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19-AMB-0005

JAN 31 2019

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Addressees:

COMPLETION OF THE 2019 HANFORD LIFECYCLE SCOPE, SCHEDULE AND COST REPORT - FEDERAL FACILITY AGREEMENT AND CONSENT ORDER (TRI-PARTY AGREEMENT) MILESTONE M-036-01I

This letter transmits the 2019 Hanford Lifecycle Scope, Schedule and Cost Report, DOE/RL-2018-11, Revision 0. This report is provided pursuant to Tri-Party Agreement Milestone M-036-01I: "The USDOE shall prepare and submit to EPA and Ecology a report setting out the lifecycle scope, schedule and cost for completion of the Hanford Site cleanup mission." The U.S. Department of Energy (DOE) will make the 2019 Lifecycle Report available on the Hanford website (www.hanford.gov) to facilitate distribution and meet the objectives of the Paperwork Reduction Act.

DOE's leadership is committed to reporting an accurate and complete liability to stakeholders, and we hope that this Lifecycle Scope, Schedule and Cost reports will provide a solid foundation to determine the best paths forward to complete the cleanup at Hanford.

If you have any questions, please contact me, or your staff may contact Gregory A. Jones, Assistant Manager for Business and Financial Operations, at (509) 372-8977.

Sincerely,

Doug S. Shoop
Manager

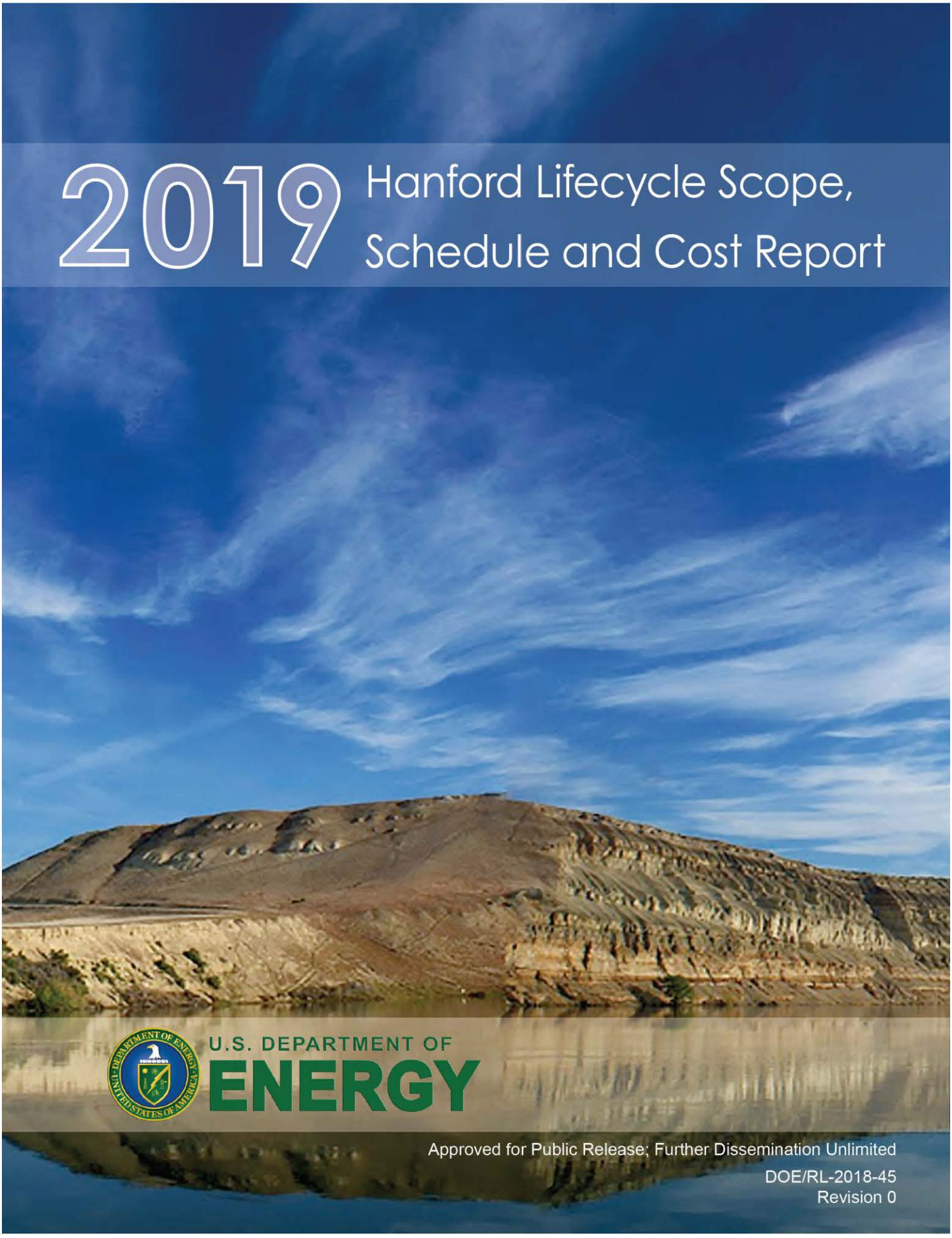
AMB:SMO

Attachment:
2019 Hanford Lifecycle Scope, Schedule and Cost Report

cc w/attach:
C. E. Cameron, EPA
J. B. Price, Ecology
Administrative Record, H6-08 (M-036)
Environmental Portal, A3-01

cc w/o attach:
J. Bell, NPT
R Buck Jr., Wanapum
M. Johnson, CTUIR
S. Leckband, HAB
L. Contreras, YN
K. Niles, ODOE
S. W. Davis, MSA
M. Cherry, MSA
M. Pardini, MSA

2019 Hanford Lifecycle Scope, Schedule and Cost Report



U.S. DEPARTMENT OF ENERGY

Approved for Public Release; Further Dissemination Unlimited

DOE/RL-2018-45
Revision 0

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2019 HANFORD LIFECYCLE SCOPE, SCHEDULE AND COST REPORT

Date Published
January 2019

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

U.S. DEPARTMENT OF ENERGY | Richland Operations Office

P.O. Box 550, MS A7-75
Richland, Washington 99352

Release Approval

Approved for Public Release
Further Dissemination Unlimited

DISCLAIMER

PREFACE

The *2019 Hanford Lifecycle Scope, Schedule and Cost Report* (Lifecycle Report [LCR]) summarizes the remaining work scope, schedule and cost estimates for Hanford Site cleanup. The report is prepared and submitted by the U.S. Department of Energy (DOE) to the U.S. Environmental Protection Agency (EPA) and Washington State Department of Ecology (Ecology) in accordance with milestone, M-036-01, requiring the annual submittal of a LCR by January 31.

The LCR provides both a low-range and a high-range cost estimate associated with the Hanford cleanup work scope, which includes the estimated cost to complete cleanup within the River Corridor, Central Plateau, tank waste, and mission support components as well as allowances for cost and schedule uncertainties. The low-range cost estimate of approximately $323.2 billion reflects the baseline planning case with allowances for schedule and cost estimate uncertainty. The high-range cost estimate of approximately $677 billion fully incorporates the realization of risks associated with uncertainty in discrete elements of work. The likelihood, and schedule and cost consequences, of risk events occurring have been quantified to provide cost impacts. These cost impacts are fully reflected in the high-range cost estimates. As noted in this analysis, the largest component to risk and thus increase to the high-range cost estimate is completion of the tank waste cleanup mission.

The inclusion of high-range cost estimates herein represents an enhancement in projecting the future Hanford Site cleanup costs. These costs, as presented in Table ES-1, reflect and account for the high degree of technical complexity and uncertainty associated with the large volume of work to be completed. A summary of the assumptions, risks, and uncertainties associated with each project baseline summary (PBS) is contained in the individual PBS sections discussed herein.

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EXECUTIVE SUMMARY

PURPOSE

This *Hanford Lifecycle Scope, Schedule and Cost Report* (Lifecycle Report [LCR]) describes the scope, schedule and cost estimates for Hanford Site cleanup. This LCR reflects all cleanup work that is to be completed by the U.S. Department of Energy (DOE), Richland Operations Office (RL), and Office of River Protection (ORP).

The LCR is prepared and submitted by DOE to the U.S. Environmental Protection Agency (EPA) and Washington State Department of Ecology (Ecology) annually by January 31, in time to support DOE's annual budget process and to help inform decision makers about schedule and work prioritization.

The LCR serves as an agreed-on foundation for preparing budget requests and for informational briefings to affected Tribal Nations, the State of Oregon, and Hanford stakeholders. The LCR supports continued discussions with EPA and Ecology on how and when RL and ORP will complete cleanup and how milestone changes and adjustments will affect lifecycle scope, schedule, and cost.

While it is important to understand what this report is, it is equally important to understand what it is not. The LCR is not a *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (42 USC 9601) or *Resource Conservation and Recovery Act of 1976* (42 USC 6901) document. The report is not a decision document that substitutes for, or preempts, the cleanup decision processes as set forth in the following:

- *Hanford Federal Facility Agreement and Consent Order*[1] (Tri-Party Agreement or TPA)
- The Consent Decree in *State of Washington v. Department of Energy*, Case No 08-5085-RMP (E.D. Wa. October 25, 2010) (DOE and Ecology 2010) and the Amended Consent Decree (DOE and Ecology 2016).
- Other legal requirements.

BACKGROUND

On October 25, 2010[2], DOE, EPA, and Ecology (Tri-Party agencies) agreed to modify the TPA to incorporate a new milestone, M-036-01, requiring annual submittal of a LCR. The LCR reflects all actions necessary for DOE to meet all applicable environmental obligations.

The 2019 LCR is the seventh edition and reflects scope, schedule, and cost status that is current as of August 31, 2018. Significant changes to cleanup obligations and related costs that have occurred after this date are noted in section 1.4 and will be incorporated into future reports.

PUBLIC INVOLVEMENT PROCESS

The Tri-Party agencies encourage and support public participation, and believe it is essential to the cleanup process, as stated in *Hanford Public Involvement Plan* (Ecology et al. 2012). The 2019 LCR will be available to all interested parties on the DOE website at www.hanford.gov. Feedback regarding the 2019 LCR will be considered as future reports are developed. Feedback can be emailed to lcssc@rl.gov.

[1] Ecology et al. 1989, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington, as amended.

[2] M-036-01 was negotiated as part of broader negotiations that occurred between the parties, culminating in the Consent Decree and a package of TPA modifications, all of which became effective when the Consent Decree was signed and entered into Federal District Court on October 25, 2010.

SUMMARY OF LIFECYCLE SCOPE, SCHEDULE, AND COST

Hanford Site cleanup has three major components: River Corridor cleanup, Central Plateau cleanup, and tank waste cleanup. The tank waste cleanup area is located geographically on the Central Plateau. The cleanup also includes mission support activities that provide essential infrastructure and services to support the Hanford Site cleanup.

Hanford's remaining active cleanup schedule covers activities for cleanup and waste management, leading to transition of portions of the Hanford Site to long-term stewardship (LTS). The active cleanup schedule, using the baseline planning case, is from fiscal year (FY) 2019 to FY 2078, and LTS extends through FY 2095. Although the time period evaluated in this report ends at 2095, LTS actually extends longer because some waste sites and disposal facilities will have institutional controls requiring stewardship activities beyond that date. The Federal Government plans to have a presence at the Hanford Site well beyond FY 2095.

This LCR presents the RL and ORP planning cases encompassing a low- and high-range estimate. The ORP planning horizon represented in the low-range estimate is predicated on the baseline case of the *River Protection Project System Plan* (ORP-11242, Rev. 8 [System Plan 8]). System Plan 8 is a computer modeling exercise that evaluated a set of 11 technical scenarios and provided rough cost and schedule estimates for completing the Site's River Protection Project (RPP) mission. While the baseline case reflects a theoretically achievable technical approach for completing the RPP mission based on conditions, constraints, assumptions, and direction existing at the time the System Plan 8 modeling effort began in early 2016, it does not account for delays associated with addressing tank vapors-related issues and makes other technical assumptions that have not been proven to be implementable. In contrast, the high-range estimate accounts for the impact of these and other technical challenges across all PBSs, and is intended to ensure transparency among all Hanford stakeholders of the inherent risks in achieving the agreed upon cleanup goals (i.e., milestones).

The baseline case (low-range estimate) identifies estimated tank waste retrieval and treatment completion dates that incorporate the revised milestones contained in the 2016 Amended Consent Decree. Under the baseline technical approach, System Plan 8 forecasts a significant increase in lifecycle cost and schedule for completing the RPP mission. The high-range cost estimate presented for each PBS incorporates an unconstrained estimate for identified risks and increases the confidence of completion at or below this estimate. It should be noted that the high-range estimate is intended to ensure transparency among all stakeholders involved in the Hanford cleanup program of the inherent risks associated with achieving the agreed upon cleanup goals.

The remaining estimated cleanup costs[3] for Hanford include a low-range estimate of approximately $323.2 billion (Figure ES-1) and a high-range estimate of approximately $677.0 billion (Figure ES-2). This includes the estimated cost to complete cleanup within the River Corridor, Central Plateau, tank waste, and mission support components, as well as allowances for cost and schedule uncertainties. The largest contributor to the high-range estimate is comprised of the estimated cost, the likely risks that could be realized, and the uncertainties associated with the tank waste cleanup mission, including the Waste Treatment and Immobilization Plant (WTP) (estimate of $548.4 billion). Table ES-1 summarizes total low-range and high-range estimated costs by PBS.

Remaining estimated cleanup costs do not include upper bound cost estimates prepared for selected future cleanup actions in prior LCRs. These future actions to be analyzed are identified in Appendix B, Table B-5.

[3]The expression "cleanup costs" is used to represent the costs for those remaining actions that are necessary for DOE to fully meet all applicable environmental obligations and complete the Hanford Site cleanup mission.

COST ESTIMATE ALTERNATIVE ANALYSES FOR SELECTED CLEANUP ACTIONS

The Tri-Party agencies considered the remaining cleanup actions to be analyzed (Appendix B, Table B-6) and agreed that the 2019 LCR would not include an alternatives analysis.

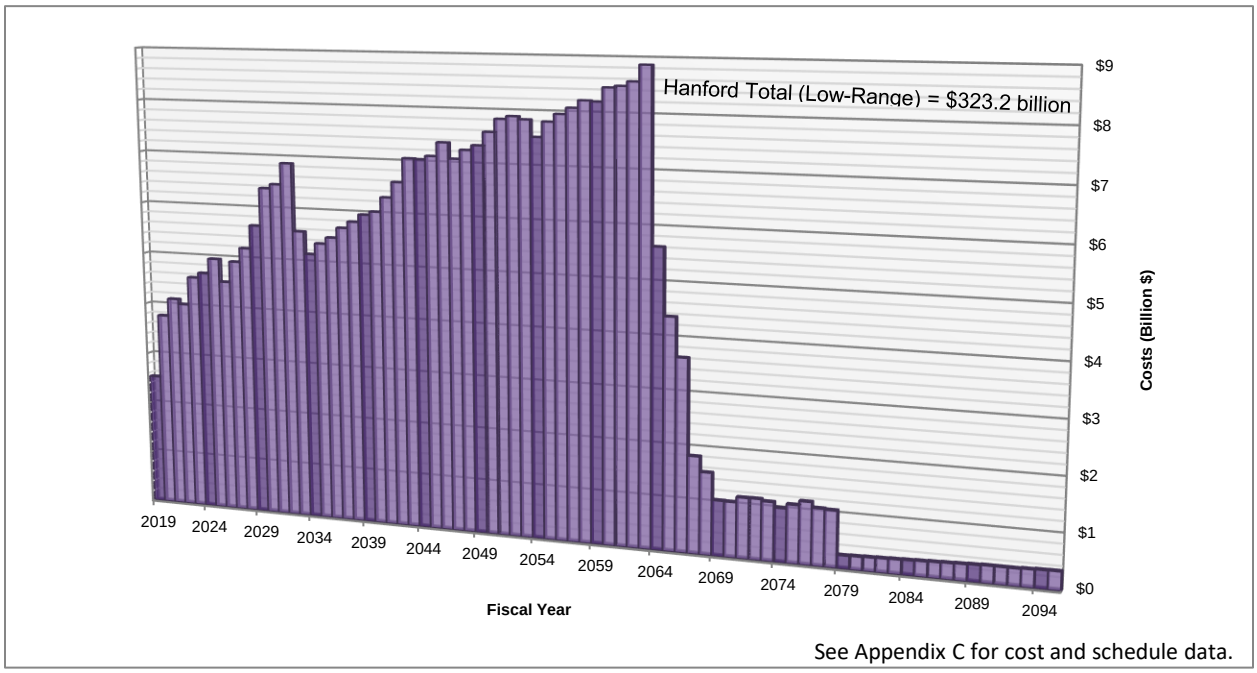

Figure ES-1. Hanford Site Remaining Estimated Cleanup Costs (Low-Range) by Fiscal Year (includes both RL and ORP).

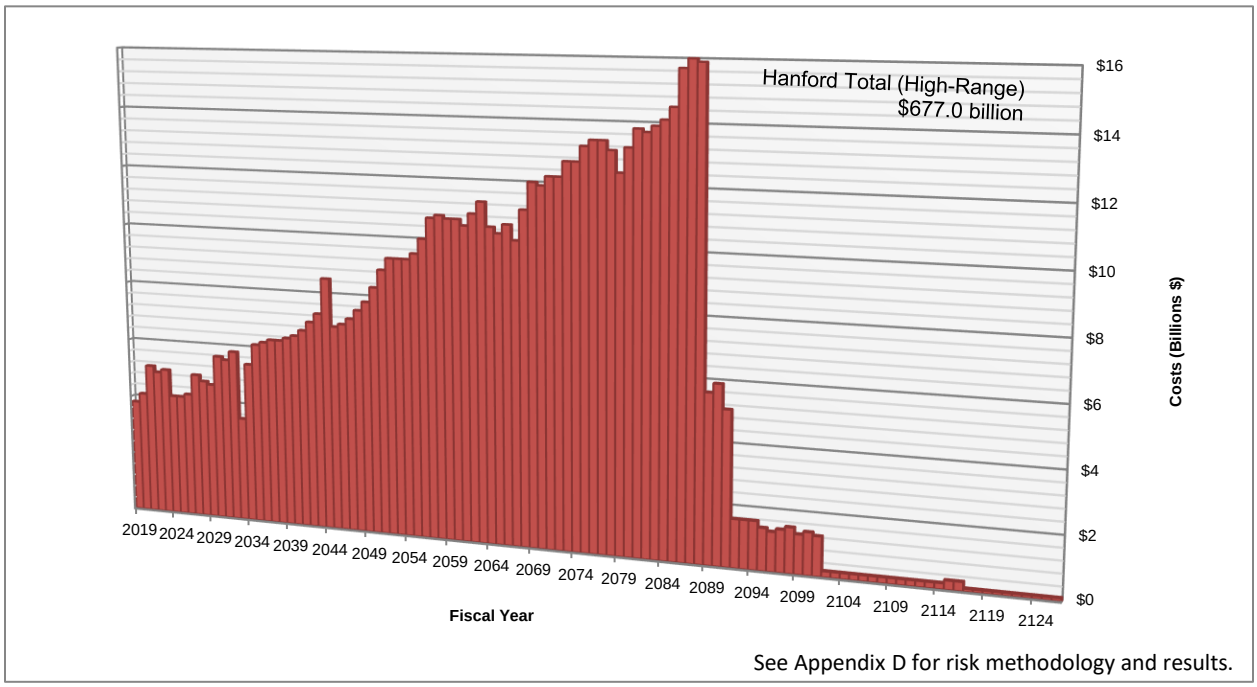

Figure ES-2. Hanford Site Remaining Estimated Cleanup Costs (High-Range) by Fiscal Year (includes both RL and ORP).

Table ES-1. Hanford Site Remaining Cleanup Cost Estimated Ranges by PBS.

Project Work Scope	Estimated Cleanup Costs[1] (Billion $)
NM Stabilization and Disposition - PFP (PBS RL-0011)	$0[2]
SNF Stabilization and Disposition (PBS RL-0012)	$0[3]
Solid Waste Stabilization and Disposition - 200 Area (PBS RL-0013C)	$11.5 - $15.1
Safeguards and Security (PBS RL-0020)	$10.1 - $23.9
Soil and Water Remediation - Groundwater/Vadose Zone (PBS RL-0030)	$9.6 - $10.5
Nuclear Facility D&D - Remainder of Hanford (PBS RL-0040)	$20.6 - $26.8
Nuclear Facility D&D - River Corridor Closure Project (PBS RL-0041)	$1.8 - $2.0
Nuclear Facility D&D - Fast Flux Test Facility Project (PBS RL-0042)	$1.0 - $1.1
Richland Community and Regulatory Support (PBS RL-0100)	$1.1 - $1.7
Hanford Sitewide Services (PBS RL-0201)	$20.4 - $32.8
Radioactive Liquid Tank Waste Stabilization and Disposition (PBS ORP-0014)	$221.4 - $518.1
Major Construction - Waste Treatment Plant (PBS ORP-0060)	$18.5 - $30.3
Waste Treatment Plant Operations (PBS ORP-0070)	$0[4]
Hanford Site Total Remaining Estimated Cleanup Costs	**$316.1 - $662.4**
Long-Term Stewardship (PBS RL-LTS)[5]	$5.2 - $12.7
Final Reactor Disposition[5]	$1.9
DOE-Office of Environmental Management Total Remaining Estimated Cleanup Costs	**$323.2 - $677.0**

[1]Cost ranges are shown in this table to reflect cost and schedule uncertainty; the lower number is used throughout this report. Values are rounded; see Appendix C for the low-range details and Appendix D for the high-range details.
[2]Includes $46.2 million in FY 2019 only.
[3]Includes $18.9 million in FY 2019 and FY 2020 only.
[4]Includes $30 million in FY 2019 and FY 2020 only. WTP operational costs are currently within ORP-0014 and will be shown in ORP-0070 in future reports.
[5]Shown separately to align with DOE-Headquarters fund source accounting.

D&D = decontamination and decommissioning.
DOE = U.S. Department of Energy.
NM = nuclear materials.
ORP = DOE, Office of River Protection.
PBS = project baseline summary.
PFP = Plutonium Finishing Plant.
RL = DOE, Richland Operations Office.
SNF = spent nuclear fuel.
WTP = Waste Treatment and Immobilization Plant.

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APPENDICES

FIGURES

TABLES

TERMS

CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CH	contact-handled
CSB	Canister Storage Building
CWC	Central Waste Complex
D&D	decontamination and decommissioning
D4	deactivation, decontamination, decommissioning, and demolition
DFLAW	direct feed of low-activity waste
DOE	U.S. Department of Energy
DST	double-shell tank
Ecology	Washington State Department of Ecology
EIS	environmental impact statement
EM	U.S. Department of Energy, Office of Environmental Management
EMF	Effluent Management Facility
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ETF	Effluent Treatment Facility
FFTF	Fast Flux Test Facility
FY	fiscal year
HAB	Hanford Advisory Board
HAMMER	Volpentest HAMMER Federal Training Center
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
HSF	Hanford Shipping Facility
HLW	high-level waste
HQ	U.S. Department of Energy, Headquarters
HWMA	*Hazardous Waste Management Act* (Washington State)
IDF	Integrated Disposal Facility
IHLW	immobilized high-level waste
IHS	Interim Hanford Storage
ISS	interim safe storage
Lab	WTP Analytical Laboratory
LAW	low-activity waste
LAWPS	Low-Activity Waste Pretreatment System
LBL	LAW Facility, Balance of Facilities, and Lab
LCR	Lifecycle Report
LDR	Land Disposal Restrictions
LERF	Liquid Effluent Retention Facility
LM	U.S. Department of Energy, Office of Legacy Management
LTS	long-term stewardship
MLLW	mixed low-level waste
MSC	Mission Support Contract
NEPA	*National Environmental Policy Act*
NM	nuclear materials
NRDAR	Natural Resource Damage Assessment and Restoration
OMB	Office of Management and Budget
ORP	U.S. Department of Energy, Office of River Protection
OU	operable unit
PBS	project baseline summary
PFP	Plutonium Finishing Plant
PJM	Pulse Jet Mixer
PNNL	Pacific Northwest National Laboratory

PRC	Plateau Remediation Contract
PT	pretreatment
PUREX	Plutonium Uranium Extraction (Plant)
RCRA	*Resource Conservation and Recovery Act of 1976*
REDOX	Reduction-Oxidation Facility (S Plant)
RH	remote-handled
RI/FS	remedial investigation/feasibility study
RL	U.S. Department of Energy, Richland Operations Office
ROD	record of decision
RPP	River Protection Project
RTD	remove, treat and dispose of
S&M	surveillance and maintenance
SALDS	State-Approved Land Disposal Site
SNF	spent nuclear fuel
SST	single-shell tank
TBD	to be determined
TEDF	Treated Effluent Disposal Facility
TOC	Tank Operations Contract
TPA	Tri-Party Agreement
Tri-Party agencies	U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRIDEC	Tri-City Development Council
TRU	transuranic
TRUM	transuranic mixed (waste)
TSD	treatment, storage, and disposal
TWCS	Tank Waste Characterization and Staging
USACE	U.S. Army Corps of Engineers
USDOE	U.S. Department of Energy
WBS	work breakdown structure
WESF	Waste Encapsulation and Storage Facility
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving and Processing (Facility)
WTP	Waste Treatment and Immobilization Plant
WTPC	Waste Treatment and Immobilization Plant Contract

1.0 INTRODUCTION

In October 2010, the U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and Washington State Department of Ecology (Ecology) (Tri-Party agencies) added a new milestone to the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989), commonly referred to as the Tri-Party Agreement (TPA). TPA M-036-01 requires that DOE submit a *Hanford Lifecycle Scope, Schedule and Cost Report* (Lifecycle Report [LCR]) to EPA and Ecology each year.

