Commenters state that the reactors are the primary sources of contamination in the operable units and that the reactors have the potential to affect groundwater in the future. Requests were made to consider reactor plumes in the RI/FS evaluations, as well as potential upgradient sources.

Response: The RI/FS report evaluated the 100-D/H Area to identify sources. Upgradient contaminant sources that may migrate to groundwater from a different source OU would be part of the remedy decision for the source OU.

There was a misconception that there are reactor plumes at 100-D/H. However, there are no soil or groundwater contamination plumes emanating from the reactors in 100-D/H. Buildings (including the D, DR and H Reactors) are not part of the 100-DR-1, 100-DR-2, 100-HR-1 and 100-HR-2 OUs. Therefore, the reactors are not being addressed by this ROD. Reactors in the 100-D/H Area have been placed in interim safe storage to prevent release of contaminants, and are not acting as groundwater contamination sources. The majority of remedial actions for waste sites that were contaminant sources in 100-D/H have been completed as part of interim remedial action with post-remedy samples allowing for final decisions to be made.

Remedial Design/Remedial Action (RD/RA)

Commenters requested that the specific details of pumping rates, numbers of wells, and remedial action duration be included in the Proposed Plan and ROD. Details should also include the cost of maintenance to the pump and treat system if the preferred alternative fails to achieve cleanup standards as set out in the Proposed Plan. Commenters also expressed concern about ongoing remedial actions under the Interim ROD during the timeframe between the signing of this ROD and the development of the RD/RAWP, and whether these interim actions taken to meet the final cleanup levels required a ROD amendment or ESD.

Response: Based on the evaluation presented in the RI/FS, the Agencies have confidence that the selected remedy will achieve cleanup levels and be protective. The Proposed Plan and ROD identify the technology to be used for remedial action and the associated estimated costs. This cost includes operations and maintenance costs which capture monitoring and evaluation of the remedy over time. EPA guidance identifies that the cost estimate in a ROD should be within an accuracy of -30% and +50%. If the selected remedy fails to achieve cleanup levels as required, then alternative courses of action would be evaluated, including as a result of the 5-year review process. The RD/RAWP will further define monitoring and evaluation activities that are identified in the ROD. Based on ongoing experience from the interim remedial actions, the Tri-Parties have confidence that the pump and treat system will continue to provide effective groundwater treatment and maintain protectiveness of the Columbia River.

Design, operation, maintenance, and other detailed specifications are not required or appropriate in a ROD. CERCLA guidance identifies that this level of detail be presented in the RD/RAWP. The TPA requires DOE to submit a RD/RAWP within 180 days of ROD signature, unless another time period is specified in the ROD. The RD/RAWP will provide design aspects of the treatment system that will conform to the ROD. The RD/RAWP will include completion criteria for the groundwater remedy. Typically the completion process will include a rebound study when the pump and treat system would be turned off and groundwater concentrations would be monitored over time. The pump and treat system would be re-started unless data provides a technical basis that the groundwater will continue to meet cleanup levels in the future without continuing operation of the pump and treat system.

Section 4.1 of the ROD provides, "The sequence and timing of the remedial action to be conducted at these OUs will be specified in a work plan written by DOE to be submitted to Ecology for approval within 6 months after ROD approval. In-progress interim action remediation for these OUs under the 1999 *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington (100 Area Remaining Sites)* (EPA/ROD/R10 99/039) and 1996 *Record of Decision for the 100-HR-3 and 100-KR-4 Operable Units Interim Remedial Actions, Hanford Site, Benton County, Washington* (EPA/ROD/R10 96/134) shall continue, except that the cleanup levels selected in this ROD shall be used immediately upon issuance of this ROD. All other aspects of the interim actions for these OUs shall continue to be performed in accordance with the existing approved RD/RAWPs. When the new RD/RAWP for the remedies selected by this ROD is approved, that document will direct future remedial action and will replace all interim action RD/RAWP requirements." An additional ESD or ROD amendment is not needed.

Selection Criteria

Commenters questioned the evaluation of alternatives relative to the CERCLA selection criteria used to determine the Preferred Alternative. Comments questioned the specific ranking for alternatives along with the cost assumptions behind the alternatives presented in the Proposed Plan. Commenters disagreed with making a decision without final remedial design. One comment questioned why an alternative (void-fill grouting) from Draft A of the Proposed Plan was not included in the Proposed Plan that was out for Public Comment.

Response: The application of the remedy alternatives evaluation criteria was re-evaluated between Draft A and Rev 0 of the Proposed Plan, and again for the ROD. The scoring/ranking of each of the alternatives, based on the CERCLA remedy selection criteria, is explained in Section 10 of the ROD. The preferred alternative provides what the Tri-Parties believe is the best of the alternatives that are protective of human health and the environment and comply with ARARs, because it provides the best balance of tradeoffs under the modifying criteria, including cost estimates.

Remedial design is conducted in the RD/RAWP following issuance of the ROD. Conceptual design is the basis for cost estimate and evaluations of the alternatives in the RI/FS. Neither the RI/FS nor the Proposed Plan are the appropriate CERCLA documents for detailed remedy design, including any treatment systems.

Void-fill grouting as a technology was removed from the alternatives after Draft A of the Proposed Plan because confirmation sampling conducted at the one proposed void-fill grouting site after Draft A was issued demonstrated that the waste site contaminant concentrations are protective of UU/UE. Because the waste site is already protective of UU/UE it was changed to no action.

Vadose Zone Contributions to Groundwater

Commenters expressed concern regarding uncertainties with the potential for residual vadose zone contamination continuing to contribute to groundwater. Additional groundwater monitoring was requested for groundwater plumes near the reactors.

Response: The ROD requires cleanup of shallow and deep soil contamination that poses a risk of contaminating groundwater or surface water above levels protective of human health and ecological receptors. Implementation of the selected remedy results in no residual vadose zone contamination that will result in groundwater or surface water concentrations above applicable standards protective of human health and ecological receptors. All groundwater plumes in the 100-HR-3 OU are addressed by this remedy, and ongoing monitoring will continue to collect groundwater data until cleanup levels are met. The Tri-Parties believe the monitoring system is adequate.

Past and Ongoing Action on River Corridor

Commenters were not in agreement for the level of ongoing efforts needed along the River Corridor. One commenter indicated that Alternative 1 (No Action) should be selected because work has been ongoing along the River Corridor for years and should be done. Other commenters indicated that all remaining waste sites should be RTD.

Response: Substantial progress has been made on cleanup in the River Corridor through the interim action RODs. The final action ROD for the 100-D/H Area and five other similar RODs will require additional cleanup when needed or select no action for sites that meet cleanup levels.

Since the early 1990s, the Tri-Parties have been committed to extensive use of the remove-treat-dispose remedy in the River Corridor. The 100-D/H Area has been subject to extensive excavation to remove contamination under the interim ROD. This ROD identifies remaining cleanup requirements to ensure that human health and ecological receptors are not at risk. The No Action alternative was selected for waste sites where it has been confirmed that they meet cleanup levels protective of human health and the environment. However, interim actions protective of human health and the environment have not been completed at all of the waste sites that pose unacceptable risk, so remaining actions are required to be protective. The RTD remedy is the selected remedy for most of these waste sites.

An IC remedy was selected for a number of radiologically contaminated waste sites where radioactive decay will achieve cleanup levels. A pipeline end-capping and IC remedy was selected for a contaminated pipe so as not to disturb a bat colony. The selected remedies meet the CERCLA remedy selection threshold criteria of protectiveness and ARAR compliance and provide the best balance of tradeoffs among the other alternatives with respect to the balancing criteria.

The TPA Agencies have prioritized cleanup of the River Corridor since cleanup began. A majority of the cleanup along the River Corridor has been completed and substantial progress has been made to prevent contamination from entering the river. The TPA Agencies are working diligently to get the remaining River Corridor RODs in place to finalize the cleanup. Even while those RODs are being developed, interim actions are being completed, so work does not have to wait until the final action RODs are completed.

Land Management and Land Use

Land Management

Commenters suggested that because Hanford is subject to the National Monument Proclamation, the HRNM lands should be cleaned to a more protective level, restored, and that additional lands should be managed by U.S. Fish and Wildlife Services.

Response: The Proclamation states, "Nothing in this proclamation shall affect the responsibility of the [DOE] under environmental laws, including the remediation of hazardous substances...nor affect any [DOE] activities on lands not included within the monument." The remedial actions will achieve cleanup requirements that are protective of reasonably anticipated future uses, including recreational and other uses associated with the property's status as a national monument. In fact, the selected remedy will achieve more stringent cleanup levels protective of residential uses.

DOE consults with the Department of the Interior under its existing agreements. Any decisions regarding which agency will manage monument lands, including any expansion of USFWS's land management responsibilities, are matters to be otherwise addressed and are not addressed by this ROD.

Land Use

Commenters believe that the Preferred Alternative for groundwater is not consistent with the Comprehensive Land-Use Plan (CLUP), specifically regarding the timeframe for use of ICs. Additionally, commenters expressed that the remedy is not protective of human health and the environment, nor is it cost effective. Commenters expressed that reliance on the CLUP land use designations allows for a less stringent cleanup. Tribes commented that the land use designations do not uphold their treaty rights and that the CLUP should be revised.

Response: The selected remedy in the ROD is protective of human health and the environment and cost effective as described in the 100-D/H RI/FS and Section 12.3 of this ROD.

The CLUP designated future land use of the 100-D/H Area is conservation (mining) and preservation. However, the Tri-Parties have agreed to cleanup to residential cleanup levels. This level of cleanup will be protective for all current and reasonably anticipated future land uses. There was a misconception that the preferred remedy in the Proposed Plan is not consistent with the CLUP. Table 1-3 in the CLUP (DOE/EIS-0222F) shows the relationship of the CERCLA documents to the Land-Use Plan. ICs as described in the CLUP and the preferred remedy and the ROD are consistent. The CLUP assumes ICs will continue for a minimum of the next 50 years.

ICs are required before, during and after the active phase of remedial action implementation where ICs are needed to protect human health and the environment. ICs are used to control access to residual contamination in soil and groundwater above standards for UU/UE. DOE is responsible for implementing, maintaining, reporting on, and enforcing ICs. Although the DOE may designate another party to perform work by contract, property transfer agreement, or through other means, the DOE does not delegate ultimate responsibility for remedy integrity and ICs. In the event that land is transferred out of federal ownership, deed restrictions (proprietary controls such as easements and covenants) may be required that are legally enforceable against subsequent property owners. The Tri-Parties will continue oversight of ICs for the foreseeable future.

Most of Hanford's shoreline has been designated as a national monument. There is also a Manhattan Project National Historic Park presence for the B reactor and other locations at Hanford. The reactors are identified in a NEPA ROD as possibly being removed 75 years from the issuance of that ROD, but a final

CERCLA ROD has not been issued yet. In addition, several groups, including the Hanford Natural Resource Trustee Council, have identified the habitat value of this area as very high, being one of the last contiguous shrub-steppe habitats in Washington and therefore worth preserving. Residential development and unrestricted well drilling is highly unlikely for the foreseeable future.

DOE understands the CTUIR disagrees with some of DOE's land use designations and DOE's position on tribal treaty rights in the CLUP. The CLUP is DOE's comprehensive land use plan which addresses land use for Hanford. The CLUP is reviewed every five years, resulting in a Supplement Analysis (SA) that documents this review. DOE's most recent SA was completed in April 2015. Information on the CLUP and previous SA evaluations is at https://energy.gov/nepa/eis-0222-hanford-comprehensive-land-use-plan. DOE will consider this CTUIR concern, as well as other CTUIR input, as it conducts its next SA. Comments addressing DOE's revision of the CLUP are beyond the scope of this ROD.

Contaminant Identification and Cleanup Levels

Contaminants of Concern

Commenters questioned the process for identification and selection of COCs for soil and groundwater, and why some chemicals were not included. Comments included questions regarding how results from the River Corridor Baseline Risk Assessment (RCBRA) were integrated into the RI/FS process to identify chemicals of concern. Commenters expressed that additional contaminants will remain unaddressed by the preferred alternative, along with requests to consider specific groundwater contaminants including manganese and historical contaminants of potential concern. Commenters expressed they did not support the rationale for exclusion of iron and zinc for remedial action.

Response: The CERCLA process to identify contaminants of potential concern (COPCs) and COCs was followed. The RI/FS used multiple methods to identify COPCs as identified in the RI/FS (DOE/RL-2010-95). Through this process, the list of COPCs is refined several times to determine the final list of COCs that would need to be addressed to protect human health and the environment. COCs are carried forward to the FS for evaluation of remedial actions, whereas COPCs are not.

The RCBRA had a process for identifying COPCs. This was discussed in the RI/FS. The RI/FS re-evaluated these COPCs as they related to 100-D/H OUs. As a result, the RI/FS identified the COCs applicable to 100-D/H. The COCs are those contaminants that are determined to pose unacceptable risk to human health or the environment.

Regarding the specific additional contaminants mentioned in the comments and historical COPCs, the COPC identification process in the RI/FS identified analytes that historically have been detected in groundwater at concentrations above their respective action level. However, these contaminants were not identified as COCs and are not identified in the ROD for remedial action because they are at concentrations that do not pose unacceptable risk to human health or the environment. The maximum manganese concentration reported in the RI for 100-HR-3 groundwater is 122 µg/L (Table 6-35), which is less than the MTCA Method B action level of 384 µg/L for groundwater for unrestricted land use (WAC 173-340-720(4)(b)(iii)(A) and (B)). The secondary drinking water standard for manganese is 50 µg/L, but that is not required to be met to protect human health or environmental receptors. It is a non-mandatory water quality standard established for aesthetic purposes. Iron and zinc are associated with the reducing conditions from the In Situ Redox Manipulation (ISRM) barrier area in 100-D. Although the ISRM remains in place, it is not part of the selected alternative.

Groundwater Co-Contaminants

Comments were received requesting that co-extracted contaminants like nitrate and strontium-90 (as well as several other contaminants) be treated, in addition to hexavalent chromium. With strontium-90, comments suggested that treatment could reduce the overall cleanup time for this contaminant. Commenters disagreed with the Preferred Alternative timeframe of 44 years for cleanup of strontium-90 using the Monitored Natural Attenuation alternative, and commenters expressed concern regarding strontium-90 impacts to the Columbia River. There was also a comment regarding the cessation of the pump and treat system when chromium cleanup is achieved and how this could affect other contaminant plumes like strontium-90, especially if groundwater cleanup levels start to increase after the shutdown of pump and treat activities. A specific comment was received that the Proposed Plan use the new RfD value for the MCL for uranium in groundwater and then carry this contaminant into the FS for evaluation.

Response: The selected remedy for strontium-90 and nitrate in groundwater is MNA, which meets the CERCLA remedy selection threshold criteria and provide the best balance of tradeoffs among the other alternatives with respect to the balancing criteria. The operations of the pump and treat system do not influence this decision. The operation of the pump and treat system does not significantly impact the strontium-90 plume. The nitrate plume is expected to achieve cleanup levels years before the cessation of the pump and treat.

Low level strontium-90 is difficult to extract from the aquifer, so radioactive decay is almost as effective as extraction and treatment. The mechanism of radioactive decay is well understood. With respect to co-extracted contaminants, the pumping network extracts groundwater from many different locations, and brings it to the treatment buildings using a single piping system. The use of a single piping system is much more cost effective and practical than using individual piping for each extraction well. Treated water meets cleanup standards before exiting the treatment system.

The RI/FS presents the evaluation of COPCs and identifies the COCs based on CERCLA guidance. COPCs were not carried forward to the FS for evaluation of remedial actions. The COCs for groundwater are hexavalent chromium, total chromium, nitrate and strontium-90. Co-extracted strontium-90 and nitrate treatment will not be necessary because groundwater extracted and run through the treatment system will not exceed cleanup levels on re-injection. Co-extracted contaminants will not be re-injected at concentrations above drinking water standards.

Remedial actions have been implemented at known source areas that have contributed to groundwater COC plumes at 100-D/H. This is particularly important to supporting selection of MNA for groundwater. The expected efficacy of source area remedial alternatives at 100-D/H was considered in the overall assessment of MNA for groundwater plume remediation.

The groundwater contaminant plumes are generally well defined for 100-D/H, and current ICs (for example, prohibitions against use of groundwater as a source of drinking water) prevent exposure to human receptors. Existing groundwater pump and treat systems operating at 100-D/H are exerting groundwater capture forces that have reduced the discharge of contaminated groundwater into the Columbia River.

Natural attenuation of radionuclides is effective because radioactive decay is an irreversible process that proceeds at an invariable rate (as compared to biological or chemical attenuation processes). At Hanford, the Tri-Parties have taken advantage of radioactive decay for relatively immobile isotopes that have relatively short half-lives (e.g., 30 years or less).

Natural attenuation processes in groundwater, including diffusion and dispersion of nitrate and radioactive decay of strontium-90, will be monitored to confirm natural attenuation. Recent trends over the last three years do not show increasing concentrations of strontium-90 at the river interface nor is this expected. Monitoring results in 2015 did not report any strontium-90 aquifer tube sample results exceeding the 8 pCi/L DWS. The MNA processes are expected to achieve cleanup standards for nitrate in 6 years and strontium-90 in 44 years.

The TPA requires DOE to submit a RD/RAWP within 180 days of ROD signature, unless another time period is specified in the ROD. The RD/RAWP will include completion criteria for the groundwater remedy. Typically, the completion process will include a rebound study when the pump and treat would be turned off and groundwater concentrations would be monitored over time. The pump and treat would be re-started unless data provides a technical basis for a determination that the groundwater will continue to meet cleanup levels in the future.

The RfD was not used to establish a new maximum contaminant level (MCL). The toxicity information for soluble salts of uranium published in 1989 in EPA's Integrated Risk Information System (IRIS), including non-cancer oral reference dose (RfD) for chronic exposure, has not been updated to reflect more recent data. However, the MCL for uranium was revised in 2000 to reflect more recent studies that were used by Agency for Toxic Substances and Disease Registry (ATSDR) in their uranium toxicity value. The uranium concentrations in 100-HR-3 groundwater meet the 2000 promulgated MCL. Therefore, uranium, was not carried forward to the FS as a contaminant of concern.

Cleanup Levels

Many comments indicated concern over the cleanup levels selected for the 100-D/H Area. Some commenters were speaking generically, while others requested different cleanup levels for specific contaminants such as arsenic, lead, and hexavalent chromium. Clarification was requested on the methods for selecting cleanup levels and the inputs into those methods. Commenters requested that risk levels for radionuclides and chemicals be reconsidered. Commenters also requested cleanup levels to account for irrigation. Commenters also recommend using more stringent cleanup levels and to not use industrial cleanup levels for groundwater protection. Commenters were concerned about waste sites completed after 2012 under the Interim Actions and that they would not meet final cleanup levels in this ROD.

Response: The **c**leanup levels that were selected are protective and meet ARARs. The current version of MTCA was used for setting cleanup levels for chemicals. In most cases, the final direct contact cleanup levels protective of residential uses are unchanged from the Interim Action RODs that were established for the River Corridor because those MTCA cleanup levels did not change. Cleanup levels for soil to protect groundwater and surface water have been updated from the Interim Action to reflect the current MTCA standards, and site specific parameters used in the RI/FS. The RI/FS contains the evaluation for these site-specific cleanup levels. Updates to MTCA reflect the current state of knowledge for toxicity and risk. The interim remediated waste sites were compared to the current MTCA cleanup levels in the RI/FS evaluation (specific details can be found in the 100-D/H RI/FS report, [DOE/RL-2010-95]).

None of the cleanup levels (including the groundwater protection values) are based on industrial land use. The selected cleanup levels are protective of residential uses and ensure the MCLs are met in groundwater and that water quality criteria and state surface water quality standards are met in surface waters.

Cleanup levels for radionuclides are based on $1X10^{-4}$ excess lifetime cancer risk or 15 mrem/year radionuclide dose, whichever is more stringent, and is consistent with CERCLA NCP requirements.

Cleanup values account for irrigation infiltration and recharge rates.

For those waste sites remediated after 2012, a disposition evaluation will be completed based on the ROD and final cleanup levels to verify that interim actions for these waste sites meet the final cleanup levels.

Waste sites will meet cumulative risk levels as described in the 100-D/H RI/FS.

For the comments regarding arsenic and lead, the MTCA Method A cleanup levels for arsenic and lead for residential land use were selected as the cleanup levels. The arsenic level is based on the statewide natural background. The range of arsenic in background samples at Hanford is as high as 27 mg/kg and the selected MTCA Method A cleanup level is 20 mg/kg.

For hexavalent chromium, the cited Kd value is used to predict the fate and transport behavior of residual hexavalent chromium that remains in the vadose zone. Chapter 5 of the 100-DH RI/FS report (DOE/RL-2010-95) provides the detailed evaluations and summarizes site-specific leaching tests that support this Kd value for this particular evaluation. It should be stated that this value was selected based on the fact that about 90% of the site-specific Kd measurements for residual hexavalent chromium were greater than 0.8.

Remedial Action Objectives (RAOs)

Commenters expressed concern that the RAOs are not definitive enough to be used for cleanup decisions.

Response: The Proposed Plan identified RAOs as required by the NCP. The RAOs specified the contaminants and media of concern and remediation goals based on site risks and ARARs.

Risk Assessment/Modeling Approach

Exposure Point Concentrations (EPCs)

Comments expressed concern over the Exposure Point Concentration (EPC) calculation methods and how ProUCL statistical software is used.

Response: Small samples sizes are only used for focused sampling campaigns which were used to target specific areas of interest within waste sites. The risk assessment provides the details of the ProUCL use and the selection of the EPCs. For the situations where the ProUCL calculation did not provide a valid Upper Confidence Limit (UCL) value, the uncertainty analyses provides an evaluation of the impacts of these calculations on the stated conclusions.

EPCs were recalculated in the RI using data from the closeout documents based on current guidance. The calculation of EPCs used EPA's ProUCL software and followed EPA methodology.

Modeling Approach

Commenters expressed concern over the uncertainty with the modeling approach used in assessing fate and transport and its ability to be applied for use in making cleanup decisions. Commenters wanted the modeling run using a different infiltration rate based on revegetation timeframe.

Response: The STOMP modeling that was used has been accepted by EPA and Ecology for use at Hanford, and represents the state of the science for modeling movement of contaminants through the vadose zone.

The model input values included irrigation, in addition to annual precipitation, for transport calculations to identify PRGs for soil contaminants that will not result in exceedances of drinking water standards in groundwater and ambient water quality criteria and state surface water quality standards in surface water.

Observed times for mature communities of plants to be established following restoration efforts are less than 10 years. The timeframes used in the modeling for mature communities of plants is conservative.

Risk Assessment Approach

Commenter requested that all sampling be reviewed and that additional sampling be taken for those results where only filtered samples were taken. Additionally, a commenter requested that both interim cleanup values and final cleanup values be included in the ROD.

Response: All of the sampling was reviewed as part of the RI/FS. There was a misconception that only filtered samples were used. The risk assessment in the RI used results from unfiltered samples. Additional sampling is not needed for further assessment.

Table 8-3 in the RI/FS contains the interim action cleanup values along with the revised PRGs that are consistent with current guidance. Final cleanup values are in the ROD and replace the interim cleanup values.

River Corridor Baseline Risk Assessment (RCBRA)

Concern was raised by commenters that the RCBRA was used as part of the risk assessment process and that PRGs were derived from this document. Comments express that this document has not been accepted by state and federal agencies, that it contains deficiencies that stakeholders have shared, and that it should be revised.

Response: Important information from the risk assessment activities that have been conducted along the River Corridor, including the RCBRA, the Columbia River Component Risk Assessment and the baseline human health risk assessment in the 100-D/H RI/FS Report, were all considered in making decisions about risk and remedial action. There is no justification to revise or redo the RCBRA.

The RCBRA was used to develop the first PRGs for protection of human health, and that document was a secondary document that did not require regulator approval. The PRGs were updated in the baseline risk assessment of the 100-D/H RI/FS Report consistent with the latest EPA and MTCA guidance and regulation.

The risk assessment in the RI/FS relied on a comprehensive review of all available data for each waste site, including field data, radiological surveys, process history, analogous site information, personal interviews, engineering drawings and as-builts, and any other information identified during the development of the RI/FS. Post-interim remediation action data, including closeout verification documentation, were included in the risk assessment if the data were available as of November 2012.

Ecology, EPA, and DOE have determined that the RI/FS contains adequate risk assessment information to make remedial action decisions. The RCBRA was discussed in detail in the RI/FS because it was a significant effort that contributed to DOE's understanding of site risks. The RCBRA, the Columbia River Component, and RI/FS risk assessments all contributed to the evaluation of risk.

Ecological Risk Assessment

Commenters expressed concern that aquatic and ecological receptors will not be protected from risk by the selected preferred alternative, specifically ICs. Additionally, commenters expressed concern over how the proposed action could affect threatened or endangered species in the Columbia River. Commenters requested that DOE consult with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service. There was also a comment disagreeing with the use of the Scientific Management Decision Point (SMDP) that was used to determine which waste sites were carried into the FS for evaluation for ecological receptors, as well as the overall method used to determine risk to these receptors.

Response: The remedial action will be protective of ecological receptors and endangered species. The RI/FS did not identify any terrestrial or riparian animal risks in the 100-D/H Area, so the selected remedy does not include provisions for the protection of ecological receptors in terrestrial or riparian habitats. The selected remedies will be protective of aquatic receptors.

ICs are being used to address risks to human health, they are not being used address risks to aquatic and terrestrial animal receptors. Deep waste sites have contamination 15 feet or greater below ground surface, making them relatively inaccessible to birds and mammals. Shallow radiological waste sites have had clean backfill applied.

The evaluation of potential effects (positive or negative) to endangered species, including steelhead, some salmon, and bull trout, was included within the RI/FS and summarized in the Proposed Plan. The conclusion of this evaluation was that there was no effect on these endangered species. Endangered species consultation with National Marine Fisheries Service and the U.S Fish and Wildlife Service is not required when there is no effect on endangered species.

The overall risk assessment approach for waste sites remediated under interim actions used in the 100-D/H RI/FS was consistent with CERCLA guidance and accepted practice. The details of the ecological risk assessment are presented in Chapter 7 of the RI/FS report. Regarding the SMDP, the process follows EPA guidance for ecological risk assessment, including the evaluation of home ranges. Ecology comments on early drafts of the RI/FS have been addressed and Ecology agrees with the conclusions of the SMDP. This approach has been used on prior River Corridor ecological risk assessments leading to 100-F/IU and 300 Area RODs.

Endangered Species Act (ESA)

Commenters expressed concern over how the proposed action could affect threatened or endangered species in the Columbia River. Commenters requested that the Department of Energy consult with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS).

Response: The Hanford Reach contains three species listed as threatened or endangered under the federal ESA (7 USC 136, 16 USC 1531). These include the upper Columbia River spring-run Chinook salmon, steelhead, and bull trout. The spring-run Chinook salmon do not spawn in the Hanford Reach but use it as a migration corridor. Steelhead spawning has been observed in the Hanford Reach. The bull trout is not considered a resident species and is rarely observed in the Hanford Reach.

The ESA, Section 7, includes an administrative requirement that federal agencies consult with USFWS and/or the NMFS before taking any action that may affect an endangered or threatened species. Administrative requirements are not part of the ARAR. The selected remedies identified in the ROD for the 100-DR-1, 100-DR-2, 100-HR-2, 100-HR-2, and 100-HR-3 OUs includes the ESA as an ARAR. Therefore, substantive ESA requirements to protect endangered species must be met. DOE and EPA determined there was no effect on fish species listed as threatened or endangered. This determination of no effect was discussed with the NMFS who did not disagree with the DOE and EPA determination.

The selected remedy will not jeopardize the continued existence of listed species or result in the destruction or adverse modification of habitat critical to them. This conclusion is based on two lines of evidence. First, the preferred remedy does not take an action in the Columbia River, so there will not be any direct physical effects on fish or their habitat. Secondly, there are no adverse effects of contaminants on listed species of fish before, during or after the remedial actions.

Sediment Management Standard

Commenters requested that the Washington State Sediment Management Standards (SMS), WAC 173-204, be included as ARARs for this ROD for the Columbia River Shoreline. Commenters requested that the sediments along the Columbia River be identified as contaminated media and have PRGs established.

Response: The sediments along the Columbia River are not part of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, or 100-HR-3 OUs addressed by the ROD. Also, the 100-D/H RI/FS concluded through numerous lines of evidence that there is no unacceptable risk to aquatic life exposed to sediments associated with discharges from the 100-D/H Area.

The Columbia River Component Ecological Risk Assessment found no evidence of risk from sediment in the river resulting from Hanford contamination. Washington State Department of Ecology publication 11-09-054 (author: Theresa Michelsen) provides proposed sediment quality values. Table ES-1 in this publication has the same values as those found in SMS Table VI of WAC 173-204-563. The Theresa Michelsen publication table values were used as screening levels in evaluating sediment contamination in the Columbia River Component risk assessment, which was a primary document approved by Ecology and EPA. While the SMS were not included as ARARs, a technical approach identical to the SMS was used to evaluate sediment contamination as part of the Columbia River Component risk assessment. Additionally, the conclusion of no unacceptable risk is based on several lines of evidence that do not identify adverse effects to biota in the river, including bioassay results and measurements of biodiversity. Contaminant concentrations in the Hanford Reach are similar to what is found upstream in the Columbia River.

Tribal Comments

National Historic Preservation Act (NHPA) and Cultural Resources

The Yakama Nation commented that the Proposed Plan and decision document should explain how cleanup adequately meets the NHPA consultation process and identify how cleanup in cultural areas will proceed in a manner that prevents disturbances of cultural areas. The cost associated with these efforts was also requested. The NHPA has not been adequately addressed in the 100-D/H CERCLA documents according to the Yakama Nation. The Yakama Nation commented that Section 110 surveys have not been conducted to fully understand the nature and extent of the cultural resources present.

The Yakama Nation feels measures necessary to ensure compliance with the Antiquities Act of 1906 are unclear.

The Yakama Nation renewed its request for a site-wide review identifying traditional cultural properties (TCPs), a process the Yakama Nation feels is necessary to adequately address potential adverse effects resulting from site-wide undertakings and decisions. Additionally, a request was made for the alternatives to be compared against the nine balancing criteria based on the effects on a TCP.

Tribal requests were made to include and fully comply with government-to-government requirements prior to making decisions that could impact TCPs and development of remediation plans.

Response: DOE and the Yakama Nation have consulted regarding cleanup in cultural areas and methods to avoid or minimize potential disturbances in those areas and across the Hanford Site. Cultural resource determinations for the 100-D/H Area have been completed as explained in DOE’s January 20, 2017 Cultural Resource Program’s Summary Statement Report contained in the Administrative Record. (17-AMRP-0111). This ROD identifies the ARARs selected, including NHPA. Requirements for any additional cultural resource determinations will be incorporated into the RD/RAWP as necessary to meet standards.

DOE and the Yakama Nation have consulted on the identification and documentation of TCPs. The RD/RAWP will address compliance with ARARs, including the NHPA.

The Antiquities Act of 1906 does not apply and is not an ARAR.

NHPA ARAR requirements must be met in implementing and completing the remedy, but need not be completed in advance of remedy selection and incorporated into the ROD. The costs of addressing NHPA are included in the cost estimate included with each alternative. The alternative remedies were evaluated against the nine CERCLA criteria for remedy selection. Those criteria include ARAR compliance, which in this case includes NHPA.

DOE and EPA formally notified the CTUIR, Yakama Nation, Nez Perce, and Wanapum, of the upcoming planning for this cleanup decision and invited formal consultation in a letter dated January 28, 2016. The area tribes did not respond. DOE sent the Proposed Plan to area tribes on July 26, 2016. On August 17, 2016, DOE, EPA and Washington State Department of Ecology project leads, experts and contractors held a workshop on the Proposed Plan and addressed concerns and questions. Representatives from the area tribes participated and all information requested was provided. DOE is committed to continue to work with the Yakama Nation on NHPA and any needed mitigation in implementing the remedy. DOE will provide additional opportunity for consultation as appropriate.

Tribal Land Use and Access and Treaty Rights

CTUIR requested that the ROD be amended to reflect that Hanford-affected tribes use the stretch of the river flowing past the 100-D/H Area for treaty reserved activities including fishing.

CTUIR requested that DOE work with tribal staff to establish and continue a tribally managed resource monitoring program for as long as contamination remains on site.

The Yakama Nation stated that the discussions in the document on NEPA and environmental justice fail to consider tribal exposure and tribal treaty rights in the selection of the alternative.

Yakama Nation requests that USDOE formally acknowledge their hunting rights on the HRNM. The Yakama Nation wants their treaty rights to be acknowledged as an ARAR in the ROD and any language regarding that Hanford is not “open and unclaimed” lands should be removed. The preferred alternative should be consistent with USDOE’s American Indian Policy.

The Yakama Nation expressed that the use of ICs must be addressed in light of Yakama Nation treaty rights which guarantee use of the land for specific purposes which are considered inseparable from the Yakama way of life. The Yakamas disagree with the land use designation that was used to derive PRGs because of Yakama Nation treaty rights that guarantee use of groundwater.

Response: DOE has modified the text in Section 5.1 of the ROD to address the comment regarding tribal use of the river flowing past the 100-D/H Area. DOE will continue to consult with area tribes regarding ongoing environmental monitoring that currently takes place at the Hanford Site.

The establishment of a CTUIR managed resource monitoring program is outside the scope of this ROD. DOE will continue to consult with the area tribes on the protection of cultural and natural resources.

DOE incorporated the NEPA values discussion into the RI/FS. The discussion of NEPA values and environmental justice was not included in the Proposed Plan or ROD. The selected alternative is consistent with EPA’s Environmental Justice and USDOE’s American Indian Policy.

Under CERCLA, ARARs are applicable or relevant and appropriate requirements under federal environmental, state environmental, or facility siting laws that address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site. Treaties do not meet the definition of an ARAR. Treaty requirements cannot be waived as ARARs can under CERCLA. The treaties reserve specific rights and resources and reflect the unique legal relationship between the Federal Government and Indian tribal governments. While Treaties are not ARARS, there are several ARARS that provide protection for cultural and natural resources such as the Code of Federal Regulations (CFR) "Protection of Historic Properties" (36 CFR 800) under the National Historic Preservation Act (16 USC 470, et seq.); "National Historic Landmarks Program" (36 CFR 65); "Native American Graves Protection and Repatriation Regulations" (43 CFR 10)(25 USC §§ 3001 et seq.); and the "Archeological and Historic Preservation Act" (16 USC 469a 1 through 469a 2(d)).

The selected remedy in the ROD meets the CERCLA NCP threshold criteria of being protective of human health and the environment. DOE uses the CLUP to designate future land use of the 100-D/H Area as conservation (mining) and preservation. However, the Tri-Parties have agreed in the ROD to cleanup contaminated soil to residential cleanup levels and groundwater to MCLs, risk-based levels, and to levels protective of surface water where applicable. This level of cleanup is protective for all current and reasonably anticipated future land uses. ICs are necessary until those cleanup levels are achieved to protect both the public and tribal members

The final Proposed Plan and ROD do not include language on open and unclaimed land. DOE's position on treaty rights is in the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, including Appendix F. That document is available at http://www.hanford.gov/files.cfm/Final_Hanford_Comprehensive_Land-Use_Plan_EIS_September_1999_.pdf.

Tribal Involvement and Consultation

The CTUIR requested that DOE address CTUIR on a government-to-government basis and as a partner when developing remedial action plans which would require soliciting feedback earlier in the development.

CTUIR also requests that DOE work with them and other Hanford-affected tribes to establish a co-management strategy that would allow the Tribes to transition to the role of long-term stewards. CTUIR also stated Tribal use should be considered as a future land use at Hanford and that Tribal access to Hanford should be considered.

With DOE leaving waste in the deep vadose zone, CTUIR requested that DOE provide funding to the Tribes to assess the loss of this land for tribal use.

Yakama Nation specifically commented on the 100-D island and requested consultation due to the casual recreation user scenario used for decisions.

Response: While the tribes do not have a regulatory role in CERCLA decisions at Hanford, DOE took steps to involve them in the decision making process. For example, DOE and EPA formally notified the CTUIR, Yakama Nation, Nez Perce, and Wanapum, of the upcoming planning for this cleanup decision and invited formal consultation in a letter dated January 28, 2016. The area tribes did not respond. DOE sent the Proposed Plan to area tribes on July 26, 2016. On August 17, 2016, DOE, EPA and Washington State Department of Ecology project leads, experts and contractors held a workshop on the Proposed Plan and addressed concerns and questions. Representatives from the area tribes participated and all information requested was provided. DOE will provide additional consultation as appropriate.

DOE consults with the Department of the Interior under its existing agreements regarding the management of lands within the HRNM. Decisions regarding which agency will manage remediated lands, including any expansion or contraction of USFWS's land management responsibilities, are beyond the scope of this ROD. Additionally, the scope of this ROD does not include access rights. DOE and the CTUIR recently entered into a Memorandum of Understanding that commits to the development of protocols to analyze increased tribal access, address safety and security, and to consider related activities.

Addressing alleged damages or funding to external parties is beyond the scope of this ROD.

Tribal use of the area is a reasonably anticipated future land use at Hanford. Tribal access and use will be addressed in the Memorandum of Understanding mentioned in the comment response above or as otherwise agreed to by DOE consistent with DOE's position on treaty rights in the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*. The Tri-Party Agencies believe the decision will be protective of tribal peoples' health. The selected residential based cleanup levels will be protective of conservation and preservation uses, residential use, and reasonably expected traditional tribal use of these areas as set forth in the ROD.

Cleanup levels were established based on CERCLA guidance and ARARs, as documented in the ROD. Chapter 6 of the RI/FS contains a more detailed explanation of how risks to tribal members were addressed, including a discussion of the uncertainties associated with the tribal scenarios.

100-D Island is designated as "preservation" under the CLUP. The 100-D Island already meets the residential cleanup standards.