The 2019 LCR reflects the Hanford scope, schedule, and cost estimate information from fiscal years (FY) 2019 to 2095. The 2019 LCR information reflects scope, schedule, and costs that are current as of August 31, 2018. Significant changes that have occurred after this date are noted in section 1.4 and will be incorporated into future reports. The costs shown have been escalated for inflation and include ranges for discrete scopes of work to account for the technical and estimate uncertainty associated with completing the cleanup actions.

1.1 PURPOSE OF THE LIFECYCLE REPORT

To plan for the future and make the best use of each year's funding, the Tri-Party agencies work together and share information about the scope, schedule, and cost of cleaning up the Hanford Site. TPA M-036-01 states that the LCR should serve:

> *…as an agreed upon foundation for preparing budget requests and for informational briefings of affected Tribal Governments and Hanford stakeholders.*
>
> *…as the basis for annual discussions among USDOE, EPA, and Ecology on how and when the USDOE will complete cleanup, how Congressional appropriations for the Hanford Site for that year may affect assumptions presented in the report, and how milestone changes and adjustments will affect lifecycle scope, schedule and cost.*

TPA M-036-01 includes a number of requirements for the LCR. Table 1-1 provides the full text of the approved TPA M-036-01.

Detail regarding logic used by the Tri-Party agencies to meet the intent of the milestone can be found in section 1.5 of the 2013 LCR (DOE/RL-2012-13).

1.2 HANFORD CLEANUP OVERVIEW

The 580-square-mile Hanford Site[4] is located along the Columbia River in south-central Washington State (Figure 1-1). Beginning in the 1940s with the Manhattan Project, Hanford played a pivotal role in the nation's defense, eventually producing approximately 74 tons of plutonium — nearly two-thirds of all the plutonium recovered for government purposes in the United States. Today, the Hanford Site includes numerous former nuclear material production areas, active and closed research facilities, waste storage and disposal sites, and large areas of natural habitat and buffer zones all underlain by groundwater.

Under the direction of DOE, the Hanford workforce is now engaged in the environmental cleanup of contaminated facilities, groundwater, and soil. Hanford cleanup is further described in *Hanford Site Cleanup Completion Framework* (DOE/RL-2009-10).

[4]This area accounts for the September 2015 land transfer from DOE to the Tri-City Development Council (TRIDEC).

Table 1-1. Tri-Party Agreement Milestone M-036-01.

M-036-01A (Subsequent Annual Milestones to be Lettered B, C, D, etc.) *Due date to submit the report to be January 31 and annually thereafter, except that the first report to be due no sooner than 9 months after incorporation of this milestone in TPA.*
The USDOE shall prepare and submit to EPA and Ecology a report setting out the lifecycle scope, schedule and cost for completion of the Hanford Site cleanup mission. The report shall reflect all of those actions necessary for the USDOE to fully meet all applicable environmental obligations including those under the HFFACO, the consent decree in State of Washington V. Chu, Case No. 08-5085-FVS, and the Hanford RCRA/HWMA Permit. The report shall include scope, schedule and cost for completing work at each of the operable units and RCRA TSD groups/units that are listed in Appendixes B and C of the HFFACO, in the consent decree in State of Washington V. Chu, Case No. 08-5085-FVS (DOE and Ecology 2010) and in the Hanford RCRA/HWMA Permit, including the Hanford Waste Treatment and Immobilization Plant. The report will include all other cleanup and monitoring activities (including post-closure activities) and all related actions necessary to complete the cleanup mission to provide a complete understanding of the resources necessary for the Hanford cleanup mission. *This report shall take into account circumstances existing as of the end of the fiscal year preceding the month of the report, including funds appropriated by Congress for the Hanford cleanup, but shall not assume any limitation on funding for future years. However, the report will take into consideration critical resource availability not based upon assumed future funding limitations and the practical limits of project acceleration when developing an executable plan. USDOE may also include costs other than those directly related to environmental obligations (such as security costs) but shall clearly distinguish expenditures for environmental obligations from other expenditures. Costs shall be displayed by program baseline summary. Additional levels of detail will appear in appendixes to the report. Cost information will provide sufficient detail to validate consistency with the scope and schedule for individual cleanup projects. Reporting in the appendixes will typically be one level below the PBS for the lifecycle, and at levels below that for the next two to five years beyond the execution year (usually at the activity level within the budget assigned to a specific project, e.g., RL-0011, WBS element 011.04.01, Nuclear Material Stabilization and Disposition – PFP, Disposition PFP, Transition 234 5Z). EPA and Ecology project managers may request additional levels of detail be provided by their DOE counterparts.* *In circumstances where final cleanup decisions have not yet been made, the report shall be based upon the reasonable upper bound of the range of plausible alternatives or may set forth a range of alternative costs including such a reasonable upper bound. In making assumptions for the purpose of preparing the initial report, USDOE shall take into account the views of EPA and Ecology and shall also take into account the values expressed by the affected Tribal Governments and Hanford stakeholders regarding work scope, priorities and schedule. The report shall include the scope, schedule and cost for each such PBS level two element and shall set forth the bases and assumptions for each cleanup activity.* *After USDOE submits the report, the USDOE will revise the report based upon EPA and Ecology comments to reflect a common vision of the scope, schedule and budget for the remainder of the cleanup mission. If the agencies are unable to reach resolution on specific aspects of the scope of cleanup actions, the revised document will present a range of potential actions with the associated schedule and budget, thereby completing the milestone. DOE, EPA and Ecology shall attempt to reach agreement on the report so it can serve as an agreed upon foundation for preparing budget requests and for informational briefings of affected Tribal Governments and Hanford stakeholders. The report shall also serve as the basis for annual discussions among USDOE, EPA and Ecology on how and when the USDOE will complete cleanup, how Congressional appropriations for the Hanford Site for that year may affect assumptions presented in the report, and how milestone changes and adjustments will affect lifecycle scope, schedule and cost.* *Without limiting any DOE obligation under any other provisions of this agreement, and without limiting any DOE obligation to disclose information that is otherwise publicly available, nothing in this milestone shall be construed, either alone or in combination with any other provision of the HFFACO, to require disclosures related to internal federal budget deliberations.*

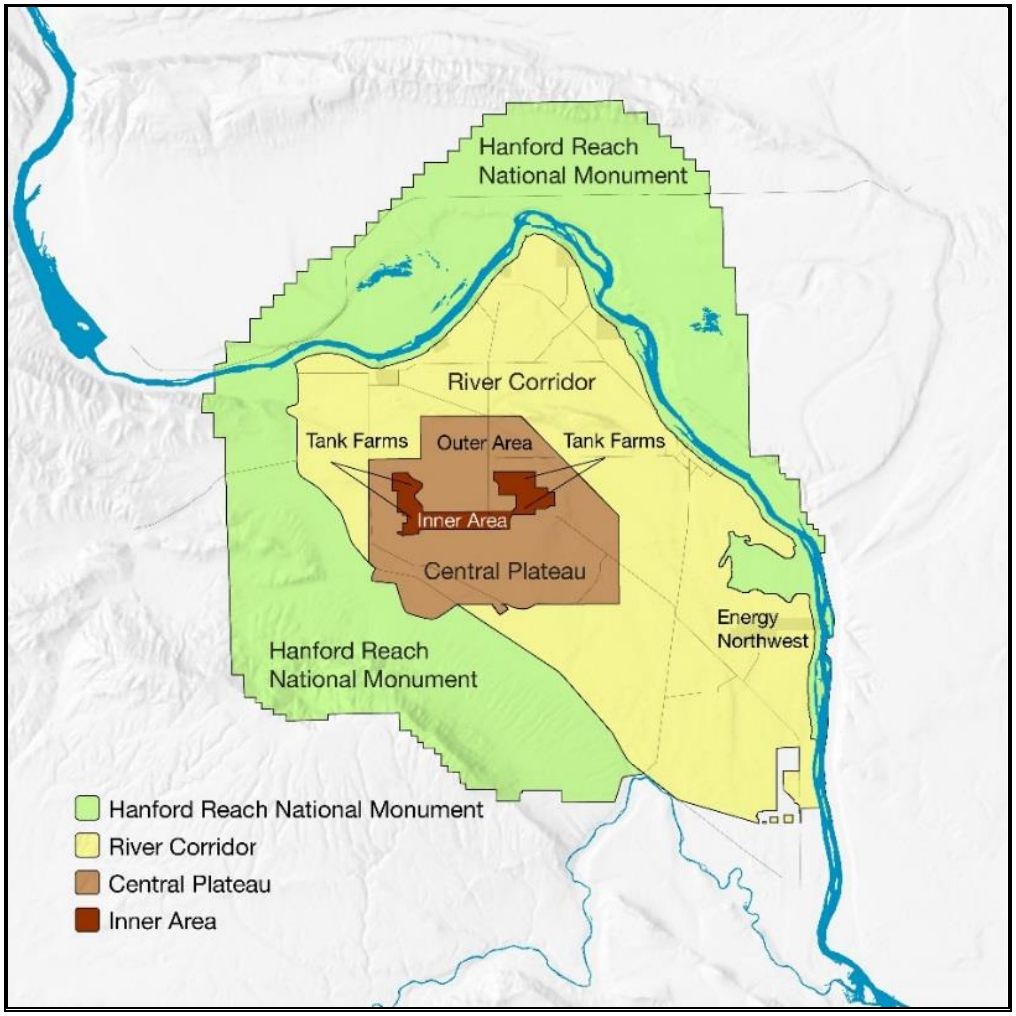

Figure 1-1. Hanford Site Map Showing Principal Areas Designated for Cleanup.

1.2.1 Hanford Cleanup Goals

The overarching cleanup goals are noted in Table 1-2. These goals embody more than 20 years of dialogue among the Tri-Party agencies, Tribal Nations, State of Oregon, stakeholders, and the public. The goals carry forward key values captured in earlier forums such as the Hanford Future Site Uses Working Group, the Tank Waste Task Force, Hanford summits, and Hanford Advisory Board (HAB) Exposure Scenario Workshops, as well as approximately 300 advice letters issued by the HAB (http://www.hanford.gov/page.cfm/hab). These goals help guide all aspects of cleanup and help set priorities to apply resources and sequence cleanup efforts for the greatest benefit. Cleanup activities at various areas of the Site support the achievement of one or more of these goals.

The cleanup goals reflect DOE's recognition that the Columbia River is a critical resource for the people and ecology of the Pacific Northwest. The 50-mile stretch of the river that flows through the Hanford Site, known as the Hanford Reach, is the last free-flowing section of the Columbia River in the United States. As one of the largest rivers in North America, the Columbia's waters support a multitude of uses that are vital to the economic and environmental wellbeing of the region; it is particularly important in sustaining the culture of Native Americans.

Table 1-2. Cleanup Goals Identified for the Hanford Site.[1]

Goals for Cleanup	
Goal 1:	Protect the Columbia River.
Goal 2:	Restore groundwater to its beneficial use to protect human health, the environment, and the Columbia River.
Goal 3:	Clean up River Corridor waste sites and facilities to • Protect groundwater and the Columbia River • Shrink the active cleanup footprint to the Central Plateau • Support anticipated future land uses.
Goal 4:	Clean up Central Plateau waste sites and facilities to • Protect groundwater and the Columbia River • Minimize the footprint of areas requiring long-term waste management activities • Support anticipated future land uses.
Goal 5:	• Safely mitigate and remove the threat of Hanford's tank waste • Safely store tank waste until it is retrieved for treatment • Safely and effectively immobilize tank waste • Close tank farms and mitigate the impacts from past releases of tank waste to the ground.
Goal 6:	Safely manage and transfer legacy materials scheduled for offsite disposition, including special nuclear material (including plutonium), spent nuclear fuel, transuranic waste, and immobilized high-level waste.
Goal 7:	Consolidate waste treatment, storage, and disposal operations on the Central Plateau.
Goal 8:	Develop and implement institutional controls and long-term stewardship activities that protect human health, the environment, and Hanford's unique cultural, historical, and ecological resources after cleanup activities are completed.

[1]DOE/RL-2009-10, 2013, *Hanford Site Cleanup Completion Framework*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

1.2.2 Hanford Cleanup and Management Areas

Hanford cleanup is overseen at DOE Headquarters (HQ) by the Office of Environmental Management (EM), and is directed and implemented locally by two DOE field offices: the Richland Operations Office (RL) and the Office of River Protection (ORP).[5] RL manages cleanup of most of the Hanford Site and provides human resource, administration, and security services, as well as physical infrastructure necessary to perform the cleanup. ORP was established in response to section 3139 of the *Strom Thurmond National Defense Authorization Act for Fiscal Year 1999* to manage the River Protection Project (RPP). The RPP is responsible for the safe storage, retrieval, and transfer of tank waste currently stored in the 200 Area tank farms; construction of the Waste Treatment and Immobilization Plant (WTP) to process and immobilize the tank waste in a process known as vitrification; and associated tank farm operation, maintenance, engineering, and construction activities.

Hanford cleanup focuses on two broad geographic areas: The River Corridor and the Central Plateau. Tank waste cleanup is a separate cleanup component located in the Central Plateau. The River Corridor includes approximately 220 square miles of the Hanford Site, encompassing the 100 and 300 Areas along the south shore of the Columbia River, portions of the 400 and 600 Areas, and the contiguous lands that extend to the Central Plateau boundaries. This includes a considerable land area not directly affected by production operations (non-operational areas). The 100 Area contains nine retired plutonium production reactors, numerous support facilities, and solid and liquid waste disposal sites that have contaminated soil and groundwater. The 300 Area, located north of the city of Richland, includes former fuel fabrication facilities, nuclear research and development facilities, and associated solid and liquid waste disposal sites that have contaminated soil and groundwater. The non-operational areas include substantial land area

[5]In addition to the ongoing cleanup mission, numerous research and environmental support activities are conducted at Hanford by the Pacific Northwest National Laboratory, which is overseen by DOE's Office of Science, Pacific Northwest Site Office.

adjacent to the 100 and 300 Areas and extending to the Central Plateau that was never used for production operations.

For sites in the River Corridor, the goal of remedial action is to restore groundwater to drinking water standards wherever practicable and to achieve ambient water quality standards in the groundwater before it discharges into the Columbia River. In those instances where remedial action objectives are not achievable in a reasonable time frame, or are determined to be technically impracticable, programs will be implemented to limit contaminant migration and prevent exposure to contaminated groundwater. River Corridor Cleanup work also removes sources of contamination close to the Columbia River to the Central Plateau for final disposal. The intent is to shrink the footprint of active cleanup to within the Central Plateau by removing excess facilities and remediating waste sites. Cleanup actions will support anticipated future land uses consistent with the Hanford Reach National Monument, where applicable, and the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (DOE/EIS-0222-F).

The River Corridor has been divided into six geographic areas to obtain and implement source and groundwater cleanup remedies. These decisions will provide comprehensive coverage for all areas within the River Corridor and will incorporate ongoing interim action cleanup activities. Cleanup levels will be achieved that support the anticipated land uses of conservation and preservation for most of this area and industrial use for the 300 Area. At the conclusion of cleanup actions, the Federal Government will retain ownership of most land in the River Corridor and will implement LTS activities to ensure protection of human health and the environment.

The Central Plateau consists of about 75 square miles in the central portion of the Hanford Site and includes an Inner Area (about 10 square miles) and Outer Area (about 65 square miles). The Inner Area contains major nuclear fuel processing, waste management, and disposal facilities. The Inner Area will be dedicated to long-term waste management and containment of residual contamination. The Outer Area is that portion of the Central Plateau outside the boundary of the Inner Area. The Outer Area will be remediated to be protective of human health, the environment, and groundwater. Cleanup levels will support future reasonably anticipated land uses. Completing cleanup of the Outer Area will shrink the footprint of the active cleanup area by an additional 65 square miles leaving just the Inner Area.

Cleanup of the Central Plateau is highly complex because of the large number of waste sites, surplus facilities, active treatment and disposal facilities, and areas of deep soil contamination. Past discharges of more than 450 billion gallons of liquid waste and cooling water to the soil have resulted in about 65 square miles of contaminated groundwater across the Site (DOE/RL-2017-66, *Hanford Site Groundwater Monitoring Report for 2017)*. Today, some plumes extend far beyond the plateau. Containing and remediating these plumes remains a high priority. For areas of groundwater contamination in the Central Plateau, the goal is to restore the aquifer to achieve drinking water standards. In those instances where remediation goals are not achievable in a reasonable time frame, programs will be implemented to contain the plumes, prevent exposure to contaminated groundwater, and evaluate further risk reduction opportunities as new technologies become available. Near-term actions will be taken to control plume migration until remediation goals are achieved.

At the completion of cleanup efforts, some residual hazardous and radioactive contamination will remain, both in surface disposal facilities and in subsurface media within portions of the Inner Area. DOE's goal is to limit the area used for long-term waste management activities that require institutional controls to ensure protection of human health and the environment.

Tank waste cleanup focuses on retrieving and treating Hanford's tank waste, and closing or remediating the tank farms. The tank farms comprise 18 distinct waste storage units that include 177 underground storage tanks (149 single-shell tanks [SST] and 28 double-shell tanks [DST]) located in the Inner Area of the Central Plateau. The storage tanks range in capacity from about 55,000 to 1,250,000 gallons and, in total, contain approximately 56 million gallons of radioactive and chemical waste from past processing operations. Sixty-seven of the SSTs are confirmed or presumed to have collectively leaked up to 1 million

gallons. In some areas, releases from some SST farms have reached groundwater. DOE expects these impacts to groundwater could increase in the future unless near-term actions are taken.

Today, actions are being taken to slow the movement of contaminants that were previously released. DOE also is containing and recovering those contaminants once they reach groundwater. A key step in reducing the risk that tank waste poses to human health and the environment is retrieval, treatment and disposition/disposal of the tank waste. A number of associated tank waste facilities, waste transfer lines, the 242-A Evaporator, and the WTP (under construction) are associated with the tank waste cleanup component. This component is one of Hanford's most challenging legacies.

Significant portions of the Hanford Site have been designated and preserved as part of the Hanford Reach National Monument (Figure 1-1). Much cleanup work has been accomplished within the designated monument area, and remaining work is expected to be completed within the next few years either as part of the River Corridor or Central Plateau cleanup project. DOE is coordinating with the U.S. Department of Interior, U.S. Fish and Wildlife Service, and other agencies to provide care and maintenance of the Hanford Reach National Monument lands. The *Carl Levin and Howard P. "Buck" McKeon National Defense Authorization Act for Fiscal Year 2015 (Public Law 113-291)* authorized the Manhattan Project National Historical Park. The B Reactor, the world's first production reactor, is a signature facility of the Manhattan Project National Historical Park.

DOE leases Hanford Site land to several non-DOE entities, such as the Laser Interferometer Gravitational Wave Observatory and the State of Washington, which in turn leases land to US Ecology, Inc., a private firm that operates burial grounds for commercial radioactive low-level waste. DOE leases land to Energy Northwest (a consortium of public utility companies), which operates Washington's only operating commercial nuclear power reactor, the Columbia Generating Station. These operations are not part of cleanup at Hanford and are not included in the LCR.

1.3 CLEANUP DECISIONS AND ALTERNATIVES

Cleanup is achieved through an ongoing process for making and then implementing cleanup decisions in accordance with approved work plans and procedures, which are the bases for performing cleanup actions. When making cleanup decisions, the Tri-Party agencies ensure compliance with applicable laws and regulations, compare various cleanup alternatives, consider the interests of the public and other affected parties, consult with Tribal Nations, and document selected cleanup actions in legally binding agreements.

In portions of the cleanup, the Tri-Party agencies have agreed to schedule final cleanup decisions until a time when more information and experience has been gained, or after certain facilities are no longer needed. For example, decisions on cleaning up the T Plant Canyon Building in the Central Plateau will not be made until the Tri-Party agencies have determined when T Plant will not be needed to support Hanford cleanup.

The LCR is required to include scope, schedule, and cost information for the entire Hanford Site regardless of whether final cleanup decisions have been made. Where cleanup decisions are not known (i.e., there are alternatives being considered) or are only partially defined (i.e., not final), the LCR base case (low-range estimate) assumes the options representing the reasonable upper cost bound for the range of plausible alternatives are implemented. The low-range estimate, as presented in the LCR, is predicated on the selected scope within the framework of the assumptions and constraints established for the lifecycle analysis. These bases introduce several concepts that are not fully defined in TPA M-036-01:

- **Cleanup decisions.** How are cleanup decisions made and when are they considered to be final decisions?
- **Alternatives.** How are alternatives considered when making cleanup decisions and determining what cleanup actions should be performed?

- **Reasonable upper bound.** How is a reasonable upper bound defined for a range of alternatives and how are an upper bound cost and schedule calculated?

Appendix A describes the multiple kinds of cleanup decisions made at Hanford and identifies decisions that are considered to be final for the Site. Appendix B describes future actions required to complete Hanford cleanup and presents information on plausible alternatives for future cleanup actions. Table 1-3 lists the cleanup actions for which final cleanup decisions have not yet been made.

Table 1-3. Cleanup Actions for which Final Decisions Have Not Been Made.

River Corridor Cleanup Actions	
• Disposition N Reactor • Disposition 100 Area K West Basin • Remediate 100 Area Contaminated Soil Sites • Restore 100-BC-5 Groundwater OU to Beneficial Use • Restore 100-KR-4 Groundwater OU to Beneficial Use	• Restore 100-NR-2 Groundwater OU to Beneficial Use • Disposition 300 Area Facilities Retained by PNNL • Disposition 100 Area former Orchard Contaminated Soil Sites (100-OL-1 OU)
Central Plateau Cleanup Actions	
• Disposition Remaining Outer Area Buildings and Facilities (200-OA-1 OU) • Remediate Remaining Outer Area Contaminated Soil Sites (200-OA-1, 200-CW-1, 200-CW-3 OUs) • Disposition Below-Grade Portions of Plutonium Finishing Plant • Disposition B Plant Canyon Building/Associated Waste Sites (200-CB-1 OU) • Disposition PUREX Canyon Building/Associated Waste Sites (200-CP-1 OU) • Disposition PUREX Storage Tunnels (200-CP-1 OU) • Disposition REDOX Canyon Building/Associated Waste Sites (200-CR-1 OU) • Disposition T Plant Canyon Building/Associated Waste Sites • Disposition Cesium/Strontium Capsules • Remediate Solid Waste Landfill and Non-Radioactive Dangerous Waste Landfill (200-SW-1 OU) • Disposition Remaining Liquid Waste Disposal Facilities	• Disposition Remaining Waste Treatment, Storage, and Disposal Facilities • Remediate Pipelines, Pits, Diversion Boxes and Associated Tanks (200-IS-1 OU) • Remediate Land Disposal Units (200-SW-2 OU) • Remediate Remaining 200 West Inner Area Contaminated Soil Sites (200-WA-1 OU) • Remediate Remaining 200 East Inner Area Contaminated Soil Sites (200-EA-1 OU) • Disposition Remaining Inner Area Buildings and Facilities • Remediate Contaminated Deep Vadose Zone (200-DV-1 OU) • Restore 200 West Groundwater (200-UP-1 OU) to Beneficial Use • Restore 200 East Groundwater (200-PO-1/200-BP-5 OUs) to Beneficial Use
Tank Waste Cleanup Actions	
• Tank Retrieval and Single-Shell Tank Farm Closure • Tank Waste Treatment • Secondary Waste Treatment	• Double-Shell Tank Closure • Waste Treatment and Immobilization Plant Closure
FFTF = Fast Flux Test Facility. OU = operable unit. PNNL = Pacific Northwest National Laboratory.	PUREX = Plutonium Uranium Extraction (Plant). REDOX = Reduction-Oxidation Facility (S Plant).

The LCR includes many assumptions about future cleanup actions and decisions, considers the ranges of plausible alternatives for specific cleanup actions, and what would be reasonable upper bounds for the ranges of alternatives. Alternatives and upper bounds for future cleanup actions contemplate potential decisions, events, contingencies, and cost and/or schedule uncertainties, and take into account the views and values of regulators, Tribal Nations, and stakeholders.

The Tri-Party agencies have agreed the LCR should consider developing in-depth information about some of the future cleanup actions for which final decisions have not been made. The Tri-Party agencies identified approximately 33 cleanup actions for which final cleanup decisions are still needed (Table 1-3),

and Appendix B (Table B-6) proposes a schedule for preparing cost estimate alternative analyses for these cleanup actions. The Tri-Party agencies considered the remaining cleanup actions to be analyzed and agreed that the 2019 LCR would not include an alternatives analysis.

1.4 CHANGES FROM PREVIOUS REPORT

1.4.1 Incorporated Changes

Written feedback related to prior LCRs was considered when preparing this report. Feedback received on the previous LCRs is available on the DOE website at www.hanford.gov.