Tribal Risk Assessment Scenarios

The CTUIR would like the DOE to work with them more to develop remedial action goals and to select an alternative that is more protective of tribal rights and resources. Additionally, CTUIR and the Yakama Nation requested that their tribal risk scenarios be incorporated into the human health risk assessment. Tribal commenters also stated that the exposure scenarios in the documents do not include all of the activities of tribal people. Tribes are concerned the alternative selected will not be protective of tribal members' health. The Yakama Nation requests official recognition from DOE that Native Americans are the most vulnerable people to environmental contaminants at Hanford.

Response: DOE has made efforts to work with tribal groups to discuss and consider concerns in developing and selecting the remedial actions addressed in the ROD. In addition, DOE funded tribes to develop their own risk scenarios, and tribes did so. There were many uncertainties with those scenarios, as explained in risk assessment documents, including the RCBRA, the Columbia River Component Risk Assessment, and individual Remedial Investigations and Feasibility Studies. For examples, please see the uncertainty sections in Chapter 6 and Appendix G of the 100-D/H RI/FS, and uncertainty sections in the RCBRA and the Columbia River Component risk assessment.

Technical evaluations of the tribal scenarios were conducted by EPA and the Washington State Department of Ecology, which included an assessment of the physiological plausibility of several exposure pathways within the scenarios. (See Administrative Record documents numbered D7468517, 0904130549, DA06587560 and DA06587578.) For example, some components of the tribal scenarios are metabolically implausible (e.g., inhalation rate) and other components are not physiologically sustainable. These scenario components do not represent a reasonably anticipated future land use and were not used as a basis for setting cleanup levels.

The request that DOE recognize Native Americans living by the Hanford Site as most vulnerable to environmental contaminants is outside the scope of this ROD. Nonetheless, the selected remedy is protective of tribal members based on reasonably anticipated future land uses.

Additional Comments

General Comments

Comment: What is the total number of waste sites in the 100-D/H operable units included within this plan, both remediated and unremediated? Requested Action: Include a statement indicating the total number of waste sites present that fall within the operable units addressed in this Plan, both remediated and unremediated.

Response: Table 1 provides the total number of waste sites within the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs addressed by the ROD, both remediated and unremediated, by selected remedy category.

Comment: Oregon supports the decision to move forward with completing remediation of the 100-D/H Area. We agree with the choice of the Preferred Alternative (Alternative 3) out of the alternatives evaluated. We especially support the focus on groundwater remediation through an increased capacity pump and treat with up to 80 new wells. This alternative represents a decreased time frame for cleanup of chromium groundwater contamination (12 years versus 25 or 29 years for other alternatives considered), of the nitrate plume (6 years versus 13 years), and the strontium plume (44 years versus 56 years).

Response: The Tri-Parties acknowledge the comments and support for the selected remedy.

Comment: Comments were received that identified concerns with the following individual waste sites:

The Preferred Alternative includes no proposed action on 153 waste sites in the 100-D/H Area. In most cases, we agree with the decision. However, sufficient data is not available to us in supporting documents to assure us that no action is the proper choice for several different waste sites:

100-D-108 – no information was provided in Appendix E of the 100-D/H RI/FS report and previous documents related to the D/H Area also did not include much information on this waste site.

100-D-109 – no information was provided in Appendix E of the 100-D/H RI/FS report and previous documents related to the D/H Area also did not include much information on this waste site.

100-H-38 is listed as a burial ground with no other information available, including no characterization data to support no action

100-D-47 is listed as a burial ground for Project CQ "rod burial," but no depth of excavation was provided. Only 2,800 cubic meters of soil were excavated, indicating the excavation was likely fairly shallow.

116-D-2 and 116-D-4, both cribs, contained "possible ruptured fuel elements" and "lab fluids with fission products." These waste sites were only excavated to depths of 3 meters and 2.8 meters.

There is conflicting information provided about 100-H-7, which is a French Drain. Appendix E states that Hexavalent Chromium and PCB exceed the cleanup-screening levels based on Washington Administrative Code. Yet the "Basis for Reclassification" (Remaining Sites Verification Package) reports the same waste site "meets remedial action objectives" and this site will "support future unrestricted land uses…support unrestricted future use of shallow zone soil and is protective of groundwater and the Columbia River."

A request was made to add several wells to the 183-H RCRA TSD groundwater monitoring network and to include responses to comments on the 183-H RCRA TSD groundwater monitoring network.

Clarification was requested for technicium-99 waste site remediation.

Response: The Remaining Sites Verification Packages (RSVP) for waste sites 100-D-31:11, 100-D-31:12, and 100-D-72 includes the sample data for 100-D-108 and 100-D-109, but omitted an evaluation. The 100-D-108 and 100-D-109 waste sites have been added to the RTD remedy list for the final ROD. These waste sites will be evaluated to determine if they meet the cleanup levels in Tables 4 and 5. This evaluation will be consistent with the evaluation that was conducted and reported in the 100-D/H RI/FS report (DOE/RL-2010-95). Waste sites with contamination exceeding cleanup levels in Tables 4 and 5 will be required to complete the RTD remedy.

Oregon Department of Energy (ODOE) is correct regarding 100-H-38. The site was not a “burial ground” in the usual sense, but a staging area for original 100-H construction activities where it was conjectured that some residual construction debris may have been buried. Nothing anomalous was located during field investigation, and the samples collected were all basically at background levels with some trace total petroleum hydrocarbon detections. It has been added to the list of waste sites subject to the RTD remedy and will be evaluated and addressed as indicated above.

100-D-47 was a relatively small site as it was just used for a dedicated disposal effort for a specific upgrade project. Generally, the floor depth of the final excavation was 4 m, with a maximum depth of 5.5 m below ground surface. Excavations removed contaminated soil and debris exceeding soil cleanup levels in the ROD. No action is required.

116-D-2 and 116-D-4 were both low-volume cribs. Remediation of both sites used active field screening to guide depth of remediation prior to verification sampling. These were shallow waste sites with very specific discharge streams. Post excavation sampling confirmed that cleanup levels in Tables 4 and 5 were met.

The conflicting information provided in Appendix E (page E-87 of the 100-D/H RI/FS report) regarding 100-H-7 was included in error. Sampling results data for the waste site should have been included in that section. The conflicting statement, although not a direct quote, was information from Ecology’s letter transmitting the signed waste site reclassification form for the waste site that was based on an evaluation that Ecology performed in 2009. At that time, Ecology was using conservative Kd values to perform the calculations rather than site-specific information. The RI used current MTCA to calculate values based on Hanford site-specific information. Table G-35 which appears later in the RI (page G-3202) correctly lists the total risk for 100-H-7 as 4.16 E-10 and a Hazard Index of 2.39 E-4 which meets the cleanup requirements.

ODOE is correct for waste site 100-H-38 regarding the lack of an evaluation in the Administrative Record (AR) against the cleanup levels required in this ROD. The AR does contain documentation on the field investigation sampling performed for waste site 100-H-38 that confirms chemicals are basically at background levels. The site was known as a pre-Hanford gravel pit and used for preconstruction staging at 100-H. It has been added to the RTD remedy and DOE will evaluate it as indicated above for final cleanup action.

The 183-H RCRA TSD unit is, and any associated groundwater monitoring is, outside the scope of this ROD.

Only one waste site (118-DR-2:2) was identified with technicium-99 contamination and the selected remedy for that site is RTD, which will ensure that cleanup levels for technicium-99 will be met.

Comment: 1. Remove all nuclear waste, 2. Do not allow anymore nuclear waste into the facility, 3. Replace all the single storage tanks, 4. Stop all the nuclear leakage entering the Columbia River.

Response: #1 – The 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, or 100-HR-3 OUs no longer contains nuclear waste such as spent rods or sludge. Residual radioactive contamination from operations has been or will be reduced to meet cleanup levels within the reasonable timelines identified in this ROD.

#2 and #3 are outside the scope of this ROD. Single shell storage tanks are not within the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, or 100-HR-3 OUs that are addressed by this ROD.

#4 - The selected remedies, including MNA, address Hanford contaminants of concern in groundwater identified through the RI/FS. Source control measures and completion of groundwater cleanup will result in no contaminant discharges above standards, including spring discharges.

Comment: In 2008, with shovel ready projects, DOE and it cleanup contractors pronounced Vision 2015. This included the beginning of ERDF and the massive movement of contaminated soil from the 100 areas. Men and machinery were mobilized and D/H were cleaned-up. Select Alternative 1. No Action should be selected, as these areas have been cleaned-up and no further expense is needed or warranted.

Response: Consistent with the 2015 Vision, substantial progress has been made on cleanup in the Columbia River Corridor under previously issued interim action RODs. The final action ROD for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 OUs selects no action for many of the waste sites in these OUs because of the work that was done previously. However, some additional work is necessary to address groundwater contamination and remaining soil contamination that exceeds cleanup levels.

Comment: Nothing in the Alternatives has discussed disposition of boiler sludge. The Yakama Nation ERWM program requests clarification of disposal of boiler sludge. If not yet disposed, Yakama Nation ERWM requests this waste stream and its disposal be included in the preferred alternative and ROD remedy.

Response: There is no boiler sludge waste in 100-D/H.

Comment: Clearly the discussions within these documents (and other reports; aquifer tube samples) supports the need to define the Columbia River adjacent to the Hanford Site boundaries as an Operable Unit. Yakama Nation ERWM program requests clarification as to what consideration is being given to establish an operable unit for the Columbia River.

Response: The Tri-Parties engaged in the Columbia River Component (CRC) remedial investigation in 2005. The results of the risk assessments (CRC human health and ecological - DOE/RL-2010-17, Vols. I and II) identified that Hanford contamination would effectively be addressed in a manner that would protect the Columbia River by addressing the existing operable units in the River Corridor. It was determined that an independent operable unit for the river was not warranted.

While the river is not part of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, or 100-HR-3 OUs addressed by this ROD, the ROD requires action to protect the Columbia River.

Comment: Contaminant concentrations in some springs are above applicable water quality standards (as noted in DOE/RL-2013-18, Revision 0 Hanford Site Environmental Report for CY2012).

Response: The selected remedies, including MNA, address Hanford contaminants of concern in groundwater that were identified through the RI/FS. Source control measures and completion of groundwater cleanup will result in no contaminant discharges above standards, including spring discharges.

Comment: General Comments on Void-Filling:

a. Discussion of details of void-filling is found in the RI/FS alternative descriptions and not in the Proposed Plan. If grout is not to be used, then the RI/FS should re-evaluate the Alternatives.

b. Clarify if there are pipelines at deeper depths that will not be removed. Include this information in the Proposed Plan.

Response: Void-fill grouting as a technology was removed from the alternatives after Rev. 0 of the RI/FS. Sampling confirmed at the one proposed void-fill grouting site after the RI/FS was issued that the waste site contaminant concentrations are protective of UU/UE. Because the waste site is already protective of UU/UE it was changed to no action.

Other than 100-D-50:2, pipelines left in place do not have contamination that exceeds cleanup levels. The 100-D-50:2 waste site is currently an area used by a maternal bat colony, and the pipelines in that location will be end-capped.

Comment: Miscellaneous Comments:

- Identify ‘particulates’ as fuel particles, and/or fission and irradiation byproducts.
- Identify Nitrate as a COC in Table 2 of the Proposed Plan.

Response: Particulates refer to solids suspended in water or air. Particulates are not fuel particles or fission and irradiation byproducts. Nitrate is a COC in groundwater, but not in soil. Table 2 identifies COCs in soil.

Comment: Minimum Standards for Construction and Maintenance of Wells" (WAC 173-160 & -162), should be the ARAR regulations for the location, design, construction, and abandonment all 100-D/H Area wells.

Response: Substantive portions of WAC 173-160 governing well construction and decommissioning of wells have been included as ARARs as shown in Table 12. WAC 173-162 does not have any substantive provisions and is not included as an ARAR in this ROD.

Comment: Policy and Guidance: (Board requests future decision documents should fully explain use of non-EPA document such as RESRAD over requirement to use of our guidance).

> a. Response stated, when appropriate, the Region (i.e., Region X) may choose to use non-EPA guidance tools and that the rationale for using these types of tools is provided in the supporting technical documents. YN ERWM has previously noted concerns with RESRAD.

Response: When appropriate, non-EPA guidance tools may be used. The rationale for using such tools is provided in the supporting technical documents. The Tri Parties recognize that YN ERWM has previously noted concerns with RESRAD, but the Tri-Parties have determined that the use of RESRAD is appropriate.

As part of addressing comments from the National Remedy Review Board, the Tribes, and the public on the proposed plan, the selected remedy for soils was further evaluated using the EPA PRG Calculator, which confirmed that the residual contamination below 15 feet following excavation and placement of clean fill under the interim ROD, does not pose an unacceptable risk.

The Tri Parties will continue to consider any applicable EPA guidance when developing supporting documents and decision documents, and when appropriate may choose to use non-EPA guidance tools, such as RESRAD and STOMP. Decision documents for the Hanford Site will have the technical details and rationale provided in the supporting technical documents.

NEPA

Comment states that the relationship of NEPA and NEPA values is not clearly presented.

Response: NEPA values were addressed in the RI/FS. Section 5.7 of the TPA Action Plan states, "The purpose of the NEPA requirements is to ensure that potential environmental impacts of investigation and cleanup activity are assessed.

Orchard Lands

Commenter requested that the Proposed Plan be amended to discuss Orchard Lands.

Response: This ROD does not make the determination of whether additional remedial actions are appropriate for the 100-OL-1 operable unit.

Public Participation

Commenters requested that the TPA Agencies provide more opportunities for public participation in Hanford cleanup decisions. Requests included holding public hearings, and providing clear, understandable, and timely public information materials. A specific comment was received regarding an "EPA representative's statement presented at the August River and Plateau Committee." Concern was shared that the information that has been presented to the public was confusing and lacked transparency on certain waste sites and contaminant information. A commenter stated that there was not adequate information provided in the Fact Sheet and Public Notice.

Response: The TPA Agencies appreciate this feedback and will continue to work with the Hanford Advisory Board and public for continued input and improvement on public information materials to ensure the public is provided information that is clear and understandable. The Tri-Parties hold public meetings or hearings, and offer that option in public notices of important decisions (as was done in advance of this ROD). There was no request for a public meeting for this decision during the public comment period.

The Proposed Plan was made available for public review and comment. The public notice and fact sheet are brief summaries. More detailed information was made available in the RI/FS and Proposed Plan which was referenced in the public notice and fact sheet.

The selected remedy was modified from the Proposed Plan based on a number of factors including comments received from the public. For example, the state of Oregon identified a couple of errors that were corrected, which are documented in Section 14, "Documentation of Significant Changes," of the ROD.

Hanford cleanup is large and complicated, with over several thousand individual waste sites. The TPA Agencies have subdivided Hanford into operable units to manage the cleanup in smaller pieces. For example, the 100-D/H ROD addresses nearly 300 individual waste sites. Due the complex nature of Hanford cleanup, the TPA Agencies carry out an annual evaluation of the effectiveness of our public involvement activities, and continually seek to improve them. We appreciate the specific nature of your comments in this area, and we will consider them as we develop public information materials for future public comment periods.

ACRONYMS

ACM	asbestos-containing material
ALARA	as low as reasonably achievable
AR	Administrative Record
ARAR	applicable or relevant and appropriate requirement
BA(R)CT	best available (radionuclide) control technology
bgs	below ground surface
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CGWSA	Centralized Groundwater Waste Storage Area
COC	contaminant of concern
COPC	contaminant of potential concern
CRC	Columbia River Component
Cr(VI)	hexavalent chromium
CSM	conceptual site model
DOE	U.S. Department of Energy
DWS	drinking water standard
Ecology	Washington State Department of Ecology
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERDF	Environmental Restoration Disposal Facility
ESD	explanation of significant differences
FS	feasibility study
HHE	human health and the environment
HRNM	Hanford Reach National Monument
HWMA	Hazardous Waste Management Act (RCW 70.105)
IC	institutional control
LDR	land disposal restriction
LFI	limited field investigation

MCL	maximum contaminant level
MNA	monitored natural attenuation
MTCA	"Model Toxics Control Act—Cleanup" (WAC 173-340)
NCP	National Contingency Plan (40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan")
NPL	National Priorities List (40 CFR 300, Appendix B)
O&M	operations and maintenance
OU	operable unit
PCB	polychlorinated biphenyl
RAO	remedial action objective
RCBRA	River Corridor Baseline Risk Assessment
RCRA	*Resource Conservation and Recovery Act of 1976*
RI	remedial investigation
ROD	record of decision
RTD	removal, treatment, and disposal
RUM	Ringold Formation upper mud (unit)
SARA	*Superfund Amendments and Reauthorization Act of 1986*
STOMP	Subsurface Transport Over Multiple Phases
TMV	toxicity, mobility, or volume
TPA	Tri-Party Agreement
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
Tri-Parties	U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology
USFWS	U.S. Fish and Wildlife Service
UU/UE	unlimited use/unrestricted exposure

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Appendix A

Comments Received During Public Comment Period on the Proposed Plan for the Remediation of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units

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The table below provides the comments received during the public comment period conducted from July 26, 2016 through September 16, 2016. In some instances the “Comment” column does not include the entire text of the comment, but instead references the comment letter itself. The referenced comment letters are provided at the end of the table and are identified based on the “Tracking Number” provided in the table. The “Comment Categories in Responsiveness Summary” column in the table indicates which responsiveness summary categories address the Comments. Comments numbered from 001-103 were received during Public Comment period and comments numbered from 200-222 were received after the close of Public Comment period. Comments received after the close of the public comment period are not addressed directly in the Responsiveness Summary.

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
100-D/H-001	Letter	Rodney S. Skeen, Department of Natural Resources Energy and Environmental Sciences Program Manager, Confederated Tribes of the Umatilla Indian Reservation	Letter Attached	Alternatives – Cost, Evaluation, Selection Land Management and Land Use Risk Assessment/Modeling Approach Tribal Land Use and Access and Treaty Rights Tribal Involvement and Consultation Tribal Risk Assessment Scenarios General
100-D/H-002	E-mail/Letter	Hanford Advisory Board. Consensus Advice #290	Letter attached	Alternatives – Cost, Evaluation, Selection Land Management and Land Use Risk Assessment/Modeling Approach Public Participation

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100-D/H-003	Letter	Ken Niles, Assistant Director for Nuclear Safety, Oregon Department of Energy	Letter attached	Alternatives – Cost, Evaluation, Selection General Comments
100-D/H-004	Letter	Marlene George, Yakama Nation Acting ERWM Program Manager, Confederated Tribes and Bands of the Yakama Nation ERWM	Letter attached	Alternatives – Cost, Evaluation, Selection Land Management and Land Use Contaminant Identification and Cleanup Levels Risk Assessment/Modeling Approach National Historic Preservation Act and Cultural Resources Tribal Land Use and Access and Treaty Rights Tribal Involvement and Consultation Tribal Risk Assessment Scenarios General

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100-D/H-005	E-mail	(b) (6)	1. Remove all nuclear waste, 2. Do not allow anymore nuclear waste into the facility, 3. Replace all the single storage tanks 4. Stop all the nuclear leakage entering the Columbia River.	General Comments
100-D/H-006	E-mail	(b) (6)	In 2008, with shovel ready projects, DOE and it cleanup contractors pronounced Vision 2015. This included the beginning of ERDF and the massive movement of contaminated soil from the 100 areas. Men and machinery were mobilized and D/H were cleaned-up. Select Alternative 1. NO Action should be selected, as these areas have been cleaned-up and no further expense is needed or warranted.	General Comments
100-D/H-007	E-mail	(b) (6)	I have been involved as a very concerned citizen for over 25 years, since the Tri-Party Agreement was made. I continue to see the parties dancing around the difficult but absolutely necessary job of digging up the soil around the 100D/H area. Yes, it is extraordinarily expensive BUT IT MUST BE DONE. DOE must bite the bullet and make it happen. There are a million people at risk down river and untold amount of environmental aspects including fish and agriculture in peril.	Alternatives – Cost, Evaluation, Selection
100-D/H-008	E-mail	(b) (6)	PLEASE work with the government to 'really' clean up Hanford's nuclear mess so that our children's children will have the opportunity to enjoy the beautiful area surrounding Hanford. • It is not reasonable to believe that the USDOE should, or can, restrict access to the groundwater until the year 2060 or soil areas until the year 2203 (187 years from now) along the Columbia River at the D and H Reactor areas - in the Hanford Reach National Monument.	Alternatives – Cost, Evaluation, Selection

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			• Dig up and treat the soil contamination - don't just leave it and call it cleanup by giving it a fancy name "monitored natural attenuation." • Have the pump and treat cover all the groundwater contaminants.	
100-D/H-009	E-mail	(b) (6)	Be careful. Americans are increasingly fed up with non-responsive government agency policy such as the one for the Handford Nuclear site clean-up. When we stop voting for money to fund needed projects, when we no longer trust our government to do the right thing — this will be the reason why! Restore our faith in representative governance — DO THE RIGHT THING!! CLEAN UP HANFORD AS IF YOUR GRANDCHILDREN LIVED HERE!!	Alternatives – Cost, Evaluation, Selection
100-D/H-010	E-mail/Letter	Daniel R. Serres, Conservation Director, Columbia Riverkeeper	Letter attached	Alternatives – Cost, Evaluation, Selection Land Management and Land Use Risk Assessment/Modeling Approach Public Participation
100-D/H-011	E-mail/Letter	Tom Carpenter, Hanford Challenge Executive Director	Letter attached	Alternatives – Cost, Evaluation, Selection Risk Assessment/Modeling Approach General Comments Public Participation

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100-D/H-012	E-mail/Letter	Shannon Cram, Ph.D., Assistant Professor, University of Washington Bothell	Letter attached	Alternatives – Cost, Evaluation, Selection Risk Assessment/Modeling Approach General Comments Public Participation
100-D/H-013	E-mail	(b) (6)	I have looked over the plan as presented and disagree with the timeline and I disagree with the suppositions about groundwater security and lack of danger of exposure of the contaminated soils and water to erosion or to accidental opening of the secured soils and waters to erosion. It is NOT acceptable!	Alternatives – Cost, Evaluation, Selection
100-D/H-014	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm,	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	

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100-D/H-015	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination.	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-016	E-mail	(b) (6) [redacted]	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-017	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-018	E-mail	(b) (6) [redacted]	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-019	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination.	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-020	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-021	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to:	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-022	E-mail	(b) (6) [redacted]	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils.	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-023	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic.	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-024	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-025	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-026	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-027	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-028	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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100-D/H-029	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-030	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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100-D/H-031	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-032	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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100-D/H-033	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-034	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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100-D/H-035	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-036	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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100-D/H-037	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-038	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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100-D/H-039	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-040	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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100-D/H-041	E-mail	(b) (6)	I urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-042	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill	

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			wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-043	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-044	E-mail	(b) (6) [redacted]	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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			area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-045	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-046	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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			area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-047	E-mail	(b) (6) [redacted]	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-048	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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			area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-049	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-050	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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100-D/H-051	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-052	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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100-D/H-053	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-054	E-mail	(b) (6)	Protecting the environment is my highest priority issue, and I urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This	Alternatives – Cost, Evaluation, Selection Public Participation

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy	Endangered Species Act

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100-D/H-055	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			She will not suffer, but the human race will suffer greatly because they have shown such disregard for nature. It is not the first time that a civilization will be brought to its knees, and there have been civilizations much more advanced than our present one that has been destroyed for the same reason....Ego. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-056	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-057	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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			area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-058	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-059	E-mail	(b) (6) [redacted]	We can't leave our lands polluted with radioactive wastes! I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford	Alternatives – Cost, Evaluation, Selection Public Participation

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy	Endangered Species Act

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			hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-060	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives. The agreement is to clean up, not ignore contamination for up to 187 years!	

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100-D/H-061	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination.	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			• Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-062	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised	

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			Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-063	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-064	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish.	

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			Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-065	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination.	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			• Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-066	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment.	

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			• Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-067	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to:	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			• Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-068	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils.	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result,	

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			heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-069	E-mail	(b) (6) [redacted]	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic.	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-070	E-mail	(b) (6) [redacted]	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill	

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			wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-071	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-072	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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			area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-073	E-mail	(b) (6) [redacted]	I urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-074	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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			area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-075	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-076	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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			area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-077	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-078	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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100-D/H-079	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-080	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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			area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-081	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-082	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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			area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-083	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-084	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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			area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-085	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-086	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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			area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-087	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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			contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-088	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

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100-D/H-089	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-090	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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100-D/H-091	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-092	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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100-D/H-093	E-mail	(b) (6) [redacted]	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-094	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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100-D/H-095	E-mail	(b) (6) [redacted]	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-096	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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100-D/H-097	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-098	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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100-D/H-099	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-100	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

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			area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-101	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-102	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook	Alternatives – Cost, Evaluation, Selection Public Participation

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H	Endangered Species Act

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-103	E-Mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Current plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Hold public hearings for important decisions like this one in the River Corridor. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you for considering these comments.	Alternatives – Cost, Evaluation, Selection Public Participation Endangered Species Act

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100-D/H-201	E-mail/Letter	Gerry Pollet, JD, Executive Director, Heart of America Northwest	Letter Attached	Comments received after close of public comment period
100-D/H-202	E-mail	(b) (6) [redacted]	Worse than "friendly fire" is this neglect of lethal weaponry smoldering on a. Ahoy waterway in ur own country. Pretty unpatriotic to defer the clean up this long. Get it cleaned up now. Congress has just passed a bill to clean up the Columbia. Senator Merkley armed on getting that through to give the EPA some after to protect the river. Ramp it up Richard. Your job is to ensure safety for American citizens. We are watching.	Comments received after close of public comment period
100-D/H-203	E-mail	(b) (6) [redacted]	The expected time line for cleanup at 44 to over 100+ years is clearly unreasonable and considering the number of previous extensions given through many decades it is clear more is not better. Further I am very concerned with regards to the planned vitrification Process being implemented that also calls for liquid wastes to also be immeshed with glass for long term storage however the heat expected in the process is also going to cause large amounts of the highly radioactive liquids to be released and do not want any chance or process gas escaping as I'm down wind and living in Spokane, WA. It needs to be demonstrated that no further radioactive particles are being released and of any kind from the Hanford Nuclear Reservation site and I fear as in the past that that will not be the case in the planned processing and storage approved planning and that should not be if any further contamination is a direct result	Comments received after close of public comment period

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100-D/H-204	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination.	Comments received after close of public comment period

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			• Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-205	E-mail	(b) (6)	My name is (b) (6). I am (b) (6), a demographic DOE isn't often reaching, as far as I know. I am a (b) (6) and (b) (6). Two summers ago, I (b) (6), one of the non-profit public outreach groups that Ecology cut funding to by ceasing to provide Public Participation Grants. I understand the Hanford Nuclear Site to be the most contaminated site in the Western Hemisphere, a severe threat to major ecosystems in the Pacific Northwest, and incredibly complex and hazardous to clean up. I could go on, but frankly, I do not have time, nor do you likely have that much time to read this.	Comments received after close of public comment period

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			I have been dismayed that even after a summer spent diving headfirst into the Hanford Site cleanup, the public comment periods are still extremely confusing. That is why I am grateful to groups like Heart of America Northwest: they can distill the confusing Hanford jargon and offer guidance on what to include in the response. Please consider the advice below, an aggregation of points from both the Hanford Advisory Board and Heart of America Northwest, as cleanup of 100-D&H continues (emphasis mine). Insure the removal and treatment of the co-extracted non-chromium contaminants that exceed MCLGs *before treated water is re-injected*. (That means design the system to extract and treat groundwater to also cleanup the extensive Strontium 90, Nitrate and other dangerous contaminants, not just the chromium.). · Incorporate the maintenance of the pump and treat system into the final alternative to allow the system to be restarted to ensure groundwater and surface MCLGs continue to be met. · Apply the Washington State SMS (Chapter 173-204 of the Washington Administrative Code [WAC 173-204]) as ARARs for the Columbia River shoreline. · The Board advises DOE to explore strategic **removal of concentrated mass of isotopes in the deep vadose zone before adopting Institutional Controls and MNA**, especially if the period to reach remediation goals exceeds 100 years. · As proposed plans or other documents come forward for public review, the Board advises the TPA agencies to continue working with the Board to **create clear,**	

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			understandable, and timely public information materials which include: the history of the contamination; interim cleanup actions; work remaining within that specific unit; and how each proposal impacts and protects human health and the environment. · **The cleanup plans must be revised to prevent exposure above standards from all reasonably foreseeable exposure paths, including use of the Yakama Nation's exposure scenario for its members' use of resources along the Hanford Reach pursuant to Treaty rights and other rights protected by federal and state laws. (#NativeLivesMatter)** · The *reasonable maximum exposure scenario is required to take into account the exposures from all sources, including skin, dust ingestion, food ingestion and groundwater ingestion* following the reasonably predictable failure of the institutional controls. This failure would be expected at the time that USDOE declares cleanup of the 100 Areas soil sites complete, which is expected in under a decade. At that point in time, actual experience at Superfund sites in the Northwest shows that it is quite likely that uncontrolled excavations will occur, which would expose deeper contaminated soils, and groundwater may be used without any permitting required. · We agree with EPA and Washington Ecology that unrestricted / residential uses are reasonably foreseeable and must be the basis of cleanup plans in exposure scenarios. However, **the reasonably foreseeable uses include unrestricted uses pursuant to Treaty rights by Tribal Nations, which are more intensive than the residential exposure scenario relied upon**.	

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			· It is not reasonable to have a Plan which relies on restricting access to either soil sites or groundwater in the Hanford Reach National Monument beyond the current anticipated end date for active cleanup and opening of areas for Monument use. For the sites with radioactive contamination in soil below fifteen feet which would exceed standards if there are excavations, animal or plant disturbance, erosion, etc… the cleanup plan must remove contamination from the Hanford Reach, and treat the contamination for proper disposal. The plan must cleanup all groundwater contaminants of concern in a 10-12 year period. It must include all groundwater contaminants and be designed to meet applicable and relevant state standards. It must not rely on restricting use of groundwater in the Hanford Reach National Monument, since that would prevent desired uses of the Monument and **impair Treaty rights**. · The cleanup standards applied to all sites must prevent exposure to carcinogens with a **summed risk from all carcinogens** – both radioactive and chemical – which does not exceed a risk range of one additional fatal cancer for every 10,000 to 100,000 persons (1E-4 to 1E-5). There can be no carried over use of the old 15 millirem dose standard relied on in prior 100 Area interim plans or a 12 millirem dose standard from more recent plans. CERCLA and MTCA require that the plan be based on the total carcinogen risk from both radionuclides and nonradioactive carcinogens, rather than calculated separately Further, CERCLA standards and EPA guidance require the end to use of the dose based cleanup level setting used previously and in this proposed plan. *EPA National Remedy Review Board*, March 27, 2015, in commenting on the Hanford 100-D and H Plans, explicitly	

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			reaffirmed that *the applicable "appropriate and relevant" standard for Hanford cleanup may not exceed the 12 millirem dose for cleanup levels*; that the standard bars use of dose based cleanup levels; and, requires choice of a remedy based on cleanup levels (or PRGs) resulting in a cancer risk "meeting the 10-4 to 10-6 cancer risk range. This policy was reaffirmed in the June 13, 2014 updated version of OSWER Directive No. 9285.6-20, 'Radiation Risk Assessment at CERCLA Sites: Q and A'. The Board recommends that DOE develop new risk-based concentrations for those cleanup levels based on dose." US EPA National Remedy Review Board for Hanford 100- D and H Remedial Action Plans, March 27, 2015. ["12 mrem/yr is now considered to correspond approximately to 3 x 10-4 excess lifetime cancer risk" based on EPA's Federal Risk Guidance Report 13, 1997.viii] · Washington State's Freshwater Sediment Management Standards must be applied as applicable, appropriate and relevant (ARAR) standards in this cleanup plan. The standards are particularly important for a "shoreline of statewide significance", which 100 Area and contaminated sites in this Plan fall within. · A new Plan should be developed based on the comments of the Advisory Board and public – **with a meaningful public involvement plan**. This should include holding meetings around the region (at a minimum including Spokane, Hood River, Seattle and Tri-Cities) for discussion and comment. Presentations and materials are required to include descriptions of the restrictions proposed on resource use and encouraging comment on reasonably foreseeable	

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			exposure scenarios and the failure of institutional or engineering controls.	
100-D/H-206	E-mail	(b) (6)	I know that when a nuclear power facility ceases operations, it must complete decommissioning within 60 years, according to the U.S. Nuclear Regulatory Commission. Operators of closed facilities have three options: 1. Immediate dismantling, which implies facilities are taken down, and structures and devices contaminated with radioactivity are removed or decontaminated to levels that permit the release of property; 2. Deferred dismantling, which occurs when the facility is maintained and monitored to allow radioactive decay to occur on site, or 3. Entombment, which permanently encases the site and its radioactive contaminants in a material such as concrete until radioactive materials have decayed away. (U.S. Nuclear Regulatory Commission, "Backgrounder on Decommissioning Nuclear Power Plants," May 14, 2015, http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/decommissioning.html.) The last of the reactors (N reactor) at the Hanford site ceased operations in 1987. Using that very latest date for calculation purposes, decommissioning of the site must be completed by 2047. I know that in the 1960s the scientists at Hanford developed a vitrification process to convert wastes generated at Hanford into glass. The technology developed back then formed the basis of the process now used at the Savannah River site in South Carolina. (Hanford Oral History Project at Washington State University Tri-Cities, "Interview with Jack McElroy," Hanford History Project, accessed August 24, 2016, http://www.hanforD/History.com/items/show/46.)	Comments received after close of public comment period

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			I know that the partnership between the DOE and Bechtel on building a vitrification plant at Hanford has been fraught with difficulties, not the least of which has been abiding by the safety standards of the nuclear industry. (Aloise, Gene. Director Natural Resources and Environment, Testimony Before the Subcommittee on Energy and Water Development and Related Agencies, Committee on Appropriations, House of Representatives. "Hanford Waste Treatment Plant: Contractor and DOE Management Problems Have Led to Higher Costs, Construction Delays, and Safety Concerns." April 6, 2006. http://www.gao.gov/assets/120/113514.html; U.S. Government Accountability Office, *Hanford Waste Treatment Plant: DOE Needs to Take Action to Resolve Technical and Management Challenges.* Washington D.C.: U.S. Government Office Accountability Office, December 19, 2012. "What GAO Found"). Now the vitrification plant must be operational by 2036 (by court order). But it seems that the way contractors feel they will achieve that date is by risking the health and safety of their workers and the public. The track record of this project does not lead me to believe that the timelines now proposed will be aD/Hered to, that promises will be kept. And now we hear that we'll have to wait even longer for radioactive materials to decay before other areas of Hanford will be safe or usable. The residents of Washington have waited long enough. People's lives and livelihoods are at risk here. Why won't someone stand up and do the right thing for a change? In the 1940s a group of scientists built Hanford from the desert and created the atomic bomb in less that two years. Why	

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			can't we get a group together to put the same kind of thought and energy into cleaning up the mess that has been left behind?	
100-D/H-207	E-mail	(b) (6)	Please clean up Hanford… not in 44 years, not in 187 years. Get the contaminated soil out of the watershed now, and give us the rivers back.	Comments received after close of public comment period
100-D/H-208	E-mail	(b) (6)	Waiting 44 years for radioactive Strontium 90 in groundwater flowing into the Columbia River at Hanford to be reduced to current standards is not a "cleanup plan." Nor is waiting up to 187 years for soil contamination below 15 feet to decay or slowly migrate until it reaches standards for unrestricted public use**.** Yet, these are the US Department of Energy's (USDOE's) estimates for how long it will take for contamination levels to fall below today's standards under its proposed cleanup plan ("Alternative 3") for the 8 square miles **alongside the Columbia River at Hanford's** D and H Reactor Areas. The Columbia River is not expendable. What can you do to help?	Comments received after close of public comment period
100-D/H-209	E-mail	(b) (6)	IMHO: DOE does not now have a credible clean up plan for the Hanford Reach mess and they should have one NOW. The fact that after all these years DOE does not have such a plan is a national disgrace. Battell is getting away with murder, literally, and that must be stopped NOW.	Comments received after close of public comment period
100-D/H-210	E-mail	(b) (6)	Please do your job for the benefit of future generations and save us money now too. **Waiting 44 years for radioactive Strontium 90 in groundwater flowing into the Columbia River at Hanford to be reduced to current standards is not a "cleanup plan."**	Comments received after close of public comment period

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			Nor is waiting up to 187 years for soil contamination below 15 feet to decay or slowly migrate until it reaches standards for unrestricted public use. • It is not reasonable to believe that the USDOE should, or can, restrict access to the groundwater until the year 2060 or soil areas until the year 2203 (187 years from now) along the Columbia River at the D and H Reactor areas - in the Hanford Reach National Monument. • Dig up and treat the soil contamination - don't just leave it and call it cleanup by giving it a fancy name "monitored natural attenuation." • Have the pump and treat cover all the groundwater contaminants. Thank you for working to make our world livable,	
100-D/H-211	E-mail	(b) (6)	Your proposed plan for cleanup of the D and H Reactor areas is not unacceptable. Further your agency, the EPA, and the Department of Ecology are not including public hearings. As taxpaying citizens, we believe the Department of Ecology can do far better to keep the public informed and to honor the treaty rights of the Native Americans in the area of the Hanford Reach, regarding the cleanup proposal. I agree with the following comment: "**A new Plan should be developed based on the comments of the Advisory Board and public – with a meaningful public involvement plan. This should include holding meetings around the region (at a minimum including Spokane, Hood River, Seattle and Tri-Cities) for discussion and comment. Presentations and materials are required to include descriptions of the restrictions proposed on resource use**	Comments received after close of public comment period

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			and encouraging comment on reasonably foreseeable exposure scenarios and the failure of institutional or engineering controls. " Failing on Public Involvement: "USDOE, EPA and Washington Ecology failed to offer any public meetings around the region to discuss this very important cleanup plan and to take comments as part of public meetings. This lack of public involvement shows how seriously flawed the agencies approach to public education, involvement and willingness to listen to public concerns has become." You are dealing with **Chromium (Hexavalent Chromium, or Chrome VI), Radioactive Strontium 90, Cesium 137, Technetium 99. "**The area of contaminated groundwater above state standards is approximately 3 square miles right along the River. The groundwater flows to the River." I concur with the following points below: ? It is not reasonable to believe that the USDOE should, or can, restrict access to the groundwater until the year 2060 or soil areas until the year 2203 (187 years from now) along the Columbia River at the D and H Reactor areas - in the Hanford Reach National Monument. ? Dig up and treat the soil contamination - don't just leave it and call it cleanup by giving it a fancy name "monitored natural attenuation." ? Have the pump and treat cover all the groundwater contaminants. **·" The cleanup plans must be revised to prevent exposure above standards from all reasonably foreseeable exposure**	

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			paths, including use of the Yakima Nation's exposure scenario for its members' use of resources along the Hanford Reach pursuant to Treaty rights and other rights protected by federal and state laws. ▯ The reasonable maximum exposure scenario is required to take into account the exposures from all sources, including skin, dust ingestion, food ingestion and groundwater ingestion following the reasonably predictable failure of the institutional controls. This failure would be expected at the time that USDOE declares cleanup of the 100 Areas soil sites complete, which is expected in under a decade. At that point in time, actual experience at Superfund sites in the Northwest shows that it is quite likely that uncontrolled excavations will occur, which would expose deeper contaminated soils, and groundwater may be used without any permitting required. ▯ We agree with EPA and Washington Ecology that unrestricted / residential uses are reasonably foreseeable and must be the basis of cleanup plans in exposure scenarios. However, the reasonably foreseeable uses include unrestricted uses pursuant to Treaty rights by Tribal Nations, which are more intensive than the residential exposure scenario relied upon. ▯ It is not reasonable to have a Plan which relies on restricting access to either soil sites or groundwater in the Hanford Reach National Monument beyond the current anticipated end date for active cleanup and opening of areas for Monument use. o For the sites with radioactive contamination in soil below fifteen feet which would exceed standards if there are excavations, animal or plant disturbance, erosion, etc… the	

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			cleanup plan must remove contamination from the Hanford Reach, and treat the contamination for proper disposal. • The plan must cleanup all groundwater contaminants of concern in a 10-12 year period. It must include all groundwater contaminants and be designed to meet applicable and relevant state standards. It must not rely on restricting use of groundwater in the Hanford Reach National Monument, since that would prevent desired uses of the Monument and impair Treaty rights. • The cleanup standards applied to all sites must prevent exposure to carcinogens with a summed risk from all carcinogens – both radioactive and chemical – which does not exceed a risk range of one additional fatal cancer for every 10,000 to 100,000 persons (1E-4 to 1E-5). There can be no carried over use of the old 15 millirem dose standard relied on in prior 100 Area interim plans or a 12 millirem dose standard from more recent plans. CERCLA and MTCA require that the plan be based on the total carcinogen risk from both radionuclides and nonradioactive carcinogens, rather than calculated separately Further, CERCLA standards and EPA guidance require the end to use of the dose based cleanup level setting used previously and in this proposed plan. • EPA National Remedy Review Board, March 27, 2015, in commenting on the Hanford 100-D and H Plans, explicitly reaffirmed that the applicable “appropriate and relevant” standard for Hanford cleanup may not exceed the 12 millirem dose for cleanup levels; that the standard bars use of dose based cleanup levels; and, requires choice of a remedy based on cleanup levels (or PRGs) resulting in a cancer risk “meeting the 10-4 to 10-6 cancer risk range. This	

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			policy was reaffirmed in the June 13, 2014 updated version of OSWER Directive No. 9285.6-20, 'Radiation Risk Assessment at CERCLA Sites: Q and A'. The Board recommends that DOE develop new risk-based concentrations for those cleanup levels based on dose." US EPA National Remedy Review Board for Hanford 100-D and H Remedial Action Plans, March 27, 2015. "12 mrem/yr is now considered to correspond approximately to 3 x 10-4 excess lifetime cancer risk" based on EPA's Federal Risk Guidance Report 13, 1997.viii Washington State's Freshwater Sediment Management Standards must be applied as applicable, appropriate and relevant (ARAR) standards in this cleanup plan. The standards are particularly important for a "shoreline of statewide significance", which 100 Area and contaminated sites in this Plan fall within. **A new Plan should be developed based on the comments of the Advisory Board and public – with a meaningful public involvement plan. This should include holding meetings around the region (at a minimum including Spokane, Hood River, Seattle and Tri-Cities) for discussion and comment. Presentations and materials are required to include descriptions of the restrictions proposed on resource use and encouraging comment on reasonably foreseeable exposure scenarios and the failure of institutional or engineering controls. "**	
100-D/H-212	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and	Comments received after close of public comment period

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			explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill	

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			wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-213	E-mail	(b) (6)	The following are my comments for the USDOE plan for the 100 D and H Reactor Areas at the Hanford cleanup site: 1) Identify all the current and projected contaminant discharges to the Columbia River that have or will occur during the proposed 44 year and 187 year cleanup attenuation periods. 2) Any decision to purposely delay active remediation of soil (by 187 years) and groundwater (by 44 years) is not acceptable. 3) List all potential geologic and climatic scenarios that could cause a release of the soil and water contaminants in the future resulting in environmental and human health exposures (including site worker exposure). 4) Identify all potential ways that the proposed remaining contamination could be transported to the surface, including erosion, via plants,	Comments received after close of public comment period

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			animals, insects. For instance, the Columbia could alter it's course over the years and remove some or all of the cover soil. 5) Only calculating exposure risk based on groundwater ingestion is not acceptable. Many of the contaminants that remain buried at these reactor sites are extremely toxic if they find their way into humans or animals where they can bombard living tissues resulting in cancer and other illness. Even one tiny particle that lodges in the body can potentially cause serious illness. The air inhalation pathway and particulate ingestion pathway are two examples. Discuss how these scenarios are accounted for with all remaining toxic contaminants. 6) Have all the extensive underground piping and other buried structures been fully characterized and included in the risk and remediation plans? If not describe the full extent of uncharacterized structures and areas related to the D and H reactor areas. 7) Describe how USDOE will follow the Hanford Advisory Board recommendations for D and H reactor areas. 8) Describe how USDOE will revise the D and H reactor area plan to include a summarized risk from all carcinogens. 9) Explain why USDOE is currently not using current recommended dose-based cleanup levels.	

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			10) Describe how USDOE is complying with Washington State Freshwater Sediment Management standards. 11) Describe how Native American Tribal concerns and rights will be met for this specific area. Thank you in advance for your consideration	
100-D/H-214	E-mail	(b) (6)	One would think that cleaning up the Hanford Nuclear Waste Disaster Site would be a national priority, given that a large percentage of the local residents and down-winders get cancer from the nuclear leakage from this site and the, still active and spewing, 40 year old reactor. One would think that poisoning the Columbia River and the salmon and steelhead that worldwide humanity depends upon to eat would be cause for alarm, and that cleaning up the Hanford Nuclear Reservation that is leaking poisonous nuclear waste into the Columbia, and poisoning the fish, and poisoning the downstream populations, such as Portland, would make the cleanup a national priority. 44 years to clean it up, is not a priority. 190 years to clean it up is certainly not a national priority. And nobody even knows if it will clean itself up ever. How did the nuclear business get such a strangle hold on our national priorities that we can't even clean up the mess they made in a reasonable time frame?	Comments received after close of public comment period
100-D/H-215	E-mail	(b) (6)	Cleanup for the D and H reactor areas, must stop the ground water traveling toward the Columbia River. A radioactive Columbia River will be more disastrous than a earthquake.	Comments received after close of public comment period

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			One can return after an earthquake and rebuild. Radioactivity contamination is permanent, forever lost to human habitation.	
100-D/H-216	E-mail	(b) (6)	Waiting 44 years for radioactive Strontium 90 in groundwater flowing into the Columbia River at Hanford to be reduced to current "standards" is not a cleanup plan. Nor is waiting up to 187 years for soil contamination below 15 feet to decay or slowly migrate until it reaches standards for unrestricted public use. A new Plan should be developed based on the comments of the Advisory Board and public – with a meaningful public involvement plan. This should include holding meetings around the region (at a minimum including Spokane, Hood River, Seattle and Tri-Cities) for discussion and comment. Presentations and materials are required to include descriptions of the restrictions proposed on resource use and encouraging comment on reasonably foreseeable exposure scenarios and the failure of institutional or engineering controls.	Comments received after close of public comment period
100-D/H-217	E-mail	(b) (6)	After reading, participating in webinars of information and explanation, looking at articles, maps, and being in all kinds of discussions, I urge you to go FULL OUT! Here's why: We need an enhanced cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to life: ours, the salmon, and future generations. All will be touched and affected by the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils.	Comments received after close of public comment period

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment.	

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			• Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-218	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to:	Comments received after close of public comment period

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			• Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-219	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils.	Comments received after close of public comment period

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result,	

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-220	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic.	Comments received after close of public comment period

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination. • Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	
100-D/H-221	E-mail	(b) (6)	I am taking the time to write you personally in order to urge you as forcefully as I can to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach.	Comments received after close of public comment period

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			In the light of our recent election and the likelihood that the new administration will deny that radioactivity at Hanford is dangerous, or even exists, it is imperative that you complete the full revision of the Shallow Proposed Cleanup Plan immediately, before next year's salmon spawning begins, if you have not already done so. The safety of this stretch of the Columbia is critical to fall Chinook salmon, and future generations of people will be attracted to the Hanford Reach to use and explore its waters, almost certainly with little to no knowledge of the profound danger of the radioactive pollution that has been left behind in nearby soils. The Department of Energy has demonstrated in the past that it is capable of "digging deep" to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology, and EPA in addressing some of the highest levels of toxic hexavalent chromium via deep excavations close to the Columbia River shoreline. Unfortunately, Energy's Proposed Plan for the 100-D/H areas reflects a _shallow_ approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit the most dangerously polluted soils precisely in areas where people are likely to live, farm, and recreate. Most dismayingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. I am writing to ask that you actively consider altering and expanding your approach in this and future cleanup plans in order to:	

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			(1) Consider alternatives that address deep soil contamination; (2) Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination; (3) Hold multiple public hearings in towns and cities along the Columbia downriver from Hanford Reach for full public input on important decisions like this one in the River Corridor; (4) Recognize that all current institutional controls are highly likely to fail over very long timelines, such as the 187 years during which Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment; (5) Finally, but most essentially, I ask that you consult in depth with expert fisheries and environmental agencies on the multiple ways River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. As you well understand, radioactive contamination cannot be seen -- yet like global warming its consequences are profoundly serious, and it is now time to remedy the grossly insufficient protections that were originally put in place -- or absent -- during the wartime operations at Hanford. Thank you for considering my comments. I look forward to your announcement of a stronger and more effective revised Proposed Plan that includes a reasonable range of cleanup alternatives like those listed above.	

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
100-D/H-222	E-mail	(b) (6)	I am writing to urge you to revise and enhance your cleanup approach in one of the most sensitive places along the Columbia River, the 100-D/H Area adjacent to the Hanford Reach. This stretch of the Columbia is critical to fall Chinook salmon, and future generations will be attracted to use and explore the Hanford Reach, possibly without detailed knowledge of the pollution we leave behind in nearby soils. Energy has demonstrated in the past that it is capable of “digging deep” to accomplish better cleanup at Hanford. I appreciate the diligent effort put forward by Energy, Ecology and EPA in addressing some of the highest levels of toxic hexavalent chromium with deep excavations close to the Columbia River shoreline. Unfortunately, Energy’s Proposed Plan for the 100-D/H areas reflects a shallow approach and a lack of commitment to seeing the job through on the River Corridor. The Plan leaves future generations to inherit polluted soils in areas where people are likely to live, farm, and recreate. Most disappointingly, the Plan does not even consider alternatives that would address deep soil contamination, leaving the public no opportunity to assess whether this approach would be realistic. Please consider altering your approach in this and future cleanup plans to: • Consider alternatives that address deep soil contamination. • Consider treating co-extracted contaminants such as Strontium-90 and nitrate as you operate pump-and-treat systems that are focused on remediating chromium groundwater contamination.	Comments received after close of public comment period

Tracking Number	Method	Commenter	Comment	Comment Categories in Responsiveness Summary
			• Hold public hearings for important decisions like this one in the River Corridor. • Recognize that institutional controls are likely to fail over very long timelines, such as the 187 years when Energy hopes to prevent deep digging in some sites in the 100-D/H area. Future generations are likely to dig foundations, drill wells, and otherwise use the River Corridor. As a result, heavy reliance on institutional controls may fail to protect people and the environment. • Consult with expert fisheries agencies on how River Corridor cleanup plans like this might impact critical habitat for salmon and other fish. Thank you in advance for considering these comments, and I look forward to attending a public hearing for a revised Proposed Plan that includes a reasonable range of cleanup alternatives.	

Notes:

Comments numbered from 001-103 were received during Public Comment period and comments numbered from 200-222 were received after the close of Public Comment period.

Comment Number 100-D/H-001

August 25, 106

Letter from the Confederated Tribes of the Umatilla Indian Reservation

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Confederated Tribes *of the*
Umatilla Indian Reservation
Department of Natural Resources
Energy and Environmental Sciences Program

46411 Timíne Way
Pendleton, OR 97801
www.ctuir.org

25 August 2016

Rich Buel
U.S Department of Energy Richland Operations Office
P.O. Box 550, MSIN A7-75
Richland, WA 99354

RE: Comments on Proposed Plan for Remediation of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units

Dear Mr. Buel,

The Energy and Environmental Sciences Program of the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) Department of Natural Resources (DNR) appreciates the opportunity to comment on the Proposed Plan for Remediation of the 100-D and 100-H Operable Units. It is our desire to participate in the process on a government-to-government basis with DOE by providing the Department of Energy with comments that lead to remedial action that is as protective of human health and the environment as possible.

If you have any questions concerning the enclosed comments please feel free to contact me by phone at 541-429-7420, or by email at rodskeen@ctuir.org

Sincerely,

Rodney S. Skeen, Ph.D, P.E.
Manager, CTUIR-EESP/DNR

Cc:
File

Enclosure (1)

Comments on Proposed Plan for Remediation of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units

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Page 2, Lines 30-31: *Input from the Tribal Nations…*

Comment: Tribal input should have been solicited and incorporated into development of the Proposed Plan prior to its release to the public. Given CTUIR's status as a sovereign government and natural resource manager, in conjunction with the federal trust responsibility and DOE's duty to protect CTUIR trust resources, DOE should consider and include CTUIR as a partner on equal footing in development of such plans.

Requested Action: DOE should address CTUIR on a government-to-government basis in the process of developing its remedial action plans. This requires DOE to provide information to and solicit feedback from CTUIR in the earliest phases of the development of remediation plans.

Page 8, Line 8: *Between 1995 and November 2012, interim RTD was completed 180 waste sites…*

Comment: What is the total number of waste sites in the 100-D/H operable units included within this plan, both remediated and unremediated?

Requested Action: Include a statement indicating the total number of waste sites present that fall within the operable units addressed in this Plan, both remediated and unremediated.

Page 10, Lines 4-5: *DOE consults with these Tribal Nations.*

Comment: DOE has a legal and moral duty to do more than simply consult with Tribal nations, including CTUIR. DOE should actively seek to engage CTUIR in development of remedial action goals and in ultimately select an alternative that is protective of tribal rights and resources. One way to ensure that this level of engagement occurs would be by incorporating a tribal risk scenario, such as the one developed by CTUIR, into its human health risk assessment. Choosing an alternative that is based on protection of tribal health would result in a much better outcome for the remedial process in that it would result in a cleaner environment that is safer to use, and therefore more protective of both human health for everyone, not just tribal members.

Requested Action: As part of this Plan, DOE should work with the CTUIR to incorporate a reasonable and relevant tribal risk scenario into evaluation of the various alternatives.

Page 10, Lines 26-28: *The segment of the Columbia River adjacent to 100-D/H, which is part of the HRNM, is used for a variety of recreational activities. The land use in the HRNM includes preservation and conservation.*

Comment: The CTUIR has the treaty reserved resources within the 100-D/H area including in the river that flows past these former reactor sites.

Requested Action: This sentence should be modified to note that the Hanford-affected tribes use this stretch of the river for treaty reserved activities including fishing.

Page 22, Lines 31-33: *DOE and USFWS manage this federally owned land to protect natural and cultural resources while cleanup activities are being conducted. Such management is consistent with the* Final Hanford Comprehensive Land-Use Environmental Impact Statement *(DOE/EIS-0222-F).*

Comment: CTUIR disagrees with some of DOE's land use designations and strongly disagrees with its position on the extent of certain tribal land-based rights. DOE has a trust obligation to protect CTUIR treaty rights and treaty-related resources and failed to uphold its obligations in the Comprehensive Land-Use EIS.

Requested Action: DOE should revise the Comprehensive Land-Use EIS and acknowledge CTUIR land-based treaty rights in the Hanford area.

Page 22, Lines 31-33: *DOE and USFWS manage this federally owned land to protect natural and cultural resources while cleanup activities are being conducted. Such management is consistent with the Final Hanford Comprehensive Land-Use Environmental Impact Statement (DOE/EIS-0222-F).*

And

Page 22, Lines 40-42: *The Presidential Proclamation (65 FR 114) mandates preservation of the natural and cultural resources within the HRNM an specifically includes the possibility of adding lands to the HRNM as they are remediated*

Comment: The CTUIR is opposed to expansion of the management role of the USFWS at Hanford. This organization has not sought to honor the treaty reserved rights of the Hanford affected Tribes and has limited access to lands and resources traditionally used by these tribal nations.

Requested Action: The USDOE should work with the CTUIR and other Hanford affected tribes to establish a co-management strategy that empowers the tribal organizations to return to their role of being the long-term stewards and land managers for remediated Hanford lands.

Page 22, Lines 43-44: *DOE's reasonably anticipated future use of the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OU's is conservation and preservation.*

Comment: Tribal access and use is also a reasonably foreseeable future use and should be incorporated as part of the plan, as per DOE's treaty obligations and the federal trust responsibility.

Requested Action: DOE should uphold its treaty and trust obligations to CTUIR by formally acknowledging future tribal access and use of these OU's through incorporation of such use into this Plan.

Page 23, Lines 19-22: *For purposes of assessing future potential risk, various human exposure scenarios were evaluated in the RCBRA (DOE/RL-2007-21, Volume II), the CRC (DOE/RL-2010-117, Volume II), and the baseline human health risk assessment in the 100-D/H RI/FS report (Section 6.2.3 of DOE/RL-2010-95). These exposure scenarios were evaluated to reflect a range of land uses, including the residential scenario.*

Comment: The exposure scenarios used to establish the remediation goals do not encompass the plausible activities of tribal people and are not protective of their health. The RCBRA[1] included a Nonresidential Tribal exposure scenario that modeled unique routs of exposure, including sweat lodge use and the consumption of native plants. While this scenario did not encompass all aspects of the CTUIR's approved Native American Subsistence Scenario, it demonstrated the added risks experienced by tribal members. For example, the Avid Hunter exposure scenario reported a total cancer risk of 5×10^{-5} and a hazard index of approximately 1 (RBCRA Page 7-20, Section 7.3.2.1, Paragraph 2). In contrast, the Nonresidential Tribal scenario resulted in a 1×10^{-2} cancer risk and a hazard index between 75 and 91 (RBCRA Page 7-20, Section 7.3.2.1, Paragraph 3). A large fraction of the risks was the result of natural arsenic levels. However, even if arsenic was excluded from the analysis the Nonresidential Tribal scenario resulted in risk an order of magnitude or more greater than the Avid Hunter scenario.

Requested Action: The USDOE should consider the treaty reserved rights and resources of the Hanford affected tribes and evaluate exposure scenarios that encompass tribal activities when setting remediation goals.

Pages 30 to 33, Table 3: *MNA and ICs (deep zone) Excavation restrictions Waste sites with radiological contamination exceeding human health direct contact cleanup levels at a depth deeper than 4.6 m (15 ft) bgs*

Comment: Many of the entries in Table 3 for the deep waste sites indicate that it will take more than 100 years for natural attenuation processes including radiological decay to result in contamination levels that will drop below clean-up levels. The CTUIR is therefore concerned that residual contamination left in the groundwater at these deep waste sites is likely to cause

[1] RCBRA denotes the River Corridor Baseline Risk Assessment

CTUIR members to avoid the area, regardless of whether the operable units have been deemed "clean" for legal purposes or whether or not the resources present in those sites are accessible from the surface. Avoidance by tribal members would result in a loss of use of certain resources under the natural resource damages assessment process.

Requested Action: CTUIR will need to evaluate and account for any lost use of natural resources that might be due to the contaminated waste left in the ground at a depth of more than fifteen feet. The USDOE should provide additional funding to CTUIR for its Tribal Lost Use study in future years to evaluate and account for this loss through the natural resource damages assessment process.

Pages 36 – 38: *Description of Alternatives 2, 3 and 4*

Comment: Waste sites, including the groundwater plumes, will take decades to reach their designated clean-up levels regardless of the alternative that is selected. During the interim, contaminants will continue to migrate into the river and potentially impact terrestrial and aquatic species that tribal members harvest in accordance with their established treaty reserved rights. For this reason, the CTUIR has been developing a protocol for monitoring the culturally relevant natural resources on, and near Hanford to provide on-going, explicit proof that they are safe for use.

Requested Action: The CTUIR strongly encourages the USDOE to work with tribal staff to establish and continue a tribally managed resource monitoring program for as long as contamination is present on the Hanford site.

Pages 37 – 38: *Description of alternatives 3 and 4*

Comment: The time frame to clean up surface waste sites under the preferred alternative is unacceptably long.

Requested Action: DOE should develop a hybrid action composed of Alternatives 3 and 4 that addresses groundwater remediation as described in Alternative 3 and waste site remediation as proposed under alternative 4. This sort of hybrid approach would achieve cleanup of waste sites in a much quicker time frame than that identified in the preferred alternative, while maintaining the estimated time needed to achieve cleanup of groundwater under the preferred alternative, without a major increase in the financial burden to DOE.

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Comment Number 100-D/H-002

September 15, 2016

Letter from the Hanford Advisory Board, Consensus Advice #290

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HANFORD ADVISORY BOARD

A Site Specific Advisory Board, Chartered under the Federal Advisory Committee Act

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September 15, 2016

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Washington State Department of Ecology
3100 Port of Benton Blvd.
Richland, WA 99354

Re: Proposed Plan for Remediation of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units

Dear Messrs. Shoop and Faulk and Ms. Smith,

Background

A Proposed Plan for Remediation of the *100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units* (DOE/RL-2011-111, Rev 0) has been completed, including the preferred alternative proposed for remediation. The Hanford Advisory Board (Board) has previously provided advice to the draft Proposed Plan, and to the associated Remedial Investigation and Feasibility Study, and appropriate Tri-Party Agreement (TPA) agency responses were received. In addition, the Board appreciates the TPA agencies working in collaboration with the Board to create clear and understandable public information materials for this comment period.

The Board is generally supportive of the U.S. Department of Energy's (DOE) alternative analysis for the 100-D/H Areas, and agrees with the choice of Alternative 3 which includes removal, treatment and disposal (RTD) of the remaining chromium contaminated sites; capping of waste containing pipelines; and an enhanced pump-and-treatment remediation of groundwater with 80 new wells. The Board notes the extra effort from the TPA agencies at 100-D/H in the “big digs,” particularly in the more contaminated D-area sites, in removing concentrated chromium spills from vadose zone sediments and in reducing the time it will take to pump-and-treat 100-D groundwater to an acceptable level. The proposed alternative is predicted to take 25 years to reduce chromium, 13 years for nitrate, and 44 years for reduction of strontium, to acceptable levels in ground water.

The Board emphasizes to the TPA agencies that the co-extracted contaminants be included as part of the groundwater alternatives analysis. A number of metals and other elements are contaminants of potential concern that have been detected above the 90th percentile Hanford Site background level, above risk-based maximum levels, or above maximum contaminant levels. As the Proposed Plan states “based on the results of the groundwater risk evaluation, nitrate, strontium-90, total chromium, and hexavalent chromium are present in groundwater at levels that pose unacceptable risk if no actions are taken.” The pump-and-treat alternatives are aimed solely at chromium reduction. The Board continues to be concerned that the co-extracted non-chromium contaminants examined in pump-and–treat alternatives of the Proposed Plan should be considered for removal and treatment before that water is reinjected. The Board restates its preference for treatment of the co-extracted non-chromium contaminants instead of dilution.

Given that strontium was reported to be above the maximum contaminant level goal (MCLG) in a number of detected unfiltered groundwater samples in the 100-H Area, the Board urges the TPA agencies to consider a more aggressive approach for strontium. There is no provisional fallback remediation plan provided in the Proposed Plan for strontium if Monitored Natural Attenuation (MNA) is found not to work.

Furthermore, freshwater sediment management standards (SMS) were updated in September 2013 and it is Washington State Department of Ecology's policy that these standards apply as applicable or relevant and appropriate requirements (ARARs) if the Record of Decision has not yet been completed. The Board believes the TPA agencies should ensure that the Proposed Plan takes into account the numerical chemical and biological criteria in interpreting existing sediment chemistry and bioassay results and in setting preliminary remediation goals for Columbia River sediments in the 100-D/H Area and the River Corridor in general.

There are at least seven waste sites listed in deep decision units (vadose zone below fifteen feet below ground surface) with isotope concentrations that exceed risk levels that should require action. The isotopes within these waste sites are predicted to take more than 100 years to decay to activity levels that are less than residential screening levels (spans of time that range from 112-187 years).[1] The Board believes such a long time frame defies the reasonable ability to control the site and maintain the surveillance that will be necessary to keep intruders and other people from harm.

Advice

- The Board advises the TPA agencies to adopt Alternative 3, with the following modifications:
    - Insure the removal and treatment of the co-extracted non-chromium contaminants that exceed MCLGs before treated water is re-injected.
    - Incorporate the maintenance of the pump and treat system into the final alternative to allow the system to be restarted to ensure groundwater and surface MCLGs continue to be met.
    - Apply the Washington State SMS (Chapter 173-204 of the Washington Administrative Code [WAC 173-204]) as ARARs for the Columbia River shoreline.
- The Board advises DOE to explore strategic removal of concentrated mass of isotopes in the deep vadose zone before adopting Institutional Controls and MNA, especially if the period to reach remediation goals exceeds 100 years.
- As proposed plans or other documents come forward for public review, the Board advises the TPA agencies to continue working with the Board to create clear, understandable, and timely public information materials which include: the history of the contamination; interim cleanup actions; work remaining within that specific unit; and how each proposal impacts and protects human health and the environment.

Sincerely,

Steve Hudson, Chair
Hanford Advisory Board

This advice represents Board consensus for this specific topic. It should not be taken out of context to extrapolate Board agreement on other subject matters.

1 See *Table 3. Waste Site Alternatives* on p. 32 of Proposed Plan for Remediation of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units, Rev. 0.

cc: Frank Marcinowski, U.S. Department of Energy, Headquarters
Kevin Smith, Manager, U.S. Department of Energy, Office of River Protection
Kyle Rankin, Co-Deputy Designated Federal Official, U.S. Department of Energy Richland Operations Office
Dawn MacDonald, Co-Deputy Designated Federal Official, U.S. Department of Energy Office of River Protection
David Borak, U.S. Department of Energy, Headquarters
The Oregon and Washington Delegations

Comment Number 100-D/H-003

August 23, 2016

Letter from Oregon Department of Energy

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Oregon
Kate Brown, Governor

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August 23, 2016

Rich Buel
U.S. Department of Energy
Richland Operations Office
PO Box 550, MSIN A7-75
Richland, WA 99354

Dear Mr. Buel:

Oregon appreciates the opportunity to review and comment on important clean-up decisions, such as the Proposed Plan for *Remediation of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3 Operable Units,* (DOE/RL-2011-111, Revision 0).

In past years, the State of Oregon has provided comments on a number of different documents related to cleanup of other reactor areas, including the B/C and F Areas. Our comments have been consistent in seeking a quality, timely cleanup that is protective of the Columbia River. Our expectation is that cleanup for each of the reactor areas will be comparable in scope and protectiveness.

Oregon supports the decision to move forward with completing remediation of the 100-D/H Area. We agree with the choice of the Preferred Alternative (Alternative 3) out of the alternatives evaluated. We especially support the focus on groundwater remediation through an increased capacity pump-and-treat with up to 80 new wells. This alternative represents a decreased time frame for cleanup of chromium groundwater contamination (12 years versus 25 or 29 years for other alternatives considered), of the nitrate plume (6 years versus 13 years), and the strontium plume (44 years versus 56 years).

However, we do have concerns with plans for some of the identified waste sites, based on the information we were able to review in this and referenced documents.

Contamination in burial ground 118-D-3:1 deeper than 15 feet is proposed to be left in place and managed through a combination of Monitored Natural Attenuation and Institutional Controls. This burial ground consists of multiple trenches which received operations waste from the DR Reactor, and has the potential to contain spent nuclear fuel elements. Of particular concern to us are concentrations of nickel-63, which contain as much as 47 times the allowable risk (and which exceed EPA standards by 16 times) and are expected to take around 400 years to decay to acceptable levels. We recommend that additional excavation be planned for this waste site so as to retrieve this concentrated waste.

The Preferred Alternative includes no proposed action on 153 waste sites in the 100-D/H Area. In most cases, we agree with the decision. However, sufficient data is not available to us in supporting documents to assure us that no action is the proper choice for several different waste sites:

- 100-D-108 – no information was provided in Appendix E and previous documents related to the D/H Area also did not include much information on this waste site.
- 100-D-109 – no information was provided in Appendix E and previous documents related to the D/H Area also did not include much information on this waste site.
- 100-H-38 is listed as a burial ground with no other information available, including no characterization data to support no action.
- 100-D-47 is listed as a burial ground for Project CQ "rod burial," but no depth of excavation was provided. Only 2,800 cubic meters of soil were excavated, indicating the excavation was likely fairly shallow.
- 116-D-2 and 116-D-4, both cribs, contained "possible ruptured fuel elements" and "lab fluids with fission products." These waste sites were only excavated to depths of 3 meters and 2.8 meters.
- There is conflicting information provided about 100-H-7, which is a French Drain. Appendix E states that Hexavalent Chromium and PCB exceed the cleanup-screening levels based on Washington Administrative Code. Yet the "Basis for Reclassification" (Remaining Sites Verification Package) reports the same waste site "meets remedial action objectives" and this site will "support future unrestricted land uses . . . support unrestricted future use of shallow zone soil and is protective of groundwater and the Columbia River."

Based on these discrepancies and the lack of information, we can't at this point endorse a no action alternative for these waste sites.

If you have any questions or comments about our recommendations, please contact Dale Engstrom of my staff at 503-378-5584 (or dale.engstrom@oregon.gov).

Sincerely,

Ken Niles
Assistant Director for Nuclear Safety

cc: Alex Smith, Washington Department of Ecology
Dennis Faulk, U.S. Environmental Protection Agency
Rod Skeen, Confederated Tribes of the Umatilla Indian Reservation
Russell Jim, Yakama Indian Nation
Gabriel Bohnee, Nez Perce Tribe

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Comment Number 100-D/H-004

September 8, 2016

Letter from Confederated Tribes and Bands of the Yakama Nation ERWM

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Confederated Tribes and Bands
of the Yakama Nation ERWM

Established by the
Treaty of June 9, 1855

September 8, 2016

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Alex Smith
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Subject: Review of the Proposed Plan and Remedial Investigation/Feasibility Study for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units (DOE/RL-2010-95,) and Propose Plan (DOE/RL-2011-111, Rev 0).

Dear Ms. Holmes and Smith:

In February 2014, Confederated Tribes and Bands of the Yakama Nation submitted our comments and concerns on the draft versions of these documents to both Ecology and USDOE. Additionally, YN ERWM presented these concerns before the National Remedy Review Board (NRRB) in January 2015.

In light of our reviews of DOE/RL-2011-111, the NRRB's recommendations and subsequent comment responses from Washington State (with Region 10 EPA concurrence), YN ERWM restates our previous positions and issues (see Attachments), and offer the following additional observations and concerns.

1. Human Health Reasonable Maximum Exposure Scenarios:
   a. The tribal exposure scenarios are treated as uncertainties (i.e. tribal subsistence scenario) rather than being included among the selected current and future reasonable land use scenarios. In contrast, the scenarios developed by DOE are treated as current or expected, in the case of industrial and casual recreational scenarios, or speculative but possible, in the case of the residential monument worker scenario. However, existing tribal treaty rights clearly support explicit inclusion of tribal exposure scenarios in setting Preliminary Remediation Goals (PRGs), particularly when more speculative and less-protective scenarios are included.
   b. Inclusion of the rural farmer scenario and exclusion of the tribal subsistence scenario appears to reflect a clear bias and failure to address environmental justice issues. This is problematic, particularly in the context that no farming currently is allowed on the site, and yet treaty rights allow tribal members to engage in many, if not all, of the activities that make up the reasonable maximum exposure for the tribal subsistence exposure scenario
   c. The risk assessment in Chapter 6 of the RI/FS Report does include some discussion of the tribal exposure scenarios and how they would differ from those selected by DOE. In

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particular, the RI/FS Report notes that sweat lodge use would result in greater exposure to contaminated groundwater through dermal contact, inhalation, and greater ingestion of groundwater than in other scenarios. These exposures are discussed in the RI/FS Report but dismissed by stating that institutional controls will prevent use of groundwater until "beneficial uses have been restored," i.e., drinking water standards have been met.

d. However, it is clear from the discussion that drinking water standards are not protective of tribal individuals engaged in a traditional subsistence lifestyle. No evaluation of whether drinking water standards are protective of tribal exposures was explicitly conducted.

e. Along the Columbia River and its shoreline areas, porewater and aquifer sampling data continue to exceedances of water quality cleanup standards. It is the belief of the YN ERWM that a Federal interagency committee composed of the Department of Interior, the EPA, and USDOE should convene to define mutually the terms and conditions of habitability for native people of the Columbia River Basin (including residual contamination standards) and to establish an agreement with the Yakama Nation.

2. ARARs and Preliminary Remediation Goals (PRGs):

a. Risk levels for radionuclides have been set at 1×10-4. While this is within the EPA allowable risk range, it is at the upper limit. For all other chemicals, the Washington State Department of Ecology Model Toxics Control Act (MTCA) risk ranges are treated as ARARs, resulting in risk levels of 1×10-6 for individual chemicals for unrestricted use scenarios and 1×10-5 for industrial use scenarios. The Comprehensive Environmental Response, Compensation, and Liability Act also requires 1×10-6 as the point of departure within the allowable risk range. The RI/FS Report does not provide an explanation for the discrepancy between the risk levels for radionuclides and other chemicals. The higher allowable risk level for radionuclides would allow for the closure of a number of previously remediated waste sites that could require additional remediation under more stringent cleanup standards.

b. The Washington State Sediment Management Standards (SMS) (Section 204 of Chapter 173 of the Washington Administrative Code [WAC 173-204]) have not been identified as ARARs for the Columbia River shoreline. The sediments along the shoreline of the Columbia River should be identified as a contaminated medium and PRGs established for them. While the sediments are contaminated primarily by contaminated groundwater flowing through them to surface water, remediation of groundwater, and therefore sediments, is anticipated to take much longer than the reasonable restoration timeframe of 10 years cited in the SMS. In addition, hexavalent chromium, nitrate, and Strontium-90 is known to be precipitating out in shoreline sediments at the groundwater/surface water interface. Exposure to benthic organisms, shoreline receptors, and aquatic life is occurring due to contaminants in sediments and pore water and thus, the SMS should have been listed as an ARAR.

Freshwater SMS standards were updated in September 2013 and it is Ecology's policy that these standards apply as ARARs if the Record of Decision has not yet been completed. EPA and DOE should ensure that the Proposed Plan takes into account the numerical chemical and biological criteria in interpreting existing sediment chemistry and bioassay results and in setting PRGs for Columbia River sediments in the 100D/H Area and the River Corridor in general.