Significant changes made in the 2019 LCR include the following:

- Updated cost and schedule planning basis for each project baseline summary (PBS) to incorporate updated scope, regulatory changes, and contract changes so this information reflects the RL and ORP planning cases that are current as of August 31, 2018.
  - RL-0011 [Nuclear Materials] NM Stabilization and Disposition – PFP - Cleanup and demolition to slab-on-grade of the Plutonium Finishing Plant (PFP) complex is expected to be completed in FY 2019 using funds carried over from prior years plus $46.2 million in the FY 2019 budget. Future subsurface investigation and cleanup will be done under Nuclear Facility [Decontamination and Decommissioning] D&D-Remainder of Hanford (PBS RL-0040).
  - RL-0012 [Spent Nuclear Fuel] SNF Stabilization and Disposition – Cleanup and stabilization of the SNF sludge from the K West Reactor Fuel Storage Basin is scheduled to be completed in FY 2019 using funds carried over from FY 2018 plus $13.9 million in the FY 2019 budget. Approximately $5 million is included in FY 2020 due to cost and/or schedule uncertainty. The subsequent105-KW Basin deactivation and removal work scope will be performed under Nuclear Facility D&D–River Corridor Closure Project (PBS RL-0041) and the subsequent sludge disposition work scope will be performed under Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C).
  - RL-0100 Richland Community and Regulatory Support – Support for Washington State Department of Ecology and Washington State Department of Health included in this PBS in previous LCRs is now included in Hanford Sitewide Services (PBS RL-0201).
  - PBS RL-0201 Hanford Sitewide Services – This new PBS was established in FY 2017 and consolidates costs that were allocated to several RL PBSs in previous LCRs.
  - PBS ORP-0014 Radioactive Liquid Tank Waste Stabilization and Disposition – The ORP planning case includes the baseline case of the *River Protection Project System Plan* (ORP-11242, Rev. 8 [System Plan 8]). System Plan 8 is a computer modeling exercise, which evaluated a set of 11 technical scenarios and provided rough cost and schedule estimates for completing the RPP mission at the Hanford Site. While the baseline case reflects a theoretically achievable technical approach for completing the RPP mission based on conditions, constraints, assumptions, and direction existing at the time the System Plan 8 modeling effort began in early 2016, it does not account for delays associated with addressing tank vapors-related issues and makes other technical assumptions that have not been proven to be implementable. The baseline case identifies estimated tank waste retrieval and treatment completion dates that incorporate the revised milestones contained in the Amended Consent Decree (DOE and Ecology 2016). Under the baseline technical approach System Plan 8 forecasts a significant increase in lifecycle cost and schedule for completing the RPP mission.
  - PBS ORP-0060 Major Construction – Waste Treatment and Immobilization Plant – The ORP planning case consists of an approved baseline change to implement the capability for Direct Feed Low Activity Waste (DFLAW) to the WTP's Low-Activity Waste

(LAW) Facility and parametric evaluations performed by the U.S. Army Corps of Engineers (USACE) to estimate the costs for completing construction of the High-Level Waste Facility (HLW) and Pretreatment Facility (PT).

  - PBS ORP-0070 Waste Treatment Plant Operations – This PBS includes activities required to support the treatment of tank wastes in the plant including the implementation of the strategy of the DFLAW approach. The lifecycle costs for this project are currently within ORP-0014 and will be shown in ORP-0070 in future reports.

- Addition of a high-range cost estimate for each PBS incorporating an unconstrained estimate for identified risks and the resulting cost impact toward achieving the cleanup goals. It should be noted that the high-range estimate is intended to ensure transparency among all stakeholders involved in the Hanford cleanup program of the inherent risks associated with achieving the agreed upon cleanup goals (i.e., milestones). The risk analysis methodologies and results are provided in Appendix D.

1.4.2 Future Report Changes

The scope, schedule, and cost information presented in this LCR is current as of August 31, 2018. This section summarizes regulatory decisions and other changes that may have occurred or been completed after that date. Other pending changes that are not reflected in this LCR but will be incorporated in future reports also are noted.

Because several complex technical issues arose during design and construction activities that adversely affected ORP's ability to meet negotiated milestones in the 2010 Consent Decree, these milestone dates were extended in an Amended Consent Decree issued by the court on March 11, 2016 with a Second Amended Consent Decree issued on April 12, 2016. As a result of that litigation, the Court extended the start of initial operations milestone date for the WTP to December 31, 2036, thus necessitating changes to the TPA end dates for completing all remaining SST retrievals and completing all tank waste treatment commitments; these milestone dates were predicated on the WTP start of initial operations by December 31, 2022, as negotiated in the 2010 Consent Decree. These and related TPA milestones were the subject of formal negotiations between ORP, EPA, and Ecology in 2018. The outcome of those negotiations and any resulting TPA milestone changes will be incorporated in a future LCR.

The LCR only provides a snapshot of a complex, ongoing planning process, and the RL and ORP planning cases in this report have only been partially aligned. Continued alignment and refinement will be incorporated in future LCRs.

1.5 LIFECYCLE REPORT AND HANFORD BUDGET SCHEDULE

In developing the LCR milestone, the Tri-Party agencies sought to align submittal of the report with the annual Federal budget planning process. For most FYs, Federal planning begins about 2 years before the funded work is executed (Figure 1-2). The cycle begins when DOE field offices receive FY budget planning guidance from the President of the United States, DOE HQ, and the Office of Management and Budget (OMB). During the next 12 to 15 months, the DOE field offices develop their budgets, submit them to HQ and OMB for review, and then the President submits his budget proposals annually to Congress. Approximately 8 months later (under normal circumstances), before the start of the new Federal FY (October 1), Congress approves a budget, funding is made available, and DOE begins executing work to the approved budget.

As shown in Figure 1-2, the Tri-Party agencies scheduled the LCR to be completed in time to support the field offices' budget planning process each year. Each LCR will have the latest information available when planning begins for the next 2-year budget cycle. The period of time for developing the LCR each year overlaps with the funding approval process for the current budget execution year and with the HQ and OMB review of funding requests for the next FY.

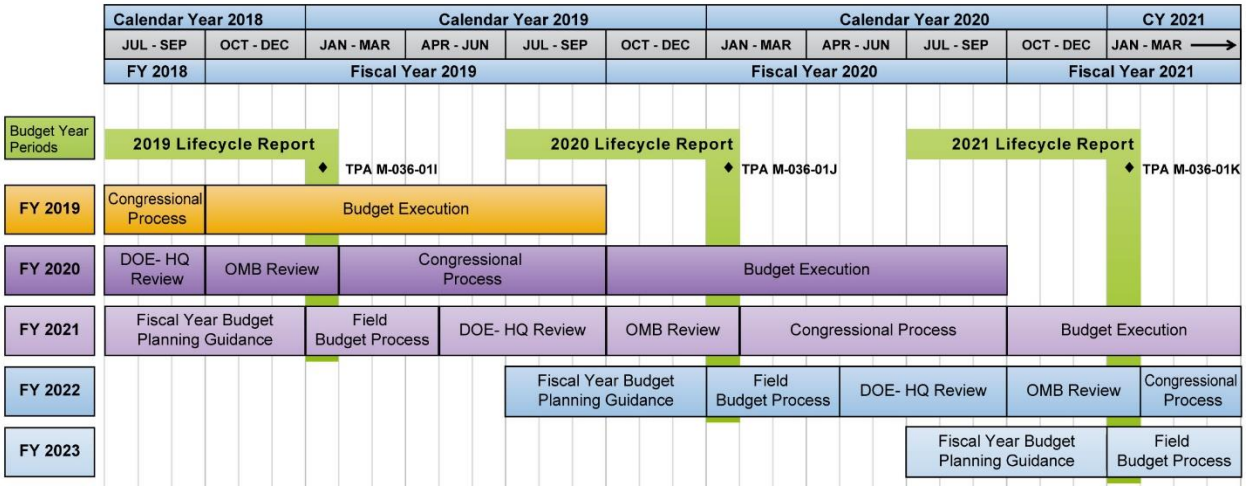

Figure 1-2. Relationship Between DOE Budget Planning and LCR Schedule.

1.6 PLANNING AND INTEGRATION OVERVIEW

This section introduces the Federal budget formulation process and DOE's overall planning and budget development practices. A general understanding of common terms and methodology will be useful later in this LCR, particularly where information about project costs is presented.

1.6.1 Annual Budget Formulation Process

Each year, DOE formulates budget requests as part of the Congressional appropriations process. The planning cycle begins during December and January, nearly 2 years before the start of a budgeted fiscal year. The process begins with budget formulation where funding requirements are analyzed, prioritized, requested, and received. Budget requests are submitted by the DOE field offices to HQ in early spring and continue with post-formulation monitoring and responding to questions to estimate impacts of actual or potential changes to budget requests. The process ends with receipt of Congressional appropriations. DOE's budget process occurs in four distinct phases:

1. **Field Budget Process.** This is the first phase of DOE's annual budget formulation process. RL and ORP submit field budget data to HQ for use in the corporate review budget process.
2. **HQ Corporate Review Budget Process.** The HQ organizations use field budget data and spring planning decisions to develop initial organizational budget requests that are jointly evaluated and considered in DOE's internal budget review.
3. **OMB Budget Review Process.** This process is the principal mechanism for preparing DOE's annual budget submission to the OMB, which is responsible for assembling the President's annual budget request to Congress.
4. **Congressional Budget Review Process.** This process determines DOE's final appropriations for the next Federal fiscal year based on policy determinations in conjunction with Federal budget deliberations by Congress.

Annual appropriations from Congress are allocated to the responsible DOE projects. Congressional budgets commonly provide different allocations, include additional requirements, or provide other directions that can affect project planning. If adjustments are required, DOE goes through a scheduling and resource-leveling process to adjust plans and accommodate the authorized budget. Sometimes this can result in cost and schedule changes to reconfigure activities resulting from budget or other constraints. DOE must determine the appropriations that will be used to fund each task to comply with applicable budget direction. Based on final Congressional appropriations, budget formulation, project planning, and

replanning are intertwined and involve iterative processes with similar steps. DOE's process for defining and managing projects and their baseline summaries are described in section 1.6.2.

1.6.2 U.S. Department of Energy Project Formulation Process

DOE follows a structured approach that organizes all EM activities into discrete projects. The following summarizes key components of DOE's cleanup project management approach.

Project Baseline Summary (PBS). EM projects that have common attributes, such as geographic location or activity type, typically are grouped as a PBS. Congressional funding authorizations typically are also allocated by PBS. Each PBS contains a logical grouping of work activities organized in discrete projects or activities by establishing technical scope, schedule, and cost baselines; defining performance metrics; and providing financial history, budget request justification, as well as other information (e.g., programmatic risk and compliance drivers). DOE may define a cleanup project as the entire PBS, or a project may be a portion of a single or multiple PBSs. A PBS or project may include operations and facility support activities such as surveillance and maintenance (S&M).

Work Breakdown Structure (WBS). The work scope associated with each PBS is further organized into discrete WBS elements. The WBS provides a product-/activities-oriented system to arrange, define, and depict all work in a structured framework. This step is essential to developing comprehensive bases for planning and managing project-specific scope, schedule, and cost. Whether the government or a contractor performs the elements, the structure must be compatible with cost estimating and scheduling requirements.

Resource Allocation. The next step is to define the resources necessary to execute each WBS element. Resources include labor, materials, and equipment. These resources are a part of work packages, which define the work for each WBS element. Planning packages are used when the work has not been completely defined. Budget is assigned to planning packages based on a mature estimate until such time as a work package can be developed.

Project Master Schedule. With a solid WBS and well-developed work packages in place, DOE can develop a master schedule that contains a reliable estimate of the total time required to accomplish each task and the sequence of execution. The master schedule should reveal tasks that must be completed or partially completed before other tasks begin. These interrelationships help define the project's critical path (the sequence of activities that must be completed on schedule for the entire project to be completed on schedule). Task schedules evolve by balancing the work to be done against the required completion date to achieve project milestones.

Resource Leveling. All resources are finite and not all work can be accomplished simultaneously, so work must be organized to ensure existing resources are not overtaxed or underutilized; e.g., an engineering or craft labor individual cannot be scheduled to accomplish more than one work package simultaneously and the same piece of equipment cannot be operated in more than one location at a time. The sequencing of tasks, therefore, addresses not only the order of things to be accomplished, but the availability and optimal use of resources. Resource leveling may result in the need to revise or update a project's master schedule.

Uncertainty and Project Risk. Risk management is essential for project management. Cost and schedule uncertainty are included in the development of Total Project Cost and the approved DOE planning case and are reserved to accommodate additional work scope related to risk events that may occur from conditions and events that were not known during project planning and other unanticipated changes or uncertainties. This includes estimates for cost and schedule uncertainty based on risk analysis methods that comply with DOE guidelines and orders. These estimates are identified as "cost and/or schedule uncertainty" in the Appendix C tables. The risk analysis results supporting the high-range estimate are documented in Appendix D.

Uncertainty addresses cost-based and schedule-based impacts on a project. Cost uncertainty is the portion of the project budget that is available for risk uncertainty related to the project, but is held outside the

contract budget and is part of the government's planning case estimate. Schedule uncertainty is the risk-based, quantitatively derived portion of the overall project schedule duration that is estimated to allow for time-related risk impacts and other project uncertainties.

Cost and schedule uncertainty is established to manage or cover the cost of unexpected events (e.g., changed conditions discovered by environmental sampling and characterization as cleanup proceeds). Money and time that have been reserved to address risks may be used to account for their effects or the handling actions necessary to mitigate or avoid risk events, but may not be used for work that is outside the scope of the planning case. Uncertainty is calculated based on DOE risks that are contained in a centralized risk register for each project. The risks are derived from various sources including project team members, project documentation and review teams. These risks are documented and are used in calculating cost uncertainty. To identify the required amount of uncertainty, a quantitative risk analysis (using a Monte Carlo methodology) is performed using the project schedule, complete with the costs of each work activity, and applying risks and uncertainty to the schedule. Stochastic modeling is used to develop a probability distribution and to calculate project cost and schedule uncertainty.

Escalation. In a budget request, cost is represented in escalated dollars. Escalation is the provision in a cost estimate for increases in cost of such resources as equipment, material, and labor to account for continuing price changes over time. Escalation is used to estimate the future cost of a project or to bring historical costs to the present. Most cost estimating is done in "current" dollars and then escalated to the time when the project will be accomplished. An escalation rate of between 2 and 4 percent per year is used.

1.7 SCOPE, SCHEDULE AND COST FOR HANFORD CLEANUP

RL and ORP have organized their work into PBSs. These PBSs include detailed work breakdowns to describe in greater context the scope of DOE's projects and operations at Hanford. Hanford cleanup encompasses 14 PBSs; eleven managed by RL and three managed by ORP, as shown in Table 1-4 and discussed further in other chapters of this LCR.

Table 1-4. Hanford Site Cleanup Project Baseline Summary.

PBS	Title
RL-0011	NM Stabilization and Dispostion-PFP
RL-0012	SNF Stabilization and Dispostion
RL-0013C	Solid Waste Stabilization and Disposition–200 Area
RL-0020	Safeguards and Security
RL-0030	Soil and Water Remediation–Groundwater/Vadose Zone
RL-0040	Nuclear Facility D&D–Remainder of Hanford
RL-0041	Nuclear Facility D&D–River Corridor Closure Project
RL-0042	Nuclear Facility D&D–Fast Flux Test Facility Project
RL-0100	Richland Community and Regulatory Support
RL-0201	Hanford Sitewide Services
RL-LTS	Long-Term Stewardship
TBD	Final Reactor Disposition
ORP-0014	Radioactive Liquid Tank Waste Stabilization and Disposition
ORP-0060	Major Construction–Waste Treatment and Immobilization Plant
ORP-0070	Waste Treatment Plant Operations

D&D = decontamination and decommissioning.
LTS = Long-Term Stewardship.
NM = nuclear materials.
ORP = DOE, Office of River Protection.
PBS = project baseline summary.
RL = DOE, Richland Operations Office.
SNF = spent nuclear fuel.
TBD = to be determined.

Table 1-5 shows Level 2 and Level 3 work breakdown associated with a single PBS. This presents a typical EM cleanup project down to a third tier of planning detail. Most work at Hanford is similarly broken down to at least Level 3.

Table 1-5. Example Cleanup Project Baseline Summary and Work Breakdown to Level 3.

PBS (Level 1)	**RL-0040 Nuclear Facility D&D-Remainder of Hanford**
Level 2	RL-0040.02 Remediation of Geographic Areas
Level 3	RL-0040.02.30 PFP Implementation Area RL-0040.02.31 U Plant Implementation Area RL-0040.02.36 B Plant Implementation Area RL-0040.02.39 PUREX Implementation Area RL-0040.02.40 T Plant Implementation Area RL-0040.02.41 REDOX Implementation Area

D&D = decontamination and decommissioning.
PBS = project baseline summary.
RL = DOE, Richland Operations Office.

Depending on the complexity of such factors as work scope, project maturity, contract period of performance, DOE's contractors typically plan their near-term work down to Level 6 and further to manage and schedule designs, approvals, and resources needed for their projects. This scope, schedule, and cost information rolls up and is included in the upper tier planning information. Table 1-6 is an example of work planning to Level 6 and how it incorporates Levels 1 through 5.

Table 1-6. Example of a Level 6 Work Breakdown Structure.

PBS (Level 1)	**RL-0040 Nuclear Facility D&D– Remainder of Hanford**
Level 2	0040.50 Maintain Safe and Compliant Facilities and Waste Sites
Level 3	0040.50.02 Central Plateau Nuclear Facilities Min-Safe
Level 4	0040.50.02.02 U Plant Min-Safe
Level 5	0040.50.02.02.02 U Plant Min-Safe Maintenance
Level 6	0040.50.02.02.02.13 U Plant Min-Safe Corrective Maintenance

D&D = decontamination and decommissioning.
PBS = project baseline summary.
RL = DOE, Richland Operations Office.

For the years beyond the contractor's near-term work, DOE maintains "out-year" planning estimates for the remaining cleanup. Out-year planning estimates are not as well developed as near-term planning (typically no further than Level 3 or Level 4).

Cost information will be updated each year to reflect work completion, recent decisions, and other changes affecting the lifecycle scope (e.g., upgrades or infrastructure modernization to support major projects). Chapters 3.0 through 6.0 summarize information at PBS Level 2, including work breakdown for each PBS, and descriptions of the lifecycle work scope and associated work elements. Each chapter provides estimated cleanup costs for corresponding work elements.

Appendix C provides more cost detail at Level 3 for near-term work and at Level 2 for all Hanford cleanup supporting the low-range estimate. Appendix D provides the detail for the high-range estimate.

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2.0 HANFORD LIFECYCLE SUMMARY

This chapter presents the overall Hanford cleanup scope, schedule, and cost. Chapters 3.0 through 6.0, as well as Appendix C and Appendix D, present additional details on the PBSs that cover the lifecycle cleanup work scope in the three major scope components and mission support.

2.1 HANFORD SITE LIFECYCLE SCOPE

Cleanup consists of three major scope components: River Corridor, Central Plateau, and tank waste (the tank waste component is contained geographically within the Central Plateau). Cleanup also includes mission support activities that provide key infrastructure and services for Hanford. Cleanup is a complex task that involves multiple contractors performing discrete, yet interdependent, scopes of work. The scope of cleanup work is broken down into a series of PBSs. The prime contract related to each PBS is noted in Table 2-1, which describes the general scope of each PBS and the chapter/section where it is addressed.

Table 2-1. Hanford Project Baseline Summaries (PBS) – RL and ORP Contracts. (2 pages)

LCR Section	PBS	Official Title	Alternate Titles	General Scope	Prime Contract
CHAPTER 3.0 – RIVER CORRIDOR CLEANUP					
River Corridor (Section 3.1)	RL-0012	SNF Stabilization and Disposition	K Basins Closure Project	Removal of the K Basin sludge, found SNF and fuel scrap.	PRC
River Corridor (Section 3.2)	RL-0041	Nuclear Facility D&D–River Corridor Closure Project	None	Cleanup of the River Corridor waste sites and facilities, including placing the reactors in interim safe storage (this scope excludes groundwater remediation, which is addressed through PBS RL-0030). Includes 105-KW SNF Basin deactivation and removal work scope that was transferred from RL-0012 in FY 2012.	PRC
River Corridor (Section 3.3)	TBD	TBD	Final Reactor Disposition	Disposition of 100 Area production reactors (excluding B Reactor).	TBD
CHAPTER 4.0 – CENTRAL PLATEAU CLEANUP					
Central Plateau (Section 4.1)	RL-0011	NM Stabilization and Disposition–PFP	PFP Closure Project	Demolition of aboveground facilities and structures at PFP.	PRC
Central Plateau (Section 4.2)	RL-0013C	Solid Waste Stabilization and Disposition–200 Area	Solid and Liquid Waste Disposition Project	Waste management operations including treatment, storage, and disposal of Hanford Site waste streams and offsite wastes[1].	PRC
Central Plateau (Section 4.3)	RL-0030	Soil and Water Remediation–Groundwater/ Vadose Zone	Groundwater Project	Decision-making process for groundwater and waste sites and Hanford Sitewide groundwater remediation.	PRC
Central Plateau (Section 4.4)	RL-0040	Nuclear Facility D&D–Remainder of Hanford	Central Plateau Remediation	Cleanup of the Central Plateau waste sites and facilities, including canyon facilities.	PRC
Central Plateau (Section 4.5)	RL-0042	Nuclear Facility D&D–Fast Flux Test Facility Project	None	Demolition of the Fast Flux Test Facility and associated waste sites and structures.	PRC

Table 2-1. Hanford Project Baseline Summaries (PBS) – RL and ORP Contracts. (2 pages)

LCR Section	PBS	Official Title	Alternate Titles	General Scope	Prime Contract
CHAPTER 5.0 – TANK WASTE CLEANUP					
Tank Waste Cleanup (Section 5.1)	ORP-0014	Radioactive Liquid Tank Waste Stabilization and Disposition	None	Operations, retrieval, treatment, and closure of the single-shell and double-shell tanks.	TOC
Tank Waste Cleanup (Section 5.2)	ORP-0060	Major Construction–Waste Treatment and Immobilization Plant	None	Construction of the Waste Treatment and Immobilization Plant.	WTPC
Tank Waste Cleanup (Section 5.2)	ORP-0070	Waste Treatment Plant Operations	None	Activities required to support the treatment of tank wastes in the WTP including implementation of the DFLAW strategy.	TOC
CHAPTER 6.0 – MISSION SUPPORT					
Mission Support (Section 6.1)	RL-0020	Safeguards and Security	None	Protection of the Hanford Site, special materials, resources, and workers.	MSC
Mission Support (Section 6.2)	RL-0100	Richland Community and Regulatory Support	None	Support for community interaction, including Hanford Advisory Board, Oregon Department of Energy and other entities.	Various grants
Mission Support (Section 6.3)	RL-0201	Hanford Sitewide Services	None	Management, repair, and capital upgrades to infrastructure and other Sitewide services.	MSC
Mission Support (Section 6.4)	RL-LTS	Long-Term Stewardship (LTS)	Post-cleanup LTS [2]	Infrastructure support, surveillance and maintenance, community support, and management activities following completion of cleanup activities.	TBD

[1]Waste from other sites will not be received until the Waste Treatment and Immobilization Plant is operational.
[2]See section 6.3 for the current ongoing LTS program.

D&D = decontamination and decommissioning.
LCR = Lifecycle Report.
LTS = long-term stewardship.
MSC = Mission Support Contract.
NM = nuclear materials.
ORP = DOE, Office of River Protection.
PBS = project baseline summary.
PFP = Plutonium Finishing Plant.
PRC = Plateau Remediation Contract.
RL = DOE, Richland Operations Office.
SNF = spent nuclear fuel.
TBD = to be determined
TOC = Tank Operations Contract.
WTPC = Waste Treatment and Immobilization Plant Contract.

2.2 HANFORD CLEANUP SCHEDULE

The remaining cleanup schedule covers activities for waste cleanup and waste management, leading to transition of portions of the Hanford Site to LTS. Chapters 3.0 through 6.0, as well as Appendix C and Appendix D, present additional schedule details for the River Corridor, Central Plateau, tank waste, and mission support activities.

To support cleanup, RL has responsibility for mission support activities related to safeguards and security, community and regulatory support, and Hanford Sitewide Services. These activities align with the cleanup through FY 2078, as represented in the baseline planning case (low-range estimate). RL has planned for an LTS period that runs from FY 2079 through FY 2095 as part of mission support.

Figure 2-1 shows River Corridor cleanup complete by FY 2041, final reactor disposition complete by FY 2068, tank waste cleanup complete by FY 2069, and Central Plateau cleanup complete by FY 2078 (including schedule uncertainty).

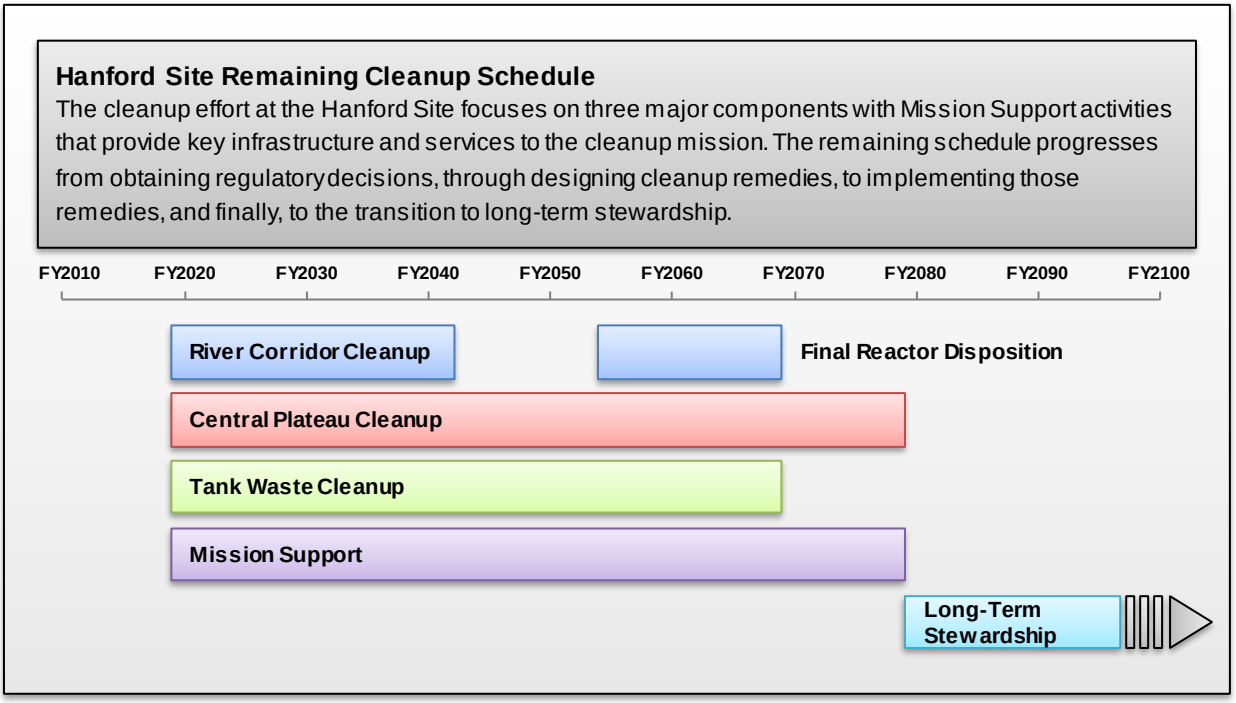

Figure 2-1. Hanford Site Remaining Cleanup Schedule.