The SMS contains numeric guidelines, both biological and chemical, as well as numeric risk ranges and remediation time frames that should have been applied in setting PRGs for the Columbia River Corridor and selecting a remedial alternative for the 100-D/H Areas. Pertinent requirements of the SMS include the following:

- o WAC 173-204-561(2) of the SMS reiterates the MTCA risk levels for all chemicals, and explicitly includes radionuclides among these classes of chemicals. The SMS allows selection of up to 1×10-5 for individual chemicals, but only if it is not technically possible to achieve 1×10-6 or if there would be greater net environmental harm in doing so.
- o While the freshwater sediment standards technical report (Ecology, 2011) since adopted into rule is referenced in the RI/FS Report to provide sediment PRGs for many chemicals, uranium is not among the chemicals for which freshwater chemical standards have been developed. However, WAC 173-204-563(3) of the SMS includes numeric biological standards that apply to interpretation of bioassay tests for any chemical. These numeric biological standards are ARARs and can be used as surface water cleanup standards or for monitoring. Although the results of bioassays conducted in the area where the uranium plume intersects the shoreline are discussed very generally in the RI/FS Report, no formal comparison to the numeric standards was conducted.
- o WAC 173-204-570(4) of the SMS reinforces the preference in MTCA for treatment and permanent solutions to the maximum extent practicable.
- o WAC 173-204-570(3) of the SMS requires source control to meet cleanup standards and ARARs at the point of compliance along the shoreline. Additionally, the SMS states "preference shall be given to alternatives that include source control measures that are more effective in minimizing the accumulation of contaminants in sediment caused by discharges."
- o Under WAC 173-204-570(5) of the SMS, cleanup standards are required to be met within a reasonable restoration time frame (the default is 10 years) after completion of the active component of the remedy (i.e., application of polyphosphate treatment solution or active removal of source material). Preference is given to alternatives that achieve cleanup standards within this time frame. Alternative 5 in the 300 Area ROD is the only alternative to meet this requirement.
- o Alternatives that will not meet cleanup standards in sediments or pore water within 10 years after completing active remediation are required by the SMS to establish a Sediment Recovery Zone (SRZ), which is not a permit but rather a substantive requirement of the SMS. The SRZ must be identified in the Record of Decision as part of the selected remedy and should include all elements outlined in WAC 173-204-590. In particular, the SMS requires consideration of whether it is technically practicable to reduce the size and duration of the SRZ, identification of the projected recovery time frame, monitoring to ensure that recovery is occurring, and identification of contingency measures to be implemented if sediments are not found to be recovering as expected.

c. The results of the River Corridor Baseline Risk Assessment (RCBRA) are inconsistently used to justify finding that there is no risk in soils and risks from only nitrate, chromium, hexavalent chromium, and strontium 90 in groundwater. Specifically, if a chemical was found to be present in the 100D/H area at levels of concern but not in the RCBRA, which encompasses a broader area, it was eliminated. However, if a chemical was found to be of concern in the RCBRA, but not through Area-specific evaluations, it was also eliminated. One or the other evaluation should have been used consistently, or in a defined weight-of-evidence approach, to identify chemicals of concern.

d. Both aquatic and terrestrial bioassays were conducted, but toxicity results were discounted if they could not be correlated with specific chemicals of concern at the site. However, it is seldom the case that bioassay results can be effectively correlated with individual chemicals other than through complex toxicity identification evaluation (TIE) procedures or collection of many more paired data points than were obtained for the area evaluated. Sediment Management Standards (SMS) and MTCA regulations do not require identification of the chemical(s) causing toxicity; the toxicity itself can be interpreted as evidence of an unacceptable impact. Due to the difficulty of identifying appropriate numeric screening levels for plants and other trophic levels, field-based surveys should also be used to identify potential chemical impacts, such as evaluating the extent of stressed vegetation or the species richness of plant communities in comparison to baseline.

3. Preferred Alternative (Remedy Selection):
   a. The preferred alternative should include active remediation of strontium-90 in groundwater and vadose scils to address the 100-H plume. As demonstrated by sampled collected during the chromium rebound test in October 2009 the observed activity within the plume exceeds MCLs by a factor of up to 13. Aquifer tube measurements indicate that the plume is discharging to the Columbia River at activities that exceed the 8 pCi/l MCL.
   b. In general the pump and treat system that has been proposed under Alternative 3 appears adequate for treatment of hexavalent chromium in groundwater. However, due to the large area that is being remediated rebound of hexavalent chromium concentrations is possible following completion of remedial actions. Maintenance of the pump and treat system during initial performance monitoring should be incorporated into the final alternative to allow the system to be restarted to ensure groundwater and surface water screening levels continue to be met. Once performance monitoring indicates rebound is unlikely to occur the system can be decommissioned.
   c. Many of the alternatives described in the RI/FS Report include *institutional controls for the protection of human health and ecological receptors during the time frame of this remedial alternative*. However, no institutional control will prevent exposure by aquatic receptors or many terrestrial receptors, such as birds and small mammals. In addition, institutional controls are not appropriate where tribal treaty rights would be affected. The ineffectiveness and/or inappropriateness of institutional controls under these conditions should add additional weight towards the selection of a more protective remedy than Alternative 3.

   In evaluating the proposed remedial alternatives, the RI/FS Report also addresses National Environmental Policy Act considerations, including environmental justice. However, the brief discussion of environmental justice fails to consider tribal treaty rights or tribal uses of the land and water. The statement that "no effects associated with proposed activities associated with the 100-D/H Areas Site could reasonably be determined to affect any member of the public; therefore, they would not have the potential for high and disproportional adverse effects on minority or low income groups" does not appear to have considered both known and protected uses of the site by tribal members and shoreline uses by the general public. Additionally, tribal exposures and tribal treaty rights do not appear to have been considered in the selection of the cleanup standards and Alternative 3, although the tribes are arguably the group most affected by the contamination and remedial actions implemented at the Hanford site.

Overview of NRRB recommendations for the 100-DR-1, 100-DR-2, 100-HR-1 and 100-HR-2 Operable Units at the Hanford Superfund Site March 27, 2015: Little substantive consideration given by EPA Region 10 (or Ecology) to several of the Board's comments/recommendations regarding the following:

1. Relative roles of MCLs and State surface water quality standards in achieving remedial action objectives (RAOs).
    a. Rather than identify definitive tasks or standards to be met to achieve the objective, these (RAOs) remain filled with subjectivity and uncertainty.
    b. YN ERWM disagrees with statement that a risk range of $1X\ 10^{-4}$ to $1X10^{-6}$ will prevent unacceptable risk to tribal health. YN ERWM requests RAO#5 be edited to reflect cleanup levels set at values protective to YN ERWM tribal members .
2. Lines of evidence to support a monitored natural attenuation (MNA) remedy for groundwater and soils.
    a. The Preferred Alternative states nitrate and strontium-90 plumes are co-located within the Cr(IV) plume and mitgration is controlled through the groundwater extraction system. However, statements within the RI/FS report indicate the strontium-90 plume is discharging to the Columbia River at activities that exceed the 8 pCi/L MCL. (see YN ERWM comments on needed treatment for Sr-90).
    b. MNA failures not discussed, nor the costs associated with actions such as potential ESD's (explanations of significant differences) and should be addressed within the Alternatives.
3. Scope and extent of potential risks to human health and the environment associated with the 100-H-36 structure, including potential contamination of sediments.
    a. Response stated characterization data indicated this waste site (an underground spillway/flume for reactor coolant effluent) did not present a threat to human health and the environment. This information is more clearly detailed in Waste Site Reclassification Form No. 2011-012, and supporting "Remaining Sites Verification Package for the ***116-H-5,*** 1904-H Outfall Structure," Rev.0. However, remediation at this site extended only to the Ordinary High-Water Mark (OHWM). Closeout verification information does not indicate inclusion of examination of contamination of sediments.
4. Principle Threats (discussion recommended to be included in site decision documents) :
    a. While the proposed plan includes a discussion of principal threat waste, it defines these as only wastes associated with 100-D/H such as fuel fragments, concentrated liquid sodium dichromate, and highly Cr(VI) contaminated soil and debris, stating no waste sites remain in the source OUs with contaminant concentrations that would constitute principal threat waste. CERCLA asks that all *primary sources* of contamination be included in RI/FS evaluations. As stated, it is misleading to the public. The 100-D/H Area reactors are the primary sources that are not considered in this Proposed Plan yet the groundwater beneath these most certainly are contaminated.
5. Institutional Controls and Future Land Use: (Conflicting future uses of the site were presented to the Board. The Board's recommendation was clearly identify the future land use and how the preferred alternative will be protective of that use and which specific IC would be needed, and upon what authority they would be enforced over the long-term).
    a. The response provided to the Board and within the RI/FS report (DOE/RL-2010-95, Rev 0) more clearly defines the approach to land use, but does not clarify or consider how the preferred alternative will be protective of traditional Tribal use of the lands.
    b. The Proposed Plan generally indicates the types of institutional control applied to waste site but does not identify what COCs are responsible for the exceptionally long periods of time required for IC (e.g., ICs~187 yrs. 116-D-1A (2203)). The Proposed

Plan does not identify how many sites will require ICs after the implementation of preferred alternative or potential impacts to groundwater should ICs fail.

   c. Contrary to what is implied, YN ERWM does not consider itself to be participants in USDOE's land use planning process.
   d. The Washington Dept of Fish and Wildlife currently recognizes Yakama treaty right to hunt within the Hanford Reach Nation Monument, and acknowledges the tribe's corresponding off-reservation co-management and law enforcement role there. We believe a similar recognition and acknowledgement by USDOE is long overdue for the entire Hanford Site.[1]& .[2]

6. Remedy Performance: (In the event a proposed treatment technology does not remove contaminants to a protective level in the soil or groundwater, the Board recommends inclusion of contingency treatment technologies to achieve remedial action objectives).
   a. Response indicated that groundwater monitoring results have provided data that support the attenuation of the nitrate plume and decay of strontium-90 that will achieve cleanup within estimated time frame for the alternatives. The Preferred Alternative (or Proposed Plan) does not include the required description of the contingency measures that will be implemented should the monitoring show that natural attenuation is unable to achieve the cleanup goals. Conditions that would trigger the contingency should also be specified (e.g., continued plume migration or contaminant levels are well above levels predicted for a specified time) (EPA 540-R-98-03 1).
7. Cleanup levels: (It is not clear whether completed interim remedial actions will satisfy the final ROD cleanup levels). Response stated waste sites remediated under the interim ROD cleanup levels after 2012 will be compared to final ROD cleanup standards to identify whether the cleanup is protective of HHE.
   a. The YN ERWM Program does not support "backsliding" on any of the more stringent IROD cleanup values.
8. ARARs: (The Board recommended the Tri-Party work together regarding application of MTCA Method B. The Board also recommended the proposed plan and decision document should explain how cleanup adequately meets the National Historic Preservation Act (NHPA) consultation process and identification of specific and concrete steps for how cleanup in the cultural areas will proceed in a manner that prevents disturbances and the associated costs.)
   a. Response indicated agreement that MTCA and NHPA are ARARs but disagree with Board recommendation that the proposed plan or decision document are the appropriate document to explain the NHPA process, preferring to reflect this in a 'guiding document' that will be used in post-ROD decision documents. YN ERWM believes the ROD is the appropriate document to capture the full NHPA process requirements.
   b. YN ERWM supports response by EPA (and Ecology) evaluation of appropriateness of the 15ft depth for RTD sites due to *proximity of the Columbia River, and other considerations.*
9. Monitored Natural Attenuation: (Recommendations that decision documents include an explanation of the MNA lines of evidence that support how radioactive decay will address the strontium plume consistent with OSWER Directive No. 9200.4-17P, April 1999, etc. Recommendation that a containment alternative for groundwater be considered to prevent negative impacts to the river from strontium-90 during decay period).

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[1] YN ERWM letter to Secretary Moniz, USDOE, 2016. [Attachment #2]

[2] YN ERWM letter to Marlene Zichlinsky, USDOI, 2012.[Attachment #3]

a. Response did not provide lines of evidence to support MNA and indicate no need to provide a containment alternative. See comments on #6 above.

10. Stakeholders: (Acknowledgement that a number of issued discussed during presentations to the Board were related to tribal consultation and cultural values, as captured by the NHPA and the treaty rights asserted by YN ERWM, and recommendation that decision documents clearly state the cultural resource issues for each specific waste site be addressed prior to completion of the selected remedial action for the waste site.).
    a. Response agreed with recommendation to continue to work with the Tribes regarding cleanup in culturally sensitive areas, yet continued to disagree with recommendation to include information (e.g., protocols or procedures) within decision documents. See YN ERWM comments on #8.
11. Effectiveness: (Board recommend re-evaluation of long-term effectiveness and permanence criterion and the reduction of toxicity, mobility, or volume (TMV) by treatment criterion for Alternative 4, etc).
    a. Response indicated Alternative 2 & 3 may be rated slightly lower than Alternative 4 yet Table 4 of PP (evaluation of remedial alternatives) lists them all equal. For long-term effectiveness and performance.
    b. Response indicated Alternative 4 is said to provide the least reduction of TMV because it involves the greatest RTD volumes, yet they are rated equal. While YN ERWM recognizes the criteria for evaluation of TMV does not consider RTD as treatment, source removal definitely overall reduces toxicity, mobility, and volume.
12. Policy and Guidance: (Board requests future decision documents should fully explain use of non-EPA document such as RESRAD over requirement to *use of our guidance*).
    a. Response stated, when appropriate, the Region (i.e. Region X) may choose to use non-EPA guidance tools and that the rationale for using these types of tools is provided in the supporting technical documents. YN ERWM has previously noted concerns with RESRAD.

We look forward to discussing our vision of cleanup and our concerns regarding the current cleanup plans for Hanford with you further.

Sincerely,

Marlene George

Marlene George
Yakama Nation Acting ERWM Program Manager

cc:
Doug Shoop, Manager, US Department of Energy
Ken Niles, Oregon Department of Energy
Rod Skeen, CTUIR
Gab Bohnee, Nez Perce
Administrative Record

Attachments #s:1,2,3,4,5,6,7, 8, 9

Attachment #1: Yakama Nation ERWM Comments on the 100-D/H Area Proposed Plan & Remedial Investigation / Feasibility Study:

Protection of Yakama Nation treaty rights, including full access to cultural resources on the Hanford Site by the Yakama Nation:
Ensuring Treaty compliance is a critical intergovernmental concern. By and through this document, USDOE supports the participation of Yakama Nation in activities related to remediation and restoration of resources affected by Hanford and implements its trust responsibility and enforceable obligations to the Yakama Nation. From the YN ERWM ERWM's perspective, efforts to include the tribal program in the development of the RI/FS/PP were weak.

a. The Treaty, which reserves specific rights and resources for the Yakama Nation, should be acknowledged as an ARAR or a "must comply" standard for cleanup decisions. This includes the right to practice full subsistence activities in Yakama Nation usual and accustomed use areas. All future Interim and Final Record(s) of Decision(s) should be in harmony with treaty rights of the Yakama Nation under the Treaty of 1855 including upland treaty rights.
b. All statements included in the Proposed Plan and RI/FS documents that convey the USDOE's "beliefs" or "positions" regarding the extent of tribal treaty rights, including statements that it is the USDOE's position that Hanford is not "open and unclaimed land," should be removed from the documents.
c. All potential impacts to treaty-reserved rights and resources should be thoroughly evaluated and considered in a revised RI/FS and Proposed Plan and supporting documents. The preferred alternative should be consistent with the USDOE's American Indian Policy, with the federal trust responsibility, and with the terms of the Treaty of 1855.
d. The YN ERWM Program believes Preferred Alternative is not protective; does not meet ARARs; is inconsistent with anticipated (*and feasible*) future land and groundwater use; and does not represent the maximum extent possible a permanent solution in a cost effective manner.

Land Use:
Language in the Proposed Plan and selected Preferred Alternatives indicates that DOE is not considering cleanup to unrestricted use and is striving toward a less stringent cleanup based on the Comprehensive Land-Use Plan (i.e. use of Method A-Industrial Standards for Arsenic vs. Method B-Unrestricted Standards). While cleanup decisions may ultimately be defined by management boundaries, the risk assessment should be based upon actual human behaviors.

The Preferred Alternative for groundwater with ICs for extended time periods is inconsistent with the CLUP (It is stated that cleanup actions will support reasonably anticipated future land uses consistent with the Hanford Reach National Monument and "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement (the "CLUP') (HCP EIS) (64 FR 61615). CLUP is designated for 50 years operational and 100 years for institutional controls. Beyond that time period, the site could be used for any and all types of land use; including irrigation. It is known that there will be continued releases above cleanup levels for over 100 years. Yakama Nation ERWM remains concerned that any remedy reviews (i.e. 5-year ROD reviews) will not include appropriate sampling actions or technological systems review to confirm performance of these IC.

a. Furthermore, the final CLUP did not include any suggestions, or address any concerns provided by the Yakama Nation.[3]
b. All potential impacts to treaty-reserved rights and resources should be thoroughly evaluated and considered in a revised RI/FS and Proposed Plan and supporting documents, including use of the Yakama Nation Risk Scenario as the basis for setting cleanup levels.
c. The preferred alternative should be consistent with the USDOE's American Indian Policy, with the federal trust responsibility, and with the terms of the Treaty of 1855.
d. The CLUP was a Federal undertaking that determined what type of activities could occur within the Hanford landscape, yet traditional cultural properties (TCP) were never addressed. Areas designated for industrial use, research, and development, and conservation mining could have significant impacts on the landscape, and adversely affect a TCP should one be present.

Cultural Resources & Institutional Controls:
The YN ERWM expects a discussion of the culturally sensitive areas with reference to both historic and prehistoric Native American use within the Proposed Plan and the decision documents (i.e. RI/FS/ROD).The YN ERWM requests that these document include a clear description of the cleanup (i.e. protocols and procedures) required in cultural areas. The YN ERWM requests consultation with DOE to determine if there is a need for an Memorandum Of Agreement (MOA). This MOA would then need to be incorporated into the ROD prior to finalization.

Pgs ii-iii (RI/FS), states cultural surveys are routinely conducted to protect sensitive areas. Surveys are only conducted to support projects. The use of the word "routine" is misleading the reader. Section 110 surveys have not been conducted to fully understand the nature and extent of the cultural resources present. A traditional cultural property (TCP) study has not been conducted to determine if TCPs are present, therefore these resources are not being taken into consideration in determining adverse effects to these resources. Site wide undertakings and decisions such as clean up levels, restoration, vegetation management, land use plans, the use of barriers and institutional controls need to take into consideration their effects on TCPs. It is the obligation of DOE under the National Historic Preservation Act (NHPA), Section 110, to inventory and evaluate properties to determine eligibility under the agency's jurisdiction.

There is the assumption of, and over-reliance on, the use of Institutional Controls to ensure protectiveness rather the primary objective that is protectiveness of the environment and human health through selection of remedies that employ treatment technologies that permanently and significantly reduces the volume, toxicity, or mobility of hazardous substances, pollutants, or contaminants.

The philosophy underlying the cleanup of Hanford should be guided explicitly by the goal of allowing Native Peoples to safely live the lifestyle to which they are entitled. This way of thinking will be particularly important when considering how to incorporate non-quantitative elements into the Preferred Alternative such as the spiritual or cultural value of a site.

The Yakama Nation has previously expressed deep concern in leaving in place large quantities of hazardous radiological and chemical wastes on the site with the long-term

[3] Yakama Nation letter to John Wagoner, Manager, Department of Energy, Richland Operations Office, June 30, 1998.

use of institutional controls as protective measures. DOE has acknowledged Sr-90 is present throughout the vadose zone in the 100 Area, and it will continue to impact groundwater quality until the residual contamination is removed through radioactive decay. Within the timeframes that are realistically applicable to this scenario (estimated to be approximately 200 years) institutional controls will almost inevitably fail and allow some exposure to human health and the environment.

Use of institutional controls must be addressed in light of, and with appropriate deference to, Yakama Nation treaty rights which guarantee use of the land for specific purposes which are considered inseparable from the Yakama way of life.

a. Regarding the use of institutional controls at DOE waste sites, the National Research Council pointed out: "While there is typically a tacit recognition that engineered barriers and waste stabilization approaches have limited periods of effectiveness, these technologies are frequently employed with inadequate understanding of, or attention to, the factors that are critical to their success. These include the need for well-conceived plans for performance monitoring that identify and correct potential failures and plans for maintenance and repair, including possible total system replacement." (NRC, 2000). This level of planning, both technical and financial does not appear to have been included in the analysis of alternatives. YN ERWM requests this level of detail be included in the Proposed Plan and ROD rather than simple statements that this will be in the RD/RAWP.
   i. Footnote in Table 9-4 indicates additional IC maybe included through closure reclassifications. All potential costs estimates must be identified within the remedy selected for each waste site. It is understood that ICs will be maintained for a minimum 10-15 years beyond the time that the cleanup goals are initially achieved. YN ERWM requests that DOE verify that cost estimates for each alternative are correct.

b. Currently, there are several projects and major decisions that will be made that affect the entire Hanford Site, yet still a comprehensive Traditional Cultural Property (TCP) study has not been performed. Site wide undertakings and decisions such as clean up levels, restoration, vegetation management, land use plans, the use of barriers and institutional controls need to take into consideration their effects on TCPs. It is the obligation of DOE under the National Historic Preservation Act (NHPA), Section 110, to inventory and evaluate properties to determine eligibility under the agency's jurisdiction.

c. Cultural resources have not been adequately addressed in either of the 100-D/H documents (RI/FS and PP). Please refer to the EPA document, <u>CERCLA Compliance with Other Laws Manual: Part II</u>[4] (hereafter referred to EPA Guidance), where it details out how to be in compliance with the NHPA during the CERCLA process in Section 4 (attached). Section 4.1.3 clearly states efforts should be made to identify cultural resources. Generally DOE carries out these efforts during the Section 106 process for each project, however between 2003 and 2011, 127 projects were carried out under the "no potential to cause effect" classification in the 100-D/H Areas. This means these projects were completed without proper Tribal consultation, and did not have a full Section 106 cultural review.

d. As outlined in the EPA Guidance document Section 4, once cultural properties are

[4] RPA, CERCLA Compliance with Other laws Manual: Part II. Clean Act and Other Environmental Statues and State Requirements, EPA/540/G-89/009, OSWER Directive 9234. 1-02, August 1989

identified it needs to be determined if they are eligible and if the proposed actions will have an adverse effect on the eligible properties. Further the EPA Guidance states any adverse effects to eligible properties must be mitigated, "this mitigation plan should be included in an MOA signed by the consulting parties (page 4-10)". EPA Guidance 4.1.4.2 states, "The remedial design process should provide for scheduling and funding of the development and implementation of a detailed cultural resources mitigation plan."

The EPA Guidance 4.1.5 (page 4-11) details proper documentation, "Compliance with the NHPA requirements should be documented in the RI/FS report, describing, as appropriate, the determination of whether cultural resources are or are not present; the results of the Cultural resource survey (CRS) process and recommendations on the eligibility of the identified cultural resources for the national Register; the impact, if any, on such resources; and the associated mitigation measures to minimize potential "no adverse" or "adverse" effects. When cultural resources are present, the ROD should identify the NHPA as an ARAR. For each alternative, the ROD should identify whether the alternative will comply with substantive NHPA requirements. For the selected remedy, the ROD should also include a brief statement describing what compliance with NHPA entails, e.g. that there will be no impact on cultural resources or what mitigation measures will be required and should consultation with DOE determine the need for a Memorandum Of Agreement (MOA), this MOA should be incorporated into the ROD prior to finalization.

e. The 40 CFR 300.435(b)(2) states; "During the course of the RD/RA, the lead agency shall be responsible for ensuring that all federal and state requirements that are identified in the ROD as applicable or relevant and appropriate requirements for the action are met."

f. It is evident the RI/FS and Proposed Plan documents do not meet EPA guidelines. DOE has not performed the necessary tasks to determine effects to cultural resources, in consultation with the YN ERWM to determine effective avoidance, minimization, and/or mitigation measures. The final ROD must reflect compliance with NHPA, which will be impossible with current data.

g. YN ERWM requests EPA and DOE to complete the necessary task of "describing what compliance with NHPA will entail" and if necessary based on proper field evaluation complete a necessary MOA to mitigate for any adverse effects to the newly discovered TCPs, in consultation with YN ERWM.

h. Although the report speaks of ethnographic studies by PNNL, there has been no attempt to identify new cultural properties or traditional cultural properties in many years, as mandated under Section 110 of the National Historic Preservation Act. The Hanford Cultural Resource Management Plan outlined a process for identifying one TCP per year; however this has not been done. DOE has not been meeting their Section 110 obligation of identifying cultural properties on the Hanford site. There are known TCP that have not been evaluated that include:
   i. White Bluffs
   ii. Coyote Rapids
   iii. Columbia River
   iv. Wahluke Slope
   v. Other potentially unknown TCPs in the Hanford area.

Cultural properties are only being addressed through the Section 106 process, on a project by project basis, which is entirely ineffective. This piecemeal method does not allow for a comprehensive landscape study and does not allow for proper consultation with YN ERWM. None of the Alternatives were evaluated against the nine balancing criteria based on effects on a TCP. The YN ERWM Program requests this be done.

i. It is unclear as to what is in place to ensure compliance with the Antiquities Act of 1906. Under the Antiquities Act of 1906, the Hanford Reach National Monument (HRNM) was created by Proclamation 7319 in 2000. The Proclamation lists the resources that are to be protected including: riparian, aquatic, and upland shrub stepped habitats, native plant and animal species as well as archaeological, historic, and sacred sites throughout the monument. While the majority of the HRNM is managed by USFWS, the river corridor lands underlying the Hanford reactors and operational areas are managed by DOE. These lands contain high levels of contamination and significant cultural resources.

j. It is recognized in the Proclamation that DOE has the responsibility to clean up hazardous substances and the restoration of natural resources. The Proclamation further states, "As Department of Energy and US Fish and Wildlife Service determine that lands within the monument managed by the Department of Energy become suitable for management by the US Fish and Wildlife Service, the US Fish and Wildlife Service will assume management by agreement with the Department of Energy." Clearly it was the intent of the President that the HRNM land would be cleaned, restored, and then managed by the USFWS.

The entire HRNM would then be managed according to the mission of the USFWS guided by the HRNM Comprehensive Conservation Plan (CCP), which states a primary purpose of, "Protect and restore biological, cultural, geological and paleontological resources." Areas in the River Corridor 100 Areas are some of the most contaminated, and it remains the obligation of DOE to clean and restore these areas within the HRNM and areas that could affect the HRNM in consultation with the Department of Interior. Anything other than complete cleanup and restoration of the HRNM would be in direct conflict with the Antiquities Act, Proclamation 7319, and the HRNM CCP.

k. Full compliance with government-to-government requirements are not fulfilled by the vague statements found in the Proposed Plan (page 10) and Table 10-7 (RI/FS): "The DOE and EPA consult with tribal governments before taking actions, making decisions, or implementing programs that may impact tribal traditional, cultural and religious values and practices; natural resources; and treaty and other federally recognized and reserved rights. The Tri-Parties take a proactive approach to soliciting input from tribal governments on Tri-Party Agreement (Ecology et al., 1989) policies and issues. Specifically, the Tri-Parties conduct periodic briefings for the affected tribal governments. DOE routinely provides copies of Tri-Party Agreement (Ecology et al., 1989) documents concurrently to tribal governments, Ecology, and EPA"

   i. The Proposed Plan and decision documents do not adequately explain how cleanup meets the National Historic Preservation Act consultation process, including, for example, the specific and concrete steps for how cleanup in the cultural areas will proceed in a manner that prevents disturbances (e.g., specific soil sampling designs to protect artifacts).

l. THE YN ERWM program requests consultation regard decisions for D-Island. We remain concerned as it is as bounded by a casual recreational user scenario) (page 8-59, RI/FS) which is not protective of YN ERWM tribal members.

Proposed Alternative: Alternative 4a:

Several sites indicate need for more remediation at reasonable depths (~16ft to 50ft) which would minimize and/or eliminate the need for ICs with an overall reduction in costs of groundwater treatment systems, monitoring and maintenance and reliance on IC for protection of Human Health and the Environment, with the permanent removal of contamination. The Proposed Plan lists 34 waste sites located in the 100-D and 100-H areas with deep radionuclide contamination that exceeds human health criteria, All of these sites are within several hundred yards of the Columbia River shoreline and within ~70ft of the groundwater table, several within ~35ft of groundwater.

Radionuclides associated with historical waste disposal contribute a majority of the ELCR (cesium-137, cobalt-60, europium-152, europium-154, nickel-63, and strontium-90). Modeling indicates these radionuclides will decay to levels corresponding to EPA's target risk range within ~ 185 years. However, these results indicate the potential for unacceptable exposure from deep soil excavation and drilling activities within these defined areas. Use of ICs for beyond 100 years is simply not supported by science. Furthermore use of Institutional Controls along the River shoreline is clearly in violation of YN ERWM Treaty Rights.

YN ERWM believes incorporation of the following points into Alternative 4a would result in best performance overall with less disadvantages or uncertainties when compared to the other alternatives along with the highest degree of certainty that the alternative will prove successful in meeting the RAOs and gaining public acceptance. Costs increases could be minimal as stated "modifications to the existing pump-and-treat facilities may provide the additional capacity."

Point 1: Additional remediation to depth (~16ft to 50ft below wastes site final remediation depths) for the following waste sites identified in Table 6 of the Proposed Plan to have MNA and ICs as their remedy. Although some call for ICs under a 100 years, these waste sites are within ~35-60ft of the groundwater table and/or adjacent to the River shore and are associated with radionuclides such as effluent from retention basin during reactor fuel element failure shut downs.

a. 100-D Area sites: 100-D-48:1, 100-D-49:1, 100-D-49:2, 116-D-1A & -1B, 116-D-7, 116-DR-1 & 2, 118-D-6:3 & :4
b. 100-H area sites: 100-H-1, 100-H-11, 100-H-12, 116-H-1, 116-H-7, 118-H-6:3, 118-H-6:6

Point 2: Technicium-99 hot spot soil' remediation at waste sites adjacent to groundwater monitoring wells D-5-21, D-29, D-5-129, D-8-62, H4-49, H4-58, H4-61H4-63, H4-72, H4-69, H4-15(e.g., 116-H-1 Trench, the 116-H-7 Retention Basin);

Point 3: Groundwater treatment of Strontium plume;

Point 4: Increased Capacity Groundwater Pump & Treat for Groundwater as necessary [including treatments for Nitrates].

Supporting info to Alternative 4a:

a. Tables 6-13 through 6-19; Tables in Appendix G and information in Appendix M: Several sites indicate need for more remediation at reasonable depths (~16ft to 50ft) would minimize and/or eliminate the need for ICs with an overall reduction in costs of groundwater treatment systems, monitoring and maintenance and reliance on IC for protection of Human Health and the Environment, with the permanent removal of contamination.

b. Current designation of short-term effectiveness of Alternative 3 is inconsistent with previous classification of similar Alternatives. Classification should be reduced to moderate.
c. Current designation of reduction of toxicity, mobility, or volume by treatment should be the moderate across the alternatives. Discussion of cost (Section 10.3.7) state the RD/RAWP will determine if new facilities are needed or if modifications to the existing pump-and-treat facilities will provide needed capacity. There is not an affirmed design to support the current designation of Alternative #3 higher than other alternatives.
d. Current designation of long-term effectiveness and permanence should be higher for Alternative #4 than Alternative #3. We believe the weight applied to ranking of the effectiveness of the alternatives to be incorrect. Alternative 4 far better more fully meets this definition than the other alternatives (i.e., The NCP (40 CFR 300) defines effectiveness as the "degree to which an alternative reduces toxicity, mobility, or volume through treatment; minimizes residual risk; affords long-term protection; complies with ARARs; minimizes short-term impacts; and how quickly it achieves protection.") RTD for waste site certainly reduces the volume of contamination over grouting even given the statement that RTD is not treatment. RTD requires treatment should conformational sampling indicate cleanup levels are exceeded. Grouting does not "*permanently reduce*" the TMV.

Evaluation of the Comparative Analysis of Alternatives:

a. Protection of the health of Yakama Nation tribal members and sustainable habitability of Hanford for Yakama Nation Tribal members, including their safety and welfare or trust resources, is a major concern of the Yakama Nation ERWM Program. Accumulated scientific evidence demonstrates that Native Americans are, as a statistical cohort, subject to the highest risk of disease and cancer from exposure to environmental contaminants. The Columbia River Basin Fish Contaminant Survey (EPA, 2002) is a technical report that assesses the amount of chemical pollution in certain species of fish, and the potential health risks from eating fish those fish. The study is based on fish samples collected between 1996 and 1998 from tribal fishing waters in Washington, Oregon, and Idaho. EPA funded the study which was coordinated by the four member tribes of the Columbia River Intertribal Fish Commission (CRITFC).

b. YN ERWM requests official DOE recognition that Native Americans living near the Hanford site are the most vulnerable people to environmental contaminants, as underscored by EPA's Columbia River Fish Contaminant Survey. Adults in CRITFC's member tribes who eat fish frequently (48 meals per month) over a period of 70 years may have cancer risks that are up to 50 times higher than those of the general public who consume fish about once a month.

c. We remain concerned the health of Yakama Nation tribal members with the needed extensive remediation of the groundwater as there will be continued effects and potential new COCs from the 100-D/H Area Reactors which are not considered in this Proposed Plan. CERCLA asks that all *primary sources* of contamination be included in RI/FS evaluations. To state remaining primary sources are minimal is misleading to the public as the 100-D/H Area reactors are the primary source. As upland plumes enter the river, we are concerned that any remedy reviews will not include actual sampling actions or technological systems review to confirm performance or to consider these missing source area contaminants.

d. YN ERWM does not believe the Preferred Alternative *as a remedy for* the groundwater meets the selection criteria, in particular in its ability to demonstrate no adverse impacts to drinking water supplies, other groundwaters, surface waters, ecosystems, sediments, air, or other environmental resources. We believe Preferred Alternative is not protective does not fully meet and/or identify all ARARs; is inconsistent with anticipated (*and feasible, including exercise of treaty rights*) future land and groundwater use; and does not represent the maximum extent possible a permanent solution in a cost effective manner.

e. Alternative 4's evaluation should read Alternative 4 RTD for Waste Sites and Pump-and-Treat for Groundwater meets threshold criteria, performs well for long-term effectiveness and implementability, and performs well for short-term effectiveness and reduction of TMV.

f. Soil contamination should be documented in both vertical and horizontal directions from <u>all</u> potential sources *(EPA/540/G-89/004-Guidance for Conduction Remedial Investigations and Feasibility Studies Under CERCLA)*. None of the Alternatives fulfill this requirement. This would necessarily include contaminant plumes underlying the 100-D/H Area reactors.
   i. The 100-D/H Area site boundaries include the Columbia River and its shorelines. Portions of the site are within the boundaries of the National Monument. Interactions among media (i.e., soils and groundwater) at the 100-D/H Area are important. As such, the effect of source control actions on the remediation levels or time frames for other media should be evaluated. Data should *not* be selective (e.g., excluding waste sites or contaminants) but should include all data sources applicable to evaluating current and future conditions at all upland, riparian, and nearshore operational and non-operational areas. A holistic approach would ensure that protective decisions are made for the site in its entirety. YN ERWM request DOE include evaluation of risks due to area reactor plumes be included in the RI/FS.

g. Consideration of the adequacy and reliability of controls does not appear to have been done during the evaluation of the Long-term Effectiveness and Permanence of the alternatives. Was there an assessment of the reliability of management controls for providing continued protection from residuals? Clarify if done location in document(s), and clarify if the evaluation include the assessment of the potential need to replace technical components of the alternatives, such as a cap, a slurry wall, or treatment systems (groundwater wells/treatment systems-see bullet below) and the potential exposure pathway and risks posed should the remedial action need replacement. YN ERWM requests DOE revise the Proposed Plan to address these deficiencies and include detailed cost information for each alternative.
   i. Uncertainties remain regarding the potential for continued contribution of residual vadose zone contaminants to underlying groundwater. Strategies for addressing potential residual contamination will be discussed in the FS. Remedial alternatives evaluated in the FS portion of this report will consider monitoring requirements that will verify the assumptions for vadose zone contaminant behavior. Existing groundwater plumes of Cr(VI), strontium-90, and nitrate near the reactor condensate cribs, the FSBs, the retention basins, the cribs, and the cooling water head houses should be considered for specific monitoring of potential future vadose zone contributions. This action does not appear to be specifically included in the Alternatives.
   ii. The monitoring well network and performance monitoring program will be defined in the remedial design phase of the project. This is required to be presented in the Preferred Alternative and discusses in the Proposed Plan with all costs estimates presented.

h. Alternative design details (i.e., specific provisions for sustainable elements) are to be identified in the RDR/RAWP to be prepared after the ROD is issued. EPA guidance (EPA 540-R-98-031) states this information should be included in both the Preferred Alternative Section of the Proposed Plan and the Selected Remedy Section of the ROD, not in the workplan. YN ERWM program requests this information be included.
   i. Examples in Proposed Plan: "Specific pumping rates, numbers of wells, and remedial action duration were developed for comparison purposes and will be further refined during remedial design." "

   i. Footnote in Table 9-4 indicate additional IC maybe included through closure reclassifications. All potential costs estimates must be identified within the remedy selected for each waste site. YN ERWM requests that DOE verify that cost estimates for each alternative are correct.

j. Nothing in the Alternatives has discussed disposition of boiler sludge YN ERWM program requests clarification of disposal of boiler sludge. If not yet disposed, YN ERWM requests this waste stream and its disposal be included in the preferred alternative and ROD remedy.

k. It is unclear if any of the Alternatives were evaluated against the nine balancing criteria based on what happens with transition to Long-term Stewardship prior to completion of remediation under the Record of Decision (e.g., Was a cost benefit analysis of remedy costs including long-term stewardship costs done?) The environmental consequences of doing this action or not doing it have not been evaluated. It is unclear how any of the Alternatives can ensure compliance with the balancing criteria with transition into Long-term Stewardship. These analyses should be done as this action will clearly need to be reflected and integrated into the final ROD.

General Comments on the Analysis of the Alternatives:

a. The YN ERWM disagrees with use of for arsenic and lead, 2007 MTCA ("Tables" [WAC 173-340-900]), Table 740-1 Method A, soil cleanup level for unrestricted land use of 20 mg/kg and 250 mg/kg for arsenic and lead. Cleanup levels for arsenic should be set at Hanford site background levels ~7mg/kg. Cleanup levels for lead should be set no higher than ~150mg/kg.[5]

b. YN ERWM disagrees with the Cr (VI) proposed cleanup level which is set to the interim action remedial action goal (RAG) of 2.0 mg/kg (DOE/RL-96-17, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*). YN ERWM believes the distribution coefficient value used was incorrectly derived and should be set at 0.0, supporting Hexavalent Chromium=0.19 mg/kg (soil protective of groundwater).

c. The Preferred Alternative (or Proposed Plan) does not include the required description of the contingency measures that will be implemented should the monitoring show that natural attenuation is unable to achieve the cleanup goals. Conditions that would trigger the contingency should also be specified (e.g., continued plume migration or contaminant levels are well above levels predicted for a specified time) (EPA 540-R-98-031). Update and provide details in the Proposed Plan for public review including cost of implantation of contingency measures.

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5 See Attachment #4

d. The most important deficiency in this alternative is the decision not to deal with the strontium-90 plume. Given that strontium was reported to be above the Drinking Water Standard in ~38 percent of detected unfiltered groundwater samples in the 100-H Area, a more aggressive approach to the strontium is necessary. Using 44+ years of recirculating pump-and-treat groundwater and monitored natural attenuation (MNA) does not seem prudent. The Columbia River is a discharge boundary for the aquifer system, and the unconfined aquifer is in direct communication with the river along the shoreline of 100-D/H. By their inter-connectedness, to ensure continuity of the Hanford site groundwater remediation efforts, treatment of Strontium-90 should also be included in the 100-D/H ROD GW remediation plan.

   i. The YN ERWM Program requests DOE revise the RI/FS and Proposed Plan action alternatives to incorporate proven treatment technologies, or technology that is supported by a full CERCLA Feasibility Study as the best alternatives to reduce volume, toxicity, and mobility of the strontium-90 contaminated groundwater. Any contamination that is mobilized as part of the proposed remedial actions should be contained, containerized, and disposed of according to the applicable legal requirements.
   ii. MNA failures isn't discussed, nor the costs associated with actions such as potential ESD's (explanations of significant differences). There is also no provisional remediation plan (i.e., Contingency Plan) for strontium if MNA is found not to work. YN requests this been done and all Alternatives updated to reflect this.
   iii. What contingencies are planned should the selected groundwater remediation remedy not meet RAOs as described for other COCs?
   iv. Clarify if short-term effectiveness evaluations for all alternatives were based on only the time to build/implement the remedy or if it includes the time to achieve all remedial action PRGs.

e. Clearly the discussions within these documents (and other reports; aquifer tube samples) supports the need to define the Columbia River adjacent to the Hanford site boundaries as an Operable Unit. YN ERWM program requests clarification as to what consideration is being given to establish an operable unit for the Columbia River.

f. YN ERWM program requests clarification as to whether the supplemental survey (as required by data gap table) to be conducted at 100-D when remediation has been completed. If not identify when this will be done and potential affects to alternative selection, costs, etc.

g. The Proposed Plan's Preferred Alternative 3 does not include all the required information: The Preferred Alternative does not include the required description of contingency measures that will be implemented should the remedial alternative monitoring show that the alternative is meeting remedial action objectives and performance criteria.

   i. Conditions that would trigger the contingency should also be specified (e.g., continued plume migration or contaminant levels are well above levels predicted for a specified time) (EPA 540-R-98-031). The Proposed Plan and Preferred Alternative should incorporate remedial actions that will meet these thresholds and state explicitly the contingency measures and additional actions that will be taken should CERCLA monitoring demonstrate the Preferred Alternative has not worked as planned. YN ERWM requests DOE update the Proposed Plan to provide details for public review including cost of implementation of contingency measures.
   ii. Use of natural attenuation as a component of a groundwater remedy requires contingencies for additional or more active remedial actions to be incorporated that are triggered by specific contaminant concentration levels in the site groundwater monitoring

network (or other criteria as appropriate).[6] These contingencies were not developed or included in the RI/FS or the Proposed Plan.

Comments Regarding Groundwater:

Groundwater discharges to the Columbia River via springs and areas of upwelling. Groundwater:

a. The Proposed Plan for cleanup of the 100-D/H Area and the associated RI/FS Report does not support an adequate cleanup of the area groundwater or soils. While identified waste sites were heavily contaminated, the fact remains that a significant quantity of strontium 90 and Cr(VI), cesium-137, technicium-99 (and other radionuclide contaminants and RCRA metals [e.gs., arsenic, antimony barium, cadmium, , carbon tetrachloride, cobalt, copper, lead, nickel, silver, and zinc] and nitrates) will remain unaddressed under the current Preferred Alternative. In order to achieve long-term protection of the Columbia River, these contaminants will need to be removed from the vadose zones in the 100-D/H Areas. YN ERWM Program believes the Preferred Alternative is not protective does not meet ARARs; is inconsistent with anticipated (*and feasible*) future land and groundwater use; and does not represent the maximum extent possible a permanent solution in a cost effective manner.

b. Exposure pathways to contaminated media have been documented to be complete. Both the Proposed Plan and the RI/FS assert that there are "no complete exposure pathways for risk to human populations" based on the formally designated land use and existing institutional controls. However, this statement is contradicted by DOE's own description of the 100-D/H Areas. Natural seeps are observed along the shoreline, in the riparian zone, associated with the early summer drop of the Columbia River water levels. These seasonal seeps represent secondary contaminant sources to the riparian zone." The seeps are monitored by the DOE's Public Safety and Resource Protection Program. None of the Alternatives address remediation of this complete pathway.

c. YN ERWM believes there are areas of uncertainty within the groundwater modeling approach (STOMP-1D), and its application is inappropriate until all issues are resolved. The graded approach to evaluating groundwater protection and STOMP-1D modeling has many uncertainties (e.g., what criteria will be used to assess the validity of the Preliminary Remediation Goals [PRGs] as they apply to site conditions).

   i. Application of this model for making cleanup decisions is inappropriate until all issues are resolved. (See Attachments #5).

   ii. Clarify if an irrigation recharge scenario was used. (See Attachment #7).

d. Contaminant concentrations in some springs are above applicable water quality standards (as noted in DOE/RL-2013-18, Revision 0 Hanford Site Environmental Report for CY2012).

   i. Wells # 199-H4-5 and 15 A, B, C. should be in the RCRA TSD groundwater monitoring network for the 183 H unit as it is closely associated. See Attachment #6 regarding the groundwater monitoring and permit for the 183-H TSD unit. YN ERWM requests responses to comments on 183-H.

   ii. Minimum Standards for Construction and Maintenance of Wells" (WAC 173-160 & -162), should be the ARAR regulations for the location, design, construction, and abandonment all 100-D/H Area wells.

[6] EPA; Directive 9234.2-25

e. Ecology has consistently requested use of hexavalent chromium K_d=0 mL/g, based on field observations of chromium mobility and results of site-specific leaching and batch sorption tests. The Proposed Soil cleanup levels for Hexavalent Chromium to ensure protection of groundwater should be set at 0.2 mg/kg. This value is found using a K_d value of 0 mL/g and more accurately depicts movement of this contaminant through soils. Fate and transport simulations presented in DOE/RL-2010-98 should be recalculated using 0.0 K_d value. The YN ERWM Program requests the use of 0.0 K_d value and that concentrations in the groundwater and along the shoreline and the subsequent timeline should be re-evaluated for decline in concentration.

f. Groundwater is not generally considered a primary source, yet the YN ERWM Program is concerned that any remedy reviews will not include appropriate sampling actions or technological systems review to confirm performance or to consider missing source area contaminants (i.e. the 100-D/H Area reactors/fuel basin plumes). Clarify how and demonstrate (using travel times, etc) that contamination from these COCs will be prevented downstream and/or from reaching the river in exceedances of the DWS, MCLs, AWQS and SMS (Sediment Management Standards).

g. The YN ERWM Program requests EPA use of the new RfD value (0.0006) for Uranium by EPA's Office of Drinking Water as the basis of the Maximum Contaminant Level for drinking water is noted in the Tri-Party approved comment resolution document attached to DOE letter (13-AMRP-0041) to EPA and Ecology, 11/21/2012. YN ERWM program also requests uranium be evaluated in the FS. (Also see Attachment # 8).

h. Missing from the alternatives analysis are all of the co-extracted contaminants of concern. Antimony, arsenic, cadmium, carbon tetrachloride, chloroform, cobalt, copper, fluoride, gross alpha, gross beta, iron, lead, manganese, mercury, nickel, nitrate, nitrite, selenium, silver, strontium-90, sulfate, technetium-99, tetra-chloroethene, thallium, tritium, uranium, vanadium, and zinc are COPCs that have been detected above the 90th percentile Hanford Site background level, risk based levels, or maximum contaminant levels (MCLs). The pump-and-treat alternatives all appear to be solely aimed at chromium reduction. The pump-and–treat alternatives fail to address any type of treatment of non-chromium contaminants, and don't plan for how these co-extracted contaminants will be treated and reduced before reinjection. The YN ERWM program requests clarification within the RI/FS/PP and preferred alternative of specific treatments for these co-extracted contaminants of concern.
   i. YN ERWM program requests Manganese be retained as a co-contaminant of concern as it exceeds DWS of 50ug/L and is measured at very close to surface water cleanup levels (i.e., 814ug/L).
   ii. YN ERWM program does not support exclusion rationale for Iron and Zinc exceedances. Although they may be due to a function of the ISRM barrier, the chosen alternative includes cites continued use of the barrier and as such these should be evaluated in the FS.

i. It is noted that both filtered and unfiltered samples were taken. YN ERWM program requests that all sampling data be reviewed and additional samples taken were only filtered samples were taken.

Nitrates are identified as co-contaminants and concurrently removed. YN ERWM program request details of their treatment are included in the PP and the ROD.

Caution is appropriate if young children might be exposed, such as in the Nonresident Tribal scenario, because they are particularly at risk for methemoglobinemia, the critical effect for nitrate exposure (IRIS 2009).

Comments Regarding Human Health Risks:

The Yakama Nation Exposure Scenario was developed to describe a traditional subsistence lifestyle, including dietary patterns and seasonal activities. The lifestyle may result in exposure to radioactive and hazardous chemical contamination, now and in the future, from Hanford. The project resulted in a conceptual site model that was developed to illustrate potential exposure pathways from Hanford Site contaminant releases to not just soil and groundwater, but also plants (shoots, roots, leafy material, and berries), fish, and other animals such as wild game. Not only do these resources provide food and medicines, but also material for tools, shelter, and accessories. The scenario isn't just for information and comparison, but it compiles information specific to the Yakama Nation to be considered in evaluating potential risk from contamination and to support *appropriate* cleanup decisions. Exposure parameters were estimated for inhalation, dermal contact, and ingestion of air, soil, water, fish, meat, vegetables, fruit, and milk, and reflect a current and anticipated subsistence lifestyle. The Yakama Nation expect that the scenario will used to evaluate risk *comprehensively* for Hanford, incorporating all sources, radiological and chemical contaminants, exposure pathways, and natural resource uses.

There remains unacceptable risk to the YN ERWM tribal members from both chemical and radiological contaminants. Much of the risk assessments are based on the RCBRA and other supporting documents. In the Proposed Plan, PRGs are described as "PRGs are more specific than RAOs and establish acceptable exposure levels for specific contaminants and exposure pathways that are intended to be protective of HHE." However, since PRGs were not developed for any tribal scenarios they do not represent levels that are protective of tribal health. DOE should incorporate the YN ERWM Exposure Scenario into the risk assessments used to determine appropriate remedial actions.DOE should develop cleanup plans that are protective of human health & the environment, and allowing safe unrestricted Tribal uses.

The YN ERWM program requests DOE apply the Yakama Nation Exposure Scenario to develop cleanup levels protective of tribal members who will be living and utilizing the resources on the Hanford site, upland areas, nearshore, and Columbia River.

YN ERWM program requests DOE include (for clarification) in RI/FS/PP how many sites would fail if the YN ERWM risk scenario were applied.

a. Accumulated scientific evidence demonstrates that Native Americans are, as a statistical cohort, subject to the highest risk of disease and cancer from exposure to environmental contaminants. The Columbia River Basin Fish Contaminant Survey is a technical report that assesses the amount of chemical pollution in certain species of fish, and the potential health risks from eating fish those fish. The study is based on fish samples collected between 1996 and 1998 from tribal fishing waters in Washington, Oregon and Idaho. EPA funded the study which was coordinated by the four member tribes of the Columbia River Intertribal Fish Commission (CRITFC).
   i. Official recognition that Native Americans living near the Hanford site are the most vulnerable people to environmental contaminants, as underscored by EPA's Columbia River Fish Contaminant Survey. Adults in CRITFC's member tribes who eat fish frequently (48 meals per month) over a period of 70 years may have cancer risks that are

up to 50 times higher than those of the general public who consume fish about once a month.

ii. One scenario utilized to calculate risk to YN ERWM Tribal members is incorrectly identified as non-resident use. Even as such, there remains unacceptable risk to the YN ERWM tribal members from both chemical and radiological contaminants. Much of the risk assessments are based on the RCBRA and other supporting documents (unapproved or has unresolved comments by the Tri-Party Agencies). See following excerpts (and risk values) from the RCBRA (River Corridor Baseline Risk Assessment Volume II, Part 1: Human Health Risk Assessment August 2011), the Proposed Plan, and 100-F & UI 2/6 RI/FS.

iii. Vol. II, Part 1: Human Health Risk Assessment August 2011pg 7-34: For the Nonresident Tribal scenarios, the total cancer risk estimates exceed 10^{-4} and HIs exceed 1.0 for all ROD areas, mostly due to exposures that are associated with ingestion of plants assumed to be gathered from the Hanford Site. A large proportion of Nonresident Tribal cancer risk and HI is related to arsenic soil concentrations that are approximately equivalent to levels in areas unaffected by Hanford Site activities. When cancer risk estimates are calculated without the contribution of arsenic, the total cancer risk estimates still exceed 10^{-4} for all six ROD areas. The key risk drivers other than arsenic are technetium-99, carbon-14, strontium-90, benzo(a)pyrene, and Aroclor-1254, predominantly by the plant and game ingestion pathways.

iv. Because the Native American resident scenarios include very high food ingestion rates, strontium-90 continues to play a significant role in food-related exposures at year 2075.

v. By year 2150, Native American resident cancer risks above 1×10^{-4} are also dominated by arsenic exposure from ingestion of garden produce. Average arsenic concentrations at remediated waste sites range between 1.1 and 17.3 parts per million. Some of these arsenic concentrations exceed the Hanford Site background value of 6.5 parts per million (DOE/RL-92-24). However, all of the RME values for arsenic are less than the IAROD cleanup value of 20 parts per million, which is based on the MTCA Method A cleanup level. YN ERWM does not support the proposed cleanup value for arsenic.

b. Tribal risk information from the Remedial Investigation/Feasibi"ty Study indicates unacceptable ranges of over the allowed risk for cancer/ noncancer health effects. Native American scenarios indicate Tribal risks are greater than the EPA upper target risk threshold of 1×10^{-4} and HI of 1.

i. Sections under 6.2.5.5 Summary of Risk Estimates by Exposure Scenario (RI/FS): This summary indicates that several interim closed out waste sites do not meet risk criteria and need additional remedial actions.

ii. Table 6-13 indicates unacceptable radionuclide risk level exceedances in the shallow zone (outside the risk range of $1X10^{-4}$ to $1X10^{-6}$) at multiple sites at waste sites. Additional remedial action is necessary for all waste sites which do not meet the risk range criteria.

c. Table 6-59 (and elsewhere in Chapter 6 starting ~ Page 6-223) of the 100-D/H RI/FS states: The total cumulative ELCRs for the CTUIR and Yakama Nation for the 100-D Source exposure scenarios are 8.9×10^{-4} and 9.3×10^{-4}, respectively, when groundwater is used as a drinking water source. The total cumulative ELCRs for both Native American scenarios are greater than the EPA upper target risk threshold of 1×10^{-4}. The primary contributors to risk for the CTUIR scenario are arsenic, carbon tetrachloride, chloroform, tetrachloroethene, strontium-90, and tritium. The primary contributors to risk for the Yakama Nation scenario are arsenic, carbon tetrachloride, chloroform, tetrachloroethene, strontium-90, and tritium. The total HI for the 100-D Source exposure area is for both the CTUIR and Yakama Nation exposure scenarios.

The cumulative ELCR is 5.0×10^{-1} for the CTUIR scenario and 7.6×10^{-1} for the Yakama Nation scenario when groundwater is used as a source of steam for a sweat lodge. The cumulative risk for the Native American scenarios is greater than the EPA upper target risk threshold of 1×10^{-4}. The individual ELCR values for cobalt and Cr (VI) are greater than the EPA upper target risk threshold of 1×10^{-4}. The HI for the 100-D Source exposure area is 99 for the CTUIR scenario and 205 for the Yakama Nation scenario when groundwater is used as a source of steam for a sweat lodge, which is greater than the EPA target HI of 1. The primary contributors to the noncancer HI are Cr (VI), cobalt, nickel, and barium.

d. Page (6-225) of the 100-D/H RI/FS states: The total cumulative ELCRs for the 100-H Source exposure area for the CTUIR and Yakama Nation exposure scenarios are 4.0×10^{-4} and 4.3×10^{-4}, respectively, when groundwater is used as a drinking water source. The total cumulative ELCRs for both Native American scenarios are greater than the EPA upper target risk threshold of 1×10^{-4}. The primary contributors to risk for the CTUIR scenario are arsenic, carbon tetrachloride, chloroform, strontium-90, technetium-99, and tritium. The primary contributors to risk for the Yakama Nation scenario are arsenic, carbon tetrachloride, chloroform, strontium-90, technetium-99, and tritium. The total HI for the 100-H Source exposure area is 3.3 for both the CTUIR and Yakama Nation exposure scenarios.

The cumulative ELCR is 1.8×10^{-2} for the CTUIR scenario and 3.7×10^{-2} for the Yakama Nation scenario when groundwater is used as a source of steam for a sweat lodge. The cumulative risk for the Native American scenarios is greater than the EPA upper target risk threshold of 1×10^{-4}. The individual ELCR value for Cr (VI) is greater than the EPA upper target risk threshold of 1×10^{-4}. The HI for the 100-H Source exposure area is for the CTUIR scenario and for the Yakama Nation scenario when groundwater is used as a source of steam for a sweat lodge, which is greater than the EPA target HI of 1. The primary contributors to the noncancer HI are Cr (VI), cobalt, nickel, and barium.

e. Page 6-225 of the 100-D/H RI/FS states: The total cumulative ELCRs for the horn exposure area for the CTUIR and Yakama Nation exposure scenarios are 5.7×10^{-4} and 6.2×10^{-4}, respectively, when groundwater is used as a drinking water source. The total cumulative ELCRs for both Native American scenarios are greater than the EPA upper target risk threshold of 1×10^{-4}. The primary contributors to risk for the CTUIR scenario are 1,2-dichloroethane, arsenic, carbon tetrachloride, chloroform, tetrachloroethene, trichloroethene, strontium-90, and tritium. The primary contributors to risk for the Yakama Nation scenario are 1,2-dichloroethane, arsenic, carbon tetrachloride, chloroform, tetrachloroethene, trichloroethene, strontium-90, and tritium. The total HI or the horn exposure area is 4.5 for both the CTUIR and Yakama Nation exposure scenarios. Cr (VI) is the primary contributor to the noncancer HI for the Native American scenario.

The cumulative ELCR is 4.9×10^{-2} for the CTUIR scenario and 9.9×10^{-2} for the Yakama Nation scenario when groundwater is used as a source of steam for a sweat lodge. The cumulative risk for the Native American scenarios is greater than the EPA upper target risk threshold of 1×10^{-4}. The individual ELCR value for Cr(VI) is greater than the EPA upper target risk threshold of 1×10^{-4}. The HI for the horn exposure area is 14 for the CTUIR scenario and 29 for the Yakama Nation scenario when groundwater is used as a source of steam for a sweat lodge, which is greater than the EPA target HI of 1. The primary contributors to the noncancer HI are Cr(VI) and barium.

f. The methodology used to assess risks for the RI/FS uses PRGs developed in the RCBRA (DOE/RL-2007-21).
   i. The YN ERWM has outstanding issues with the use of River Corridor Baseline Risk Assessment and its 'sub-documents'[i.e. Tier 1 document for wildlife or the Tier 2 document for plants and invertebrates] as a major supporting document in cleanup decisions for the River Corridor Areas. To our knowledge these documents are not finalized or approved nor have our comments and concerns been addressed. [7]
   ii. RCBRA (River Corridor Baseline Risk Assessment Volume II, Part 1: Human Health Risk Assessment August 2011): Volume II, Part 1: Human Health Risk Assessment August 2011, pg 7-34: For the Nonresident Tribal scenarios, the total cancer risk estimates exceed 10^{-4} and HIs exceed 1.0 for all ROD areas.

g. Conservation/mining land use is as a part of the basis for the preliminary remediation goals (PRGs). YN ERWM program disagrees with this land use designation to develop PRGs. Yakama Nation Treaty rights guarantee (among other rights) use of groundwater for sweat lodge activities. Groundwater is to be restored to its most beneficial use, which is drinking water standards (i.e. Method B, unrestricted land-use values). All PRGs should be calculated based on unrestricted land-use (at the very minimum.) YN ERWM has submitted previous comments on the development of the PRGs.

h. Calculation of radionuclide PRGs based on use of a risk ELCRs of a 1 in 10,000 risk or radionuclide dose (15 mrem/year) is in opposition the EPA guidance which states the point of departure for risk is 1 in a million. The allowable target risk range is $1X10^{-4}$ to $1X10^{-6}$ but DOE continues to drive cleanup with the lowest level rather than initially striving to meet the highest standard of 1 in a million ($1X10^{-6}$). $1X10^{-6}$ is consistent with MTCA (WA States regulations) and it should be DOE's cleanup goal.[8] As MTCA explicitly defines radionuclides as hazardous substances, the combined limit for radionuclides and chemicals should correspond to a lifetime cancer risk of $1 X 10^{-5}$ or less at the minimum.
   i. Clarify the need for an additional evaluation of HH ELCR and hazards were performed when MTCA Method B would suffice.
   ii. Exposure Point Concentrations (EPCs) were used to calculate the ELCRS and noncancer hazards. Frequently these EPCs resulted in deletion of COPCs when used to compare COCs against the applicable standard or risk-based concentration. What was the process used to validate the results from which the EPCs were derived? Please refer to our prior discussions of EPCs in response letter to Hanford Risk Assessments, etc.
   iii. Years to attain mature plant revegatation is more correctly identified as a range of 80 to 100 years. Recalculate infiltration rates using this more appropriate range of years. Adjust Alternatives to incorporate these values to reflect a more accurate timeline in achieving remediation goals.

j. Many PRGs have been inappropriately developed and uncertainties remain as these documents still require revision. Our concerns remain regarding the methodology used to calculate the EPCs. EPA's ProUCL methods were identified yet in some instances a 95UCL

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[7] YN ERWM , February 28, 2011 letter to the Tri-Party Agencies (DOE-Matt McCormick, EPA-Dennis Faulk, and Ecology- Jane Hedges

[8] The 15 millirem per year (mrem/yr) dose limit used by DOE in the past is not protective enough; this dose equates to a lifetime cancer risk of 3×10^{-4}, which is three times the maximum allowable value under CERCLA. Note: If the EPA's own risk coefficients for radiation are used, it equates to a fatal cancer risk of more than 5×10^{-4} and a cancer incidence risk of 1×10^{-3}, which is well outside the CERCLA target range of 10^{-4} to 10^{-6}.)

was not calculated (a maximum value used instead). Use of the max ignores most of the information in the data set.

i. Example of EPC calculation issues: Agreed to use max for focused samples basically because there were not enough samples taken and they did not want to take more. In many waste site decision unit samples this response or a simple one was the justification for using the max concentration as the default EPC when in fact frequency of detection was 100% (4 samples taken). More samples should have been taken and the data processed to reflect a more accurate EPC. The following comment was made "Warning: This data set only has 4 observations. Data set is too small to compute reliable and meaningful statistics and estimates." In this example, the data set for variable arsenic was not processed.

ii. When the number of measurements is small (e.g., n<5) or the detection frequency is low (<5%), ProUCL ultimately recommends collection of more samples to compute defensible statistics.[9] Collection of additional samples was <u>not</u> done. Some unremediated waste sites may have exceedances of PRGs due to limited sample size, which would provide the basis for remedial action or further evaluation.

iii. A review of CVP documents for a number of waste sites raised concerns. Several indicate the use of outdated standards or as of yet agreed to (by the Tri-Parties) values (i.e. the 100 Area Analogous Sites RESRAD Calculations (BHI 2005a) to calculate non-radiological COCs, [e.g. copper, lead, selenium, TPH; Aroclor-1254]. Many state use of MTCA 1996 values or soil RAGs based on "100 time groundwater cleanup rules and 100 times dilution attenuation factor times surface water quality criteria. Provide a more detailed explanation of the review of all CVPs including the comparison process and whether additional characterization and/or sampling was performed for those CVPs where filtered sampling results, etc where utilized. See Attachment # 9. YN ERWM requests review and adjust the need for addition site-specific remediation as warranted.

k. The YN ERWM Program does not support "backsliding" on any of the more stringent IROD cleanup values.

l. YN ERWM disagrees with approach applied to remediation of Arsenic.

i. Its application (20mg/kg) has resulted in residual levels for arsenic which do not reflect the Unrestricted Land Use Soil Cleanup Standards WAC 173-340-740(3)]) 2007 Method B value (0.67 mg/kg) and the MTCA ("Deriving Soil Concentrations for Groundwater Protection" [WAC 173-340-747(3)(a)]), groundwater protection value (0.00737 mg/kg) cleanup values (which would default to site background levels of 6.5mg/kg). The proposed 20 mg/kg value for arsenic exceeds the 1×10^{-6} individual cancer risk based on the MTCA.

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[9] quotes from EPA sources, supporting use of the 95% UCL:1) Dec 2002 OSWER 9285.6-10 (http://www.hanford.gov/dqo/training/ucl.pdf) "It is important to note that defaulting to the maximum observed concentration may not be protective when sample sizes are small, because the observed maximum may be smaller than the population mean..... The use of the maximum as the default EPC is reasonable only when data samples have been collected at random from the exposure unit and sample size is large" (p. 20). 2) ProUCL Ver. 3.0 (Singh et al, 2004) (http://www.epa.gov/nerlesd1/tsc/images/proucl3apr04.pdf)

"It is recommended that the maximum observed value NOT be used as an estimate of EPC....It should be noted that for highly skewed data sets, the sample mean indeed can even exceed the upper percentiles (e.g., 90%, 95%), and consequently, a 95% UCL of the mean can exceed the maximum. This is especially true when dealing with log normally distributed data sets of small sizes" (page 55).

ii. In simple terms, the risk analysis showed that casual users of the River Corridor as it is have low enough risk to be safe. However, all of the residential user scenarios have unacceptably high risk. Some of the risk was associated with uranium, mercury, chromium, cadmium, and radiological contaminates. But a major part of the high risk levels found in the residential scenarios is from consumption of arsenic contaminated plants, animals, and water. A large proportion of Nonresident Tribal cancer risk and HI is related to arsenic soil concentrations that are approximately equivalent to levels in areas unaffected by Hanford Site activities. When cancer risk estimates are calculated without the contribution of arsenic, the total cancer risk estimates still exceed 10^{-4} for all six ROD areas.

iii. While much of the arsenic is assumed to be from pre-Hanford agricultural practices, there was a portion that could be attributed to Hanford operations. That amount of the Hanford process arsenic load should be determined, and the cleanup of that arsenic should be a part of the Hanford cleanup plan.

iv. YN ERWM questions the statement on page 6-225 of the RI/FS wherein it is implied that arsenic is considered only naturally occurring on the Hanford site while elsewhere you identify it as a known soil applicant and used by DOE. Clarification is requested.

m. The Proposed Soil cleanup levels for Hexavalent Chromium to ensure protection of groundwater should be set at 0.2 mg/kg. This value is found using a Kd value of 0 mL/g and more accurately depicts movement of this contaminant through soils. YN ERWM program requests fate and transport simulations presented in DOE/RL-2010-98 be recalculated using 0.0 Kd value. Concentrations in the groundwater and along the shoreline and the subsequent timeline for decline in concentration re-evaluated.

n. The YN ERWM Program disagrees with the statement "As a result, risks are overstated because the UCL and the EPC do not take credit for the existing clean backfill that covers the remediated waste site." Risk from remaining contamination is what is supposed to be evaluated; YN ERWM requests this text be deleted.

o. Alternatives should be identified to establish remedies which meet or exceed the <u>combined</u> excess lifetime cancer risk level of 1×10^{-5}. PRGs for individual radionuclides based on a 1×10^{-4} target cancer risk are not supported by EPA guidance as outlined in bullets below.

i. EPA's Regulatory risk 'Point of Departure' (target risk cleanup value) is $1X10^{-6}$. Although a risk range of $1x1^{0-4}$ to $1x1^{0-6}$ is permissible, to state that the 'regulatory risk target threshold of $1x10^{-4}$' has met is misleading to the public. Edit language throughout document to clearly clarify that the preferred risk target is $1x1^{0-6}$. Based on the requirements of MTCA and CERCLA regulations the radiological and nonradiological cancer risks should be combined and compared to the standard that Washington State has determined is protective of human health. This standard has an upper limit of lifetime risk for combined carcinogens of $1x10^{-5}$.

ii. While the USDOE's practice has been to apply MTCA risk requirements only to nonradiological contaminants, MTCA defines radionuclides as hazardous substances. Although MTCA does not include cleanup levels for individually named radionuclides, it clearly states, "radionuclides are hazardous substances under the act." [Washington Administrative Code (WAC) 173-340-200]. Radionuclides are carcinogens, and MTCA defines the maximum allowable incremental cancer risk level for individual carcinogens as $1x10\text{-}^{6}$. It defines the maximum allowable incremental lifetime cancer risk level for multiple carcinogens and multiple exposure pathways as $1x10\text{-}^{5}$.

iii. MTCA's inclusion of both chemicals and radionuclides in assessing cancer risks is consistent with U.S. Environmental Protection Agency (USEPA) guidance on establishing cleanup levels for CERCLA sites with radioactive contamination (USEPA, 1997). That guidance states that:
   1. The USEPA is aware of "no technical, policy, or legal rationale for treating radiation risks differently from other risks addressed under CERCLA."
   2. The USEPA uses a consistent methodology for assessing cancer risks at CERCLA sites no matter the type of contamination.
   3. The USEPA classifies radionuclides as known carcinogens.
   4. Cancer risks for radionuclides should generally be estimated using the slope factor approach.
   5. Cancer risks from radiological and non-radiological contaminants should be summed to provide risk estimates for persons exposed to both types of carcinogenic contaminants.
   6. Note: Radiation exposure risk from the National Academy of Sciences (BEIR VII Report, 2005), from which acceptable risk levels are supposed to be updated, indicates 15 millirem of annual exposure is projected to cause a lifetime cancer risk of 8 fatal cancers in adults for every 10,000 exposed – this is 8 times the CERCLA maximum risk level and 80 times the state MTCA level. Annual exposure values would be more representative if reduced to approximately 5millirem.

p. YN ERWM has reviewed comments of the Washington State Department of Ecology submitted on the draft 100-D/H Area RI/FS documents and agree with their comments regarding human health and ecological risk and groundwater modeling. The YN ERWM disagrees with many of the scientific management decision point (SMDP) reasons given for elimination of a waste site from the being carried forward into the FS (e.g., Appendix H, Table H-20). A review of this process, and use of an AUF is requested. YN ERWM notes, "Normally across the State, Ecology evaluates ecological impacts using the wildlife exposure model-the default model -WAC 173-340-7492 and -7493 which does not employ an AUF. Use of AUF is the exception rather than the norm.".

   i. Examples of language: *There is ample unaffected habitat for terrestrial invertebrates available in adjacent area and along the River Corridor. For plants, if adverse effects did occur, habitat fragmentation in the Source OUs would not be likely given the current level of ecological services the habitat is providing in the current condition and the available habitat refugia nearby.*

q. The YN ERWM request additional clarification of RBSL development and use as screening values for convenience in evaluation of deep zone contamination. RBSL are industrial in nature and we question their validity/usefulness as measures of impact to residential groundwater Method B cleanups.

r. YN ERWM requests all sites with the status of 'no further action' and requiring IC for deep soil zones be evaluated against current MTCA 2007 standards, while not backsliding from previously more stringent IROD cleanup values.

s. YN ERWM requests DOE include in the Proposed Plan tables that list the interim cleanup values and the final cleanup values for each contaminant.

Orchard Lands:

The Proposed Plan makes little mention of waste sites to be addresses under a separate CERCLA decision as a part of the Orchard Lands OU. The only clear language for discussing the relationship between the 100-D/H scope and the Orchard Lands is found in Section 4.1 pages 4-2 to 4-4 in the RI/FS. Similar language needs to be included in the PP to discuss the overlap between these two projects.

The RI/FS makes the statement "An RI of the 100-OL-1 OU will be conducted to determine if actions are needed to mitigate potential environmental or human health impacts. If results from the RI indicate a need for action, an FS will be conducted to identify and evaluate a range of remedial alternatives." Clarifying text needs to be inserted regarding the evaluation of impacts to known/unknown cultural resources within the Orchards Lands OU.

a. The YN ERWM disagrees with suggested approach with regards to not chasing waste site contamination COCs into 'orchard land' waste sites or vice versa. This approach is not in alignment with the observational approach and risks leaving unacceptable levels of contamination (see page 4-2).

8. **General Comments on Principal Threat Wastes & Current and Future Exposure Scenarios:**

   1. It is unclear in the discussion of the Alternatives why there is no treatment included for long-lived the identified radionuclide of technicium-99. Clarify in this section and in the Alternatives discussions.

   2. Scope and Role:

   A holistic approach would ensure that protective decisions are made for the site in its entirety. We disagree with exclusion of contaminants emanating from offsite. The Preferred Alternative does not include an evaluation of contribution from other sources (i.e. the D/H Reactor plumes) nor does it include upgradient contaminant sources.

      1. YN ERWM Program recommends the 100-D/H Area ROD include a detailed schedule for completion of the reactor removal, and the event that removal does not occur, a contingency to address the remaining soil contamination.

9. **General Comments on the Remedial Action Objectives:**

   a. The purpose of Remedial Action Objectives (RAOs) is to explain and address site risks and to include an action (and specifics/details) to be taken achieve the objective. RAOs are the measurement tools for evaluating the success of the ROD remedy during the CERCLA 5 year review process. Without a specific action, the metrics for measurement are filled with subjectivity and uncertainty.

      i. Four of the five (5) RAOs do not have a definitive task or standard to be met. An Example of a specific action to include using RAO#3: Prevent COCs migrating and/or leaching through the soil that will result in groundwater concentrations exceeding federal and state standards and risk-based thresholds for protection of surface water and groundwater *by treatment of the contaminated soils or RTD.*

      ii. Clarify all RAOs with specific action(s) to be performed and/or standard(s) to be met.

   b. Calculation of radionuclide PRGs based on use of a risk ELCRs of a 1 in 10,000 risk or radionuclide dose (15 mrem/year) is in opposition the EPA guidance that states the point of departure for risk is 1 in a million. The allowable risk range is $1X10^{-4}$ to $1X10^{-6}$ but DOE continues to drive cleanup with the lowest level rather than initially striving to meet the highest standard of 1 in a million($1X10^{-6}$). $1X10^{-6}$ is consistent with MTCA (WA States regulations) and it should be DOE's beginning remediation point and ultimate cleanup goal.

c. Cleanup levels (i.e., PRGs) should reflect the current MTCA Method B standards and in cases where they are less stringent than before, there should be no back-sliding from previous cleanup commitments in the Proposed Plan or RI/FS.

d. YN ERWM Program requests the following edits to Proposed Plan Tables 7-thru 9 and corresponding RI/FS table(s):
   - Edit current values to reflect the following
   1. Arsenic = 6.5mg/kg (direct contact)
   2. Barium=1,600mg/kg (soil protective of groundwater)
   3. Hexavalent Chromium=0.19 mg/kg (soil protective of groundwater)
   4. Nitrogen in Nitrate=40 mg/kg (soil protective of groundwater)
   5. Mercury=2mg/kg (soil protective of groundwater)
   6. Pu-239/240=23.5*
   7. Thorium-228=2.2*
   8. Thorium-232=2.2*
   9. Tritium=241*

   * Note: Proposed PRG "backslides" from current IROD for RCRA TSD.

e. YN ERWM Program requests the following edits to Proposed Plan Table: Summary of 100-D/H OU Proposed Soil Cleanup Levels Based on Human Health, Groundwater Protection, and Surface Water Protection PRGs) values(mg/kg): All cleanup should be to unrestricted use (with irrigation):
   i. Strontium-90=0.35 pCi/L[10]

f. We note with the exception of carbon tetrachloride, the following RCRA COCs/PCOCs were included in Rev 0. As historical COPCs but since, their presence was not associated with a specific location or trend and the analytical methods deemed not of sufficient accuracy, they were eliminated from the risk characterization. YN ERWM program does not support elimination of COPCs based on these assumptions and requests the inclusion of the following:
   i. Arsenic
   ii. Antimony
   iii. Barium
   iv. Cadmium
   v. Carbon tetrachloride
   vi. Cobalt
   vii. Copper
   viii. Lead
   ix. Nickel
   x. Silver
   xi. Zinc

g. More clarification is needed on how cleanup levels will be adjusted to account for waste site-specific residual contaminations and for sites with multiple residual contaminants. The same is needed for evaluation of groundwater exceedances.

[10] Nez Perce Tribe' July 15, 2010 letter to Matt McCormick regarding DOE/RL-2009-54, Rev O; Proposed Plan for Amendment of 100-D/HR-1/NR-2 Interim Action Record of Decision

h. Clarification and inclusion of information is need in the Proposed Plan and analysis of the appropriate alternatives in several areas:
   i. Cost analysis for required well-conceived plans for performance monitoring that identify and correct potential failures and plans for maintenance and repair, including possible total system replacement is missing (NRC, 2000). This level of planning, both technical and financial (i.e., costs, does not appear to have been included in the Proposed Plan or the analysis of alternatives).
   ii. The Preferred Alternative (or Proposed Plan) does not include the required description of the contingency measures that will be implemented should the monitoring show that natural attenuation is unable to achieve the cleanup goals. Conditions that would trigger the contingency should also be specified (e.g., continued plume migration or contaminant levels are well above levels predicted for a specified time) (EPA 540-R-98-031). Update and provide details in the Proposed Plan for public review including cost of implantation of contingency measures.
   iii. Design elements for Alternatives selection should be described in sufficient detail in the Proposed Plan so that the public can evaluate and comment on the proposal (EPA 540-R-98-031). The Proposed Plan provides the foundation for the ROD to defer the final technology selection to the remedial design phase. Implied design changes (e.g., through the RD/RA work Plan) or design studies for implementation of the remedy need more discussion within the Proposed Plan. Any associated costs should be included in the Proposed Plan.
   iv. It is unclear if any of the Alternatives were evaluated against the nine balancing criteria based on what happens with transition to Long-term Stewardship prior to completion of remediation under the Record of Decision (e.g., Was a cost benefit analysis of remedy costs including long-term stewardship costs done?) The environmental consequences of doing this action or not doing it have not been evaluated. It is unclear how any of the Alternatives can ensure compliance with the balancing criteria with transition into Long-term Stewardship. These analyses should be done, as this action will clearly need to be reflected and integrated into the final ROD.