2.3 HANFORD SITE ESTIMATED CLEANUP COSTS

The low-range of the remaining cleanup costs[6] are estimated to be about $323.2 billion to complete the scope for the River Corridor, final reactor disposition, Central Plateau, tank waste, and mission support activities, and LTS. RL's scope accounts for about $83.3 billion of the total costs and ORP's scope accounts for about $239.9 billion. These estimates include cost uncertainty because many of the final cleanup decisions have not been made. Once these decisions are made, estimates will be revised. The high-range of the remaining cleanup costs are estimated at approximately $677.0 billion. ORP's scope accounts for about $548.4 billion of the total high-range cost while the RL scope accounts for approximately $128.6 billion.

Figure 2-2 summarizes the estimated remaining cleanup cost for RL and ORP for both the low- and high-ranges. Figure 2-3 shows the low-range remaining cleanup costs by year for RL and ORP. Figure 2-4 summarizes the low-range estimated cleanup costs by RL and ORP PBSs. Figure 2-5 shows the Hanford high-range remaining cleanup costs by year. Table 2-2 summarizes the total estimated cleanup costs for each PBS, incorporating both the low- and high-ranges. The methodology for risk analysis and the detailed results are discussed in Appendix D.

[6] The expression "cleanup costs" is used to represent the costs for those remaining actions that are necessary for DOE to fully meet all applicable environmental obligations and complete the Hanford Site cleanup mission.

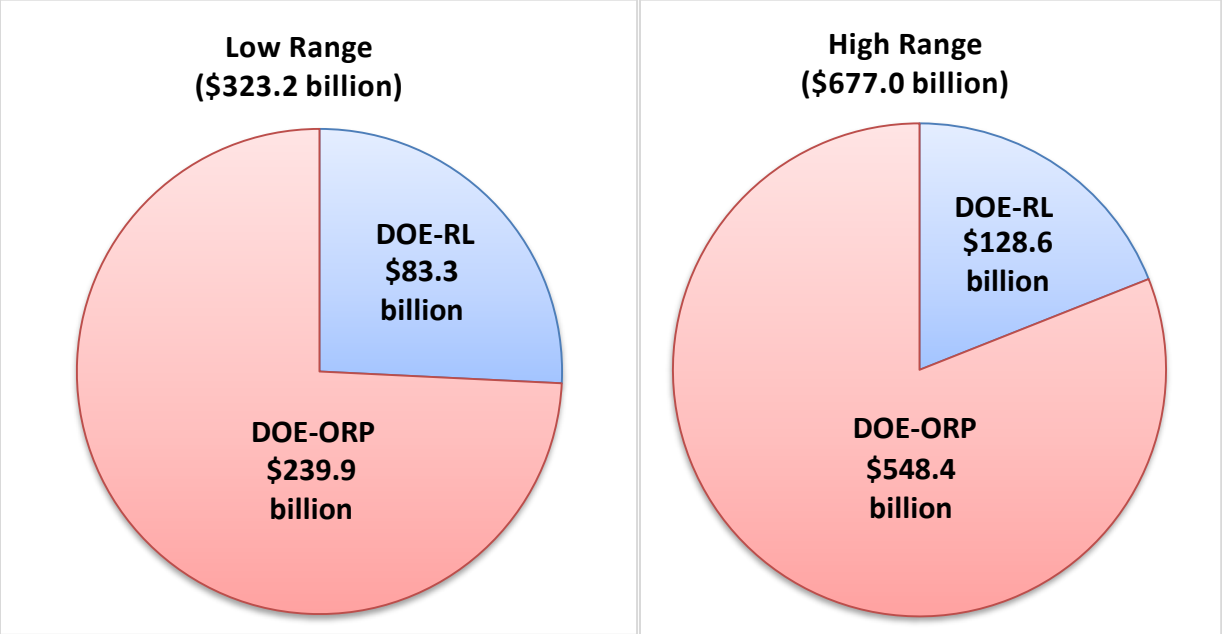

Figure 2-2. Hanford Site Estimated Cleanup Cost Distribution by DOE Field Office.

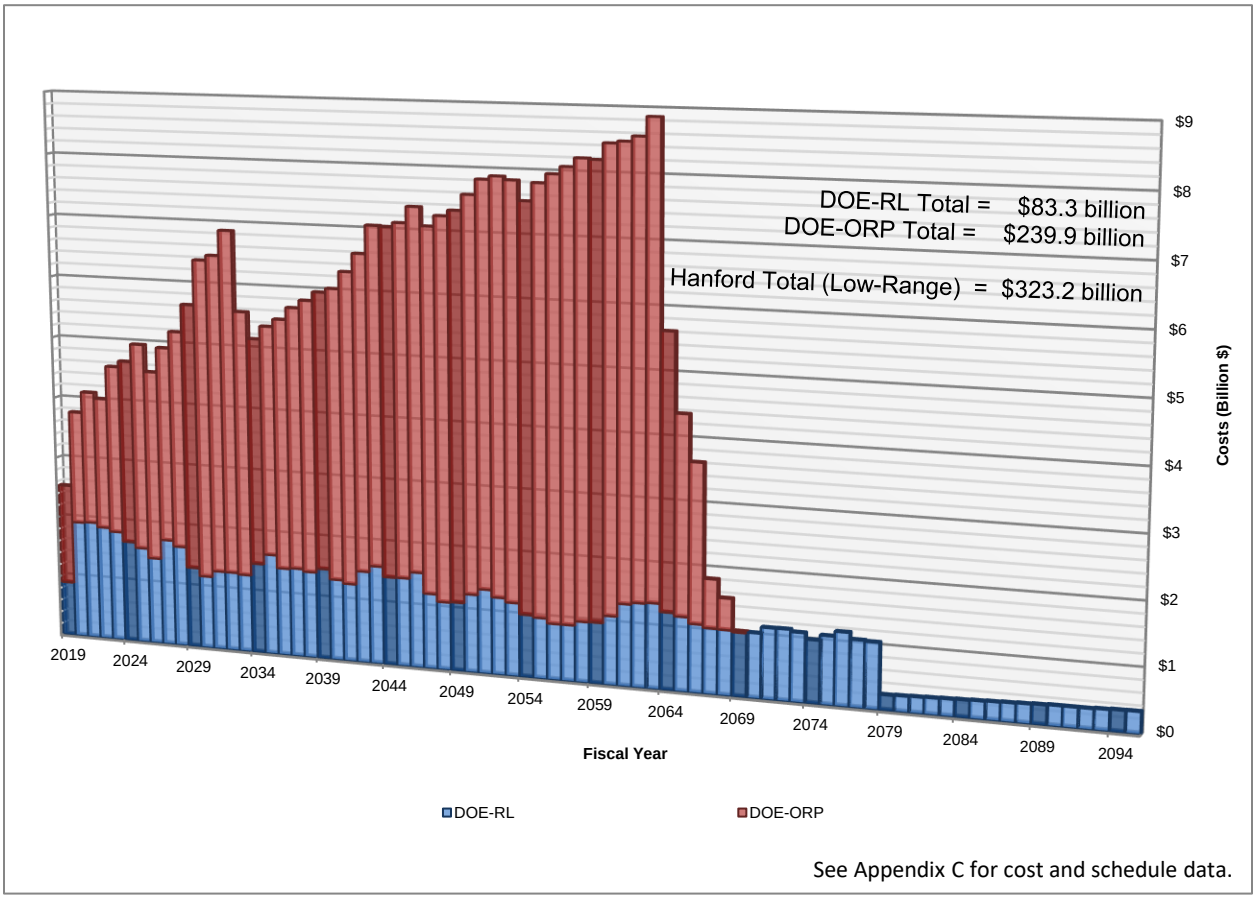

Figure 2-3. Hanford Site Low-Range Remaining Cleanup Costs by Fiscal Year.

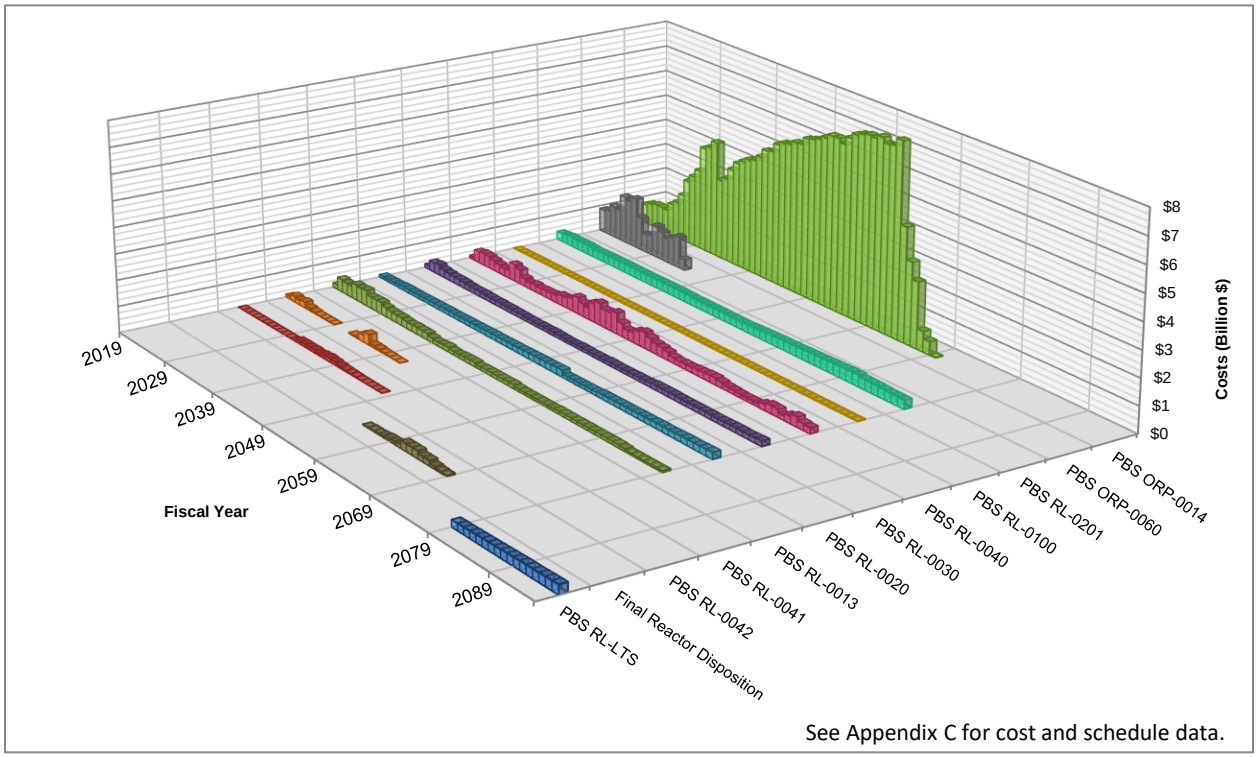

Figure 2-4. Hanford Site Low-Range Remaining Cleanup Costs by Project Baseline Summary.

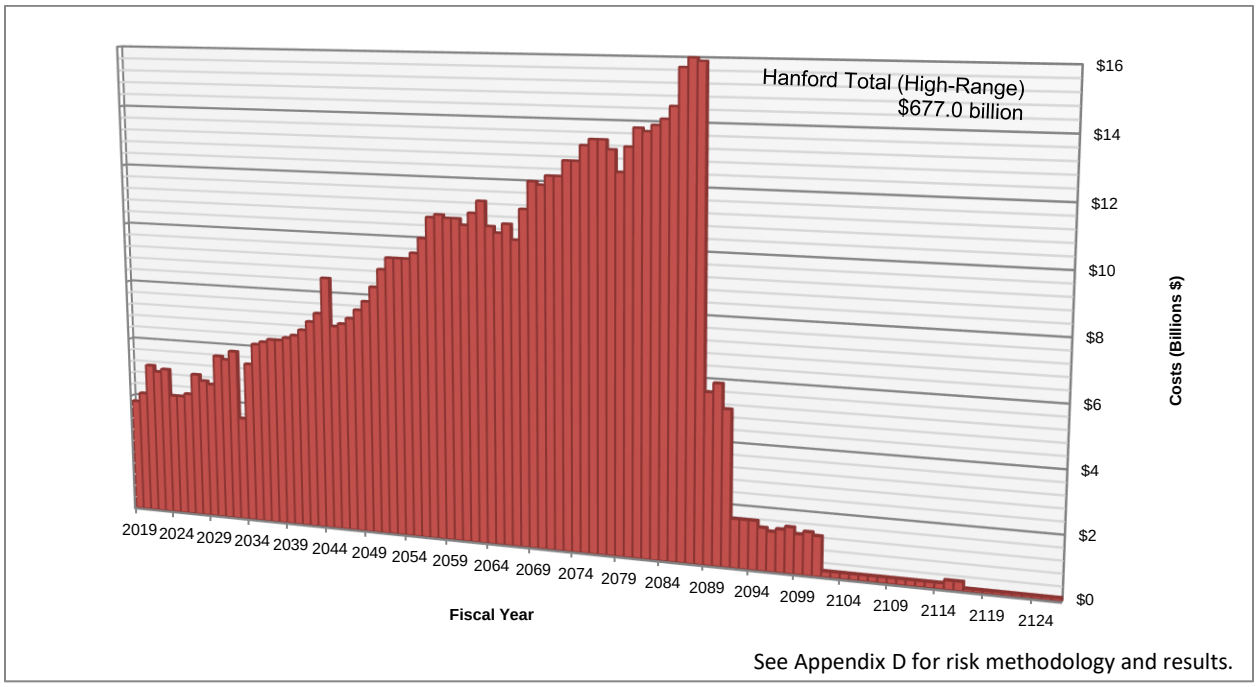

Figure 2-5. Hanford Site High-Range Remaining Estimated Cleanup Costs by Fiscal Year (includes both RL and ORP).

Table 2-2. Hanford Site Remaining Cleanup Cost Estimated Ranges by PBS.

Project Work Scope	Estimated Cleanup Costs[1] (Billion $)
RL Total Remaining Estimated Costs	**$83.3 - $128.6**
NM Stabilization and Disposition - PFP (PBS RL 0011)	$0[2]
SNF Stabilization and Disposition (PBS RL 0012)	$0[3]
Solid Waste Stabilization and Disposition - 200 Area (PBS RL-0013C)	$11.5 - $15.1
Safeguards and Security (PBS RL-0020)	$10.1 - $23.9
Soil and Water Remediation - Groundwater/Vadose Zone (PBS RL-0030)	$9.6 - $10.5
Nuclear Facility D&D - Remainder of Hanford (PBS RL-0040)	$20.6 - $26.8
Nuclear Facility D&D - River Corridor Closure Project (PBS RL-0041)	$1.8 - $2.0
Nuclear Facility D&D - Fast Flux Test Facility Project (PBS RL-0042)	$1.0 - $1.1
Richland Community and Regulatory Support (PBS RL-0100)	$1.1 - $1.7
Hanford Sitewide Services (PBS RL-0201)	$20.4 - $32.8
Long-Term Stewardship (PBS RL-LTS)	$5.2 - $12.7
Final Reactor Disposition	$1.9
ORP Total Remaining Estimated Costs	**$239.9 - $548.4**
Radioactive Liquid Tank Waste Stabilization and Disposition (PBS ORP-0014)	$221.4 - $518.1
Major Construction – Waste Treatment Plant (PBS ORP-0060)	$18.5 - $30.3
Waste Treatment Plant Operations (PBS ORP-0070)	$0[4]
Total Remaining Estimated Costs	**$323.2 - $677.0**

NOTE: The remaining estimated cleanup cost does not include the upper bound cost estimates prepared for selected future cleanup actions. These are summarized in Appendix B, Table B-5.

[1]Cost ranges have been shown in this table to reflect cost and schedule uncertainty; the lower number is used throughout this report. Values are rounded; see Appendix C for the low-range details and Appendix D for the high-range details.
[2]Includes $46.2 million in FY 2019 only.
[3]Includes $18.9 million in FY 2019 and FY 2020 only.
[4]Includes $30 million in FY 2019 and FY 2020 only. WTP operational costs are currently within ORP-0014 and will be shown in ORP-0070 in future reports.

D&D = decontamination and decommissioning.
LTS = long-term stewardship.
NM = nuclear materials.
ORP = DOE, Office of River Protection.
PBS = project baseline summary.
PFP = Plutonium Finishing Plant.
RL = DOE, Richland Operations Office.
SNF = spent nuclear fuel.
WTP = Waste Treatment and Immobilization Plant.

3.0 RIVER CORRIDOR CLEANUP

The River Corridor, the area of the Hanford Site along the Columbia River, includes four production and operations areas:

- **100 Area.** Location of nine former production reactors, associated support facilities, and related waste sites.
- **300 Area.** Location of research and development facilities, former fuel fabrication facilities, and related waste sites.
- **400 Area**. Buildings and waste sites other than operating facilities, Fuels and Materials Examination Facility, and the Fast Flux Test Facility (FFTF).
- **600 Area**. Location of a major burial ground (618-11) with some additional soil and debris sites.

DOE manages the remaining River Corridor cleanup through the Nuclear Facility D&D–River Corridor Closure Project (PBS RL-0041). PBS RL-0041 addresses cleanup of waste sites, burial grounds, and facilities in the 100, 300, 400, and 600 Areas and the interim safe storage (ISS) of the C, D, DR, F, H, KE, KW, and N Reactors. Section 3.2 discusses the scope of this project.

Although currently not considered to be a project, final reactor disposition will address cleanup of the 100 Area surplus production reactors. Section 3.3 discusses the scope of this activity.

Groundwater cleanup is ongoing in the River Corridor. RL manages the groundwater cleanup through Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030), which covers groundwater remediation for the entire Hanford Site. Groundwater associated with the River Corridor is discussed with Central Plateau cleanup in section 4.3.

Cleanup is performed in accordance with interim and final RODs and action memoranda as listed in Appendix A and with key TPA milestones listed in Table 3-1. These TPA milestones provide the structure that the Tri-Party agencies have agreed to for Hanford priorities and scope sequencing.

Table 3-1. River Corridor Cleanup Key Tri-Party Agreement Milestones.

Milestone	Title	Compliance Date
Nuclear Facility D&D–River Corridor Closure Project (PBS RL-0041)		
M-016-85A	Complete remote excavation of 300-296 waste site.	9/30/2019
M-016-178	Initiate Deactivation of 105-KW Fuel Storage Basin.	12/31/2019
M-016-85	Complete remedial actions for 300-296 waste site and disposition for 324 Building and ancillary buildings.	9/30/2021
M-016-86	Complete remedial actions for 618-11 Burial Ground in accordance with DOE/RL-2014-13-ADD1.	9/30/2021
M-016-181	Complete Deactivation, Demolition and Removal of 105-KW Fuel Storage Basin.	9/30/2023
M-016-186	Initiate Soil Remediation Under 105-KW Fuel Storage Basin.	12/31/2023
M-016-00C	Complete all response actions for the 100-K Area.	9/30/2024
M-016-143	Complete the interim response actions for the 100-K Area within the perimeter boundary and to the river for Phase 2 actions.	9/30/2024
M-093-27	Complete 105-KE and KW Reactor ISS.	9/30/2024
M-089-00	Complete closure of mixed waste units in 324 Building Cells B and D.	TBD
M-093-00	Complete final disposal of 100 Areas surplus production reactor buildings.	TBD

D&D = decontamination and decommissioning. ISS = interim safe storage. OU = operable unit. PBS = project baseline summary. TBD = to be determined.

3.1 SNF STABILIZATION AND DISPOSITION (PBS RL-0012)

Cleanup and stabilization of the SNF sludge from the K West Reactor Fuel Storage Basin is scheduled to be completed in FY 2019 using funds carried over from FY 2018 plus $13.9 million in the FY 2019 budget. Approximately $5 million is included in FY 2020 due to cost and/or schedule uncertainty. The subsequent 105-KW Basin deactivation and removal work scope will be performed under PBS RL-0041 (see section 3.2). The subsequent sludge disposition work scope will be performed under PBS RL-0013C, Solid Waste Stabilization and Disposition–200 Area (see section 4.2).

3.2 NUCLEAR FACILITY D&D–RIVER CORRIDOR CLOSURE PROJECT (PBS RL-0041)

The Nuclear Facility D&D–River Corridor Closure Project (PBS RL-0041) will clean up the areas of Hanford located in the River Corridor in accordance with existing records of decision (ROD) and action memoranda (see Appendix A). Anticipated land uses for the River Corridor are described in DOE/EIS-0222-F and in the pursuant ROD. The River Corridor Closure Project established the following cleanup objectives:

- Remediate waste sites.
- Deactivation, decontamination, decommissioning, and demolition (D4) of facilities.
- Place eight plutonium production reactors into ISS. Figures 3-1 and 3-2 depict C Reactor before and after the ISS process. Table 3-1 provides the status of the reactors. (Note B Reactor's status as part of the newly established Manhattan Project National Historical Park.)
- Complete substantive remediation to allow the 100 and 300 Areas to be deleted from the National Priorities List.
- The River Corridor Closure Project includes remediation of the 618-11 Burial Ground.

Figure 3-1. C Reactor Before Interim Safe Storage.

Figure 3-2. C Reactor in Interim Safe Storage.

Table 3-2. Reactor Status.

Reactor	Status	Remaining Activity
B	Named National Historic Landmark by U.S. Department of Interior in 2008. Reactor open for escorted public tours.	Operation, maintenance and management of B Reactor as a facility of the Manhattan Project National Historical Park.
C	Reactor placed in ISS.	Final disposition of reactor block.
D	Reactor placed in ISS.	Final disposition of reactor block.
DR	Reactor placed in ISS.	Final disposition of reactor block.
F	Reactor placed in ISS.	Final disposition of reactor block.
H	Reactor placed in ISS.	Final disposition of reactor block.
KE	Fuel storage basin demolished; continued deactivation, decommissioning, and demolition activities in preparation for emplacement of safe storage enclosure.	Reactor ISS began in 2011 and is scheduled for completion by 2021; final disposition of reactor block.
KW	Sludge removed; proceed with demolition of adjacent buildings and installation of safe storage enclosure to complete ISS activities.	ISS is scheduled for completion by 2024; final disposition of reactor block.
N	Reactor placed in ISS.	Final end state of the reactor has not been determined.
ISS = interim safe storage.		

Table 3-3 summarizes the scope for the Level 2 work elements.

Table 3-3. Nuclear Facility D&D-River Corridor Closure Project (PBS RL-0041) Level 2 Scope Summary.

Work Element	Scope Description
River Corridor Cleanup	Includes work remaining to complete 100-K Area and 100-N Area remediation, including project management, demolition of K West Basin, disposition of K East and K West Reactors, remediation of the 618-11 burial ground and waste site 300-296 (contaminated soil below the 324 Building B Hot Cell), D4 of support structures, waste site closeout sampling and documentation, and waste site backfill and revegetation.
River Corridor Maintain Safe and Compliant Facilities and Waste Sites	Includes radiation surveys, surface contamination treatment, sign replacement, tumbleweed collection and spraying, inactive waste sites min safe support, min safe for nuclear facilities (K West Basin and 324 Building), and min safe for general purpose facilities.
D4 = deactivation, decontamination, decommissioning, and demolition.	

Figure 3-3 presents the low-range remaining cleanup costs for PBS RL-0041 by FY, and Figure 3-4 presents the low-range remaining estimated costs by work element. The gap between FY 2029 and FY 2031 is primarily caused by the anticipated schedule to obtain a final ROD to continue waste site remediation in the 100-K area.

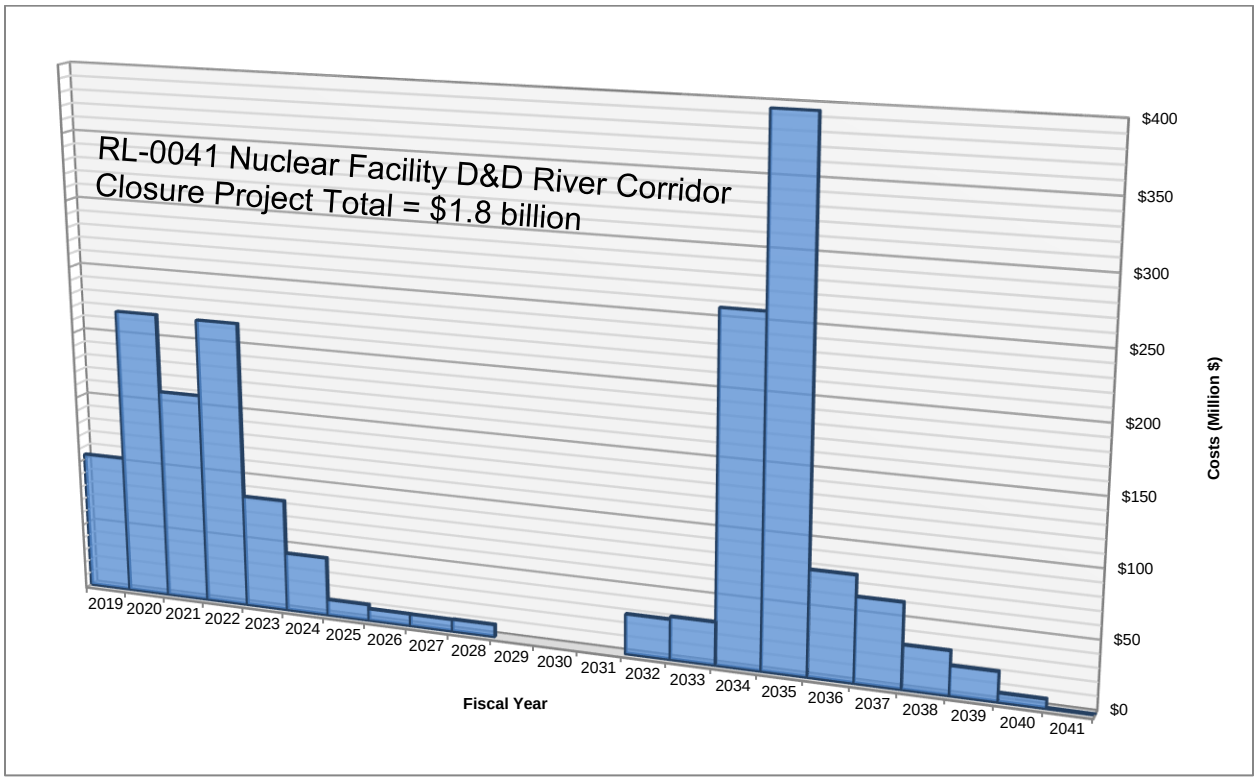

Figure 3-3. Nuclear Facility D&D–River Corridor Closure Project (PBS RL-0041) Low-Range Remaining Estimated Cleanup Costs by Fiscal Year.

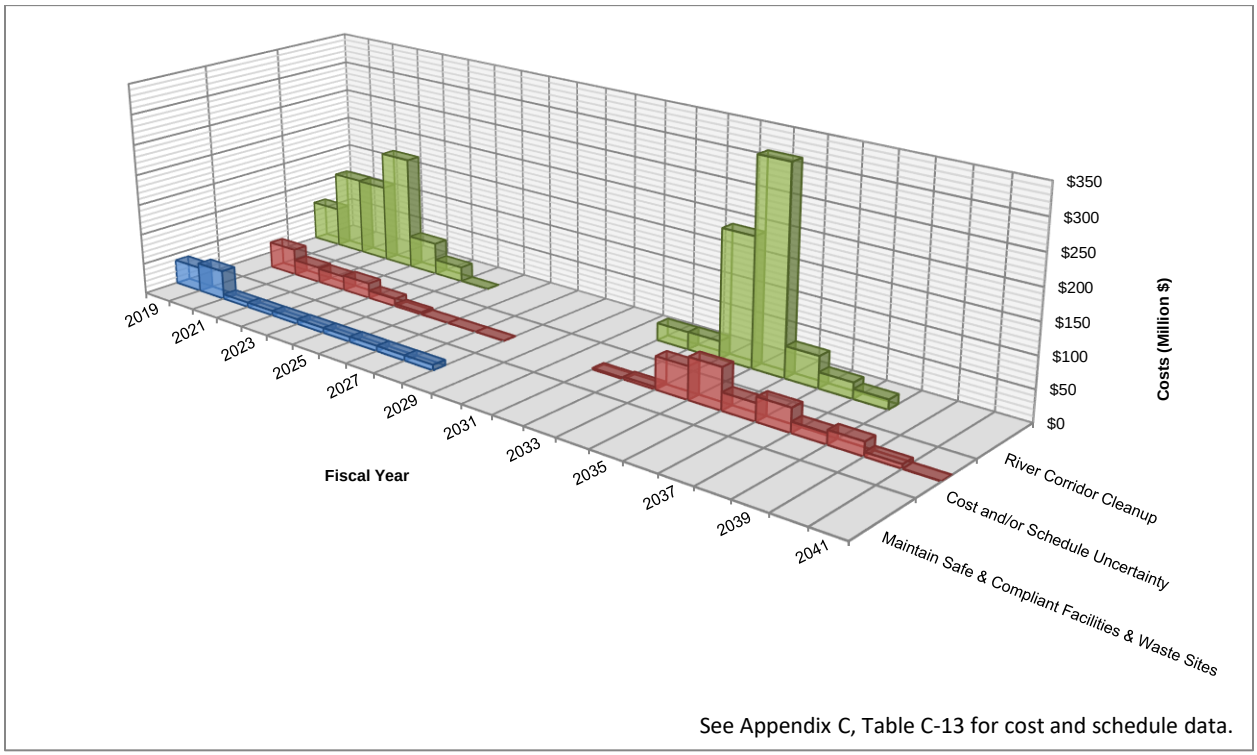

Figure 3-4. Nuclear Facility D&D–River Corridor Closure Project (PBS RL-0041) Low-Range Remaining Estimated Cleanup Costs by Work Element.

3.3 FINAL REACTOR DISPOSITION

Final reactor disposition will address cleanup of the 100 Area surplus production reactors in accordance with TPA M-093-00. Disposition of the 100 Area reactors (except for B Reactor, which is being preserved as a national historic landmark and is part of the newly established Manhattan Project National Historical Park) was one of the cost estimate alternative analyses evaluated in the 2011 LCR (DOE/RL-2010-25). See summary in Appendix B, Table B-5, River Corridor - Disposition 100 Area Reactors.

Six reactors (C, D, DR, F, H, and N) have been placed in ISS configuration (see Table 3-2). KE Reactor has completed interim ISS and is in a minimum safe state; KE Reactor and KW Reactor are scheduled to complete ISS by FY 2024. After being placed in ISS, the reactors will undergo surveillance, monitoring, and maintenance for up to 75 years to allow radionuclides to decay. Following this period, the reactor blocks will be removed from their current locations and transported to the Central Plateau Inner Area for disposal.

The 2011 LCR identified the most plausible alternative for the reactors as safe storage followed by deferred one-piece removal. This alternative was developed and evaluated in a final environmental impact statement (EIS) (DOE/EIS-0119F, *Final Environmental Impact Statement Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington*) and in a subsequent engineering evaluation (DOE/RL-2005-45, *Surplus Reactor Final Disposition Engineering Evaluation*). DOE issued 58 FR 48509, "Record of Decision: Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington," in September 1993, which implements the recommendation for safe storage followed by deferred one-piece removal of the surplus reactors. N Reactor was not included in the EIS because it was not available for decommissioning at the time of the *National Environmental Policy Act of 1969* (NEPA) EIS and ISS was approved through the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) process. Final disposition of N Reactor will be determined by a subsequent NEPA or CERCLA decision process. In the planning case presented in this report, N Reactor is assumed to undergo safe storage followed by deferred one-piece removal.

Figure 3-5 presents the remaining estimated costs by fiscal year. The schedule is based on a 14-year implementation period for one-piece removal and completion of reactor removal by FY 2068 based on the ROD issue date of 1993 with a maximum 75-year storage period, so reactor removal would start by FY 2054. The estimated $1.9 billion to complete final reactor disposition by FY 2068 is the escalated $676 million removal cost (in 2010 constant dollars) presented in Table 4-5 of the 2011 LCR.

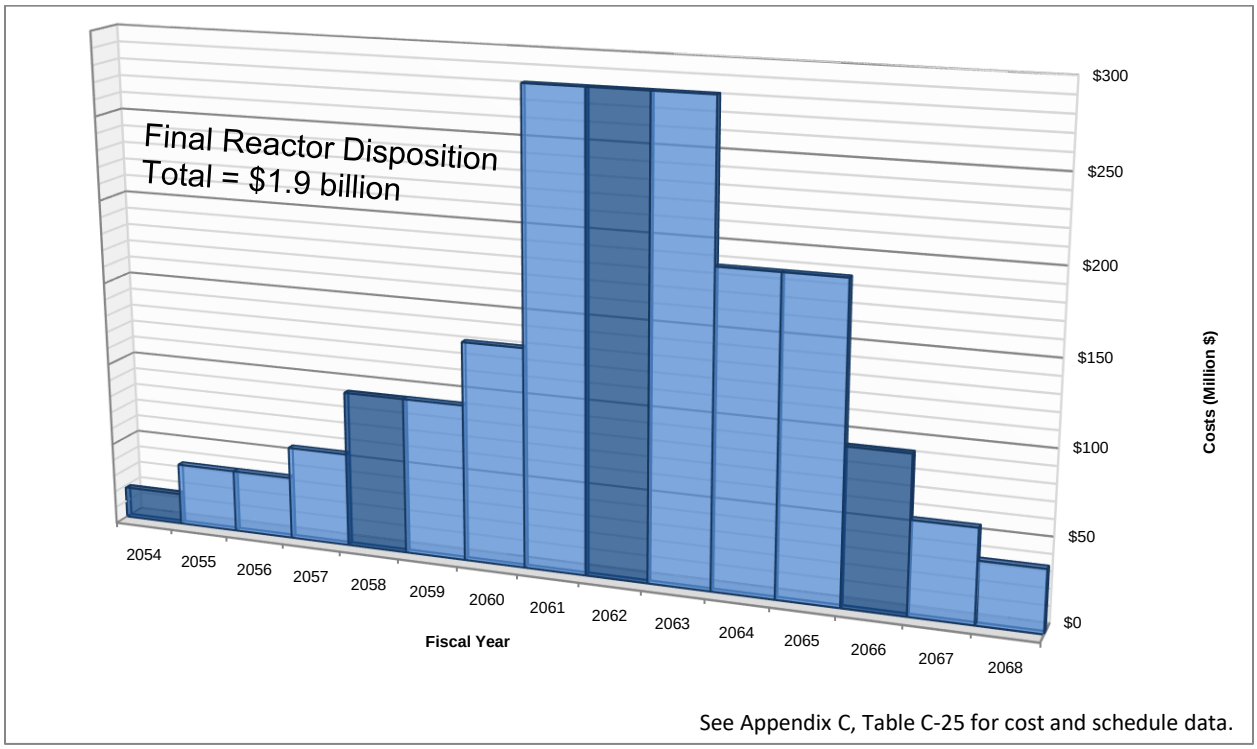

Figure 3-5. Final Reactor Disposition Remaining Estimated Cleanup Costs by Fiscal Year.

3.4 RIVER CORRIDOR CLEANUP ASSUMPTIONS AND UNCERTAINTIES

In planning for the Hanford Site lifecycle, uncertainties are analyzed to estimate potential scope, schedule and cost changes. The following assumptions were identified for Nuclear Facility D&D–River Corridor Closure Project (PBS RL-0041) low-range estimate:

- Regulatory changes will not require additional activities (e.g., document revisions, additional sampling) that would significantly impact costs or schedules.
- Pacific Northwest National Laboratory (PNNL) operating facilities will need to be available to support Office of Science missions. After PBS RL-0041 is completed, the facility D&D/waste site cleanup work will transfer to PBS RL-0040 Nuclear Facility D&D – Remainder of Hanford.
- The Hanford Natural Resource Trustee Council activities, including studies and Natural Resource Damage Assessment and Restoration (NRDAR) process will not significantly affect cost or schedule.
- Remaining costs for completion of the NRDAR process range from $5 million to $10 million with completion of the injury assessment and Restoration Compensation Plan by 2024.
- Any significant settlement funds for the NRDAR case would be obtained through the U.S. Department of Justice and the U.S. Judgement Settlement Fund.

Factors (risk and/or uncertainty) considered in determining the high-range estimate associated with the Nuclear Facility D&D–River Corridor Closure Project work scope include, but are not limited, to:

- Contamination spread associated with the 618-11 burial ground
- Remediation is more extensive than planned
- Building/system degradation and failures during S&M mode

- Total volume of high-dose 300-296 material exceeds available hot cell space
- K-West Basin residual TRU waste discovered that must be remote handled

These uncertainties and others are accounted for in the schedule and estimate uncertainty for Nuclear Facility D&D–River Corridor Closure Project.

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4.0 CENTRAL PLATEAU CLEANUP

The Central Plateau is a 75-square-mile area located near the center of the Hanford Site, that contains about 900 excess facilities, including five massive chemical processing facilities called canyons and roughly 800 non-tank farm waste sites. The Central Plateau is home to ongoing waste management operations, such as the Mixed Waste Low-Level Burial Grounds, liquid waste facilities, and the Waste Receiving and Processing (WRAP) Facility. Infrastructure services (e.g., power, water, and telecommunication lines), either existing or planned, in the Central Plateau are needed to support cleanup. These facilities, waste sites, canyons, and ongoing waste management operations and infrastructure are spread across the Central Plateau. The tank waste and WTP facilities on the Central Plateau are discussed in Chapter 5.0 as part of ORP's scope.

During Site operations, 450 billion gallons of liquid waste and cooling water were discharged to the ground; most within the Central Plateau (TRAC-0151-VA, *Historical Perspective of Radioactively Contaminated Liquid and Solid Wastes Discharged or Buried in the Ground at Hanford*). These past releases have created extensive plumes of groundwater contamination that exceed drinking water standards with a combined area of approximately 65 square miles (DOE/RL-2017-66). A significant amount of contamination remains in the soil column above the water table and poses a potential threat to groundwater.

Interim and final groundwater treatment are in place for contaminant plumes in the 200 West Area and in several locations in the 100 Areas. The Central Plateau cleanup is organized into the following three principal components (DOE/RL-2009-10):

- **Inner Area.** The footprint of the Central Plateau that will be dedicated to long-term waste management and containment of residual contamination and will remain under Federal ownership and control as long as a potential hazard exists. The Inner Area contains the majority of Hanford's active waste treatment, storage, and disposal facilities, including hundreds of waste sites, surplus facilities, miles of buried pipelines, tank farms, and large canyon facilities. Cleanup of the Inner Area will make this footprint as small as practical.
- **Outer Area.** All areas of the Central Plateau beyond the boundary of the Inner Area. It is DOE's intent to clean up the Outer Area to a level comparable to the River Corridor (i.e., suitable for unrestricted surface use under continued Federal ownership and control and consistent with DOE's anticipated future land use of conservation/mining). Contaminated soil and debris removed as part of Outer Area cleanup will be placed within the Inner Area for final disposal. Completion of cleanup for the approximately 65-square-mile Outer Area will shrink the active footprint of cleanup for the Central Plateau to the Inner Area.
- **Groundwater and Deep Vadose Zone Remediation.** DOE's goal is to restore groundwater to its beneficial uses (Table 1-2, Goal 2), unless restoration is determined to be technically impracticable. An important element of groundwater protection and remediation is to develop and implement ways to protect groundwater from continuing influx of contaminants from the deep vadose zone.

The cleanup work scope in the Central Plateau is managed through four projects:

- Solid Waste Stabilization and Disposition–200 Area, PBS RL-0013C (Inner Area).
- Soil and Water Remediation–Groundwater/Vadose Zone, PBS RL-0030 (entire Hanford Site, including Inner and Outer Areas and the River Corridor).
- Nuclear Facility D&D–Remainder of Hanford, PBS RL-0040 (geographical cleanup of waste sites and facilities in the Inner and Outer Areas, including the remaining canyon facilities).
- Nuclear Facility D&D–Fast Flux Test Facility Project, PBS RL-0042 (includes FFTF located in the River Corridor).

Cleanup is being performed in accordance with RODs and action memoranda as listed in Appendix A and with key TPA milestones listed in Table 4-1.

Table 4-1. Central Plateau Cleanup Key Tri-Party Agreement Milestones. (2 pages)

Milestone	Description	Compliance Date
Solid Waste Stabilization and Disposition–200 Area, PBS RL-0013C		
M-091-44T	Submit a change package for annual milestones to treat or certify and ship large container CH TRUM waste and RH TRUM waste (in aboveground storage as of June 30, 2009 and in retrievable storage) to complete the disposition of this waste.	9/30/2020
M-092-20	Submit to Ecology a disposition pathways evaluation for the cesium and strontium capsules	3/31/2022
M-016-173	Select K Basin sludge treatment and packaging technology and propose new interim sludge treatment and packaging milestones.	9/30/2022
M-091-49	Complete retrieval and designation of RH and CH retrievably-stored waste.	9/30/2028
M-091-48	Complete the offsite shipment of all TRUM waste (in above ground storage as of June 30, 2009, and in retrievable storage).	9/30/2030
M-091-00	Complete the treatment to LDR treatment standards for all Hanford Site RCRA MLLW and RCRA TRUM waste. DOE may choose to complete certification and shipment of TRUM waste for disposal at the WIPP in lieu of LDR treatment if, as of the time of shipment, such waste is exempt from LDR treatment standards when disposed at WIPP.	Date to be established pursuant to M-091-44T
Soil and Water Remediation–Groundwater/Vadose Zone, PBS RL-0030		
M-015-92B	Submit RCRA facility investigation/corrective measures study and RI/FS report and proposed corrective action decision/proposed plan (PP) for the 200-EA-1 OU (Central Plateau 200 East Inner Area) to Ecology.	11/30/2022
M-015-93B	Submit RCRA facility investigation/corrective measures study and RI/FS report and proposed corrective action decision/proposed plan for the 200-SW-2 OU to Ecology.	1/31/2023
M-015-92C	Submit RCRA facility investigation/corrective measures study and RI/FS report and proposed corrective action decision/proposed plan for the 200-IS-1 OU to Ecology.	3/31/2023
M-015-38B	Submit a feasibility study report and proposed plan(s) for the 200-CW-1, 200-CW-3, and 200-OA-1 OUs for waste sites in the Outer Area of the Central Plateau to EPA.	7/31/2023
M-015-91B	Submit feasibility study report(s) and proposed plan(s) for the 200-BC-1 and 200-WA-1 OUs (200 West Inner Area) to EPA.	7/31/2023
M-015-110B	Submit corrective measures study & feasibility study report and proposed plan/proposed corrective action decision for the 200-DV-1 OU to Ecology.	9/30/2023
M-015-00	Complete the RI/FS (or RCRA facility investigation/corrective measures study and RI/FS) process for all non-tank farm OUs except for canyon/associated past practice waste site OUs covered in M-085-00.	6/30/2026
M-024-00O	Complete required well installations in accordance with the RCRA and CERCLA groundwater requirements.	TBD
Nuclear Facility D&D–Remainder of Hanford, PBS RL-0040		
M-037-10	Complete unit-specific closure requirements according to the closure plan(s) for six (6) TSD units: 207-A South Retention Basin, 216-A-29 Ditch, 216-A-36B Crib, 216-A-37-1 Crib, 216-B-63 Trench, Hexone Storage and Treatment Facility (276-S-141/142).	9/30/2020
M-037-13	Complete unit-specific closure requirements according to the closure plan for the 241-CX Tank System (241-CX-70/71/72).	9/30/2022
M-016-200A	Complete U Plant Canyon (221-U Facility) demolition in accordance with the remedial design/remedial action work plan.	9/30/2024
M-037-11	Complete unit-specific closure requirements for two (2) TSD units: 216-B-3 Main Pond system and 216-S-10 Pond and Ditch.	9/30/2024

Table 4-1. Central Plateau Cleanup Key Tri-Party Agreement Milestones. (2 pages)

Milestone	Description	Compliance Date
M-085-76	Initiate response actions for B Plant remedial/removal action work plan.	9/30/2025
M-085-84	Initiate response actions for PUREX in accordance with the schedule in the approved remedial/removal action work plan.	9/30/2025
M-085-01	Submit a change package to establish a date for major milestone M-085-00.	6/30/2026
M-016-200B	Complete U Plant Canyon (221-U Facility) barrier construction in accordance with the remedial design/remedial action work plan.	9/30/2027
M-016-00	Complete remedial actions for all non-tank farm and non-canyon OUs.	9/30/2042
M-085-00	Complete response actions for the canyon facilities/associated past practice waste sites, other Tier 1 Central Plateau facilities not covered by existing milestones, and Tier 2 Central Plateau facilities. This includes B Plant, PUREX, and REDOX canyons and associated past practice waste sites in 200-CB-1, 200-CP-1, and 200-CR-1 OUs.	TBD

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act*.
CH = contact-handled.
D&D = decontamination and decommissioning.
Ecology = Washington State Department of Ecology.
EPA = U.S. Environmental Protection Agency.
LDR = Land Disposal Restrictions.
MLLW = mixed low-level waste.
OU = operable unit.
PBS = project baseline summary.
PUREX = Plutonium Uranium Extraction (Plant).
RCRA = *Resource Conservation and Recovery Act.*
REDOX = Reduction-Oxidation Facility (S Plant).
RH = remote-handled.
RI/FS = remedial investigation/feasibility study.
TBD = to be determined.
TRUM = transuranic mixed (waste).
TSD = treatment, storage, and disposal.
WIPP = Waste Isolation Pilot Plant.

4.1 NM STABILIZATION AND DISPOSITION–PFP (PBS RL-0011)

Cleanup and demolition to slab-on-grade of the PFP complex is expected to be completed in FY 2019 using funds carried over from prior years plus $46.2 million in the FY 2019 budget. Future subsurface investigation and cleanup will be done under Nuclear Facility D&D-Remainder of Hanford (PBS RL-0040) (see section 4.4).

4.2 SOLID WASTE STABILIZATION AND DISPOSITION–200 AREA (PBS RL-0013C)

The scope of the Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) project is to provide waste treatment and disposal services for Hanford facilities and operations. The major mission objectives are to:

- Operate waste treatment facilities, including T Plant and the WRAP Facility.
- Provide base waste management operations at the Canister Storage Building (CSB) and 200 Area Interim Storage Area, Integrated Disposal Facility (IDF), Waste Encapsulation and Storage Facility (WESF) for cesium/strontium capsule storage, and Low-Level Burial Grounds and mixed waste disposal trenches.
- Operate Environmental Restoration Disposal Facility (ERDF) to provide solid waste treatment and disposal services in support of Hanford cleanup.

Additional objectives are as follows:

- Retrieve and ship transuranic (TRU) waste for disposal to the Waste Isolation Pilot Plant (WIPP) or other permitted facility.
- Develop alternative methods for treatment and disposal of orphan waste. This could include seeking land disposal restrictions variance approvals, expanding commercial treatment facilities permit limits, and constructing and operating additional onsite treatment capabilities.

- Obtain processing capabilities to repackage large and remote-handled (RH) contaminated waste containers.

The Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) project includes completing the following activities:

- Cesium and strontium capsules will be transferred to dry storage and/or permanent disposal.
- Irradiated nuclear fuels will be removed off Site to a national repository for final disposition.
- Stored underground TRU waste will be retrieved and disposed.
- Mixed low-level waste and low-level waste will be treated as necessary and disposed of.
- Waste management facilities will be deactivated at the end of their useful lives and will be transferred to Nuclear Facility D&D-Remainder of Hanford (PBS RL-0040) for final disposition.
- Low-Level Burial Grounds (including the mixed waste trenches) will be closed and transferred to Nuclear Facility D&D-Remainder of Hanford (PBS RL-0040) for final disposition and remedial action.
- IDF will be closed according to the closure plan requirements in the Dangerous Waste Permit (WA7890008967). Closure will follow completion of tank waste vitrification.

Table 4-2 summarizes each scope element. As waste management facilities are no longer needed to support Hanford cleanup, they will be transitioned to Nuclear Facility D&D–Remainder of Hanford (PBS RL-0040) for final disposition.

Table 4-2. Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) Level 2 Scope Summary. (2 pages)

Work Element	Scope Description
Project Management	Provides for the overall project management, coordination, direction, and customer interface to ensure the proper conduct of operation for this project.
Waste Encapsulation Storage Facility (WESF)	Addresses operation of the WESF pool cells and includes life extension upgrades to ensure safe and compliant operations, retrieval, and disposition of cesium/strontium capsules, and transition of WESF for final D&D.
Canister Storage Building (CSB)	Includes safe storage of SNF while awaiting final disposition at a geologic repository, repackaging SNF for shipment, and coordination with the offsite repository for evaluations and information.
Mixed Low Level Waste (MLLW) Trenches	Includes operation of the mixed waste disposal trenches and the design, construction, and other activities necessary to add operational layers in the trenches to maintain their ready-to-serve status and to place temporary caps on the trenches.
Transuranic (TRU) Waste Retrieval	Consists of the retrieval, designation, and transfer to a TSD facility of both CH and RH solid TRU waste stored underground.
TRU Repackaging	Provides funding for WIPP production, TRU repacking operations at T Plant and WRAP (or a commercial facility), TRU program support for repackaging, and RH/large packaging capabilities.
Waste Receiving and Processing (WRAP) Facility	Provides base and minimum safe operations at the WRAP to support processing of TRU wastes to WIPP and includes transition to final D&D.
T Plant	Addresses the operation and maintenance of the T Plant Complex for waste processing operations, including necessary upgrades and transition to final D&D of the canyon.
Central Waste Complex (CWC)	Includes operation and maintenance of the CWC, including upgrades to maintain needed capability and transition to final D&D. The scope includes provision of an alternate capability (other than WRAP) to load CH TRU waste into shipping containers for shipment to WIPP.

Table 4-2. Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) Level 2 Scope Summary. (2 pages)

Work Element	Scope Description
Environmental Restoration Disposal Facility (ERDF)	Addresses the operation of the ERDF through the end of Hanford cleanup, including cell expansion and ERDF interim cover construction.
Integrated Disposal Facility (IDF)	Provides for the preparation, startup, and operation of the IDF to receive and store low-level waste and MLLW in accordance with applicable waste acceptance criteria. The scope includes provisions for IDF expansion.
TRU Disposition	Provides funding and resources for the TRU Program's coordination with the Central Characterization Project to certify TRU waste according to the WIPP Waste Acceptance Criteria. This work element also provides funding to perform Hanford WIPP closeout activities, TRU waste characterization activities at the direction or guidance of the Central Characterization Project and to establish shipping capabilities for RH TRU waste and additional CH TRU waste shipping capabilities.
SNF Disposition	Includes design and construction of a Fuel Preparation Facility, turnover of the facility to operations, and level-of-effort support to activities sponsored by the cognizant DOE office and/or programs that have responsibility for management and disposition of spent nuclear fuel.
Low Level Waste Burial Grounds	Includes supervision, work control, surveillance, radiation protection, maintenance, engineering, training, quality assurance, environmental compliance, waste management enhancements, and other support.
Sludge Treatment Phase 2	Includes activities to stabilize and package the sludge from the 105-KW Basin for final disposition to WIPP or other disposal facilities, including Phase 2 treatment and packaging, shutdown and deactivation of needed equipment, and management and support.
Management of Cesium and Strontium Capsules (MCSC)	Includes retrieval of capsules from their current storage location in the WESF pool cells, packaging into a cask storage system at WESF, transfer to a new onsite capsule storage area, and interim storage configuration pending final disposition.
Capsule Interim Storage Operations	Includes design of the cask storage system, identification and development of required transportation safety documentation based on selected cask storage technology, and preparation of transportation safety documentation necessary to support capsule transfer operations.
General Debris and Excess Cleanup	Includes a disposition decision, cleanup and disposal of general debris and excess material on the Hanford Site.