10. **General Comments on Void Filling:**

   a. Discussion of details of void fillings if found in the RI/FS alternative descriptions and not in the Proposed Plan. If grout is not to be used, then the RI/FS should re-evaluate the Alternatives.

   b. Clarify if there are pipelines at deeper depths that will not be removed. Include this information in the Proposed Plan.

11. **NEPA:**
The relationship of NEPA and NEPA values to related information is not clearly presented. While Table 10-7 identifies the NEPA Values evaluated in relationship to the Alternatives presented with much more clarity and discussion than in previous drafts.

12. **General Comments on Future Interim ROD changes:**
Future Interim ROD changes: The following statement is made: "There will be a period of time between when the final action ROD is approved and the required RD/RAWP is prepared and issued. During this period, DOE-RL plans to continue remedial activities, such as waste site RTD. In order for these actions to be consistent with the final action remedy selection, the current

interim action RD/RAWPs will be modified using the TPA (Ecology et al., 1989a) change notice process to include the final cleanup levels specified in the final action ROD when it is issued."

YN ERWM understands the need for continuity, but the CERCLA process for changes in cleanup values in a ROD requires, at a minimum, an Explanation of Significant Difference (ESD), and maybe a ROD amendment. The TPA cannot circumvent the required CERCLA process. YN ERWM expects review opportunities and request further clarification of this process in the Propose Plan and other decision documents.

13. **Miscellaneous Comments:**
    - Identify 'particulates' as fuel particles, and/or fission and irradiation byproducts.
    - Identify Nitrate as a COC in Table 2 of the Proposed Plan.

Additional Comments from our Radiological Team Member

My review focused on the radiological aspects of the RI/FS and the Proposed Plan. In order to conduct a good review of the Proposed Plan required looking at information in the 100-D/H Areas RI/FS – which contained the details.

My review identified over 20 years of reactor operations in the 100-D/H Areas resulted in discharging millions of gallons of highly radioactive contaminated reactor cooling water into the ground – through leaking retention basins, and deliberately to surface impoundments called cribs and trenches.

The RI/FS and Proposed Plan state the following:

- Reactor fuel rods used aluminum cladding which resulted in **several hundred fuel cladding failures** at both D and H Reactors. Most fuel element failures involved **natural uranium or enriched uranium** fuels. Fuel cladding failures occurred when corrosion or swelling of the aluminum cladding covering a uranium fuel slug caused the cladding to break open, releasing **uranium oxide** particles that contained **plutonium isotopes and fission products** (cesium-137 and strontium-90) into the cooling water. *Note: N Reactor fuel was cladded with zirconium. The reactor had very few fuel failures and no fission products were discharged to the soils due to fuel failures – like occurred at the 100-D/H Reactors.*

- Reactor cooling water picked up contaminants during passage through the reactor core. These contaminants included activated elements in the water caused by the high neuton flux in the core, activation products from reactor components including the graphite reactor core, steel process tubes, fuel cladding (containing tritium, carbon-14, cobalt-60, nickel-63, europium-152, -154, and -155), and **fuel fission products** (containing cesium-137, strontium-90, uranium-238/235, and transuranic elements of americium-241 and plutonium-239/240).

- The reactor cooling water was discharged to the retention basins, to allow the short lived radionuclides to decay away, before being drained to the Columbia River. The retention basins leaked over the years due to thermal stress of the extremely hot reactor cooling water – the leak rate was rated at 2,641 gallons per minute (158,460 gallons per hour – 3,803,040 gallons per day of reactor operations). The leak locations were never identified.

- When fuel failures occurred reactor cooling water was diverted to subsurface cribs and trenches – to prevent fission products from entering the Columbia River. The cribs and trenches received millions of gallons of reactor cooling water contaminated with fission products.

Characterization

The RI/FS soil and groundwater sampling information showed low or no detectable concentrations of fission products one would expect at the cribs and trenches – with the exception of strontium-90. Remediation at these sites involved limited excavation (15 feet below the ground surface), leaving deeper radiological contamination in place. DOE's preferred alternative is to implement monitored natural attenuation of the radionuclides until the decay to a safe level. The concern is the length of time needed for these radionuclides to decay to a safe level. The radionuclides released to the soils at 100-D/H include those listed on the following table.

Table. Radionuclides released to the soils and/or groundwater at 100-D/H Areas.

Radionuclide	Half-Life	Daughter Products	Half-Life
Americium-241	432 years	Neptunium-237	2 million years
Carbon-14	5,730 years	None	
Cesium-137	30 years	None	
Strontium-90	29 years	None	
Technetium-99	211,000 years	None	
Neptunium-237	2 million years	Uranium-233	159,000 years
		Thorium-229	7,300 years
Uranium-238	4,470,000,000 years	Uranium-234	245,000 years
		Thorium-230	73,380 years
		Radium-226	1,602 years
Uranium-235	710,000,000 years	Protactinium-231	32,760 years
Plutonium-239	24,125 years	Protactinium-231	32,760 years
Plutonium-240	6,537 years	Uranium-236	23,400,000 years
		Thorium-232	14 billion years

It takes 10 half-lives for a radionuclide to decay into a stable non-radioactive element – such as lead, or into other long and short lived radioactive daughter products – such as neptunium-237, uranium-238, plutonium-240. Cesium-137 and strontium-90 will be gone in less than 300 years. But as you can see from the chart the other radionuclides will remain in the vadose zone and/or groundwater for a very – very long time – in some cases over a million years.

The Future Risks

These radionuclides are invisible microscopic particles that cannot be seen, felt, smelled or tasted, that have been discharged into the vadose zone of the 100-D/H Areas, where they will remain until they decay into a non-radioactive element or by chance someone or something digs them up or moves them towards groundwater. The only way to know these radionuclides are present is with special radiation detection instrument (meter). This is an aspect that DOE never takes into consideration when making decisions to leave long-lived radionuclides in place. That they are leaving an "invisible threat" in place hoping that no one or anything exposes it. The life of these radionuclides is in the thousands if not millions of years. That's a long time to hope no one decides to construct a town or community along the beautiful Columbia River in the future, (when ICs, monitoring and Hanford knowledge is gone), that results in excavation of the old waste sites and use of contaminated groundwater for drinking, cooking, cleaning, irrigation, etc. A community receiving direct exposure to these long-lived radionuclides without any idea it's occurring – because it can't be seen, felt, smelled or tasted.

Groundwater Radiological Contamination

First off DOE is doing a good job of removing chromium from the groundwater, it's the other contaminants of concern that is a problem for the ERWM Program. The only other contaminants of issue in the RI/FS and Proposed Plan is strontium-90 and nitrate – which are being co-extracted by the Pump-and-Treat System for removal of chromium.

The RI/FS states: The co-extracted strontium-90 and nitrate pass through the ion exchange resin (designed for chromium removal) and their concentrations remain unchanged. Past operational data and groundwater model simulations indicate the strontium-90 and nitrate concentration in the influent and effluent of the pump-and-treat systems is less than their respective Maximum Contaminant Levels (MCLs) so no further treatment is evaluated for these two contaminants within the existing pump-and-treat system. If the combined extracted groundwater in the pump-and-treat effluent stream is found to exceed the MCL for strontium-90or nitrate, further treatment, if necessary, would be evaluated.

The strontium-90 and nitrates pass through the chromium treatment process and are collected in a groundwater return tank. The tank groundwater is analyzed for strontium-90 and nitrate concentrations. If the concentrations are below the MCL, the groundwater is returned to the injection wells and pumped back into the ground. If the concentrations are above the MCL, that "treatment" is simple – add water to dilution they concentration until it's below the MCL.

DOE needs to remove the strontium-90 and nitrates from the groundwater instead of simply re-injecting it back into the ground, where it will concentrate over time becoming a large underground source that will be present until the year 2260. The problem, DOE doesn't want to spend the money on constructing a radiologically controlled area for the Pump-and-Treat System. Storing strontium-90 for treatment and disposal at ERDF requires collection and increased radiological hazard and potential exposure. A cost DOE is not willing to pay.

Institutional Controls

DOE is relying on institutional controls (ICs) to prevent direct exposure to humans and biota to the underground radionuclides. ICs addressed in the RI/FS range from 50 to 190 years. The Proposed Plan only provides IC information on groundwater for strontium-90 for 44 years, and "that ICs will remain in place until cleanup levels are achieved, the concentrations of hazardous substances are at levels to allow for unlimited use/unrestricted exposure, and EPA authorizes the removal of restrictions."

DOE has no intention of removing anymore deep vadose zone radiological contamination from these waste sites associated with reactor cooling water discharges, but are instead relying on ICs. ICs are to "isolate" the contamination from direct contact with humans and the environment (biota, fish, wildlife, etc.), by restricting land use, excavation, irrigation, groundwater use, etc.

In the short term ICs will be protective as along as the waste sites are properly managed, maintained, monitored, and all restrictions enforced. The short term to be managed by the US Government who is responsible for the contamination. In the long-term there is great uncertainty due to the extremely long life of the radionuclides remaining in the vadose zone in the 100-D/H Areas.

DOE needs to be honest with the tribes, public, Congress and all interested parties about the long term threat of these radionuclides, and the cost to maintain the ICs far into the future.

Attachment #2: Letter to Secretary Moniz

Attachment #3: Letter to Marlene Zichlinsky

Attachment #4: Ecology Staff Memo regarding Arsenic cleanup values

Attachment #5: STOMP Equations

Attachment #6: 183-H

Attachment #7: Recharge Memo

Attachment #8: Hanford Uranium RfD

Attachment #9: A. Huckaby memo

Confederated Tribes and Bands
of the Yakama Nation

Established by the
Treaty of June 9, 1855

Honorable Ernest Moniz
U.S. Secretary of Energy
1000 Independence Avenue SW
Washington, DC 20585

RE: Recognition of Yakama Treaty Rights on the Hanford Site

Dear Secretary Moniz:

The Confederated Tribes of the Yakama Nation requests that the U.S. Department of Energy (DOE) formally issue an administrative directive recognizing that Yakama tribal rights reserved under the Treaty of June 9, 1855 to hunt and gather foods and medicines have never been extinguished or abrogated by the establishment or activities of the Hanford Nuclear Reservation.

DOE-Richland has taken the position for decades that Yakama treaty rights are "not consistent with the cleanup mission" at Hanford. However, only Congress may abrogate rights reserved in Indian treaties, and only with clear and explicit language, either within the statute itself or in its legislative history. There is no evidence in any of the federal statutes or legislative history authorizing the establishment of the Hanford Site, the Atomic Energy Commission, or DOE itself that Congress ever intended to abrogate the treaty hunting or gathering rights of the Yakama people. As publicly owned property, over 90% of the land within the Hanford Site clearly qualifies as "open and unclaimed" for the purpose of Yakama tribal hunting and gathering under the Treaty of June 9, 1855. Because the Yakama Nation never received compensation under the Fifth Amendment for any treaty rights reserved on Hanford lands, such rights were never extinguished even if Congress had intended to do so.

The 1999 Land Use Plan that was finalized by DOE contemplates a return within the next fifty years of most of Hanford to some form of open public use, including wildlife conservation and hunting. Therefore, the vast majority of Hanford Site lands will probably be under the management of agencies within the Department of the Interior for multiple uses, including Indian treaty resource harvest. This is already true for the Hanford Reach National Monument, where the U.S. Fish and Wildlife Service currently permits hunting by the public in National Wildlife Refuges, and has designated such hunting as a compatible use within the Monument's Arid Lands Ecology Reserve. The Washington Dept. of Fish and Wildlife currently recognizes Yakama treaty rights to hunt within the Monument, and acknowledges the tribe's corresponding off-reservation co-management and law enforcement role there. We believe a similar recognition and acknowledgment by DOE is long overdue for the entire Hanford Site.

Thank you in advance for your consideration of this matter.

Sincerely

JoDe L. Goudy, Chairman
Yakama Tribal Council

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February 13, 2012

Marlene Zichlinsky, Attorney
Office of the Regional Solicitor
Pacific Northwest Region
U.S. Department of the Interior
805 S.W. Broadway, Suite 600
Portland, OR 97205

Dear Ms. Zichlinsky:

It has come to my attention that you telephonically attended the January 19 meeting of the Hanford Natural Resources Trustee Council (HNRTC), and that you provided your legal opinion regarding whether the Yakama Nation still retains treaty reserved rights to hunt and gather foods on lands owned by the U.S. Department of Energy (DOE) at the Hanford Site. According to others who were at the meeting you told the Council that, when the United States withdrew public lands for Hanford, any treaty rights to those lands were extinguished. This opinion was apparently given in the context of whether any natural resources injured by releases of hazardous substances include those which are utilized by the Yakama Nation pursuant to hunting and gathering rights reserved in the Treaty of 1855. Any such resources lost to the tribe would be compensable in damages under § 107(f) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). I would like to take the opportunity to provide the Yakama Nation's legal position on this issue for the record so that there is no doubt where we stand.

As you know, only Congress may abrogate rights reserved in Indian treaties, and only with clear and explicit language, either within the statute itself or in its legislative history. *United States v. Dion,* 476 U.S. 734, 739-740 (1986). In *Dion,* the U.S. Supreme Court ruled that the standard for abrogation is "clear evidence that Congress actually considered the conflict between its intended action on the one hand and Indian treaty rights on the other, and chose to resolve that conflict by abrogating the treaty."

Id. at 740; see also *Minnesota v. Mille Lacs Band of Chippewa Indians*, 526 U.S. 172 (1999) (no "clear evidence" of abrogation in state enabling act). The Court examined the express language of the Bald and Golden Eagle Protection Act (BGEPA), as well as its legislative history, and determined that Congress "believed that it was abrogating the rights of Indians to take eagles." *Id.* at 743. Critical to the analysis in *Dion* was the fact that the legislative history contained extensive discussions of Indian hunting of eagles and their importance to tribes.

In contrast with the BGEPA, there is absolutely no evidence in any of the federal statutes authorizing the establishment of the Hanford Site that Congress ever intended to abrogate the treaty hunting or gathering rights of the Yakama Nation. Federal acquisition of the land which now comprises Hanford was originally authorized by Title II of the Second War Powers Act of 1942, Pub. L. 77-507 (56 Stat. 176) (Mar. 27, 1942). Nothing in the plain language of that statute evinces any intent to abrogate Indian hunting rights, and they are not discussed in the legislative history. 56 Stat. at 177; see also S. Rep. No. 77-989 and H.R. Rep. 77-1735.

Since this original acquisition, none of the statutes providing the government authority to administer the Hanford Site have ever acknowledged Yakama treaty rights despite explicit language regarding compensation for land acquisitions. The Second War Powers Act expired on March 31, 1947. 50 U.S.C. Appx. § 645. By that time Hanford had been transferred from the Manhattan Project to the Atomic Energy Commission (AEC), which received its powers from the Atomic Energy Act of 1946 (AEA). *See* Pub. L. 79-585, c. 724, § 9(a)(3) (60 Stat. 755, 765) (Aug. 1, 1946) (formerly codified at 42 U.S.C. § 1809). Again, there is nothing in the AEA even recognizing treaty hunting rights, much less intent to abrogate them through eminent domain. *Id.*, § 13 (60 Stat. at 772) (formerly codified at 42 U.S.C. § 1813). This authority was superseded by the Atomic Energy Act of 1954, which also says nothing about Indian treaty rights, either on its face or in its legislative history. Pub. L. 83-703 (68 Stat. 919); *see* 42 U.S.C. §§ 2221-2224; S. Rep. No. 83-1699 and Conf. Reps. Nos. 83-2639 and 83-2666.

None of the statutes establishing the current DOE mention treaty rights either, and thus they have not abrogated such rights. The Energy Reorganization Act of 1974, which set up the Energy Research and Development Agency, says nothing about Indian hunting. Pub. L. 93-438 (88 Stat. 1233) (Oct. 11, 1974), codified at 42 U.S.C. § 5801 *et. seq.* Its legislative history is completely devoid of Indian treaty considerations as well. *See* S. Rep. 93-707, H.R. Rep. 93-980, Conf. Reps. Nos. 93-1252 and 93-1445. The statute which transferred Hanford to the new Department of Energy fails likewise. Pub. L. 95-91, Title III, § 301(a) (Aug. 4, 1977) (91 Stat. 577), codified at 42 U.S.C. § 7151. As a result, Congress has never weighed the policies behind these statutes against Indian treaty hunting rights, and has thus never "resolved the conflict" between the two by abrogating those rights.

Although you pointed out in your comments to the HNRTC that Yakama hunting rights are "defeasible," this is true only if government lands are put into private ownership.

The minutes of the Walla Walla Treaty Council, where the Yakamas' treaty was signed, indicate that the Indians understood in 1855 that they were reserving the right to hunt on lands "not occupied by white settlers." *State of Washington v. Chambers*, 506 P.2d 311, 315 (1973) (Yakama treaty hunting rights are "restricted only in those areas staked out by the white man as his own place to settle"); see also *Confederated Tribes of the Umatilla Indian Reservation v. Maison*, 262 F.Supp. 871, 873 (D.Or. 1966). Case law interpreting Stevens treaty hunting rights has been consistent that the term "open and unclaimed lands" means "publicly-owned lands, which are not obviously occupied and which are put to a use not incompatible with hunting." *State of Washington v. Buchanan*, 978 P.2d 1070, 1082 (1999) (giving summary of Stevens treaty case law).

Under this standard, over 90% of the land within the Hanford Site clearly qualifies as "open and unclaimed" for the purpose of Yakama treaty hunting and gathering. There can be no dispute that Hanford is publicly owned by the Department of Energy. Although the United States may argue that all of Hanford is "occupied" by DOE because a small fraction of the land is still being used for the agency's cleanup mission with limited public access, this position has no merit. First, the site has had no "white settlers" occupying its lands since they were taken by the War Department. Second, with the exception of the very small industrial areas where plutonium production and waste storage occurred (and where releases of hazardous substances originate), the lands of the Hanford Site have been basically unused by the U.S. government for seven decades. Finally, there is no evidence in the Yakama treaty minutes that the Indian leaders who signed it understood that a federal agency could have authority to permanently exclude tribal members from a huge area of public land as a buffer zone for temporary government purposes. Indian treaties are to be interpreted as the Indians would have understood them at the time. See *Mille Lacs*, 526 U.S. at 196.

Although published U.S. District Court decisions regarding treaty hunting in national parks have ruled that federal lands withdrawn for a specific use inconsistent with hunting are not "open and unclaimed," these cases certainly are not controlling legal authority for hunting rights at Hanford. See *United States v. Hicks*, 587 F.Supp. 1162, 1165 (W.D.Wash. 1984); see also *United States v. Peterson*, 121 F.Supp.2d 1309 (D.Mont. 2000). In *Hicks*, the court ruled that enactment of legislation in 1942 banning all hunting in Olympic National Park "terminated" the Quinaults' hunting rights there because the park's use had become "incompatible with hunting." *Hicks*, 587 F.Supp. at 1167. In *Peterson* the court held the same for Blackfeet rights in the legislation establishing Glacier National Park. *Peterson*, 121 F.Supp.2d at 1320. These cases essentially followed *Dion*, concluding that Congress' intent to prohibit hunting was incompatible with the exercise of the treaty right, which was "clear evidence" of abrogation.

The same cannot be said for the Second War Powers Act, which provided temporary authorization in 1942 to "acquire by condemnation" any real property "that shall be deemed necessary for military, naval, or other war purposes." Pub. L. 77-507, 56 Stat. at 177. Indeed, the very purpose of the statute was "to further expedite the prosecution of the war," and any lands acquired could only be "occupied, used and improved for the purposes of this Act." *Id.*, 56 Stat. at 176-177. The war for which this law was enacted has been over since 1945, and the authorizing statute expired two years later. Since the Atomic Energy Acts only authorized the AEC to own "facilities for the production of fissionable material," it is arguable that the AEC and DOE have had little congressional authority since 1947 to retain any extensive land holdings beyond those immediately needed for nuclear fuel production. See Pub. L. 79-585, 60 Stat. at 759, 774 (atomic production "facilities" means "any equipment or device capable of such production"). Of course, by the time CERCLA was enacted in 1980 the Hanford Site's original purpose was nearing an end. In 1987 all plutonium production ceased; DOE then turned to remediation of the resulting environmental hazards - the current Hanford "mission." The primary statutes governing present activities are federal and state environmental and cultural resource protection laws being enforced through the Tri-Party Agreement. Although some energy and technology research is also being conducted, it is also restricted to a very small footprint in the industrial areas.

In other words, unlike a national park, the vast majority of Hanford has always consisted of inessential surplus lands. It is important to note that a portion of them originally consisted of checkerboard Public Domain parcels, which were owned and administered by the General Land Office (later the Bureau of Land Management (BLM)) or the Bureau of Reclamation (BOR). When the Hanford Engineer Works was established in 1943 these sections were withdrawn from the Public Domain, and they have remained under DOE ownership. According to the EIS that was developed for the Hanford Comprehensive Land-Use Plan, DOE expects to return these lands to their original land management agencies:

> When DOE relinquishes its withdrawals on lands that were historically Federal, those lands withdrawn only by DOE would revert to the Public Domain and management by BLM. Those lands withdrawn by the overlapping DOE and BOR withdrawals would remain withdrawn and managed by the BOR. The BOR's use of the withdrawn Public Domain lands after the relinquishment of DOE's overlapping withdrawal must be consistent with the purposes for which they were originally withdrawn from BLM by BOR. If they are not, the BOR would be expected to relinquish or renegotiate its withdrawal notice under the Federal Land Policy and Management Act of 1976 and the lands could be returned to the Public Domain for BLM management.

See *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS)*, U.S. Department of Energy (September 1999), at S-56.

As a result, within the next few decades over 90% of current DOE managed land at Hanford may end up back in the Public Domain under exclusive BLM stewardship. The Spokane District of the BLM is currently in the process of revising its Resource Management Plan (RMP), which governs the use, protection, and enhancement of resources on BLM administered lands in Eastern Washington pursuant to FLPMA. A preliminary document released by the Spokane District last year specifically recognizes Yakama treaty rights to hunt and gather foods and medicines on all BLM lands, and acknowledges the agency's trust obligation to consult with the Yakama Nation regarding the affect of BLM actions on treaty reserved rights. See *Eastern Washington and San Juan Resource Management Plan: Analysis of the Management Situation,* U.S. Department of the Interior, Bureau of Land Management (March 2011), at 198-202.

The Land-Use ROD that was finalized by DOE in 1999 contemplates a return within the next fifty years of most of Hanford to some form of open public use, including wildlife conservation, recreation, and treaty fishing. See *Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement,* U.S. Department of Energy, 64 Fed. Reg. 61,615 (November 12, 1999). Only small areas within the current waste management zones would be restricted from public use for exclusive DOE purposes. *Id.* at 61,623. Therefore, the vast majority of Hanford Site lands will probably be under the management of agencies within the Interior Department for multiple uses, including Indian treaty resource harvest.

This is already true for the Hanford Reach National Monument (HRNM), where the U.S. Fish and Wildlife Service currently permits hunting by the public in the Wahluke Slope/Saddle Mountain Wildlife Refuge, and has designated such hunting as a compatible use within the Arid Lands Ecology Reserve. See *Hanford Reach National Monument Final Comprehensive Conservation Plan and EIS,* U.S. Fish and Wildlife Service, (August 2008); 16 U.S.C. § 668dd(a)(3)(B)-(D); 16 U.S.C. § 668dd(a)(4)(K). Indeed, an audit report issued over a decade ago found that DOE no longer needs to retain ownership of the HRNM for any purpose. See *Audit Report: Administrative Control of the Hanford Reach National Monument,* U.S. Dept. of Energy, Office of Inspector General (July 2001) at 3-7. The Washington Department of Fish and Wildlife currently recognizes Yakama treaty rights to hunt within the HRNM, and acknowledges the tribe's corresponding off-reservation co-management and law enforcement role. See *Draft Elk Population Control Hunt Plan for the Arid Lands Ecology Reserve,* U.S. Fish and Wildlife Service (December 1, 2011).

Even assuming *arguendo* that Congress intended to extinguish treaty hunting rights, there is no evidence that the Yakama Nation was ever compensated for any taking of those rights. Treaty rights to hunt and fish are compensable under the Fifth Amendment to the U.S. Constitution. See *Menominee Tribe v. United States,* 391 U.S. 404, 413 (1968); *Peterson,* 121 F.Supp.2d at 1318, n. 12. Congress has specifically recognized this principle by authorizing federal agencies to provide just compensation to Indian tribes for any loss of such rights caused by federal projects. See *Whitefoot v. United States,* 293 F.2d 658, 660 (Ct.Cl. 1961). Although the Manhattan Project was granted authority in 1942 to condemn lands for the war effort, including plutonium production at Hanford, title to a property interest passes to the United States only when the owner receives compensation. *United States v. Dow,* 357 U.S. 17, 21 (1958). Failure by the government to provide compensation results in acquisition of only a "temporary use and occupation" of the property interest taken, not full ownership. *Id.* Because the Yakama Nation never received compensation for any usufructory property rights reserved on Hanford lands, such rights were never fully extinguished even if Congress had intended to do so.

Given the continuing nature of these rights, the Hanford natural resource damage assessment (NRDA) is an opportunity for the Yakama Nation to receive at least some compensatory remedy for any treaty reserved resources (including their "supporting ecosystems") lost through injury from hazardous releases from waste sites since 1980. The fact that tribal members have been officially prohibited by DOE from exercising treaty rights in the upland areas in the last thirty years is of no consequence. In the absence of any statutory authority abrogating treaty rights, a federal agency cannot arbitrarily keep tribal members from entering surplus federal lands to exercise treaty protected rights for the sake of government convenience. This is especially true given both the liberal canons of treaty construction and the trust responsibility of all federal agencies to protect tribal resources. In any case, governmental denial of public access to natural resources has never been a bar to any trustee seeking damages and restoration pursuant to an NRDA.

I hope that we can seek an occasion to discuss these issues further so that your client can take appropriate action within the HNRTC. You can contact me at (509) 575-1500 or (509) 949-7942.

Yours truly,

Tom Zeilman

cc: Harry Smiskin, Chair, Yakama Tribal Council
Vera Hernandez, Chair, YN R/HW Committee
Virgil Lewis, Sr., Chair, FWL&O Committee
Phil Rigdon, DNR
Russell Jim, ER/WM
Leroy Adams, Jr., WRMP
Lynn Peterson, DOI Office of the Solicitor
Patrick Spurgin, Attorney
Julio Carranza, OLC
Hanford NRTC senior trustees

MEMO

TO:	100 Area Reader File
FROM:	Beth Rochette
DATE:	11 July 2013
CC:	Nina Menard, Kim Welsch, Alicia Boyd, Cheryl Whalen
RE:	STOMP 1-D Modeling Governing Equations

Background

MTCA requirements
USDOE (2012) has elected to calculate soil concentrations protective of groundwater (i.e., soil preliminary remediation goals [PRGs] for the leaching pathway) by using an alternative fate and transport model, rather than using the default 3-phase model given in WAC 173-340-747, Equation 747-1 (Ecology, 2007). WAC 173-340-747(8) lists requirements for using alternative fate and transport models. Mathematical models for contaminant fate and transport use equations to predict contaminant behavior in the subsurface. Per WAC 173-340-702(14), which is referenced in -747(8)(c), using alternative fate and transport models carries a burden of proof in cases where assumptions other than the defaults provided in WAC 173-340 have been used. It is the responsibility of Ecology to determine if this burden has been met before approving use of alternative models. Furthermore, before deciding whether default methods or assumptions are of sufficient quality, Ecology must determine if the quality criteria in -702(16) have been met. According to this requirement, the methods or assumptions must conform to the following provisions:

- widespread acceptance within the relevant scientific community
- derived using 'standard testing methods or other widely accepted scientific methods'
- provided to Ecology with pros and cons of the alternative method
- valid and err on the side of human health and environmental protection
- address more highly exposed populations and those populations likely to be present
- developed with adequate quality assurance and control procedures
- presented with explanations of significant anomalies, limitations, and error rates.

Alternative Model
The alternative fate and transport model used was the Surface Transport Over Multiple Phases (STOMP) code (White and Oostrom, 2000). STOMP has several operational modes: Water, Water-Air, Water-Air-Energy with Ice, Water-Oil, Water-Oil-Air, Water-Oil-Air-Energy, Water-Dissolved Oil, Water-Dissolved Oil-Surfactant, Water-Salt, Water-Air-Salt, and Water-Air-Energy-Salt with Ice. The user can select the operating mode applied. According to White and Oostrom (2000), "The STOMP simulations are limited in application scope according to the solved fundamental equations, the associated constitutive theory, inherent assumptions, computer execution speed and memory, and the user's creativity." These modelers also indicate that "correct application and comprehension of output results requires an understanding of the assumptions taken to develop the various flow and transport algorithms." Considering this, it follows that regulatory agencies responsible for comprehension of the output results and approval of the model would require a similar understanding. Additionally, STOMP allows user control over an initial state and boundary conditions. Therefore, under user control, the code may assume different forms, depending on the user's objectives.

STOMP is a large, complex, modular model. In these types of models, model uncertainty can easily surpass parameter uncertainty as the most significant contribution to the variance in model outputs (Cowan et al, 1995). Therefore, the main sources of model uncertainties (e.g., model structure, model detail, validation, extrapolation, model resolution, model boundaries, model scenarios) should be adequately described and considered when making remediation decisions based on the model outputs.

Problem

USDOE (2012) describes setting PRGs for the soil leaching pathway based on an alternative fate and transport model, that is, a 1-dimensional (1-D) STOMP code. As described above, STOMP has multiple operating modes and can be tailored by the user. Ecology has not been provided with all of the equations and sufficient detail to understand how the code was tailored for use in the River Corridor.

Basis/Justification

In order to evaluate the 1-D STOMP model for regulatory purposes, the regulatory agency should be provided with complete information describing how the users have tailored the code to their purposes. A recent report (Mehta, et al., 2013) provides eight governing equations for use of 1-D STOMP, but does not specify the operating mode (the Water or Water-Air modes are suspected). This is important, because the Water-Air mode would be applicable for volatile contaminants. Without a copy of the specific code used for the River Corridor, or without a list of equations from White and Oostrom (2000), Ecology's review of the modeling can only be superficial, and uncertain. Ecology's review would be greatly improved if the appropriate equations were provided, and this could be done by providing a list of equations (using equation numbers) from White and Oostrom (2000).

Considering the requirements given previously on the bulleted list, at this time, the modeling information provided by USDOE does not meet the burden of proof requirements in WAC 173-340-702(14)(b), (required under section -747(8)(c)). Furthermore, Ecology cannot verify that the modeling is based on an accepted theory or technique (WAC 173-340-702(16)(b)(i)), even though the flexible STOMP code is capable of meeting the regulatory requirements when used properly. Dilution factors from the 1-D STOMP modeling effort are roughly 1000 to 10,000 times higher for the base case (and 10 to100 times higher for irrigation) than the default assumption in WAC 173-340-747(4) of 20. Consequently, the base case PRGs (and irrigation soil screening levels (SSLs)) are many times to orders of magnitude higher than WAC 173-340-747 default soil cleanup levels. In the absence of the model equations, readers (and Ecology) do not have completely defensible documentation showing the relevant details of the site-specific model that produces the very large SSLs and PRGs proposed in USDOE (2012) for the leaching pathway.

Recommendation

Ecology should obtain a list of equations used in the 1-D STOMP modeling done to calculate leaching pathway screening levels and PRGs for the River Corridor. The list could be prepared by using the equation numbers in White and Oostrom (2000). It would not be necessary for the full equations to be provided on the list.

There are very few, if any, other hazardous waste sites in Washington using alternative fate and transport models. The high soil cleanup levels for the leaching pathway, described in USDOE (2012), may be scrutinized by interested parties. Ecology should ensure that the modeling approach is transparent, understood by Ecology, and defensible.

Ecology's Nuclear Waste Program should share the 1-D STOMP model documents with other Ecology offices to utilize the expertise in other programs and determine if the modeling is consistent with the intent of WAC 173-340-747(8).

References

Cowan, CE, D MacKay, TCJ Fiejtel, D van de Meent, A Di Guardo, J Davies, N MacKay. 1995. The Multi-Media Fate Model: A Vital Tool for Predicting the Fate of Chemicals. SETAC Press, Pensacola, FL.

Ecology. 2007. Model Toxics Control Act (MTCA). Pub. No. 94-06. Washington State Dept. of Ecology, Olympia, WA.

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White, MD, M. Oostrom, 2000. STOMP, Subsurface Transport Over Multiple Phases, Version 2.0, Theory Guide, PNNL-12030, Pacific Northwest National Laboratory, Richland, Washington.

Comments 183-H Class 2 modification:

1. More information on the operation of the new HX pump and treat system (including wells) would be helpful in understanding the integration of the CERCLA and RCRA monitoring networks.
2. Information presented in Modification forms are inconsistent with information presented in tables within the same modification sheets. (see Table 0.1 pg. 6 of 7; table 0.2 pg. 7 of 7)
3. RCRA monitoring network well list: Edit to include following:
    - Wells # 199-H4-5 and 15 A, B, C.
4. Using Table 3.2, edit Table 3.1 as follows:
    - For all RCRA wells listed under Compliance and Corrective Action, change Sampling and Analysis Schedule to sampling codes M-2, 3. Request schedule change for 2 years. Need enough data to support effectiveness of corrective actions and groundwater flow assumptions. Semi-annually is not defensible given recent discovery of exceedances of Permit (see DOE letter 12-AMRP-0123 noting exceedances of nitrate and uranium).
5. Using Table 3.2, edit Table 3.1 as follows:
    - For all wells listed under CERCLA Remediation which are also RCRA wells, change Sampling and Analysis Schedule to sampling codes M-2, 3. Request schedule change for 2 years. Need enough data to support effectiveness of corrective actions and groundwater flow assumptions. Semi-annually is not defensible given recent discovery of exceedances of Permit (same comment previously noted by Ecology regarding defensibility given recent discovery of exceedances of Permit).
6. Analysis/Parameters: Filtered and unfiltered samples to be done for all metal analyses, except RDM collects only filtered samples. Request explanation of use of filter sampling when regulations cite unfiltered.
7. Other Analysis/Parameters: Metals Other: Laboratory Specific Uranium Method; Chromium, hexavalent: Using total chrome and subtracting is somewhat unreliable. Request specific evaluation of hexavalent chromium is performed.
8. What treatment system is reducing the Sr-90 concentrations in H Area; it's not captured by the ion exchange system? Request clarification and inclusion of treatment system for Sr-90.
9. Provide rationale for not discontinuing use of dilution factor of 1:1 to demonstrate compliance with WAC AWQS for chromium of 11ug/L in riverbed sediments or 22ug/L at compliance points.
10. RL's Temporary Authorization request: Supporting information provided does not fully meet the compliance requirements of WAC 173-303-645(8). Request re-evaluation of points of compliance, stated as wells H4-4,-4-5,-4-49,-4-63,-4-64 (some Concerns: Ex. Unclear how background water quality is determined. Flow is more northerly than east with pump and treat system actions.)
11. Unidentified figure page 21. Clarify.

MEMO

TO:	100 Area Reader File
FROM:	Beth Rochette
DATE:	2 July 2013
CC:	Nina Menard, Kim Welsch, Alicia Boyd, Cheryl Whalen
RE:	Recharge to Ground Water from the Soil and Vadose Zone at 100 Area Remediated Waste Sites

Background

USDOE (2012) has elected to calculate soil concentrations protective of groundwater, also called soil preliminary remediation goals (PRGs) for the leaching pathway, by using an alternative fate and transport model, rather than using the default 3-phase model given in WAC 173-340-747, Equation 747-1 (Ecology, 2007). Alternative models are allowed in WAC 173-340-747(8), provided that particular procedures and requirements are met. One of these requirements is consideration of infiltration (-747(8)(b)(vii)), which is related to the volume of water infiltrating, through Equation 747-5. The volume of water infiltrating (units of cubic meters/year) can be calculated as the product of the length of the contaminant source parallel to ground water flow (units of meters), the width of the contaminant source area (1 meter) and infiltration (a rate, in units of meters/year). There are two options in WAC 173-340 to obtain the infiltration rate: a default approach, or a site-specific measurement or estimate. The default approach, for locations east of the Cascade Mountains, is to multiply the annual precipitation rate by 25% (or 0.25) (-747(5)(f)(ii)(A)). For Hanford, with an average annual precipitation rate of 6.8 inches (1947-2012) (http://www.hanford.gov/page.cfm/hms/products/totprcp), this would be roughly 1.7 inches (44 millimeters). A site-specific measurement or estimate must be made without considering caps or covers, and must comply with WAC 173-340-702 (14), (15) and (16).

Problem

USDOE (2012) describes setting PRGs for the soil leaching pathway based on a recharge scenario with mature shrub steppe vegetation. This scenario represents a "best case" and is not protective, in general, for land under unrestricted use.

Basis/Justification

In the 100 Areas of the River Corridor, cleanup has proceeded with an assumption of unrestricted land use, which is the most protective assumption for land use. With this assumption there are many possible future fates for the waste sites; therefore, consideration should be given to future disturbances. These disturbances could include:

- human excavation activities (e.g., excavations for buildings, utilities and/or road construction)
- tillage and agricultural activities (e.g., physical disturbance, input of nutrients and pesticides)
- mining operations (e.g., exposure of contamination, destruction of vegetation and habitat)
- wildfires (e.g., the Hanford site had 302 wildfires in the years 1990-2010 (USDOE, 2011))
- invasive species (e.g., cheatgrass, a common invasive species after fire).