CH = contact-handled.
D&D = decontamination and decommissioning.
DOE = U.S. Department of Energy.
PBS = project baseline summary.
RH = remote-handled.
RL = DOE, Richland Operations Office.
SNF = spent nuclear fuel.
TSD = treatment, storage, and disposal.
WESF = Waste Encapsulation and Storage Facility.
WIPP = Waste Isolation Pilot Plant.
WTP = Waste Treatment Plant.

Figure 4-1 shows the low-range remaining estimated cleanup costs for the Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) by fiscal year; Figure 4-2 shows the low-range remaining estimated cleanup costs by work element.

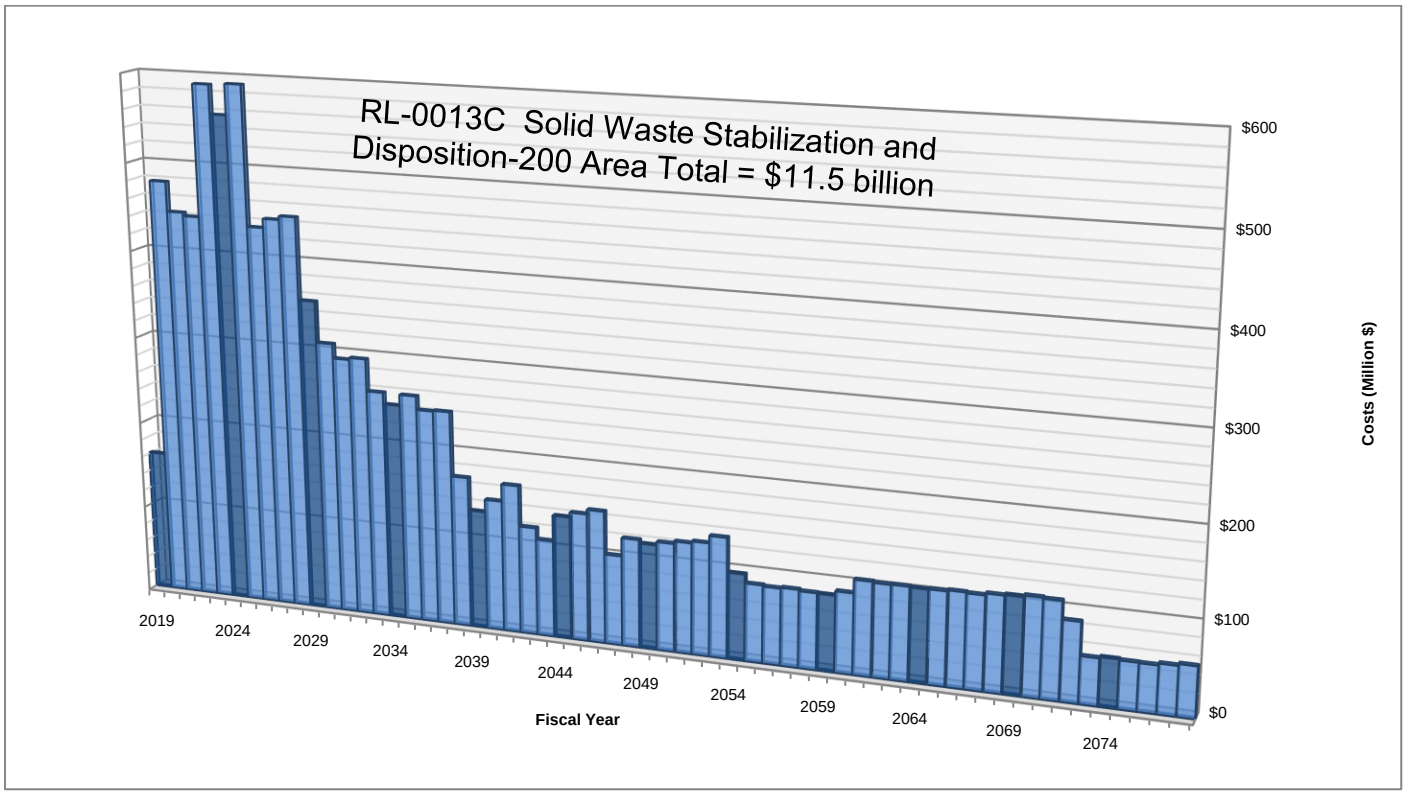

Figure 4-1. Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) Low-Range Remaining Estimated Cleanup Costs by Fiscal Year.

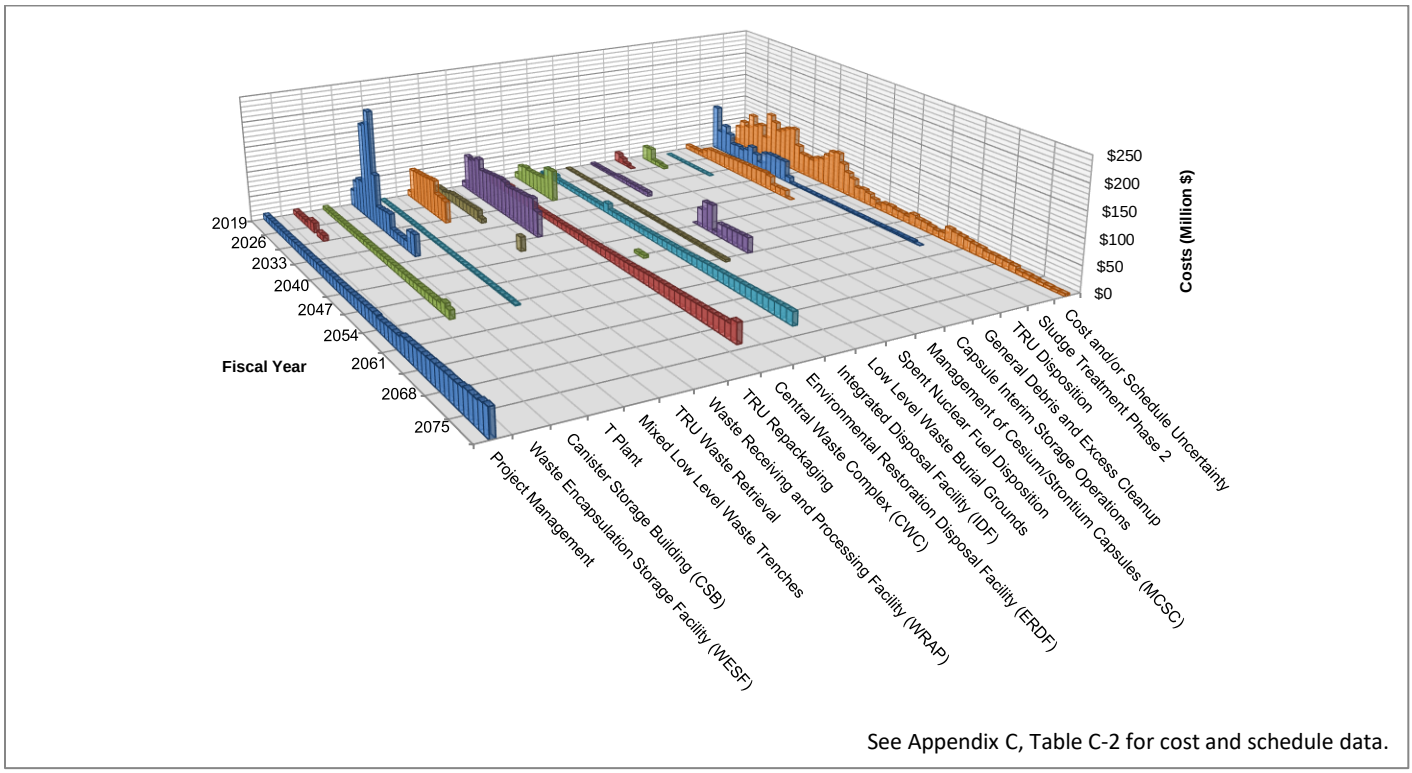

Figure 4-2. Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) Low-Range Remaining Estimated Cleanup Costs by Work Element.

4.3 SOIL AND WATER REMEDIATION– GROUNDWATER/VADOSE ZONE (PBS RL-0030)

Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030), also known as the Groundwater Project, includes the following:

- Regulatory decision-making process for all groundwater operable units (OU) on the Hanford Site.
- Remediation of all groundwater on the Hanford Site in accordance with the groundwater OU decisions.
- Regulatory decision-making process for Central Plateau waste sites (remediation of waste sites is part of the Nuclear Facility D&D–Remainder of Hanford [PBS RL-0040] project scope).
- Regulatory decision-making process and remediation for contamination in the Central Plateau deep vadose zone.

The project includes soil and groundwater characterization, groundwater monitoring, groundwater treatment, well drilling, treatability testing, evaluation of remediation options, and preparing the regulatory documentation necessary to obtain final RODs on remedial actions for soil waste sites and groundwater, including the River Corridor and Central Plateau.

Much of the contamination remains in the vadose zone soil column above the water table; however, at waste sites where large volumes of liquid were released, the more mobile contaminants have reached groundwater. The tritium groundwater contaminant plume from the Central Plateau has reached the Columbia River. Additional groundwater contaminant plumes such as chromium, strontium-90, and uranium originating in the 100 or 300 Areas also have reached the Columbia River.

The major chemical contaminants present in the groundwater include carbon tetrachloride, hexavalent chromium, nitrate, and trichloroethene. Major radioactive contaminants include iodine-129, strontium-90, technetium-99, tritium, and uranium. Other groundwater contaminants that exceed drinking water standards in several Hanford Site areas, but are of limited extent, include a volatile organic compound (cis-1,2-dichloroethene), petroleum hydrocarbons (diesel) and a radioactive contaminant (carbon-14) (DOE/RL-2017-66). The Groundwater Project (DOE/RL-2002-59, *Hanford Site Groundwater Strategy Protection, Monitoring, and Remediation*) has three major objectives:

- Take actions necessary to prevent degradation of the groundwater
- Remediate groundwater to restore it to beneficial use where practicable and protect the river
- Monitor groundwater to identify emerging problems and guide the remediation process.

To be successful, the Groundwater Project needs to obtain sufficient characterization data, evaluate performance of early actions, and develop remedial action objectives. Hanford is divided into 10 groundwater OUs; 6 in the River Corridor (100-BC-5, 100-KR-4, 100-NR-2, 100-HR-3, 100-FR-3, 300-FF-5) and 4 in the Central Plateau (200-ZP-1, 200-UP-1, 200-BP-5, 200-PO-1). Groundwater monitoring activities also are required by the *Atomic Energy Act*, CERCLA, and the *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste* (WA7890008967). Table 4-3 provides additional details on the scope of work for each of the work elements.

Table 4-3. Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030)
Level 2 Scope Summary. (2 pages)

Work Element	Scope Description
Groundwater Program Management	Includes program management oversight, integrated field work, training, well access roads, strategic integration, groundwater management plan, technical support and evaluations, project control, performance assessment, remediation decision support, sample management and reporting, environmental databases, and CERCLA 5-Year review.
Groundwater Monitoring	Includes: • Geophysical borehole logging. • Groundwater laboratory analysis and sample data management. • Groundwater sample collection, purgewater truck and operation and maintenance of the Hanford Geotechnical Sample Library (the repository for historical sediment, core, and other soil and sediment samples used for scientific studies including laboratory studies, bench tests, conceptual model development, and fate and transport evaluations for contaminant migration). • Groundwater data evaluation and reporting including the annual CERCLA, RCRA, and pump-and-treat operations reports. • Well maintenance, monitoring, and reporting. • RCRA well drilling per TPA M-024 milestones. • Miscellaneous well decommissioning. • Operation, maintenance, sampling, and dismantlement of the Modutanks used for disposal of groundwater from onsite well sampling and maintenance, characterization, and remediation activities.
200-WA-1 OU	For the 200 West Area waste sites, includes implementing the RI/FS process through field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparation of the remedial design/remedial action work plan.
200-EA-1 OU	For the 200 East Area waste sites, includes implementing the CERCLA/RCRA process through field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparation of the remedial design/remedial action work plan.
200-OA-1 OU	For the Outer Area waste sites, includes implementing the RI/FS process through field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparation of the remedial design/remedial action work plan.
200-IS-1 OU	For the 200 Area pipelines, includes implementing the CERCLA/RCRA process through field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparation of the remedial design/remedial action work plan.
200-SW-2 OU	For the 200 Area land disposal units, includes implementing the CERCLA/RCRA process through field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparation of the remedial design/remedial action work plan.
100-BC-5 OU	For 100-BC groundwater, includes completing the CERCLA process and preparing regulatory decision documents leading to a final ROD, then implementing and monitoring the remedial action to completion, including final reporting and well decommissioning.
100-KR-4 OU	For 100-KR groundwater, includes completing the CERCLA process and preparing regulatory decision documents leading to a final ROD, then implementing and monitoring the remedial action to completion, including well drilling and decommissioning, pump-and-treat operations, maintenance, and monitoring, final reporting and remedy D&D.
100-NR-2 OU	For 100-NR groundwater, includes completing the CERCLA process and preparing regulatory decision documents leading to a final ROD, then implementing and monitoring the remedial action to completion, including final reporting, well drilling and decommissioning and remedy D&D.
100-HR-3 OU	For 100-HR groundwater, includes implementing and monitoring the remedial action to completion, including well drilling and decommissioning, pump-and-treat operations, maintenance, and monitoring, final reporting and remedy D&D.
100-FR-3 OU	For 100-FR groundwater, includes implementing and monitoring the remedial action to completion, including final reporting, well drilling and decommissioning.

Table 4-3. Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030)
Level 2 Scope Summary. (2 pages)

Work Element	Scope Description
200-BP-5 OU	For 200-BP groundwater, includes completing the CERCLA process and preparing regulatory decision documents (including for 200-PO-1 OU) leading to a final ROD, then implementing and monitoring the remedial action to completion, including final reporting and well drilling and decommissioning.
200-PO-1 OU	For 200-PO groundwater, includes implementing and monitoring the remedial action to completion, including final reporting and well drilling and decommissioning.
200-UP-1 OU	For 200-UP groundwater, includes implementing and monitoring the remedial action to completion, including treatability testing, tracer study, well drilling and decommissioning, pump-and-treat operations, maintenance, and monitoring, final reporting, and remedy D&D.
200-ZP-1 OU	For 200-ZP groundwater, includes implementing and monitoring the remedial action to completion, including well drilling and decommissioning, pump-and-treat operations, maintenance, and monitoring, final reporting, and remedy D&D.
200-CB-1 OU	For the B Plant Canyon and waste sites, includes implementing the RI/FS process through field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparation of the remedial design/remedial action work plan.
200-CP-1 OU	For the PUREX Canyon and waste sites (including the PUREX Tunnels), includes implementing the RI/FS process through field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparation of the remedial design/remedial action work plan.
200-CR-1 OU	For the REDOX Canyon and waste sites, includes implementing the RI/FS process through field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparation of the remedial design/remedial action work plan.
300-FF-5 OU	For 300-FF groundwater, includes implementing and monitoring the remedial action to completion, including final reporting, well drilling and decommissioning.
200-DV-1 OU	For the Deep Vadose Zone, includes completing the CERCLA/RCRA process and preparing regulatory decision documents leading to a final ROD, then preparation of the remedial design/remedial action work plan.

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*.
D&D = decontamination and decommissioning.
DOE = U.S. Department of Energy.
OU = operable unit.
PBS = project baseline summary.
RCRA = *Resource Conservation and Recovery Act* of 1976.
RI/FS = remedial investigation/feasibility study.
RL = DOE, Richland Operations Office.
ROD = record of decision.

Figure 4-3 presents the low-range remaining estimated cleanup costs for Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030) by fiscal year; Figure 4-4 presents the low-range remaining estimated cleanup costs by work element.

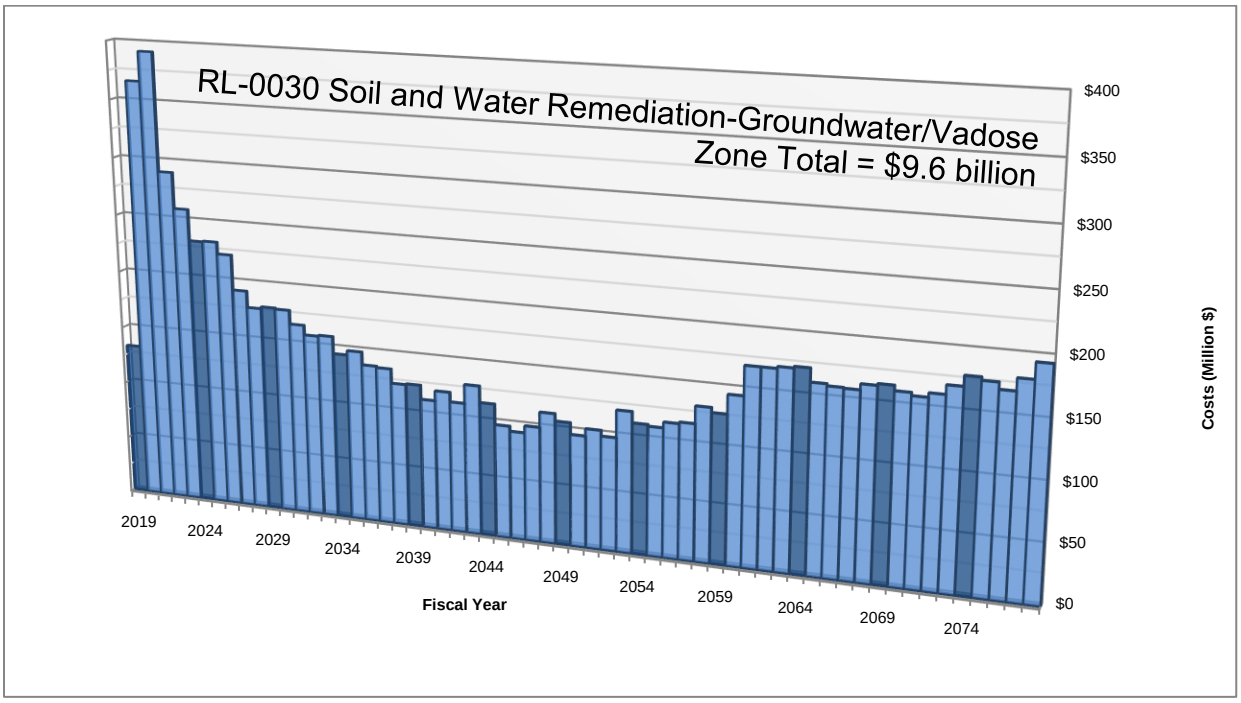

Figure 4-3. Soil and Water Remediation-Groundwater/Vadose Zone (PBS RL-0030) Low-Range Remaining Estimated Cleanup Costs by Fiscal Year.

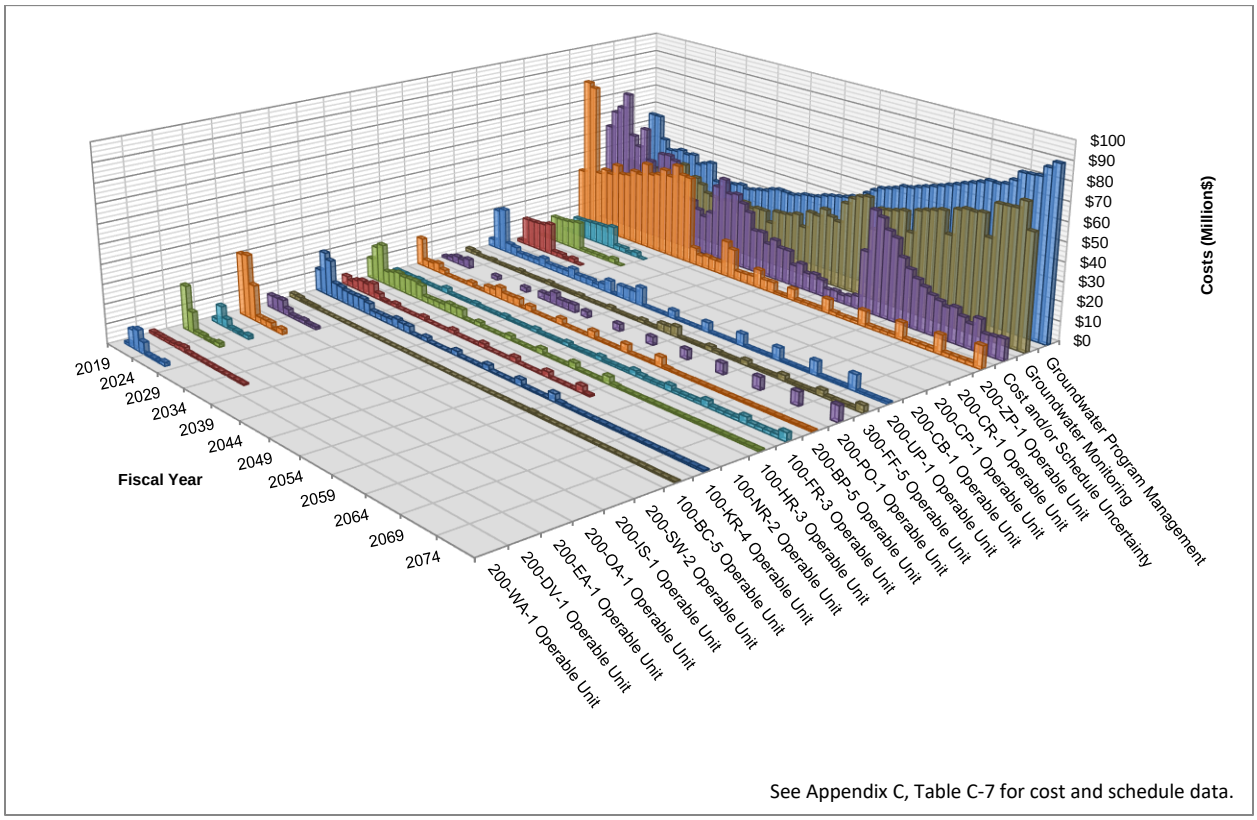

Figure 4-4. Soil and Water Remediation-Groundwater/Vadose Zone (PBS RL-0030) Low-Range Remaining Estimated Cleanup Costs by Work Element.

4.4 NUCLEAR FACILITY D&D–REMAINDER OF HANFORD (PBS RL-0040)

Nuclear Facility D&D–Remainder of Hanford (PBS RL-0040) is the geographically based cleanup and closure of the Central Plateau and remaining scope in the other Hanford Site areas. It is also known (and referred to in the rest of this section) as the Central Plateau Remediation Project (PBS RL-0040). The Central Plateau Remediation Project scope includes the demolition and remediation scope that is organized into 25 geographical areas referred to as implementation areas.

Following completion of assessment activities through decision documentation (e.g., ROD or closure plan) under Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030), completion of the remedial design/remedial action work plan and waste site/facility remediation and/or closure will be addressed under the Central Plateau Remediation Project (PBS RL-0040). The Central Plateau Remediation Project scope includes implementing the decisions through the physical cleanup of canyon facilities, buildings and structures, waste sites, pipelines, and miscellaneous sites (e.g., debris piles), and utilities to ensure appropriate protection has been provided for the cleanup.

To accomplish the Central Plateau Remediation Project (PBS RL-0040), the following major objectives have been established:

- Perform S&M of facilities and waste sites pending remediation
- Integrate planning and execution activities with other Central Plateau projects
- Remediate waste sites and pipelines
- D&D canyons
- D&D excess facilities
- Transition the Central Plateau Inner Area to LTS.

The project will be complete when the following endpoint criteria have been reached:

- Canyons and surplus facilities are removed or dispositioned and ready for transition to LTS
- Central Plateau waste sites and pipelines are remediated in accordance with approved decisions
- Final disposition of Cold War legacy wastes is complete
- Institutional controls are implemented
- Post-remediation operations and maintenance requirements are implemented.

The work scope for the Central Plateau Remediation Project (PBS RL-0040) is organized into the work elements described in Table 4-4, which provides additional details on the scope of work for each work element.

The duration, in part, depends on transition of the tank farms to the project for final disposition after closure activities are completed by ORP (see Chapter 5.0). It also depends on transition of waste management facilities that are no longer needed to support Hanford cleanup from Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) to the project for final disposition (see section 4.2).

Figure 4-5 presents the low-range remaining estimated cleanup costs for the Central Plateau Remediation Project (PBS RL-0040) by FY; Figure 4-6 presents the low-range remaining estimated cleanup costs by work element.

Table 4-4. Central Plateau Remediation Project (PBS RL-0040) Level 2 Scope Summary.

Work Element	Scope Description
Regulatory Decisions and Closure Integration	Includes program and project management, engineering studies, emergency response tasks necessary to address aging facility or waste site conditions that are above and beyond anticipated operational and maintenance plans, steam line removal, and preparation of the CERCLA 5-Year review documents.
Remediation of Geographic Areas	Includes geographic remediation of implementation areas in the Central Plateau and River Corridor. Each area has a variety of cleanup features that can include waste sites, facilities, canyons, pipelines, and remedial barriers. Actions to be taken for cleaning up each waste site, including pipelines, will be determined through the regulatory decision processes under Soil and Water Remediation–Groundwater/Vadose Zone, PBS RL-0030, and as part of remedial definition activities. Potential remedial actions for waste sites range from monitored natural attenuation to capping or removal, depending on waste site conditions. Contamination levels, risks, proximity to facilities, and other considerations are factored into the selection. Existing structures (other than the canyon facilities) are expected to be demolished and the debris disposed at ERDF.
Central Plateau Maintain Safe and Compliant Facilities and Waste Sites	Includes min safe oversight and support, radiation surveillances, tumbleweed collection, surface contamination treatment, sign replacement, surveillance, Canyon and nuclear facilities min safe, and general-purpose facilities min safe.

CERCLA = *Comprehensive Environmental Response, Compensation and Liability Act*.
ERDF = Environmental Restoration Disposal Facility
PBS = project baseline summary.

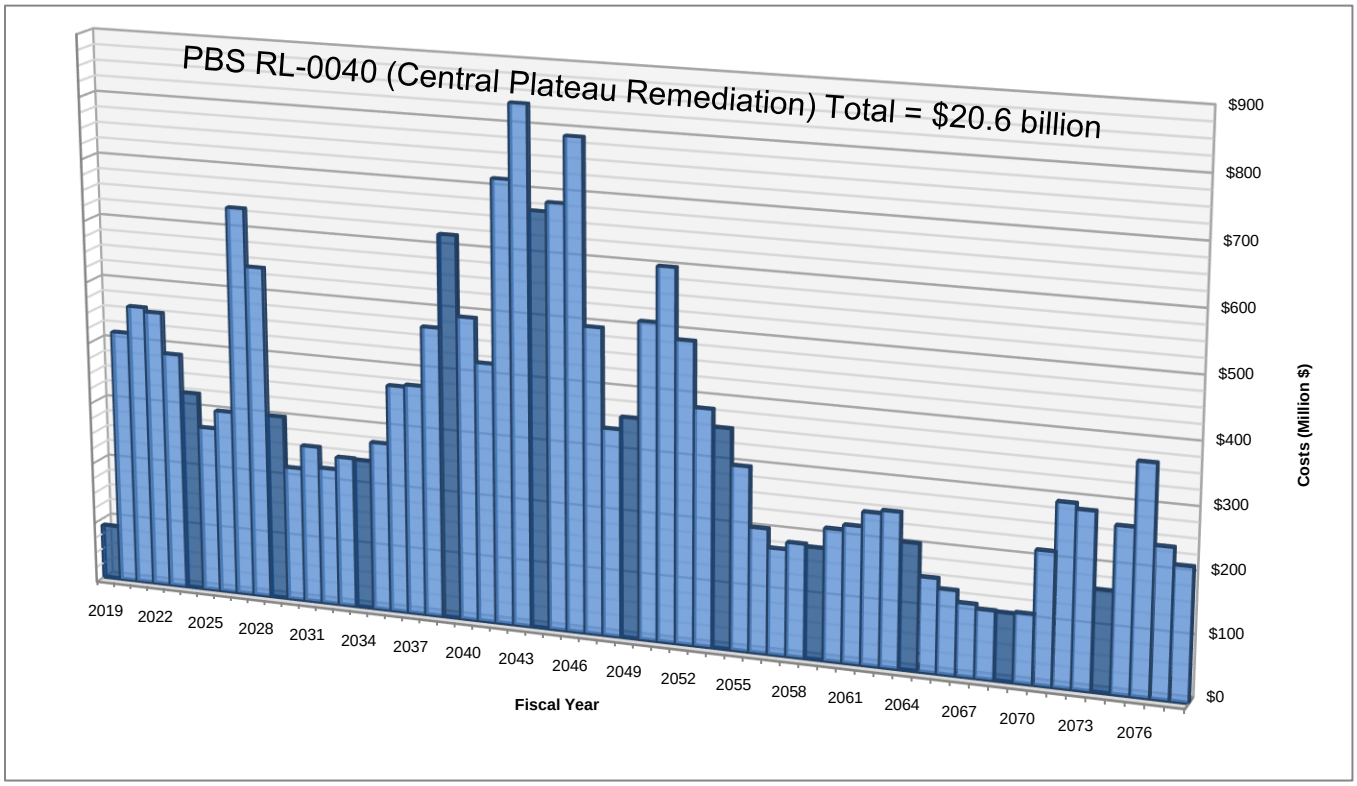

Figure 4-5. Central Plateau Remediation Project (PBS RL-0040) Low-Range Remaining Estimated Cleanup Costs by Fiscal Year.

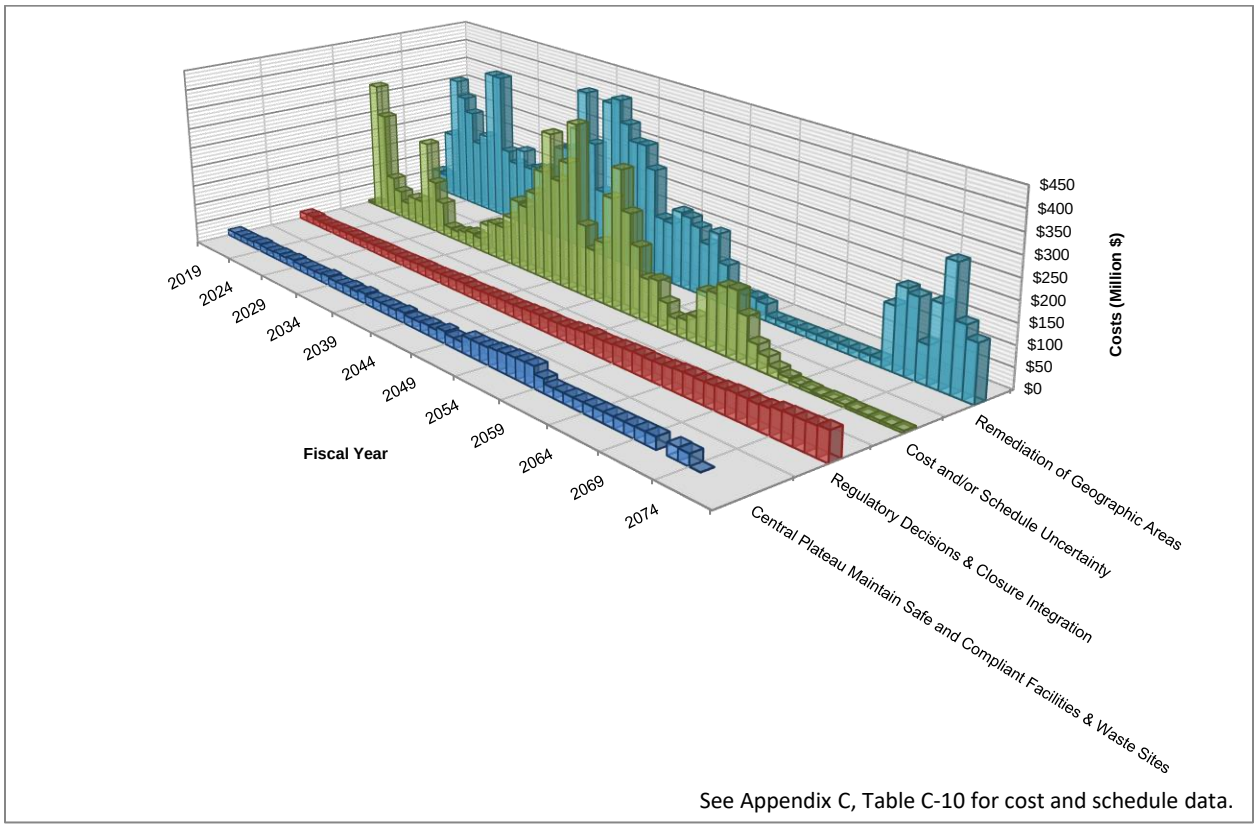

Figure 4-6. Central Plateau Remediation Project (PBS RL-0040)
Low-Range Remaining Estimated Cleanup Costs by Work Element.

4.5 NUCLEAR FACILITY D&D–FAST FLUX TEST FACILITY PROJECT (PBS RL-0042)

The FFTF is a deactivated, 400-megawatt (thermal) liquid-metal (sodium)-cooled, research and test reactor located in the 400 Area. The facility was used to develop and test advanced fuels and materials for the Liquid Metal Fast Breeder Reactor Program and to serve as a prototype facility for future Liquid Metal Fast Breeder Reactor Program facilities. DOE issued a shutdown order for FFTF in December 1993 because the Liquid Breeder Reactor Program had been cancelled.

The scope of Nuclear Facility D&D–Fast Flux Test Facility Project (PBS RL-0042) is to provide for safe D&D, secure storage, and stabilization of hazardous/radioactive materials, interim maintenance of facilities, demolition, and disposal of the waste. In the ROD (78 FR 75913), DOE decided to implement FFTF Alternative 2 Entombment. This scope consists of the following:

- RH special components will have the sodium residuals removed by treatment at the Idaho National Laboratory and then be returned to Hanford for disposal in the IDF.
- Bulk sodium inventories located at Hanford will be converted to caustic sodium hydroxide in an onsite sodium reaction facility then stored for ultimate use in the WTP.
- All structures in the 400 Area Protected Area, except for reactor containment, will be demolished to at least 3 feet below grade followed by backfill and revegetation; decommissioning waste would be disposed of at appropriate disposal facilities.
- The above-grade containment dome will be removed and dispositioned.
- The below-grade portion of the reactor containment building and the reactor vessel will be grouted.

- A RCRA-compliant engineered barrier will be installed over the grouted area.
- Post-closure care would include long-term monitoring of air, groundwater, and the vadose zone.

Waste sites in the 400 Area are included as part of the 300-FF-2 OU, which is being remediated under the Nuclear Facility D&D–River Corridor Closure Project (PBS RL-0041). Table 4-5 summarizes the work scope.

Table 4-5. Nuclear Facility D&D–Fast Flux Test Facility Project (PBS RL-0042) Level 2 Scope Summary.

Work Element	Scope Description
FFTF Program Management	Annual project management and closure services.
FFTF Cleanup	Includes D4 of the FFTF Reactor and facilities in accordance with the record of decision (78 FR 75913[1]), confirmatory radiation surveys, site monitoring plan, monitoring wells, final documentation and project management for these activities.
FFTF Sodium	Includes management, disposition and removal of sodium residuals in FFTF equipment, maintain sodium storage facility operations, and waste transportation and disposal.
Sodium Reaction Facility	Includes design, construction, operational testing and readiness review of a facility to convert the FFTF sodium to caustic sodium hydroxide.
Maintain Safe and Compliant FFTF Complex	Includes preventative and scheduled maintenance, corrective maintenance, supervision, work control and training for the FFTF Complex and 400 Area Potable/Fire Water System.

[1]78 FR 75913, 2013, "Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington," Record of Decision, *Federal Register*, Vol 78, No. 240, pp 75913, December 13, 2013.

D4 = deactivation, decontamination, decommissioning, and demolition.
FFTF = Fast Flux Test Facility.

Figure 4-7 presents the low-range remaining estimated cleanup costs for the Nuclear Facility D&D–Fast Flux Test Facility Project (PBS RL-0042) by FY; Figure 4-8 shows the low-range remaining estimated cleanup costs by work element.

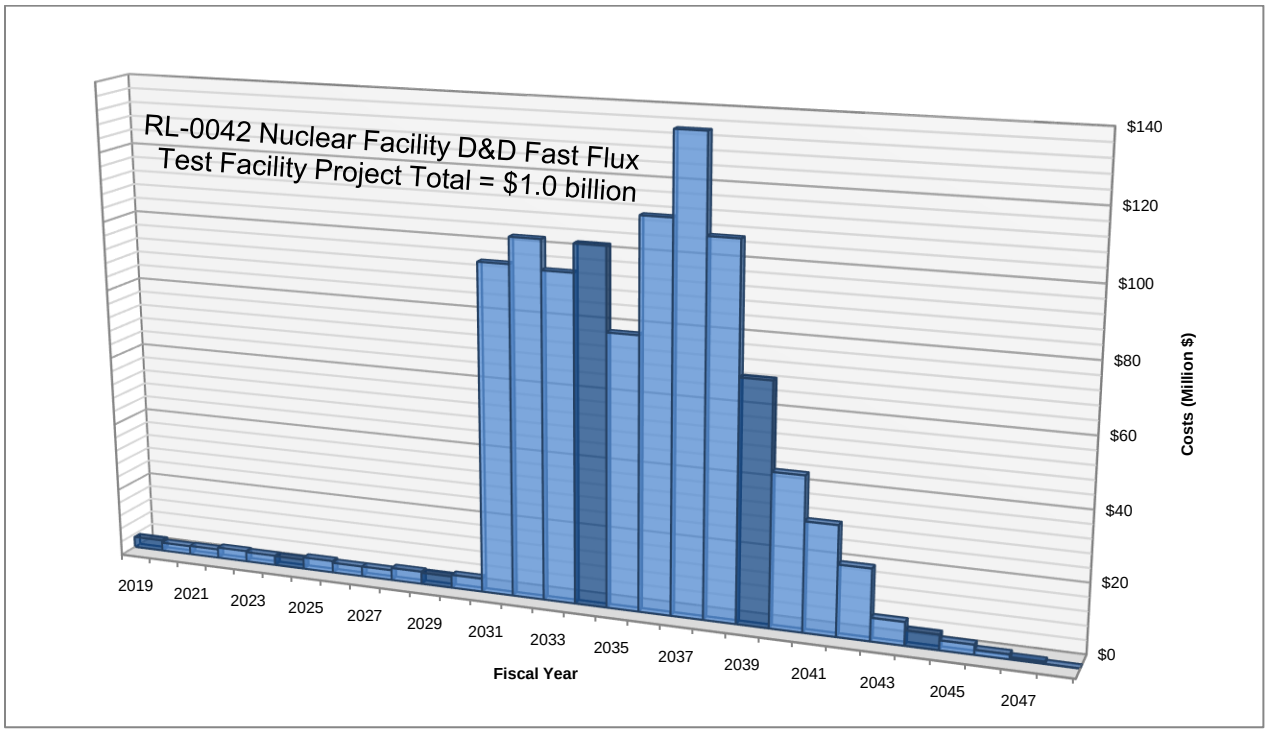

Figure 4-7. Nuclear Facility D&D–Fast Flux Test Facility Project (PBS RL-0042) Low-Range Remaining Estimated Costs by Fiscal Year.

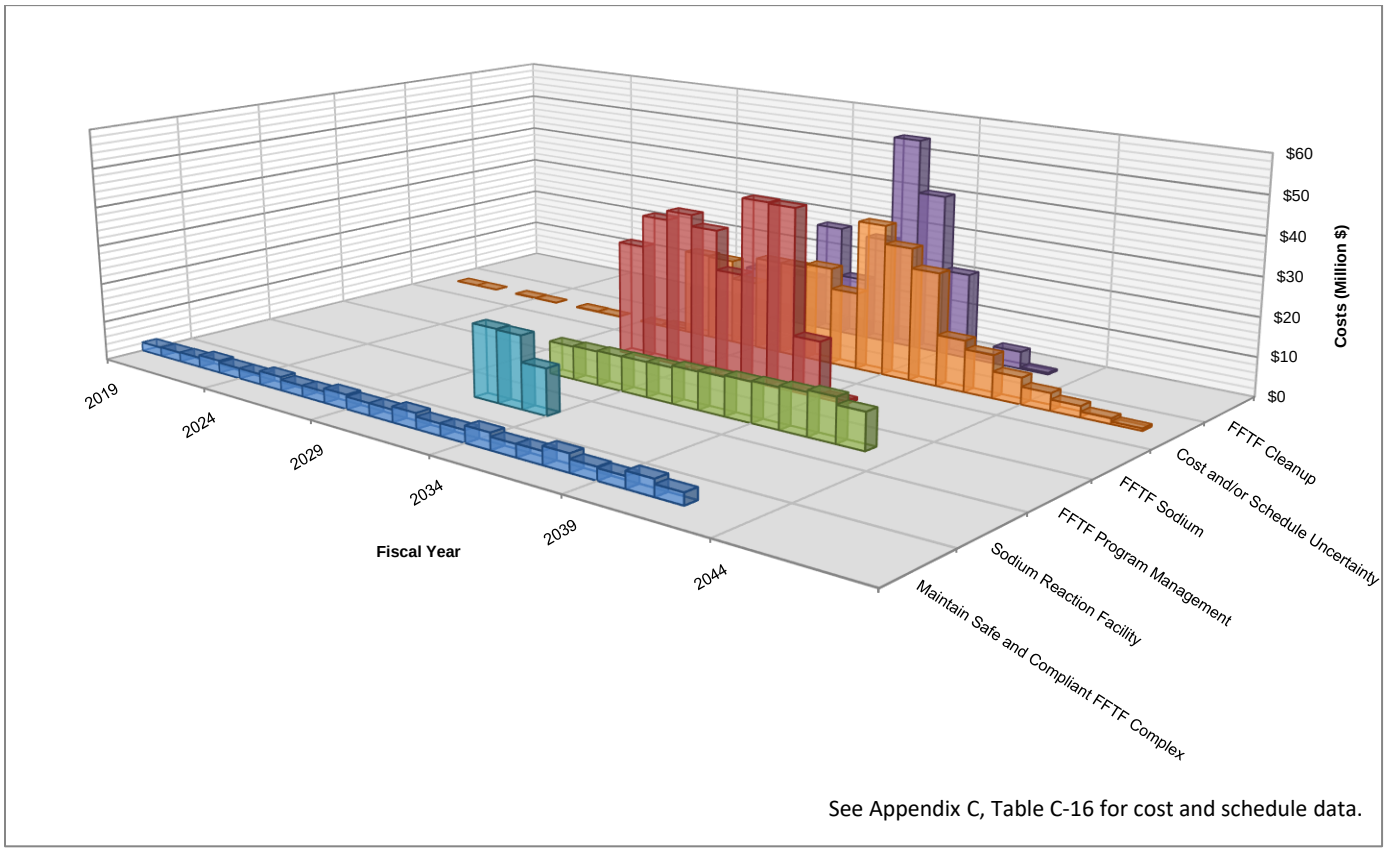

Figure 4-8. Nuclear Facility D&D–Fast Flux Test Facility Project (PBS RL-0042) Low-Range Remaining Estimated Costs by Work Element.

4.6 CENTRAL PLATEAU CLEANUP ASSUMPTIONS AND UNCERTAINTIES

In planning for the Hanford Site lifecycle, uncertainties are considered regarding estimated scope, schedule, and cost. While a number of assumptions are made to support lifecycle development, the assumptions presented here are major assumptions that drive costs.

For the Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) low-range estimate, the following assumptions were identified:

- New treatment facilities are not required to support longer WTP operations
- T Plant will be available for modification to be the facility necessary for retrieval, storage, and treatment/processing of all Hanford RCRA transuranic mixed (TRUM) waste as required by TPA M-091-01
- WIPP will remain operational through the end of Hanford cleanup operations that have the potential to generate TRU waste. Current planning has processing and shipping of TRU waste to WIPP until FY 2037.

For the Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) high-range estimate, the following assumptions include, but are not limited, to:

- Receipt of non-compliant waste from other projects.
- Spent fuel found in alpha caissons.
- Delays in receiving regulatory approvals (CH retrieval, alpha caisson retrieval and processing).

Discrete risks have been identified and assessed for the above mentioned uncertainties, as well as others, and are representative of the operational challenges associated with this work area. The uncertain timing of waste generation forecasts and waste volumes increase risk and uncertainty over the assumed operational life of the various facilities. This may lead to increased durations for ready-to-serve operations awaiting waste inputs, as well as extended durations of base operations. For example, construction of the Integrated Disposal Facility (IDF) is complete, maintaining minimum safe conditions pending waste receipt of immobilized low-activity waste (ILAW). Operations of the Central Waste Complex and the Interim Storage Area are also subject to similar uncertainties.

For Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030) low-range estimate, the following assumptions were identified:

- Planned characterization of the vadose zone below the HLW tanks will be sufficient to evaluate remedies for protection of groundwater
- No substantial new requirements will be added to meet the state's implementation of RCRA.

There is also a high degree of uncertainty with Soil and Water Remediation–Groundwater/Vadose Zone work that includes the following assumptions for the high-range estimate:

- RCRA/CERCLA issues delay records of decision.
- Significant contamination is interpreted or discovered that requires further investigation and/or remediation.
- Pump and treat operations require extended duration.

For Nuclear Facility D&D–Remainder of Hanford (PBS RL-0040) low-range estimate, the following assumptions were identified:

- An industrial worker scenario will be used to define the exposure scenarios and the threshold cleanup levels for waste sites located in the Inner Area. Cleanup levels for waste sites in the Outer Area will support the reasonably anticipated future land use of conservation/mining.
- The Central Plateau area will remain under Federal control for the foreseeable future.

- All low-level legacy waste will be managed and treated on Hanford via remove, treat, and dispose of (RTD) to approved onsite disposal facilities.
- Planning assumes that geographic aggregate barriers will be utilized. The aggregate barriers are assumed to cover canyons or other large facilities and adjacent waste sites or to cover multiple adjacent waste sites
- Removal excavations are assumed to be 15 feet below grade for planning and estimating purposes. Decision documents will identify the actual removal excavation criteria (soil cleanup level or excavation depth) for waste sites.

There also remains significant uncertainty associated with Nuclear Facility D&D – Remainder of Hanford work that includes, but is not limited to, the following assumptions for the high-range estimate:

- Records of decisions for implementation areas are not consistent with planned assumptions.
- New waste sites are discovered in implementation areas after records of decisions are issued.
- Radioactive material is considered to be contaminated waste that must be removed (rather than hold-up material).
- The nature and extent of contamination is substantially greater than the baseline assumptions for implementation areas.

For Nuclear Facility D&D–Fast Flux Test Facility Project (PBS RL-0042) low-range estimate, the following assumption was identified: FFTF funding to accomplish the scope can be carried over from year to year.

The remaining uncertainty associated with Nuclear Facility D&D – Fast Flux Test Facility includes the following assumptions for the high-range estimate:

- Major equipment failure or structural deterioration while in the S&M mode.
- No path to disposition highly radioactive components.
- WTP will not use FFTF bulk sodium.
- ETF may not be available to disposition liquid waste.
- ERDF is not available for demolition waste.
- System piping requires modification to treat residual sodium.
- Technical validation for entombment/residual sodium not defined.

The uncertainties associated with the Central Plateau Cleanup work scope have been assessed and accounted for in the high-range estimates for each of the respective PBSs.

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5.0 TANK WASTE CLEANUP

The RPP tank waste cleanup is managed by ORP as required by the *Strom Thurmond National Defense Authorization Act for Fiscal Year 1999*, and augmented by the *Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001* and the *John S. McCain National Defense Authorization Act for Fiscal Year 2019*. This chapter describes the RPP mission, scope, schedule and cost as presented in the baseline case of ORP-11242, Rev. 8. The baseline case reflects how the RPP mission will proceed to meet the Amended Consent Decree (DOE and Ecology 2016), support near-term operational needs, and reduce RPP technical and programmatic risks and challenges given current conditions, constraints, and assumptions.

The RPP mission is to safeguard the nuclear waste stored in 177 underground tanks and to manage the waste safely and responsibly until it can be treated in the WTP before final disposition. ORP is responsible for the storage, retrieval, treatment, and disposal of approximately 56 million gallons of radioactive waste contained in the Hanford Site waste tanks and closure of all the tanks and associated equipment. The RPP mission involves two parallel efforts, both aimed at reducing the threat posed to the Columbia River by the Hanford tank waste:

- Retrieve waste from 149 SSTs to DSTs where it can be safely stored awaiting treatment.
- Treat the tank waste, producing a stable waste form that can be permanently disposed.

These efforts must be performed in parallel because the DST system does not have the capacity to hold all of the waste currently in the SSTs at one time.

The RPP comprises the tank farms and WTP systems – nearly 200 interrelated waste storage, transfer, treatment, transportation, and disposal facilities. These systems are in varying stages of design, construction, operation, or future planning, and are briefly described in the following paragraphs.

The underground waste storage tanks were built in groups of 2 to 18 tanks, with each group identified as a tank farm. Seven tank farms (comprising 86 tanks) are located in the 200 West Area and 11 tank farms (comprising 91 tanks) are located in the 200 East Area. The tanks were constructed in below-grade excavations to take advantage of the earth's natural radiation shielding. The 177 underground storage tanks are of two basic design types: 149 SSTs and 28 DSTs. The smallest SSTs have about 55,000 gallons of capacity, while the largest DSTs hold up to about 1,250,000 gallons. One DST is out of service because of a confirmed leak from its primary shell to its annulus.

When Hanford was in production mode, irradiated fuel from the reactors was transported to six separations facilities for isolating the desirable radionuclides from other reactor products. From 1944 to 1989, the separations processes yielded millions of gallons of highly radioactive and chemically hazardous waste, which was pumped through underground transfer lines and subsequently stored in the underground storage tanks. Although the reactors and separations facilities have long since ceased operations, the underground waste tanks and their contents remain. The radioactive and chemical liquid waste was transferred from the separations facilities as slurry (liquid with suspended solids). Over time, the solids settled to the bottom of the tanks, creating a layer known as sludge, and leaving a clarified liquid known as supernate above the sludge.

To reduce the total quantity of waste to be stored, the supernate is periodically decanted and transferred out of waste tanks to a waste evaporation process. The evaporation process separates the heated waste slurry into a steam condensate fraction, which is relatively clean, for further treatment at the Effluent Treatment Facility (ETF) and safe onsite disposal, and a waste slurry fraction, which becomes more concentrated and is returned to the DSTs for eventual treatment in the WTP complex followed by disposal.

More information regarding the RPP system and its current state can be found in ORP-11242, sections 3.0 and 4.0.