Because of these potential disturbances, setting PRGs based on a recharge scenario with mature shrub steppe vegetation is not protective.

Other considerations include:

- The initial disturbance of soils when waste sites were created and remediated:

  - o Disturbed soils and backfill are not the same as their pre-disturbed counterparts, since topsoil has been mixed with subsoil (or lost entirely) and the material has no soil horizons.
  - o Recharge will not drop to the pre-disturbance levels until soil horizonation returns to the pre-disturbed condition.
  - o The time period for an A horizon for materials that resemble the Entisols (Burbank and Rupert) and the Aridisol (Ephrata) to form, as existed prior to disturbance and backfilling, would be at least 100 years (Birkeland, 1984).
- If cheatgrass establishes after backfilling, it may take much longer for shrub steppe vegetation to develop (Norton et al, 2004).
- The lack of references cited in USDOE (2012) to establish the recharge rates and time periods for development of mature shrub-steppe (which will parallel A horizon development) for the Hanford backfill material adds to the uncertainty about the time periods for plant succession, given potential influences of invasive plant species and human disturbance.
- The burden of proof for establishing that recharge (infiltration in WAC 173-340) has been derived in a defensible manner has not been met, as required by WAC 173-340-747(8)(b)(vii) and -702(14).

Recommendation

An irrigation recharge scenario is recommended. When this scenario (76 mm/y of recharge) is applied with STOMP modeling, all of the D/H area waste sites covered in the 100 Area D/H Remedial Investigation/Feasibility Study document pass for the leaching pathway (DOE/RL-2010-95, Section 5.7.3) (USDOE, 2012). With STOMP modeling, this results in soil cleanup levels that are 10 to 1000 times higher than default values with the 3-phase model (Ecology, 2007). Lower recharge rates for the 100-D and H areas would not change current conclusions about the leaching pathway (i.e. all sites pass with STOMP modeling for the leaching pathway).

However, if an irrigation recharge rate is not applied as a result of political decisions, natural recharge should be set to a value no lower than 50 mm/y for all time periods after remediation, consistent with lysimeter data for unvegetated sands (Gee et.al, 2005a (Table 3, sand and sandy gravel) and Gee et al., 2005b). This value is close to the WAC 173-340-747(5)(f)(ii)(A) default approach for locations east of the Cascade Mountains (multiply the annual precipitation rate by 25%, giving an annual recharge of 44 mm/y). This recharge rate would more realistically accommodate human disturbances, fires, and domination by invasive species than the low recharge rates associated with mature shrub steppe vegetation (which are generally 10 times lower).

Final Consideration:
There are very few, if any, other hazardous waste sites in Washington using alternative fate and transport models. The high soil cleanup levels for the leaching pathway, described in USDOE (2012), may be scrutinized. Consequently, we should be prepared to defend these values. We should ensure that the inputs are protective (and that the modeling approach is transparent, understood by Ecology, and defensible).

References

Birkeland, PW. 1984. Soils and Geomorphology. p. 223-225.

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Gee, GW, JM Keller, AL Ward. 2005a. Measurement and prediction of deep drainage from bare sediments at a semiarid site. Vadose Zone Journal. 4:32-40.

Gee, GW, ZF Zhang, SW Tyler, WH Albright, MJ Singleton. 2005b. Chloride mass balance: Cautions in predicting increased recharge rates. Vadose Zone Journal. 4:72-78.

Norton, JB, TA Monaco, JM Norton, DA Johnson, TA Jones. 2004. Soil morphology and organic matter dynamics under cheatgrass and sagebrush-steppe plant communities. J. of Arid Environments 57:445-466.

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EPA United States Environmental Protection Agency

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August 7, 2008

Reply to: stifelman.marc@epa.gov

MEMORANDUM

Subject:	Recommended toxicity value for uranium, noncancer endpoint for the Hanford Nuclear Reservation Site
From:	Marc Stifelman, Office of Environmental Assessment
To:	Laura Buelow, EPA ECL Richland Hanford Office Larry Gadbois, EPA ECL Richland Hanford Office Nick Ceto, EPA ECL Richland Hanford Office
Cc:	Mike Cox, Office of Environmental Assessment Rick Poeton, Office of Environmental Assessment

This memo recommends using the Reference Dose (RfD) developed by the Office of Water for the Maximum Contaminant Level (MCL) for uranium in the human health risk assessment for the Hanford Nuclear Reservation NPL Site in place of the RfD developed by Integrated Risk Information System (IRIS) for soluble salts of uranium (2000; U.S. Environmental Protection Agency & U.S. Geological Survey, 2000). Both RfDs are based on (noncancer) kidney toxicity.

Generally, human health toxicity values are selected from a recommended hierarchy of sources, where the preferred source is EPA's Integrated Risk Information System (Cook, 2003). However, application of the hierarchy is flexible and suggests criteria useful to select among different sources of toxicity values (Cook, 2003; Farland, 1993; U.S. Environmental Protection Agency, 1989b).

Excerpt from (Cook, 2003; Farland, 1993):

> "...IRIS is not the only source of toxicology information, and in some cases more recent, credible and relevant data may come to the Agency's attention. In particular, toxicological information other than that in IRIS may be brought to the Agency by outside parties. Such information should be considered along with the data in IRIS in selecting toxicological values; ultimately, the Agency should evaluate risk based upon its best scientific judgment and consider all credible and relevant information available to it."
>
> "Priority should be given to those sources of information that are the most current, the basis for which is transparent and publicly available, and which have been peer reviewed."

The IRIS RfD for soluble salts of uranium is based on what is probably the first uranium toxicity study, conducted as part of the Manhattan Project to provide information to inform occupational safety of workers handing uranium (cited by IRIS as Maynard and Hodges, 1943) (U.S. Environmental Protection Agency, 1989a; Voegtlin & Hodge, 1949). The IRIS profile has not been revised since 1989. In 2002, the IRIS program conducted a literature review for uranium which indentified new relevant studies and concluded that, "*The literature published since the oral RfD for soluble uranium salts was derived (1989) contains study data that could potentially produce a change in the RfD.*" (Agency for Toxic Substances and Disease Registry, 1999; Gilman *et al*, 1998a; Gilman *et al*, 1998b; Gilman *et al*, 1998c; U.S. Environmental Protection Agency, 2002). These same studies were used by the Office of Drinking Water to prepare a uranium RfD for the revised MCL as part of a transparent, public, peer-reviewed process using up to date risk assessment methods (2000; U.S. Environmental Protection Agency & U.S. Geological Survey, 2000).

Summary of U.S. Environmental Protection Agency Uranium Reference Doses

EPA Source	Link to Profiles	Reference Dose (mg/kg-day)	Target Organ	Critical Study
IRIS	http://www.epa.gov/iris/subst/0421.htm	0.003	Kidney	(Voegtlin & Hodge, 1949)
Office of Ground Water and Drinking Water	http://www.epa.gov/OGWDW/radionuclides/pdfs/regulation_radionuclides_rulemaking_techsupportdoc.pdf http://www.epa.gov/EPA-WATER/2000/December/Day-07/w30421.htm	0.0006	Kidney	(Gilman *et al*, 1998a; Gilman *et al*, 1998b; Gilman *et al*, 1998c)

References

(2000) National Primary Drinking Water Regulations; Radionuclides; Final Rule. In *Code of Federal Regulations* Vol. 40 CFR Parts 9, 141, and 142. pp Federal Register / Vol. 65, No. 236 / Pages 76708-76753 http://www.epa.gov/EPA-WATER/2000/December/Day-07/w30421.htm

Agency for Toxic Substances and Disease Registry (1999) Toxicological profile for uranium p 381 plus appendices. Atlanta, GA: U.S. Department of Health and Social Services, Public Health Service http://www.atsdr.cdc.gov/toxprofiles/tp150.pdf

Cook MB (2003) Human Health Toxicity Values in Superfund Risk Assessments p 4. Washington D.C.: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response http://rais.ornl.gov/homepage/hhmemo.pdf

Farland WH (1993) Use of IRIS Values in Superfund Risk Assessment: OSWER Directive 9285.7-16 p 4. Washington D.C.: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response http://www.epa.gov/oswer/riskassessment/pdf/irismemo.pdf

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Gilman AP, Villeneuve DC, Secours VE, Yagminas AP, Tracy BL, Quinn JM, Valli VE, Willes RJ, Moss MA (1998c) Uranyl nitrate: 28-day and 91-day toxicity studies in the Sprague-Dawley rat. *Toxicol Sci* **41:** 117-28 http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=9520346

U.S. Environmental Protection Agency (1989a) IRIS Toxicity Profile for Uranium, Soluble Salts p 6. Washington DC: USEPA http://www.epa.gov/iris/subst/0421.htm

U.S. Environmental Protection Agency (1989b) Risk assessment guidance for superfund (RAGS); Volume I: Human health evaluation manual (HHEM), (Part A); Interim Final Vol. 1, Part A. Washington, DC: Office of Emergency and Remedial Response, U.S. Environmental Protection Agency

U.S. Environmental Protection Agency (2002) Integrated Risk Information System (IRIS) Screening-Level Literature Review: Uranium, soluble salts p 5. Washington DC: USEPA http://www.epa.gov/iris/subst/0421.htm

U.S. Environmental Protection Agency, U.S. Geological Survey (2000) Radionuclides Notice of Data Availability Technical Support Document p iv 160. Washington, D.C.: USEPA Office of Ground Water and Drinking Water; Office of Indoor Air and Radiation, U.S. Geological Survey http://www.epa.gov/OGWDW/radionuclides/pdfs/regulation_radionuclides_rulemaking_techsupportdoc.pdf

Voegtlin C, Hodge HC (1949) *Pharmacology and toxicology of uranium compounds, with a section on the pharmacology and toxicology of fluorine and hydrogen fluoride*, 1st edn. New York,: McGraw-Hill Book Co.

Central Files ______
File Name: ______
Cross Reference: ______

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3100 Port of Benton Blvd • Richland, WA 99354 • (509) 372-7950

March 21, 2011

To: Jane Hedges, Nuclear Waste Program Manager
Nina Menard, Nuclear Waste Specialist
John Price, Tri-Party Agreement Section Manager
Cheryl Whalen, Cleanup Section Manager

From: Alisa Huckaby, Hydrogeologist 3 ADH
Nuclear Waste Program

Subject: Observations and Recommendations Associated with Waste Site Reclassification Forms (WSRF) and Accompanying Cleanup Verification Packages (CVP)

I based my recommendations provided below on my review of 100-D and 100-H Area WSRFs and accompanying cleanup verification packages as well as observations associated with data needed to support a defensible final Record of Decision (ROD):

- **I recommend that Ecology not sign WSRFs with the below wording unless vadose zone characterization data from below the base of the waste site excavation or test pit exists to "demonstrate" that "site contamination did not extend into the deep zone soils." I also recommend that Ecology not support the statement "residual contaminant concentrations are protective of groundwater and the Columbia River."**

  Specifically, WSRFs and CVPs typically include wording that states:
  "The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Site contamination did not extend into the deep zone soils. Institutional controls to prevent uncontrolled drilling or excavation into the deep zone soil are not required."

  These statements should be replaced with text that states "IROD remedial action goals were met at the waste site, since residual contaminant concentrations at the base of the excavated waste site are at or below concentrations that have been accepted for Interim Action Records of Decision." In other words, I recommend that Ecology not sign forms with inaccurate language that gives the impression that Ecology is in concurrence with those statements.

The wording currently in WSRFs is not supported by vadose zone sampling beneath waste site excavations or test pits. Rather, the above wording appears to rely on United States Department of Energy's (USDOE) conceptual site model that contamination does not increase at depth and will not migrate to groundwater. USDOE's use of Residual Radioactivity (RESRAD) modeling (which is used for radionuclide and non-radionuclide constituents) input assumes that the contamination left at the base of the excavation and/or test pit will neither increase at depth nor will migrate to groundwater in 1,000 years.

Ample documentation exists showing vadose zone contaminant concentrations have increased at depth below the base of the waste site excavation. For example, Figures 2-11, 2-13, 2-14, 2-31, 2-32, and 2-33 of reference 1 clearly shows numerous cases where vadose zone concentrations of strontium-90 and chromium have increased with depth. Similarly, Figures 2-28, 2-29, 2-30, 2-31, 2-32, 2-34, and 2-35 of reference 2 clearly shows numerous constituent vadose zone concentrations (e.g., uranium-238, uranium-233/234, plutonium-239/240, europium-152,radium-226, arsenic, hexavalent chromium, lead, cobalt, mercury, nickel, copper, di-n-octyphthalate, etc.) that have increased at depth below the base of the waste site excavation.

In addition, Ecology's letter to USDOE (reference 3) identifies that the model (RESRAD) currently used for demonstrating soil concentrations protective of groundwater and the Columbia River is severely deficient (for chemicals) and results will not be acceptable for the final ROD. This letter was cited in a recent Government Accountability Office Report (GAO-11-43, February 10, 2011) that criticized USDOE's modeling practices at Hanford.

- **I recommend that Ecology not sign "No Action" or "Interim Closed Out" WSRFs without documenting Ecology's concerns regarding contaminant concentrations remaining in the vadose zone <u>beneath the base of the waste site excavation or test pit for which no data exists</u>.** The documentation of such concern can be added to the evaluation (for consistency with corrective action requirements that will be updated within the final ROD) that Ecology already performs.

References 1 and 2 identify data gaps for which additional data is needed to support the respective final ROD. Specifically, data gap 2 states: "Vadose zone contaminant nature and extent needed to assess protection of groundwater beneath remediated waste sites." Via both workplans, additional vadose zone characterization is being or will be obtained from at least nineteen remediated waste sites. Furthermore, at N Area, of the eighteen waste sites that have been interim remediated, Ecology determined that additional vadose zone characterization should be obtained from four waste sites, additional remediation should be performed at three waste sites, and additional characterization is needed from two waste sites prior to issuance of the final ROD. In other words, at N Area, of the eighteen remediated waste sites, Ecology determined that 50% need additional characterization and/or remediation.

- **I recommend that Ecology address (as recommended above) the lack of defensibility of USDOE's assertion that site contamination did not extend into the deep zone soils when:**

  1) **Model Toxic Control Act method B soil cleanup levels (i.e., defaults from 1996 [excluding hexavalent chromium default {i.e., Kd=0 for hexavalent chromium in 100 Area soils}], 2001, and 2007 soil to protect groundwater and surface water values) were not satisfied at the base of the remediation or test pit.**

  2) **No vadose zone contaminant characterization data exists from beneath the base of the remediation or test pit.**

  3) **Groundwater quality observations from wells located in close proximity to the remediated waste site (especially liquid waste disposal sites such as dry wells) indicate negatively impacted groundwater quality.**

  Groundwater observations from wells located in close proximity to each remediated waste site (that I have evaluated) clearly indicate that the groundwater quality in the vicinity of the waste site has been negatively affected. Although no definitive conclusions may be reached about the specific source of the groundwater contamination, groundwater quality observations from wells located in close proximity to remediated waste sites does not support USDOE's assertion that site contamination did not extend into the deep zone soils.

- **For final ROD defensibility, I recommend that Ecology require all 100-D and -H Area waste sites that were reclassified as "interim closed" or "no action" be evaluated in the upcoming Remedial Investigation (RI) report.** Table 4-8 of reference 1 summarizes characterization information available for the 18 N Area waste sites remediated thus far. Of the eighteen waste sites remediated, fourteen were associated with the Hanford Generating Plant (HGP). During the development of the Remedial Investigation/Feasibility Study (RI/FS) workplan, Ecology identified significant deficiencies (e.g., contaminated soils left in place that would have designated as dangerous waste, lack of polyaromatic hydrocarbon testing for most of the petroleum contaminated waste sites, waste sites without any removal action, etc.) associated with the HGP waste site remediations. Because of the deficiencies associated with N Area remediation actions, the RI/FS workplan states: "For source units in 100-N, DOE plans to evaluate all waste sites that currently have an "interim closed" or "no action" reclassification status in the RI report."

References:

1) *Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan, Addendum 5: 100-NR-1 and 100-NR-2 Operable Units*, DOE/RL-2008-46-ADD5, Draft B

2) *Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan, Addendum 1: 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units*, DOE/RL-2008-46-ADD1, Revision 0

3) Letter dated February 10, 2010, from C. L. Whalen, Ecology, to M. S. French, USDOE, "Department of Ecology (Ecology) Review of the United States Department of Energy's (USDOE) Justification Package for Use of the Residual Radioactivity (RESRAD) Computer Code to Model Chemical Constituents"

bcc: Alisa Huckaby
NWP Central File:

1) *Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan, Addendum 1: 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units*, DOE/RL-2008-46-ADD1, Revision 0, File

2) *Integrated 100 Area Remedial Investigation/Feasibility Study Work Plan, Addendum 5: 100-NR-1 and 100-NR-2 Operable Units*, DOE/RL-2008-46-ADD5, File

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Comment Number 100-D/H-010

September 15, 2016

Letter from Columbia Riverkeeper

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September 15, 2016

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Submitted via email to: Richard.buel@rl.doe.gov, 100DHPP@rl.doe.gov[1]

RE: Proposed Plan for Remediation of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units

Dear U.S. Department of Energy:

Columbia Riverkeeper (Riverkeeper) submits the following comments on the U.S. Department of Energy's (Energy) Proposed Plan for Remediation of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units (hereafter referred to as "Proposed Plan"). Riverkeeper has significant concerns about Energy's Proposed Plan to deal with radioactive and toxic pollution in the 100-D/H Area. Riverkeeper urges Energy to take a proactive, protective approach to dealing with dangerous waste in the 100-D/H Area.

Riverkeeper has appreciated aggressive interim cleanup actions taken by Energy to address highly mobile and toxic chromium contamination at the site, particularly the "big dig" effort in the D and H areas where Energy excavated deep soils to remove contamination that was contributing to groundwater pollution with the potential to impact the Columbia River and its

[1] Note: The public notice for Proposed Plan directed comments to Mr. Buel. The Proposed Plan itself directs comments to Ms. Holmes. See Proposed Plan P. 48.

sensitive salmon habitat. Unfortunately, Energy's Proposed Plan for the remaining pollution in the 100-D/H Area relies heavily on monitored natural attenuation (MNA) and institutional controls (ICs) to address radioactive and chemical pollution, and the Proposed Plan fails to provide a well-reasoned explanation for why Energy does not adopt a more proactive approach to addressing radioactive and chemical soil contamination. Riverkeeper urges Energy to revise the Proposed Plan to address these shortcomings.

I. Riverkeeper's Commitment to Hanford Cleanup

Columbia Riverkeeper is a 501(c)(3) nonprofit organization with a mission to protect and restore the Columbia River, from its headwaters to the Pacific Ocean. Since 1989, Riverkeeper and its predecessor organizations have played an active role in educating the public about Hanford, increasing public participation in cleanup decisions, and monitoring and improving cleanup activities at Hanford.

A legacy of the Cold War, Hanford is the nation's most contaminated site and continues to leach radioactive and chemical pollution into the Columbia River. Hanford's nuclear and chemical contamination threatens the Pacific Northwest's people, river communities, the health of the Hanford Reach, which is the most productive mainstem spawning ground for Chinook salmon, and countless other cultural and natural resources. The public and Riverkeeper members continue to catch and consume fish from the Columbia River, drink water from the river, irrigate farms with water from the river, and recreate in the Hanford Reach and downstream of Hanford. The federal government has an obligation to ensure that Hanford's nuclear legacy does not compromise current and future generations' use and enjoyment of the Columbia River.

In recent years, members of the public have used and enjoyed the Hanford Reach in the vicinity of the 100-D/H Area, including during Riverkeeper-led kayak trips. Additionally, Riverkeeper and its members often observe fish and wildlife in the area that could be negatively impacted by cleanup actions that leave chemical and radioactive pollution close the Columbia River. Lastly, Riverkeeper supports cleanup that avoids reliance on monitored natural attenuation and institutional controls for over 100 years in the River Corridor.

II. Public Participation

Riverkeeper encourages EPA, Ecology, and Energy (collectively the "TPA agencies") to strive for robust pubic participation in all Hanford cleanup decisions. The TPA agencies' public notice for the Proposed Plan fails to provide the public with an accurate picture of how proposed actions will result in long-term risks to the environment. For example, the comparison of alternatives fails to explain how deep soil sites will fail to reach cleanup levels for up to 187 years. Rather, the public notice and fact sheet provide a sparse comparison of waste cleanup activities, providing no indication that soils would exceed pollution standards after 56 years. As described below, the agencies' failure to present a comprehensive comparison of alternatives undermines the public's ability to evaluate Energy's plans to rely on monitored natural attenuation (MNA) and institutional controls (ICs) for over 100 years in eight soil waste sites. Furthermore, TPA agencies did not hold a public hearing on the Proposed Plan, limiting the public's ability to understand and comment on the Proposed Plan. We request that Energy provide adequate public notice and information materials and plan to hold hearings for major decisions that impact the River Corridor.

Lastly, during our participation in the August River and Plateau Committee of the Hanford Advisory Board (HAB), we were disappointed to hear agency representatives assert that comments were unlikely to alter Energy's analysis or the outcome of its decision. According to an EPA representative in the August River and Plateau Committee meeting, the record of decision "will be issued by the end of September," and agency officials expect to respond to comments as they arrive but not to alter their Proposed Plan or expected selection of the Preferred Alternative. Unfortunately, the agencies' assertion that they plan to respond to comments but not seriously consider altering their preferred cleanup actions diminishes the importance of public involvement. Indeed, it violates the public's expectation that public involvement and public comments have the ability to shape the agencies' course of action. We urge TPA agencies to refrain from committing to a course of action until they have adequately solicited, considered and responded to public comments, and to avoid dissuading public involvement by presenting their Proposed Plans as immutable.

III. Comments on the Proposed Cleanup Plan

A. Energy's preferred alternative relies excessively on monitored natural attenuation and institutional controls, which should not be relied upon to protect human health and the environment for very long periods of time.

Energy's preferred alternative fails to protect human health and the environment by relying excessively on monitored natural attenuation (MNA) and institutional controls (ICs), an approach that will leave hazardous chemical and radiological waste in soils and groundwater for decades. For example, using its MNA approach in the Preferred Alternative, Eergy anticipates that Strontium-90 (Sr-90) will remain above acceptable levels in deeper soils in the D area for up to 187 years. In sites 100-D-46 (2203), 116-D-1B (2203), 116-D-1A (2203), 100-D-49:2 (2117), 116-D-7 (2125), 116-DR-1 & 2 (2148), 118-D-6:3 (2120), 118-D-6:4 (2143), 116-H-1 (2110),[2] the Proposed Plan concludes that soils will exceed hazardous levels for over 100 years. In all of these sites, the Proposed Plan proposes to restrict soil disturbance below 15 feet for the duration of time during which soil contamination levels remain above standards.

The TPA Agencies' exchange with the National Remedy Review Board (NRRB) highlights flaws in the Proposed Plan related to the Plan's reliance on MNA and ICs. The NRRB

[2] Proposed Plan. Table 6. p. 45. Numbers in parentheses indicate the year in which sites are expected to reach cleanup levels.

questioned the Plan's reliance on MNA and ICs and asked EPA and Ecology to provide additional "lines of evidence" to support the use of an MNA remedy in both soils and groundwater. The NRRB wrote,

> …the Board did not have sufficient information to fully evaluate certain aspects of the preferred approach, including: 1) the relative roles of maximum contaminant levels (MCLs) and State surface water quality standards in achieving the remedial action objectives (RAOs); 2) lines of evidence to support a monitored natural attenuation (MNA) remedy for groundwater and soils; 3) scope and extent of potential risks to human health and the environment associated with the I 00-H-36 tructure, including potential contamination of sediments; 4) MCLs and associated monitoring data for all potential contaminants of concern (COCs) in groundwater; 5) how sites were screened out (e.g., no future remedial action planned); 6) historic and current levels of strontium in the soils and groundwater; and 7) lack of a comprehensible conceptual site model.[3]

NRRB further questioned the Proposed Plan's reliance on MNA and ICs:

> …the Department of Energy (DOE) has reasonably anticipated future land use as conservation and preservation. EPA and Ecology believe that other uses, including residential use, are reasonably anticipated for the site. The Board recommends that future decision documents clearly identify the future land use and how the preferred alternative will be protective of that use…The package presented to the Board indicated that institutional controls (ICs) will play an important role for the 1 00-D/H Area. The Board recommends that the proposed 'plan and other decision documents clearly explain in sufficient detail which specific ICs would be needed to ensure protectiveness of human health, upon what authority they would be based and how they would be enforced over the longterm.[4]

In their response to the NRRB, EPA and Ecology provide essentially no justification for their reliance on ICs in deep soils[5] for up to 187 years. Their response focuses almost entirely on groundwater. When asked to describe how MNA is suited for groundwater and soils at the site, the agencies responded:

> The lines of evidence to support a MNA remedy for soil are proposed at sites with radioactive contamination. This was not clearly presented in the Remedy Review Board Package. The diffusion and dispersion of the nitrate, which is co-located with the Cr(V1) plume, results in attainment of the nitrate cleanup level within 13 years/or Alternatives 2, 3, and 4 (summarized in Table 4 of the Proposed Plan). The MNA of nitrate and strontium-90 in the preferred remedy is appropriate for use with the pump-and/real for

[3] National Remedy Review Board Letter to EPA. March 27, 2015. p. 2.
[4] National Remedy Review Board Letter to EPA. March 27, 2015. p. 3.
[5] Energy defines "deep" soil sites as being below 15 feet from the surface.

Cr(VI). Both the nitrate and strontium-90 plumes are co-located within the Cr(VI), and migration is controlled through the groundwater extraction system…As a result of ongoing groundwater remediation under interim action, nitrate concentrations have declined below the drinking water standard (DWS) in most wells. Only small areas continue to have concentrations above the DWS in the 100-D Area. Nitrate concentrations did not exceed the DWS in 100-H or the Horn during 2014. Strontium-90 has shown stable or declining concentrations, and is relatively immobile.[6]

Ecology's response, furnished to the NRRB by EPA, largely focused on the agencies' reasons for selecting MNA for groundwater and elsewhere stated that ICs were "proven" at the Hanford site.[7] Ecology responded, "Strontium-90 has shown stable or declining concentrations, and is relatively immobile." Yet, the Proposed Plan shows that Sr-90 levels will remain in excess of cleanup standards for 44 years,[8] and Sr-90 is mobile enough to pose a risk to groundwater, rendering the No Action Alternative unacceptable according to Energy.[9] In the Proposed Plan, in addition to sidestepping Sr-90 contamination, the agencies also did not address the potential to remove co-extracted contaminants during treatment of hexavalent chromium. The Proposed Plan should address alternatives that reduce the timeframe during which Sr-90 would remain above cleanup levels in groundwater.

Additionally, neither the agencies' response to the NRRB nor the Proposed Plan adequately explain how the very long timeframe for ICs in soil sites (up to 187 years) is reasonable for soil sites in close proximity to the Columbia River, where soil disturbance below 15 feet could be reasonably expected to occur in the next 187 years if ICs fail. In its response to comments from the NRRB and in the Proposed Plan, Energy contends ICs have been "proven" at the Hanford site.[10] While restrictions on well-drilling and excavation may be conceivable for the 44 years it will take for groundwater to reach standards, the long-term use (over 100 years) of ICs for deeper soils[11] so close to the Columbia River have not been proven to be successful: ICs are an undemonstrated approach at Hanford for areas that become publicly accessible but whose soils may pose a risk for over 100 years. Energy describes ICs in the Proposed Plan in general terms:

> Alternatives 2, 3, and 4 require ICs during the period before completion of the remedial action and following remedial action implementation where cleanup levels protective of UU/UE will not be achieved. Exposure to contamination deeper than 4.6 m (15 ft) bgs is not anticipated. Where contamination at depth exceeds the residential use cleanup levels, ICs are required to ensure that future activities do not bring this contamination to the surface or otherwise result in exposure to contaminant concentrations that exceed cleanup

[6] EPA Response Letter to NRRB. December 21, 2015. p. 2.
[7] EPA Response Letter to NRRB. December 21, 2015. p. 9.
[8] Proposed Plan, p. 45.
[9] Proposed Plan. p. 39.
[10] EPA Response Letter to NRRB. December 21, 2015. p. 9.
[11] Energy defines "deep" soil sites as below 15 feet below the ground surface.

levels. Figures 11 and 12 show the 34 deep waste sites (with sampling results as of November 2012) that indicate radiological contamination at depths greater than 4.6 m (15 ft) bgs exceeding the residential use cleanup levels, which would be addressed using MNA and would be subject to ICs under Alternatives 2, 3, and 4. In addition, any waste sites remediated after November 2012, with radiological contamination at depths greater than 4.6 m (15 ft) bgs that exceed the residential use cleanup levels, would be addressed using MNA and would be subject to ICs. Drilling and excavation would be restricted within the IC boundaries shown in Figures 11 and 12 for deep waste sites. ICs will be maintained until cleanup levels are achieved, the concentrations of hazardous substances are at levels to allow for UU/UE, and EPA authorizes the removal of restrictions. Table 3 projects the year when radioactive decay will achieve cleanup levels and ICs can be removed.[12]

Table 3 does not provide the year when radioactive decay will achieve cleanup levels for deep soil sites: rather, that information is available in Table 6 on page 45 of the Proposed Plan. More importantly, the Proposed Plan does not present an in-depth analysis of the challenges posed by implementing and maintaining ICs. The NRRB, Riverkeeper, and others have advised Energy in previous comments that the future uses of the River Corridor and interests of Tribal Nations may conflict with the use of very long-term ICs so close to the River. For example, even when groundwater reaches standards in 44 years, the drilling of a well through a waste site may bring to the surface drill casings that contain soils contaminated with high levels of Sr-90 or other contamination. For this and other easily anticipatable problems such as unexpected intrusion, building and excavation, and other activities that will be attractive so close to the Columbia River, Energy must devote a much more robust analysis to its reliance on ICs in the River Corridor. In summary, Riverkeeper urges Energy to acknowledge the potential for ICs to fail due to changing political, economic, and ecological circumstances over the very long timeframes contemplated in the Proposed Plan.

Additionally, the Proposed Plan plans to use MNA and ICs for shallow waste sites under its Preferred Alternative. Three waste sites (100-D-25, 116-D-8, and 116-DR-9) with shallow radionuclide contamination (depth less than 15 feet) would require entry restrictions until 2038. Alternative 4 considers an alternative which uses RTD for these shallow sites, a preferable approach to reducing contamination that, due to its shallower depth, may pose a greater risk for exposure to humans and ecological receptors.

To justify its chosen course, Energy must find that the timeframe for MNA is reasonable, and that ICs are likely to succeed for as long as the Proposed Plan indicates that they will be needed. We urge Energy to consider the commonsense advice from the HAB, which concludes that Energy's prolonged use of MNA and ICs will present a significant risk to human health and the environment at Hanford. The HAB has addressed Energy's past proposals for prolonged use

[12] Proposed Plan. p. 35.

of ICs by stating that "there is no reasonable way to ensure" that Energy's approach will remain effective for the very long time period required for radioactive decay or other processes to reduce contamination below cleanup levels.

According to the EPA, Energy should use a proactive cleanup approach when possible, particularly when pollutants can migrate through soils to groundwater. An EPA guidance document from 2010 states: "When relying on natural attenuation processes for site remediation, EPA prefers those processes that degrade or destroy contaminants. Also, EPA generally expects that MNA will only be appropriate for sites that have a low potential for contaminant migration."[13] Emphasizing the importance of limiting contaminant migration, EPA's guidance document highlights the importance of controlling the source of pollution. In this case, access to deep soils on the Hanford site, very close to the Columbia River, will be difficult to manage for the timeframes during which the soils will remain contaminated at dangerous levels. We urge the TPA Agencies to reconsider their proposed reliance on MNA and ICs for deep soil sites, and to offer an analysis of alternatives that could address some or all of the deep soil sites through an RTD approach.

Lastly, Yakama Nation and others have expressed concern to the TPA Agencies about the duration of pump-and-treat activities and the monitoring required to ensure that pollution levels do not rebound after pump-and-treat activities cease. For example, Energy's Preferred Alternative is expected to attain cleanup levels in 12 years for Cr(VI) and total chromium, 6 years for nitrate, and 44 years for Sr-90.[14] The Proposed Plan does not clearly identify how Energy will reach the decision to cease pump-and-treat activities and how monitoring will detect any potential rebound in contaminants (either chromium, which is the target of the pump-and-treat system, or Sr-90, which is not). Most importantly, the Proposed Plan does not establish a clear plan for re-establishing additional cleanup activities if pollution levels were to increase unexpectedly after the cessation of active cleanup. We ask that the Proposed Plan be amended to provide additional clarity on this matter.

B. Energy's Cleanup Plan Fails to Provide an Adequate Analysis of Alternatives for Cleanup of Hanford Soils & Hanford Groundwater

Energy's Proposed Plan fails to propose an alternative that adequately addresses both groundwater and deep soil contamination. Energy should combine the most pro-active components of Alternatives 3 and 4 for soils and groundwater in a 5th Alternative. Instead, Energy's Proposed Plan poses a tradeoff between Alternative 3, which includes more aggressive pump-and-treat activities and more new wells, and Alternative 4, which provides for additional remove-treat-dispose (RTD) cleanup of shallow waste sites. Alternative 4 proposes RTD for

[13] U.S. EPA. Monitored Natural Attenuation of Inorganic Contaminants in Ground Water. Volume 3. Assessment for Radionuclides Including Tritium, Radon, Strontium, Technetium, Uranium, Iodine, Radium, Thorium, Cesium, and Plutonium-Americium. September 2010. p. 2.
[14] Proposed Plan. p. 37.

three shallow waste sites and a pipeline rather than MNA and IC's, as proposed in Alternative 3. Yet, Alternative 4 would deploy fewer groundwater wells (30 wells) than Alternative 3 (80 wells).[15] Energy must provide a reasonable range of alternatives. In this case, Energy should provide analysis of an alternative that combines the most aggressive soil remediation and groundwater remediation strategies.

Energy's presentation and comparison of alternatives has additional flaws. Energy does not explain why Alternative 4 appears to be more expensive for cleaning up groundwater while offering significantly reduced cleanup activity. Alternative 4 deploys 50 fewer wells than Alternative 3. Yet, Alternative 4 costs an additional $48 million. Presumably, the additional cost results from the additional 27 years that Alternative 4's pump and treat system would be required to bring hexavalent chromium levels down to cleanup levels. As written, Table 4 remains confusing and counter-intuitive in the Proposed Plan. And it reinforces the need for Energy to propose an alternative that combines the most aggressive cleanup elements of Alternatives 3 & 4 for groundwater and soil remediation.

Energy does not present an alternative to address Sr-90 groundwater contamination, other than through MNA. As noted above, both the NRRB and EPA's own guidance set a high bar for Energy to reach the conclusion that MNA is appropriate where groundwater close to the Columbia River exceeds cleanup levels. Sr-90 is only incidentally addressed in Energy's chromium-driven groundwater strategy by being co-extracted, diluted, and re-injected throughout the site. Energy contends that Sr-90 levels will remain below groundwater cleanup levels before re-injection. Energy should consider an alternative that addresses not only hexavalent chromium contamination, but also attempts to treat co-extracted contaminants such as Sr-90 and nitrate. The hexavalent chromium pump-and-treat activity in the preferred alternative will end decades prior to Sr-90 levels reaching groundwater cleanup goals. We urge Energy to evaluate how groundwater cleanup could be targeted at Sr-90 to reduce the time period during which levels will remain elevated above cleanup levels in groundwater.

Lastly, Energy provides no alternative to address deep soil contamination in the 100-D/H Area. As noted above, in all Action Alternatives, eight soil sites below 15 feet are proposed to be addressed through MNA and IC's for 100 years or more. Energy must evaluate cleanup alternatives that reduce or eliminate the long-term reliance on MNA and ICs at soil waste sites close to the Columbia River where deep excavation for building, future well-drilling, or other processes may bring contamination below 15 feet to the surface. By failing to assess methods to address deeper soil contamination, Energy fails to provide the public with a reasonable range of alternatives. We understand that Energy is capable of excavating deep vadose zone waste: indeed, the agency has undertaken multiple "deep digs" in the River Corridor in the 100-B/C and 100-D/H areas to address highly mobile chromium contamination. The risk with deep radioactive and chemical soil contamination is both its potential to move into groundwater, and

[15] Proposed Plan. p. 38.

its potential for exposure to people in the future if ICs fail. We urge Energy to develop a sixth Alternative to address these deeper soil waste sites that will not reach cleanup goals for many decades (up to 187 years in some sites), while using the chromium-driven groundwater cleanup approach in Alternative 3.

C. Cleanup Should Protect Unrestricted Future Use of the 100-D/H Area.

In agreement with previous advice from the HAB about River Corridor cleanup plans, Riverkeeper objects to Energy's over-reliance on ICs. For up to 187 years in a few sites, and for many decades in over a dozen sites, deeper soils will exceed cleanup levels and require ICs. As a result, Energy's Proposed Plan falls far short of achieving unrestricted use in the River Corridor, leaving pollution in soils that will require a restriction on the excavation of soils – thereby limiting activities such as well-drilling that could disturb deep soils. The use of ICs should be addressed with appropriate acknowledgement and deference to future users of the Hanford site, in particular tribal nations whose treaty rights guarantee their use of the Columbia River and the River Corridor. Energy should not rely on the Comprehensive Land Use Plan (CLUP) as a justification for short-changing key cleanup decisions. Rather, as recommended by the HAB in previous advice, Energy should proceed towards cleanup that achieves an unrestricted use standard. The HAB wrote in 2014:

> The Board advises the TPA agencies to choose alternatives that meet the goal of unrestricted use along the River Corridor. Language in the Proposed Plan and selected preferred alternatives indicates that DOE is not considering cleanup to unrestricted use standard and is moving toward a less stringent cleanup based on the Comprehensive Land-Use Plan.[16]

The HAB, Riverkeeper, Yakama Nation, and others have identified that the River Corridor is highly attractive to future uses that may be difficult to restrict or prohibit using ICs. Energy's Proposed Plan is unacceptable because it curtails future uses of the Columbia River corridor rather than achieving the "unrestricted use." Disappointingly, Energy offers no alternative that would achieve safely allow "unrestricted use" of the River Corridor, instead choosing a goal of "unrestricted *surface* use."

D. The Incomplete and Flawed River Corridor Baseline Risk Assessment is not an Appropriate Source for Risk Assessment Metrics in Energy's Proposed Plan.

The Proposed Plan relies the River Corridor Baseline Risk Assessment (RCBRA),[17] a document that state and federal agencies as well as the HAB deemed severely flawed. Riverkeeper urges Energy to consider input on the RCBRA's deficiencies from agencies, tribes,

[16] HAB Advice 268.
[17] Proposed Plan. P. 22.

the HAB, and other regional stakeholders, and to revise the RCBRA. Until Energy finalizes a revised RCBRA and resolves issues raised by agencies, the Yakama Nation, the HAB, and others, the agency should refrain from relying on RCBRA's conclusions in cleanup plans, including the Proposed Plan for the 100-D/H Area.

For example, both the Proposed Plan and the RCBRA fail to address adequately the cumulative chemical and radiological risk of contaminants that are likely to enter the 100-D/H Area from outside its boundary as a result of migrating plumes from other areas of the Hanford site. For example, uranium, iodine-129, and other contaminants have the potential to flow from the Central Plateau through groundwater into the 100 Area over many hundreds of years. Like the Proposed Plan, the RCBRA itself failed to adequately incorporate potential future likely uses of the River Corridor.[18] In short, the Proposed Plan should not rely on the RCBRA, which has unresolved flaws such as anticipating a heavy reliance on institutional controls and lacking analysis of plumes entering the River Corridor from the Central Plateau over the long term.

E. Energy Must Consult with the Services Under Section 7 of the Endangered Species Act.

Pursuant to Section 7 of the Endangered Species Act (ESA), Energy must consult with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) to determine how the proposed action may affect any threatened or endangered species in the Columbia River. Riverkeeper has raised this issue in multiple comments on Hanford cleanup and other federal actions at Hanford. See Columbia Riverkeeper Comment on Mercury Storage at Hanford (Aug. 2009); Columbia Riverkeeper Comment on Tri-Party Agreement Proposed Changes and Consent Decree (Dec. 2009); Columbia Riverkeeper Comment on Tank Closure Waste Management Environmental Impact Statement (May 2010); Columbia Riverkeeper Comment on 300 Area Proposed Plan (September 2013); and Columbia Riverkeeper Comment on 100-F Area Proposed Plan (August 2014).

Section 7 of the Endangered Species Act (ESA), the heart of the ESA's requirements for federal actions, imposes strict substantive and procedural duties on federal agencies to ensure that their activities do not cause jeopardy to listed species or adverse modification to their critical habitat. 16 U.S.C. § 1536(a)(2). The ESA mandates consultations to ensure that an agency action "is not likely to jeopardize the continued existence of any" listed species or adversely modify critical habitat. 16 U.S.C. § 1536(a)(2). Because Energy's Proposed Plan may affect listed species and critical habitat, Energy has an affirmative duty to consult with the National Marine Services and the U.S. Fish and Wildlife Service.

IV. Conclusion

[18] See HAB Advice 246. June 2011.

In light of the shortcomings of the Proposed Plan, Riverkeeper urges Energy to evaluate a broader range of alternatives, abandoning an over-reliance on MNA which will not achieve protection of the Columbia River, human health, and the environment in a reasonable timeframe. Riverkeeper asks Energy, EPA and Ecology to advocate for a more aggressive cleanup strategy, one that provides a more adequate balancing analysis and does not give disproportionate weight to the cost of more protective solutions.

We look forward to working with Energy on the monumental task of protecting the public and future generations from Hanford's nuclear legacy. Thank you for considering Riverkeeper's input on the Proposed Plan.

Sincerely,

Daniel R. Serres

Conservation Director
Columbia Riverkeeper

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Comment Number 100-D/H-011

September 16, 2016

Letter from Hanford Challenge

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September 16, 2016

Rich Buel
U.S. Department of Energy
Richland Operations Office
PO Box 550, MSIN A7-75
Richland, WA 99354

Dear Mr. Buel,

Hanford Challenge appreciates the opportunity to review and provide comments on the *Proposed Plan for Remediation of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3 Operable Units, (DOE/RL-2011-111, Revision 0)*.

Public Involvement

Hanford Challenge appreciates the effort taken to develop a question and answer document in collaboration with the Hanford Advisory Board's Public Involvement Committee to answer questions related to the following information, and looks forward to continuing a similar process during future periods of document review. This document provided essential context and explanation for Board members and would have been even more helpful if it had been available on the web.

The following information was discussed in the Q&A document, which provided useful context and history during this comment period:

- Where contamination in the 100-D/H area originated during plutonium production, how contamination spread in the environment, and how it is monitored.
- How the interim decision making process works, what interim decisions were made at 100-D/H, and when those decisions went into effect.
- What interim cleanup work has been completed, and when cleanup will be finished.
- What cleanup work remains that is discussed in the Proposed Plan.
- What future cleanup work will remain after the 100-D/H ROD proposed work is done, such as reactor dismantlement and restoration, and what the estimated timeframe is for that work.
- How 100-D/H may be used as a template for other 100-Area decisions.

Hanford Challenge also appreciated the extension of the comment period to September 16, 2016, which allowed Hanford Advisory Board discussion of the 100-D/H Proposed Plan to help inform our comments.

Though the in-person discussions provided helpful context for the comment period, Hanford Challenge believes information that was exchanged could have been better utilized in public information materials. Hanford Challenge believes the Tri-Party Agencies would have been more successful in communicating information about the Proposed Plan and been more transparent about the proposed remediation by doing the following:

- Using plain language explanations of technical terminology such as Monitored Natural Attenuation (doing nothing, leaving waste in the ground) and Institutional Controls (fences and other means to keep people out).
- Providing a more straightforward discussion of the long timeframes for reaching remediation goals, which are outlined in Table 6 of the Proposed Plan (page 45) and more accessible information about the length of time Institutional Controls will need to be maintained during radioactive decay, such as including the number of years next to the date.
- Making the information gathered in the Q&A document accessible to the public via the web, presentation or other means.
- Using plain language to clearly explain that the only contaminant of concern that is removed during pump and treat of groundwater is chromium, and that the "treatment" of Strontium-90 and nitrates is solely dilution and redistribution.
- Providing an explanation of why Institutional Controls are needed.
- Providing more straightforward information about what cleanup work and monitoring requires human effort and money versus leaving waste in place and doing nothing.

<u>Preferred Alternative</u>

Hanford Challenge supports the decision to move forward with completing the remediation of the 100-D/H area through the choice of the Preferred Alternative (Alternative 3) with the following changes.

Contamination in burial ground 118-D-3:1 deeper than 15 feet is proposed to be left in place, yet this burial ground, according to Oregon Department of Energy, "consists of multiple trenches which received operations waste from the DR Reactor, and has the potential to contain spent nuclear fuel elements. Of particular concern are concentrations of nickel-63, which contain as much as 47 times the allowable risk (and which exceed EPA standards by 16 times) and are expected to take around 400 years to decay to acceptable levels. We recommend that additional excavation be planned for this waste site so as to retrieve this concentrated waste." Hanford Challenge shares Oregon DOE's concern and recommendation.

Hanford Challenge would also like to note our concern that information about this waste site was not easily accessible, and therefore raises concerns about what other useful information may be missing from documentation within the proposed plan. Transparency and accessibility are key components of public involvement. Public trust is eroded when information about contaminants and proposed cleanup remedies is unclear and difficult to find as well as when provided documentation seems to obscure the timeframe in which remediation goals will be met.

Hanford Challenge echoes concerns raised by Oregon Department of Energy regarding the following waste sites, where sufficient data was not available in supporting documents to assure that no action is the proper choice: 100-D-108, 100-D-109, 100-H-38, 100-D-47, 116-D-47, 116-D-2, 116-D-4, and 100-H-7. Based on the discrepancies noted by Oregon Department of Energy, Hanford Challenge can't endorse a no action alternative for these waste sites.

As the Hanford Advisory Board states in its September 2016 advice: "A number of metals and other elements are contaminants of potential concern that have been detected above the 90th percentile Hanford Site background level, above risk-based maximum levels, or above maximum contaminant levels. As the Proposed Plan states 'based on the results of the groundwater risk evaluation, nitrate, strontium-90, total chromium, and hexavalent chromium are present in groundwater at levels that pose unacceptable risk if no actions are taken.' The pump and treat alternatives are aimed solely at chromium reduction." Hanford Challenge does not believe that dilution and redistribution should be relied upon for non-chromium co-extracted contaminants and that DOE should continue to look for ways to remove and treat the non-chromium contaminants prior to reinjection.

Hanford Challenge recommends the Hanford Advisory Board's advice be followed to modify Alternative 3 by:

- Ensuring the removal and treatment of the co-extracted non-chromium contaminants that exceed maximum contaminant level goals before treated water is re-injected.
- Incorporating the maintenance of the pump and treat system into the final alternative to allow the system to be restarted to ensure groundwater and surface maximum contaminant level goals continue to be met.
- Applying the Washington State SMS (Chapter 173-204 of the Washington Administrative Code [WAC 173-204]) as applicable or relevant and appropriate requirements (ARARs) for the Columbia River shoreline.

Hanford Challenge also recommends that DOE strategically remove concentrated mass of isotopes in the deep vadose zone before adopting Institutional Controls and MNA for the following waste sites, which will take 48-187 years to reach remediation goals. The waste sites listed below include the name of the waste site (# of years, year remediation goal will be met). These waste sites were found on page 45 of the proposed plan in Table 6.

1. 100-D-18 (50 years or 2066)
2. 100-D-48:1 (77 years or 2093)
3. 100-D-49:1 (77 years or 2093)
4. 100-D-49:2 (101 years or 2117)
5. 116-D-1A (187 years or 2203)

6. 116-D-1B (187 years or 2203)
7. 116-D-7 (109 years or 2125)
8. 116-DR-1&2 (132 years or 2148)
9. 118-D-6:3 (104 years or 2120)
10. 118-D-6:4 (127 years or 2143)
11. UPR-100-D-4 (77 years or 2093)
12. 116-DR-9/100-D-25 (48 years or 2064)
13. 100-D-46 (187 years or 2203)
14. 100-H-11 (92 years or 2108)
15. 100-H-12 (92 years or 2108)
16. 100-H-14 (92 years or 2108)
17. 116-H-1 (94 years or 2110)
18. 116-H-7 (82 years or 2098)
19. 118-H-6:3 (82 years or 2108)
20. 118-H-6:6 (82 years or 2108)

Hanford Challenge doubts that institutional memory will effectively carry forward a practice of monitoring waste sites and maintaining institutional controls for the 48-187 years that will be required before remediation goals are met for these waste sites. Strategically removing contaminants in these waste sites would more effectively protect future generations.

As proposed plans and other documents come forward for public review, Hanford Challenge urges the TPA agencies to continue working with the Hanford Advisory Board to improve the accessibility, clarity, and distribution of its public involvement information materials and associated documents.

If you have any questions or comments about our recommendations, please contact Liz Mattson of my staff at 206-292-2850 x21 or lizm@hanfordchallenge.org

Sincerely,

Tom

Tom Carpenter
Hanford Challenge, Executive Director

Comment Number 100-D/H-012

September 16, 2016

Letter from Shannon Cram

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UNIVERSITY of WASHINGTON | BOTHELL

INTERDISCIPLINARY ARTS & SCIENCES

September 16, 2016

Rich Buel
Department of Energy
P.O. Box 550, A7-75
Richland, WA 99352

Dear Mr. Buel,

Thank you for the opportunity provide comments on the ***Proposed Plan for Remediation of the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2 and 100-HR-3 Operable Units, (DOE/RL-2011-111, Revision 0)***. After reviewing and discussing the Proposed Plan on my own and in collaboration with members of the Hanford Advisory Board (HAB), I offer the following comments.

First, I want to thank the Tri-Party Agencies for collaborating with the HAB's Public Involvement and Communication (PIC) committee to develop and discuss a question and answer document. This document provided useful explanations and context and it enabled a concrete conversation about the Proposed Plan with PIC members. In particular, the fact that the Q &A document specified where contamination in the 100 D/H area originated during plutonium production, how and where it spread, how it was monitored, and what future cleanup work will be necessary after the proposed 100 D/H ROD is completed, was particularly helpful in our committee conversation. I hope that the Tri-Party Agencies will utilize a similar format for answering questions and promoting discussion in future document and Proposed Plan reviews.

However, despite this improved communication process, there is still significant room for improvement in the public involvement materials provided by the Tri-Party Agencies on this issue. For example, the Department of Energy's 100 D/H fact sheet failed to reflect the PIC committee's recommendation that it use plain language to define such terms as Monitored Natural Attenuation and Institutional Controls. While the Department of Energy's fact sheet said, "MNA is the decrease of contaminants through natural processes such as radioactive decay, chemical stabilization, sorption or biodegradation," the PIC recommended that the Fact Sheet use more transparent language like, "MNA effectively means leaving waste in the ground—doing nothing to remove it." In addition, I would have liked to see a more straightforward and accessible discussion about what specific Institutional Controls would be put in place and how long they would need to be maintained in order to control contaminant spread during the long time frames outlined in the Proposed Plan. Finally, I was disappointed to see that the DOE's fact sheet didn't use plain language to explain that in the Proposed Plan, chromium is the only Contaminant of Concern (COC) being removed during pump and treat of groundwater, and that Strontium-90 and nitrates are being "treated" through dilution and distribution.

Though I support the decision to remediate the 100 D/H area using the Preferred Alternative (Alternative 3), I echo the Oregon Department of Energy in recommending the following change:

> Contamination in burial ground 118-D-3:1 deeper than 15 feet is proposed to be left in place, yet this burial ground, according to Oregon Department of Energy, "consists of multiple trenches which received operations waste from the DR Reactor, and has the potential to contain spent nuclear fuel elements. Of particular concern are concentrations of nickel-63, which contain as much as 47 times the allowable risk (and which exceed EPA standards by 16 times) and are expected to take around 400 years to decay to acceptable levels. We recommend that additional excavation be planned for this waste site so as to retrieve this concentrated waste." I share ODOE's concern and recommendation on this point.

Furthermore, I am concerned that information about this waste site was not easily accessible. Such inaccessibility raises additional concerns for me about what other useful information may be missing from documentation within the Proposed Plan—specifically, I echo concerns raised by Oregon Department of Energy regarding insufficient data in supporting documents to assure that no action is the proper choice about the following waste sites: 100-D-108, 100-D-109, 100-H-38, 100-D-47, 116-D-47, 116-D-2, 116-D-4, and 100-H-7. Based on the discrepancies noted by Oregon Department of Energy, I do not feel comfortable endorsing a no action alternative for these waste sites.

Finally, the Hanford Advisory Board states in its September 2016 advice: "A number of metals and other elements are contaminants of potential concern that have been detected above the 90th percentile Hanford Site background level, above risk-based maximum levels, or above maximum contaminant levels. As the Proposed Plan states 'based on the results of the groundwater risk evaluation, nitrate, strontium-90, total chromium, and hexavalent chromium are present in groundwater at levels that pose unacceptable risk if no actions are taken.' The pump and treat alternatives are aimed solely at chromium reduction." Echoing the Board's advice, I do not believe that dilution and redistribution should be relied upon for non-chromium co-extracted contaminants and that the DOE should continue to look for ways to remove and treat the non-chromium contaminants prior to reinjection.

As such, I recommend that Alternative 3 should be modified to include:

- The removal and treatment of the co-extracted non-chromium contaminants that exceed maximum contaminant level goals before treated water is re-injected.
- The incorporation and maintenance of the pump and treat system into the final alternative to allow the system to be restarted to ensure groundwater and surface maximum contaminant level goals continue to be met.
- The application of the Washington State SMS (Chapter 173-204 of the Washington Administrative Code [WAC 173-204]) as applicable or relevant and appropriate requirements (ARARs) for the Columbia River shoreline.
- The strategic removal of concentrated mass of isotopes in the deep vadose zone before adopting Institutional Controls and MNA for the following waste sites, which will take

48-187 years to reach remediation goals. The waste sites listed below include the name of the waste site (# of years, year remediation goal will be met). These waste sites were found on page 45 of the proposed plan in Table 6.

100-D-18 (50 years or 2066)
100-D-48:1 (77 years or 2093)
100-D-49:1 (77 years or 2093)
100-D-49:2 (101 years or 2117)
116-D-1A (187 years or 2203)
116-D-1B (187 years or 2203)
116-D-7 (109 years or 2125)
116-DR-1&2 (132 years or 2148)
118-D-6:3 (104 years or 2120)
118-D-6:4 (127 years or 2143)
UPR-100-D-4 (77 years or 2093)
116-DR-9/100-D-25 (48 years or 2064)
100-D-46 (187 years or 2203)
100-H-11 (92 years or 2108)
100-H-12 (92 years or 2108)
100-H-14 (92 years or 2108)
116-H-1 (94 years or 2110)
116-H-7 (82 years or 2098)
118-H-6:3 (82 years or 2108)
118-H-6:6 (82 years or 2108)

I sincerely doubt that it is possible to effectively monitor waste sites and maintain institutional controls for the 48-187 years that will be required before remediation goals are met for these waste sites. Instead, I argue that strategically removing contaminants from these waste sites would be a more effective means for protecting future generations.

Finally, I ask that as proposed plans and other such documents come forward for public review, the TPA agencies to continue to work with the Hanford Advisory Board to improve the accessibility, clarity, and distribution of its fact sheets and other public involvement information materials.

Sincerely,

Shannon Cram, Ph.D.

Assistant Professor
University of Washington Bothell

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Comment Number 100-D/H-201

September 18, 2016

E-mail/Letter from Heart of America Northwest

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Citizens' Guide and Comments of Heart of America Northwest on USDOE's Proposed Cleanup Plan for the D and H Reactor Areas Along the Columbia River ("100 D and H" Area") - September 2016

Waiting 44 years for radioactive Strontium 90 in groundwater flowing into the Columbia River at Hanford to be reduced to current standards is not a "cleanup plan."

Nor is waiting up to 187 years for soil contamination below 15 feet to decay or slowly migrate until it reaches standards for unrestricted public use. Yet, these are the US Department of

Energy's (USDOE's) estimates for how long it will take for contamination levels to fall below today's standards (comments on whether USDOE is even using the appropriate standards is discussed below) under its proposed cleanup plan ("Alternative 3") for the D and H Areas.

As the photograph and map show, the D and H reactor areas are just under 8 square miles (20 sq. kilometers) with 295 soil waste sites[i] and a large area of highly contaminated groundwater at the heart of the Hanford Reach National Monument alongside the Columbia River. Huge quantities of radioactive and chemical wastes were buried or discharged into the soil as liquid wastes from reactor operations.

Contaminants include:
Chromium (Hexavalent Chromium, or Chrome VI):

> Toxic to fish at miniscule levels. A known human carcinogen as well as toxic to people when ingested from groundwater or food, inhalation or from skin exposure "In addition, it targets the respiratory system, kidneys, liver, skin and eyes." OSHA[ii]
>
> The area of contaminated groundwater above state standards is approximately 3 square miles right along the River. The groundwater typically flows to the River. The levels of Chrome VI have been brought down by pumping and treating groundwater, but remain approximately 80 times the 10ug/L standard.[iii]
>
> The Plan does not take into account the exposure routes other than ingestion of groundwater, e.g., what the exposure may be from excavated soils when the purported institutional controls fail, as they are likely to do long before 187 years elapse.
>
> "Hexavalent chromium was detected in groundwater samples in California and other states. There was public concern about the safety of the drinking water in several California cities. Hexavalent chromium was brought to the public's attention in many ways, most notably in the movie 'Erin Brockovich.'…Children should avoid playing in soils near uncontrolled hazardous waste sites where chromium may have been discarded." National Institute for Environmental Health Sciences. [iv]

Strontium 90 – a radioactive Beta emitter. This radionuclide replaces calcium in bones and irradiates the bones, making it a powerful carcinogen. It is easily absorbed into plants, fish and and people. It bioconcentrates as it moves up the food chain. The concentration of Sr90 in the groundwater plume is as high as 12 times the drinking Water Standard (DWS = 8 pCi/L, concentrations reach 110pCi/L).[v]

Cesium 137 – a radioactive Gamma emitter.

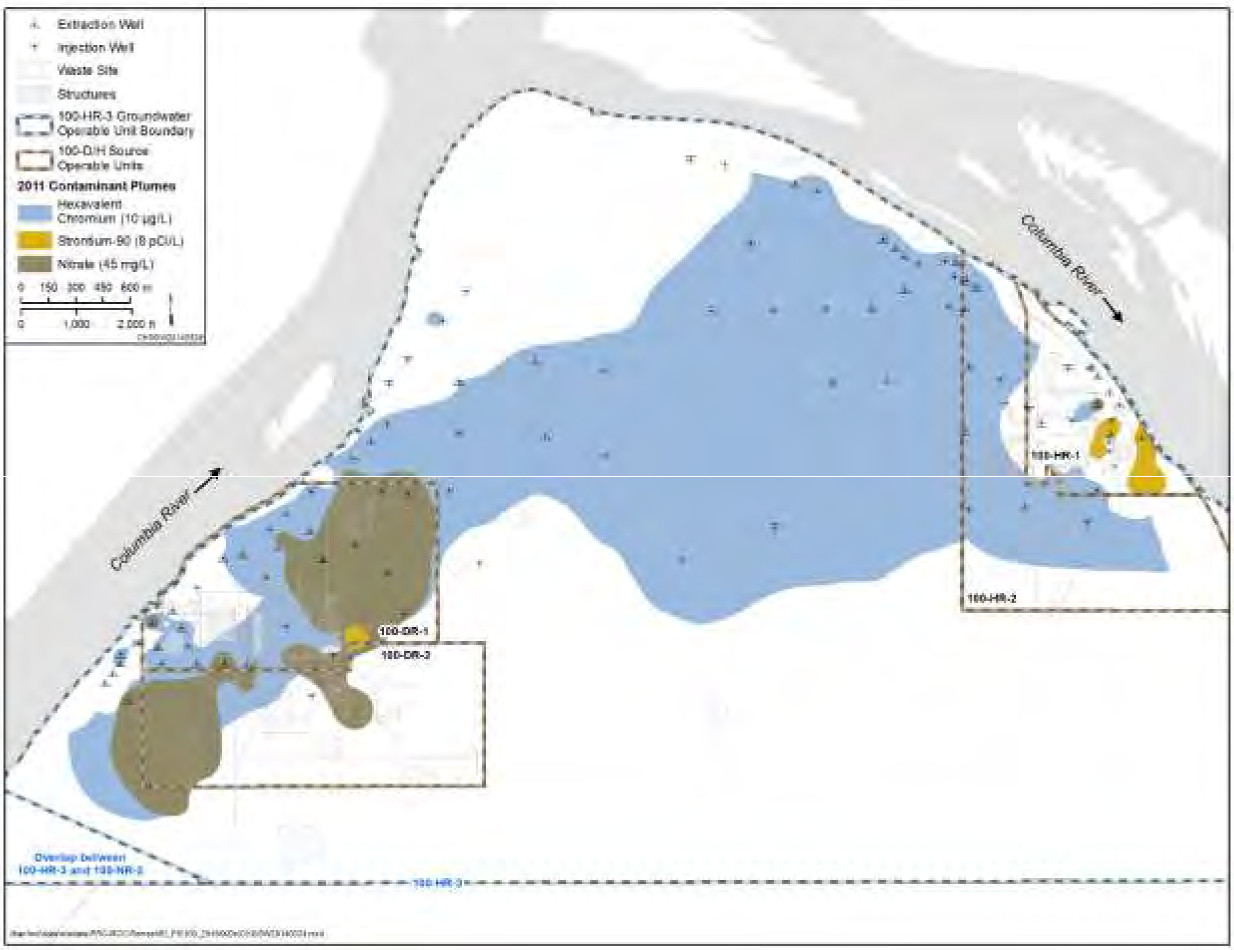
Nitrates: The source of nitrates in the soil and groundwater was in large part from use of nitric acid in reactor operations, which was then discharged without treatment. The plume exceeds standards by up to approximately 2.5 times over a small area of about a tenth of a square mile (yellow in map). .

Technetium 99 – One waste site in the area. Tc99 is a radionuclide with a half life of 212,000 years.

"Thirty-two waste sites in the 100-DR-1, 100-DR-2, and 100-HR-1 OUs contain residual radionuclide contamination at depths deeper than 4.6 m (15 ft) bgs and present a potential risk from inadvertent exposure through deep excavation activities. A risk assessment using a

residential exposure scenario for radionuclides was used to identify where unacceptable exposure could occur if the contamination was brought to the surface. These waste sites report an ELCR greater than 1 × 10-4 for the deep vadose zone contamination. Radionuclides associated with historical waste disposal contribute a majority of the ELCR and include cesium-137, cobalt-60, europium-152, europium-154, nickel-63, and strontium-90.
These waste sites require action to prevent exposure through deep excavation activities to levels that pose unacceptable risk."[vi]

Groundwater Plume Map (from Proposed Plan):



It is not reasonable to believe that the USDOE should, or can, restrict access to the groundwater until the year 2060 or soil areas until the year 2203 (187 years from now) along the Columbia River at the D and H Reactor areas - in the Hanford Reach National Monument.

The USDOE's "Preferred Alternative" (Alternative 3) is summarized in the Proposed Plan as follows (parentheticals added to explain acronyms):

> "(T)he preferred remedial alternative is Alternative 3:
> RTD (104 waste sites) (RTD = **Retrieve Treat and Dispose**),
> MNA (**Monitored Natural Attenuation**) with ICs (5 shallow and 34 deep waste sites),

Pipeline Capping with ICs (1 waste site) (IC = **Institutional Controls**), and
No Action (153 waste sites); and
Increased Capacity Pump and Treat and MNA with ICs for Groundwater in the 100-HR-3 OU.
RTD (**Retrieve Treat and Dispose**) is used to excavate contaminated soil from waste sites.
MNA (**Monitored Natural Attenuation**) with ICs (**Institutional Controls**) is used for waste sites until radioactive contamination decays to protective levels.
Pump and Treat and MNA with ICs are used to contain, treat, and prevent exposure to contaminated groundwater."

Thus, the Proposed "Cleanup Plan" would do nothing at 192 of the soil waste sites; and, the Proposed Plan description is quite misleading since it would also ignore dangerous groundwater contaminants above levels of concern other than chromium (e.g., it ignores Strontium 90 and nitrates).

Preventing anyone from using the soil or groundwater (referred to as "institutional controls" in the plan) would have to include preventing anyone from putting in visitor or other facilities serving the "horn" of the fifty mile Hanford Reach National Monument because any basements or buried utility or water lines would expose the residual contamination in the soil and create exposure routes for public users or residents.

The horn of the River (where the Columbia makes it broad turn north and then south) contains many sites which are religiously and culturally significant to the Yakama, Umatilla, Nez Perce and Wanapum peoples. The Treaty rights of the first three explicitly include the right to live along and fish the Hanford Reach.

Thus, the USDOE's cleanup plan would directly violate Treaty rights by preventing unrestricted use and access for some time between 44 and 187 years.

Excavations for buildings, utility lines or other purposes would create exposure pathways for inhalation of chromium and strontium, including inhalation and direct skin exposure, which the Plan fails to consider.

It is NOT SAFE to leave chromium, Strontium 90 or the other contaminants in soil where excavations, erosion, and other processes will expose children – Native American or others, as the National Institute for Environmental Health Sciences notes in the quote above.

The Plan fails to recognize that there are no institutional controls which would likely prevent use of the groundwater along the Reach. Washington State does not require permits for small groundwater systems (indeed systems serving a small development are exempt as well as agricultural withdrawals). Nor does the Plan recognize that State law (and federal environmental standards) bar further water withdrawals from the Columbia River. Yet, this plan, as with prior cleanup plans for the 100 Areas, improperly assumes that water for predicted camping, official facilities or Treaty use sites will be withdrawn from the River instead of from groundwater.

Here is how the USDOE describes its preferred plan:

> "For soil, Alternative 3 calls for RTD of contaminated soil and debris from waste sites with institutional controls (ICs) used to control access to residual contaminants in the soil.
>
> "For groundwater, Alternative 3 calls for increased capacity pump-and-treat, along with monitored natural attenuation (MNA) and ICs to control access to residual contaminants in the groundwater. MNA is the decrease of contaminants through natural processes such as radioactive decay, chemical stabilization, sorption or biodegradation." [vii]

However, the Groundwater portion of the Plan includes only pumping and treating for the chromium contamination, ignoring the extensive strontium 90 and nitrate contamination in the groundwater.

Failing on Public Involvement:
USDOE, EPA and Washington Ecology failed to offer any public meetings around the region to discuss this very important cleanup plan and to take comments as part of public meetings. This lack of public involvement shows how seriously flawed the agencies approach to public education, involvement and willingness to listen to public concerns has become. CERCLA (the federal Superfund law) requires consideration of public values and acceptability of the proposed plan. MTCA, the state cleanup law, further adds that public educational materials must describe how future use of resources will be limited by a plan, and take public comment on those restrictions and alternatives. For example, the materials failed to describe, and there were no meetings to take comments on: how Native American Treaty rights to live along and fish the Columbia River will be impacted; or, how visits and use of the Hanford Reach National Monument may have to be restricted due to areas of soil and groundwater contamination, lack of access to potable water, inability to place water lines or buried electrical and sewage lines.

In recent years, Heart of America Northwest would have offered workshops for the public to understand and discuss the plan – frequently in conjunction with the official public meetings. However, not only have the agencies not had a single public meeting outside of Richland on any cleanup plan for over a year, Washington Ecology eliminated all public participation grants (after having failed to consider in ranking grants the role of groups such as Heart of America Northwest in successfully producing Citizens' Guides and holding workshop and meetings around the region to enable the public to offer informed comments); and, USDOE refused to honor a commitment to continue funding Citizens Monitoring Fund grants for its cleanup sites nationwide. Without such support, public interest groups cannot organize and hold workshops around the region, as Heart of America Northwest did ten times (holding workshops in Portland and Vancouver, Spokane, Seattle, Walla Walla and Hood River) in the year prior to elimination of our Public Participation Grants.

The agencies initially scheduled the comment period to end before the Hanford Advisory Board would have been able to issue advice. While an extension to the day after the Board met to adopt advice cited here, was welcome, the agencies fail to appreciate or understand that the role of the Board includes providing advice and comments for the public to review and utilize, Indeed, the Board's critique is essential for the public. Thus, ending the comment period the day after the Board met and adopted advice would tend to prevent use of the Board's advice. This ignores a major role for any advisory board in a meaningful public involvement plan.

Thus, we urge the agencies to accept the comments which the public submits utilizing the Board's final advice or our comments and Guide, which rely on the Board's adopted advice (it is against Board policy to quote draft advice which may change prior to final adoption).

The politely critical advice of the Hanford Advisory Board includes the following points, which Heart of America Northwest also supports along with our more extensive comments:

- Insure the removal and treatment of the co-extracted non-chromium contaminants that exceed MCLGs before treated water is re-injected
    - (That means design the system to extract and treat groundwater to also cleanup the extensive Strontium 90, Nitrate and other dangerous contaminants, not just the chromium. MCLGs are the maximum allowed contaminant levels in groundwater. This explanation in lay terms added here by Heart of America NW).
- Incorporate the maintenance of the pump and treat system into the final alternative to allow the system to be restarted to ensure groundwater and surface MCLGs continue to be met.
- Apply the Washington State SMS (Chapter 173-204 of the Washington Administrative Code [WAC 173-204]) as ARARs for the Columbia River shoreline.
- The Board advises DOE to explore strategic removal of concentrated mass of isotopes in the deep vadose zone before adopting Institutional Controls and MNA, especially if the period to reach remediation goals exceeds 100 years.
- As proposed plans or other documents come forward for public review, the Board advises the TPA agencies to continue working with the Board to create clear, understandable, and timely public information materials which include: the history of the contamination; interim cleanup actions; work remaining within that specific unit; and how each proposal impacts and protects human health and the environment.

You can read the full Hanford Advisory Board advice here and use it along with this Guide to submit your own comments:
http://www.hanford.gov/files.cfm/HAB_Adv__290_100-DH.PDF

Heart of America Northwest's additional comments include:

- The cleanup plans must be revised to prevent exposure above standards from all reasonably foreseeable exposure paths, including use of the Yakama Nation's exposure scenario for its members' use of resources along the Hanford Reach pursuant to Treaty rights and other rights protected by federal and state laws.
- The reasonable maximum exposure scenario is required to take into account the exposures from all sources, including skin, dust ingestion, food ingestion and groundwater ingestion following the reasonably predictable failure of the institutional controls. This failure would be expected at the time that USDOE declares cleanup of the 100 Areas soil sites complete, which is expected in under a decade. At that point in time, actual experience at Superfund sites in the Northwest shows that it is quite likely that uncontrolled excavations will occur, which would expose deeper contaminated soils, and groundwater may be used without any permitting required.
- We agree with EPA and Washington Ecology that unrestricted / residential uses are reasonably foreseeable and must be the basis of cleanup plans in exposure scenarios. However, the reasonably foreseeable uses include unrestricted uses pursuant to Treaty

rights by Tribal Nations, which are more intensive than the residential exposure scenario relied upon.

- It is not reasonable to have a Plan which relies on restricting access to either soil sites or groundwater in the Hanford Reach National Monument beyond the current anticipated end date for active cleanup and opening of areas for Monument use.
    - For the sites with radioactive contamination in soil below fifteen feet which would exceed standards if there are excavations, animal or plant disturbance, erosion, etc… the cleanup plan must remove contamination from the Hanford Reach, and treat the contamination for proper disposal.
    - The plan must cleanup all groundwater contaminants of concern in a 10-12 year period. It must include all groundwater contaminants and be designed to meet applicable and relevant state standards. It must not rely on restricting use of groundwater in the Hanford Reach National Monument, since that would prevent desired uses of the Monument and impair Treaty rights.
- The cleanup standards applied to all sites must prevent exposure to carcinogens with a summed risk from all carcinogens – both radioactive and chemical – which does not exceed a risk range of one additional fatal cancer for every 10,000 to 100,000 persons (1E-4 to 1E-5). There can be no carried over use of the old 15 millirem dose standard relied on in prior 100 Area interim plans or a 12 millirem dose standard from more recent plans. CERCLA and MTCA require that the plan be based on the total carcinogen risk from both radionuclides and nonradioactive carcinogens, rather than calculated separately Further, CERCLA standards and EPA guidance require the end to use of the dose based cleanup level setting used previously and in this proposed plan.
    - EPA National Remedy Review Board, March 27, 2015, in commenting on the Hanford 100-D and H Plans, explicitly reaffirmed that the applicable "appropriate and relevant" standard for Hanford cleanup may not exceed the 12 millirem dose for cleanup levels; that the standard bars use of dose based cleanup levels; and, requires choice of a remedy based on cleanup levels (or PRGs) resulting in a cancer risk "meeting the 10-4 to 10-6 cancer risk range. This policy was reaffirmed in the June 13, 2014 updated version of OSWER Directive No. 9285.6-20, 'Radiation Risk Assessment at CERCLA Sites: Q and A'. The Board recommends that DOE develop new risk-based concentrations for those cleanup levels based on dose." US EPA National Remedy Review Board for Hanford 100-D and H Remedial Action Plans, March 27, 2015.
    - "12 mrem/yr is now considered to correspond approximately to 3 x 10-4 excess lifetime cancer risk" based on EPA's Federal Risk Guidance Report 13, 1997.[viii]
- Washington State's Freshwater Sediment Management Standards must be applied as applicable, appropriate and relevant (ARAR) standards in this cleanup plan. The standards are particularly important for a "shoreline of statewide significance", which 100 Area and contaminated sites in this Plan fall within.
- A new Plan should be developed based on the comments of the Advisory Board and public – with a meaningful public involvement plan. This should include holding meetings around the region (at a minimum including Spokane, Hood River, Seattle and Tri-Cities) for discussion and comment. Presentations and materials are required to include descriptions of the restrictions proposed on resource use and encouraging comment on reasonably foreseeable exposure scenarios and the failure of institutional or engineering controls.

Please use the information and bullets from Board advice and HoA's comments to send your comments as soon as possible to richard.buel@rl.doe.gov (Put 100-D&H Cleanup comments in subject line; and feel free to cc us at Heart of America Northwest: office@hoanw.org)

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[i] Proposed Plan at 2: http://pdw.hanford.gov/arpir/pdf.cfm?accession=0075807H The discrepancy in number of waste sites from Page 2 and the specific numbers of waste sites addressed by each type of action (RTD, MNA, No Action) is not explained in the Plan.

[ii] https://www.osha.gov/SLTC/hexavalentchromium/
https://www.osha.gov/OshDoc/data_General_Facts/hexavalent_chromium.pdf

[iii] Proposed Plan at 13.

[iv] https://www.niehs.nih.gov/health/materials/hexavalent_chromium_508.pdf

[v] Proposed Plan at 20

[vi] Proposed Plan at 25

[vii] Proposed Plan at 3

[viii] Radiation Risk Assessment at CERCLA Sites, US EPA Directive 9200.4-40, EPA 540-R-012-13, May 2014 at 22.
Note: EPA is basing this more protective standard barring use of cleanup levels that exceed doses of 12 mrem/year on the 1997 federal risk report. However, the National Academy of Science / National Research Council's updated 2005 Biological Effects of Ionizing Radiation Report (BEIR VII) is now considered to have made that report outdated and documents that exposure to 12 mrem/yr would result in excess fatal cancer risk levels significantly higher than 3x10-4. Thus, even the new standard is already behind the consensus scientific estimate of cancer risk and 12 mrem/yr results in a cancer risk that is more significantly outside the allowable cancer risk range for CERCLA, which is 1 x 10-4.