The baseline case in System Plan 8 strategy for completing the RPP mission involves a number of interrelated activities and facilities. The ORP's objective is to reduce risk to the environment posed by tank wastes by

- Retrieving the waste from SSTs, transferring it to DSTs, and delivering the waste to the WTP
- Constructing and operating the WTP, which includes the Pretreatment (PT) Facility, LAW Facility, HLW Facility, Analytical Laboratory, and the Balance of Facilities
- Incorporating DFLAW to the LAW Facility as part of a phased startup, which includes a Tank Side Cesium Removal (TSCR) and/or LAW Pretreatment System (LAWPS) and WTP Effluent Management Facility (EMF)
- Developing and deploying supplemental treatment capability to safely treat the remainder of the low-activity waste not immobilized by the LAW Facility
- Developing and deploying supplemental capability for separating solids, particle size reduction, if required, and removal of soluble cesium as needed (i.e., Tank Waste Characterization and Staging [TWCS] Facility)
- Developing and deploying treatment and packaging capability for potential transuranic tank waste, followed by interim storage at the Central Waste Complex (CWC) pending determination of the final disposal pathway
- Deploying interim storage capacity for the immobilized HLW pending determination of the final disposal pathway
- Disposing of packaged immobilized LAW onsite at the IDF
- Closing the SST and DST farms, ancillary facilities, and associated waste management and treatment facilities
- Sequencing the RPP mission around resolution of technical and programmatic uncertainties
- Upgrading the tank farms to provide a steady, well-balanced feed to the WTP
- Investigating trade-offs of the required amount and type of supplemental treatment and pretreatment and the amount of immobilized HLW and immobilized LAW.

Figure 5-1 illustrates the simplified process for retrieving the waste from the tanks, treatment to reduce hazards, and disposition based on the System Plan 8 baseline case. During the initial phase of DFLAW, liquid tank waste will be staged in DSTs and delivered to a temporary TSCR system to filter large solids and remove the radioactive cesium, producing a LAW feed stream to the LAW Facility where it will be immobilized for disposal at IDF. The TSCR system is expected to operate for five years, and experience obtained from TSCR operations will inform the final design and configuration of the subsequent pretreatment approach (e.g., permanent LAWPS, multiple TSCRs, etc.). Potential contact-handled transuranic (CH-TRU) tank waste from the 200 West and 200 East SSTs will be retrieved and treated on Site at a proposed supplemental TRU waste treatment facility and then interim stored at the CWC pending determination of the final disposal pathway. All other waste in the SSTs will be retrieved into the DST system, and waste in the 200 West DSTs will be transferred to the 200 East DSTs.

After 10 years of DFLAW operations, the PT Facility and HLW Facility will begin operation. Slurries from the DST system will be staged and sampled in the TWCS Facility tanks and then fed to the PT Facility. Supernate will be fed from the DSTs to the PT Facility instead of the LAWPS. The waste slurries and supernate will be combined, and the solids will then be filtered, size reduced, washed, and leached, as required, to ensure an acceptable feed to the HLW Facility. Cesium will be removed from the remaining liquid, and the cesium-depleted LAW will be concentrated. The cesium product will be combined with the treated solids. The pretreated slurry from the PT Facility will be sent to the HLW Facility, and the pretreated supernate will be sent to either the LAW Facility or a LAW supplemental treatment facility. When the supplemental treatment facility starts operations, the LAWPS will be restarted and will provide an additional source of feed to the facility.

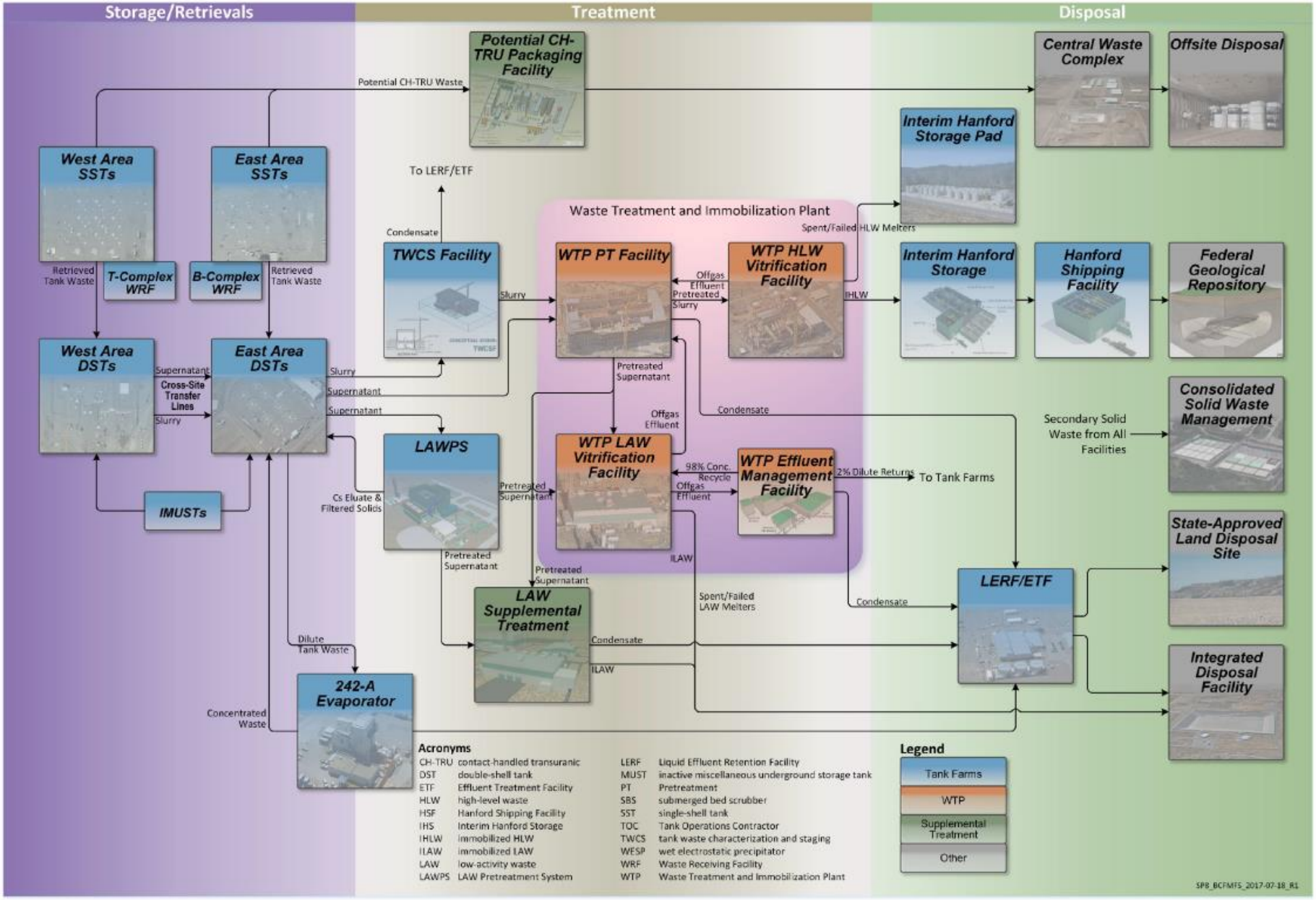

Figure 5-1. Simplified Process Diagram for Tank Waste Retrieval, Treatment and Disposal Based on SP8 Baseline Case.

The Liquid Effluent Retention Facility (LERF) will receive process condensate and other dilute liquid waste streams from the 242-A Evaporator, PT Facility, LAW Facility, and WTP EMF. Dilute waste sent to the LERF will be treated by the ETF and then disposed of, either as liquids at the State-Approved Land Disposal Site (SALDS) or as a solidified waste form at the IDF. Immobilized waste from the LAW Facility and LAW supplemental treatment facility will also be disposed of at the IDF. Immobilized waste from the HLW Facility will be transported to the Interim Hanford Storage/Hanford Shipping Facility (IHS/HSF), and then to a permanent offsite geologic repository, when available. The LAW Facility is planned to operate for 40 years, and the PT Facility and HLW Facility for 30 years.

DFLAW, in various forms (e.g., TSCR and LAWPS), which is the first step in the phased startup of the WTP, is planned to operate for 10 years beginning in December 2023 and completing in December 2033, at which time the WTP is required to initiate hot commissioning. The overall schedule objective is to complete retrieval, treatment, and closure activities by the end of FY 2071.

In part, because several complex technical issues arose during design and construction activities that adversely affected ORP's ability to meet negotiated milestones in the 2010 Consent Decree, these milestone dates were extended in an Amended Consent Decree issued March 11, 2016. The Court extended the start of initial operations milestone date for the WTP to December 31, 2036, thus necessitating changes to the TPA end dates for completing all remaining SST retrievals and completing all tank waste treatment commitments. These previous milestone dates were predicated on the WTP start of initial operations by December 31, 2022, as negotiated in the 2010 Consent Decree. These and related TPA milestones were the subject of formal negotiations between ORP, EPA, and Ecology in 2018. The outcome of those negotiations and any resulting TPA milestone changes will be incorporated in a future LCR. Key TPA and Amended Consent Decree milestones are shown in Table 5-1.

Table 5-1. Tank Waste Cleanup Key Tri-Party Agreement and Consent Decree Milestones. (2 pages)

Milestone	Description	Compliance Date
M-062-40H	Submit a system plan to Ecology describing the disposition of all tank waste managed by the Office of River Protection.	10/31/2020
D-00A-07[1]	LAW facility construction substantially complete.	12/31/2020
D-16B-03[1]	Of the 12 SSTs referred to in B-1 and B-2, complete retrieval of tank wastes in at least 5.	
M-045-85	Complete negotiations of HFFACO[2] interim milestones for closure of the remaining WMAs (including a schedule for 200 West Area closures, the submittal of closure plans and risk assessments, and final closure dates for each WMA).	1/31/2022
M-062-34-T01	Complete hot commissioning (startup and readiness prior to full operations) of Supplemental Treatment Vitrification Facility and/or WTP Enhancements.	12/30/2022
D-00A-09[1]	LAW Facility Hot Commissioning Complete	12/31/2023
D-16B-02[1]	Complete retrieval of tank wastes from the following SSTs in Tank Farms A and AX: A-101, A-102, A-104, A-105, A-106, AX-101, AX-102, AX-103, and AX-104. Subject to the requirements of Section IV-B-3, DOE may substitute any of the identified 9 SSTs and advise Ecology accordingly.	
D-00A-14[1]	Pretreatment facility construction substantially complete.	12/31/2031
D-00A-17[1]	Hot start of WTP.	12/31/2033
D-00A-01[1]	Achieve initial plant operations for the WTP.	12/31/2036
M-045-70	Complete waste retrieval from all remaining SSTs. Retrieval standards and completion definitions are provided in M-045-00.	12/31/2040

Table 5-1. Tank Waste Cleanup Key Tri-Party Agreement and Consent Decree Milestones. (2 pages)

Milestone	Description	Compliance Date
M-045-00	Complete the closure of all SST farms.	1/31/2043
M-062-00	Complete pretreatment processing and vitrification of Hanford high-level waste and low-activity waste tank wastes.	12/31/2047
M-42-00A	Complete the closure of all DST farms.	9/30/2052
M-062-45	Every six years, within six months of the issuance of the last revision of the System Plan, the parties will negotiate the following: 1. Commencing as target milestones in 2015 and enforceable milestones in 2021 and each negotiation thereafter, tank waste retrieval sequencing and milestones, and milestones for installation of infrastructure to feed tank waste from the DST system to the tank waste treatment system, for the next eight years.	TBD
M-047-00	Complete work necessary to provide facilities for management of secondary waste from the WTP.	TBD

[1]Milestones from amended Consent Decree (DOE and Ecology, 2016).
[2]Ecology, EPA and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, as amended.

DOE = U.S. Department of Energy.
DST = double-shell tank.
Ecology = Washington State Department of Ecology.
HFFACO = *Hanford Federal Facility Agreement and Consent Order*.
RCRA = *Resource Conservation and Recovery Act*.
SST = single-shell tank.
WMA = waste management area.
WTP = Waste Treatment and Immobilization Plant.

The RPP scope is conducted under PBS ORP-0014, Radioactive Liquid Tank Waste Stabilization and Disposition, PBS ORP-0060, Major Construction – Waste Treatment Plant, and PBS ORP-0070, Waste Treatment Plant Operations. Scope, schedule, and cost information for the baseline case scenario for these work activities are summarized in sections 5.1, 5.2, and 5.3, respectively. Once closure activities are completed, the tank farms will be transitioned to Nuclear Facility D&D–Remainder of Hanford (PBS RL-0040) for final disposition or LTS (see section 4.4).

5.1 RADIOACTIVE LIQUID TANK WASTE STABILIZATION AND DISPOSITION (PBS ORP-0014)

This project includes activities required to manage and stabilize approximately 56,000,000 gallons of radioactive and chemical waste stored underground in 177 tanks, including retrieval, treatment, and disposal.

The PBS ORP-0014 scope includes planning, design, construction, and operation of new facilities and equipment necessary for waste feed delivery from tank farms to the Waste Treatment and Immobilization Plant to meet the December 31, 2023, Low-Activity Waste Facility startup milestone from the 2016 Amended Consent Decree. It also includes required operations, maintenance, and upgrades and retrievals of the tank farms, the 242-A Evaporator, the Effluent Treatment Facility, and the 222-S Laboratory to manage the waste and support safe nuclear and environmentally compliant operations at Hanford and enable Waste Treatment and Immobilization Plant operations. The first phase of the Low-Activity Waste Pretreatment System project will consist of a tank-side cesium removal system to remove solids and cesium to produce the low-activity waste feed stream for the Low-Activity Waste Facility.

Additional scope information for these work elements is provided in Table 5-2.

Table 5-2. Radioactive Liquid Tank Waste Stabilization and Disposition (PBS ORP-0014) Level 2 Scope Summary.

Work Element	Scope Description
Base Operations	Provides for safe storage of waste, reduces the volume of waste through evaporation, provides laboratory support, and includes necessary support activities.
Retrieve and Close SSTs	Includes retrieval of waste from the SSTs and transfer to interim storage in DSTs. SSTs will then undergo closure in accordance with regulatory requirements, as will other associated sites in the tank farms.
Waste Feed Delivery/Treatment Planning/DST Retrieval/Closure	Covers modeling of waste characteristics and volumes; transfer, treatment and preparation of the wastes to meet the requirements for safe retrieval of the DST wastes; successful operation of the WTP; and closure of the DSTs to protect the environment and the community. This work element also includes treatment of secondary wastes generated during handling and processing of tank wastes.
Supplemental Treatment	Includes planning and analysis for supplemental low-activity waste treatment and contact-handled TRU handling, up to and including design and construction.
Treat Waste	Includes preparation for hot commissioning, operation of WTP, closure planning, and final closure activities.
Facility Closures	Includes closure and monitoring of buildings and structures in the tank farms areas, but not covered elsewhere. Closure within this scope occurs mostly in the out-years and includes mobile facilities, office buildings, and support facilities (e.g., 200 East and West evaporators).

DST = double-shell tank.
ORP = DOE, Office of River Protection.
PBS = project baseline summary.
SST = single-shell tank.
TRU = transuranic.
WTP = Waste Treatment and Immobilization Plant.

Figure 5-2 presents the low-range remaining estimated cleanup costs for Radioactive Liquid Tank Waste Stabilization and Disposition (PBS ORP-0014) by FY; Figure 5-3 presents the low-range remaining estimated cleanup costs by work element.

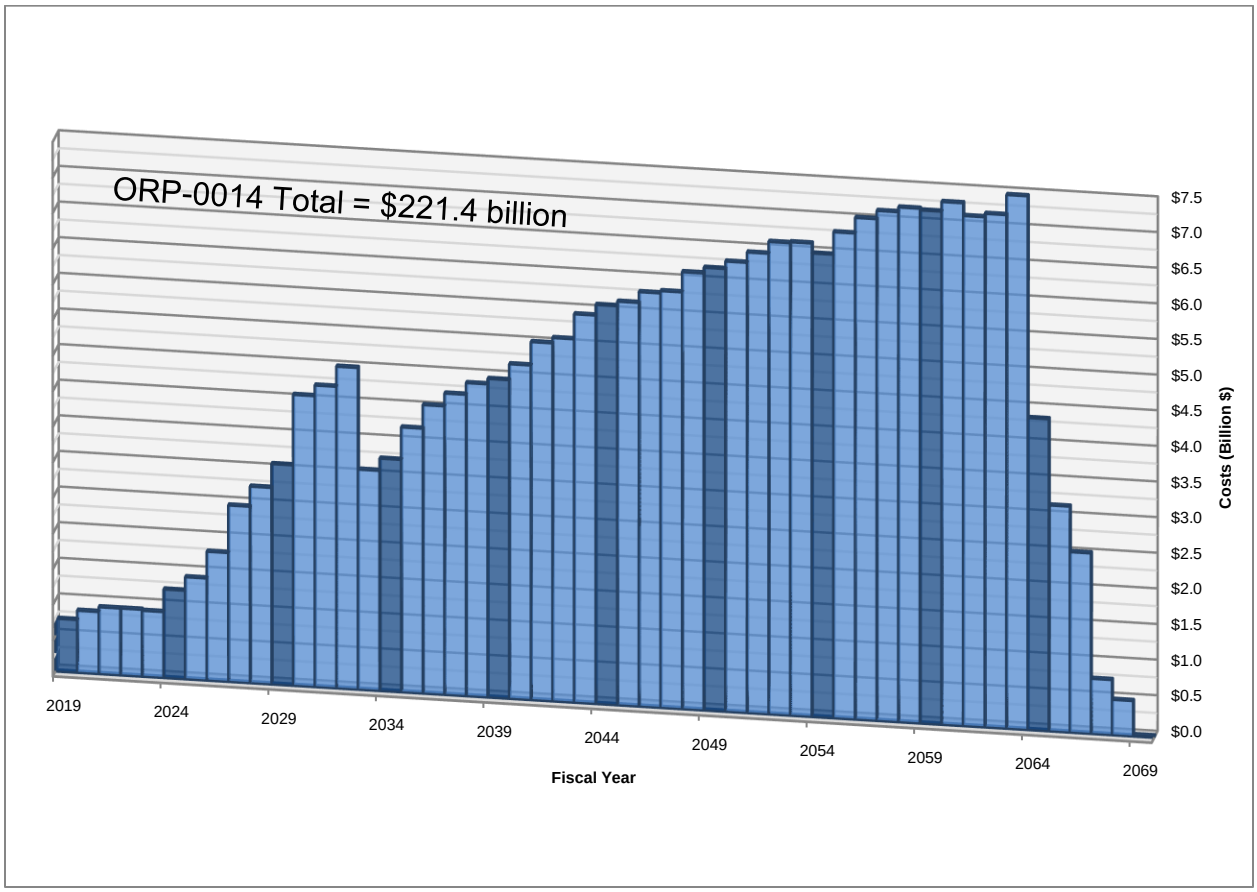

Figure 5-2. Radioactive Liquid Tank Waste Stabilization and Disposition (PBS ORP-0014) Low-Range Remaining Estimated Cleanup Costs by Fiscal Year.

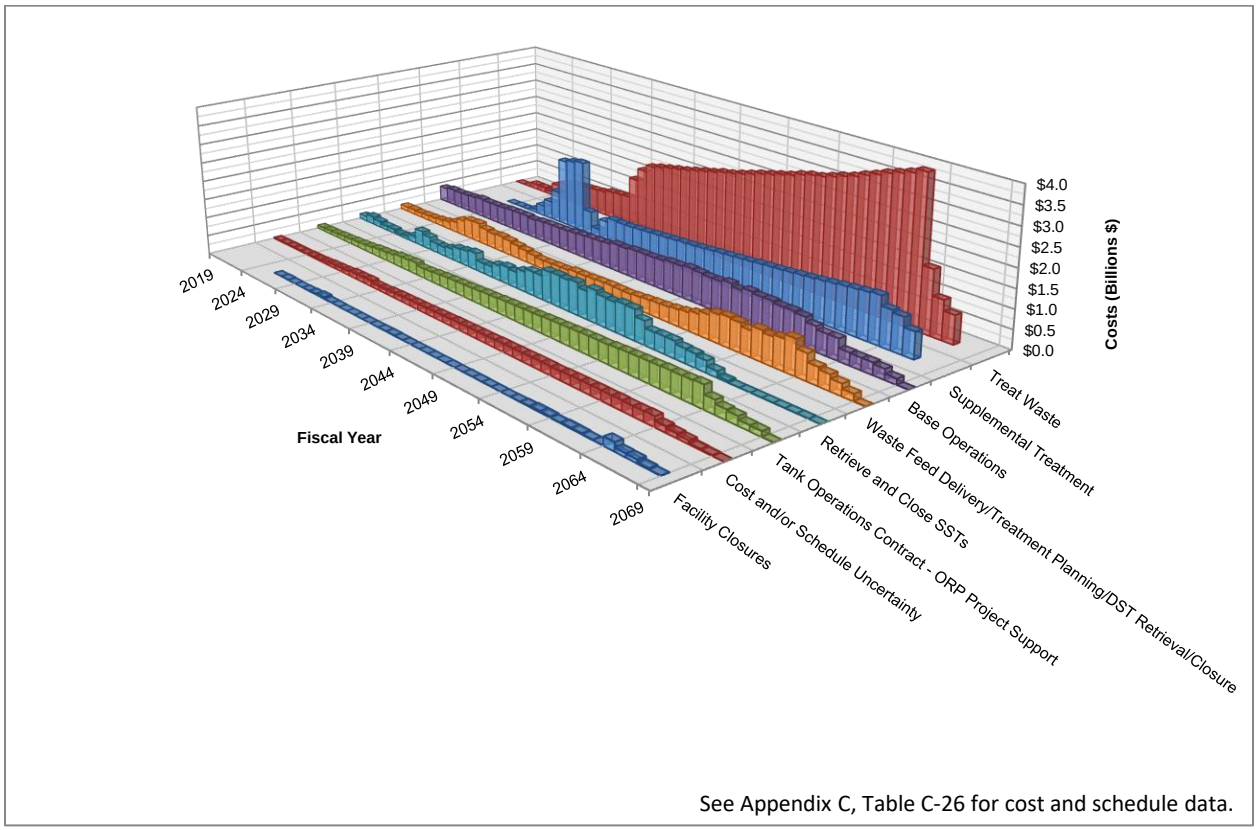

Figure 5-3. Radioactive Liquid Tank Waste Stabilization and Disposition (PBS ORP-0014) Low-Range Remaining Estimated Cleanup Costs by Work Element.

5.2 MAJOR CONSTRUCTION – WASTE TREATMENT AND IMMOBILIZATION PLANT (PBS ORP-0060)

The scope of Major Construction – Waste Treatment and Immobilization Plant (PBS ORP-0060) is critical to the completion of the Hanford tank waste program; it will provide the primary treatment capability to immobilize the radioactive and chemical tank waste at the Hanford Site. As evaluated in the baseline change request and the USACE report, the Waste Treatment and Immobilization Plant (WTP) includes construction of five major facility complexes:

- Pretreatment (PT)
- Low-Activity Waste (LAW)
- High-Level Waste (HLW)
- Balance of Facilities (BOF)
- Analytical Laboratory (Lab).

The WTP is being designed to operate under two scenarios. In the baseline configuration, DST waste will be processed first through the WTP PT Facility then sent on for vitrification at the LAW or HLW Facilities. Alternatively, under a direct-feed operating scenario, waste will be pretreated at a TSCR, then sent to the LAW Facility for immobilization.

The WTP will commence initial operations by processing waste under a direct feed option (i.e., DFLAW). In this configuration, the LAW Facility, BOF and Lab (e.g., LBL/DFLAW) will be commissioned to operate while the PT Facility and HLW Facility construction is completed. The DFLAW operations will support processing of Hanford tank waste into glass by 2023.

Upon the completion of construction and successful commissioning of the PT and HLW Facilities, the WTP will switch to the baseline configuration. The portion of DST waste not subject to direct feed

processing (i.e., not pretreated or conditioned before transfer to WTP) will be treated in the baseline configuration with PT, LAW, and HLW Facilities. These configurations are independent of one another and will not occur in parallel. However, the LAWPS portion of DFLAW is planned to restart to provide additional feed in support of Supplemental LAW operations. Additional scope information on these work elements is provided in Table 5-3.

Table 5-3. Major Construction–Waste Treatment and Immobilization Plant (PBS ORP-0060) Level 2 Scope Summary.

Work Element	Scope Description
LBL/DFLAW	Includes design, construction, and commissioning of the LAW Facility, as well as modifications to support DFLAW. When finished, the LAW will go into a melter preparation vessel where silica and other glass-forming materials are added and the mixture will be fed into one of two melters. The mixture will be heated to 2,100 °F using Joule heating. The molten mixture will be poured into large stainless steel canisters that are then welded shut. Includes design, construction and commissioning of the balance of facilities. When finished, the dedicated facilities and utilities will support the WTP. Includes design, construction, and commissioning of the Analytical Laboratory. When finished, samples will be analyzed to ensure the glass product meets requirements.
High-Level Waste (HLW)	Includes design, construction, and commissioning of the HLW Facility. Similar to the LAW, when finished the HLW will be mixed with glass-forming materials, heated to molten, and poured into stainless steel canisters.
Pretreatment (PT)	Includes design, construction, and commissioning of the Pretreatment Facility. When finished, pretreatment will physically and chemically condition the waste feed stream, separating the low-activity radioactive waste from the high-level radioactive waste.

DFLAW = Direct Feed Low-Activity Waste.
LBL = Low-Activity Waste Facility, Balance of Facilities and WTP Analytical Laboratory.
PBS = project baseline summary.
WTP = Waste Treatment and Immobilization Plant.

Figure 5-4 presents the low-range remaining estimated costs for Major Construction – Waste Treatment and Immobilization Plant (PBS ORP-0060) by FY; Figure 5-5 presents the low-range remaining estimated costs by work element.

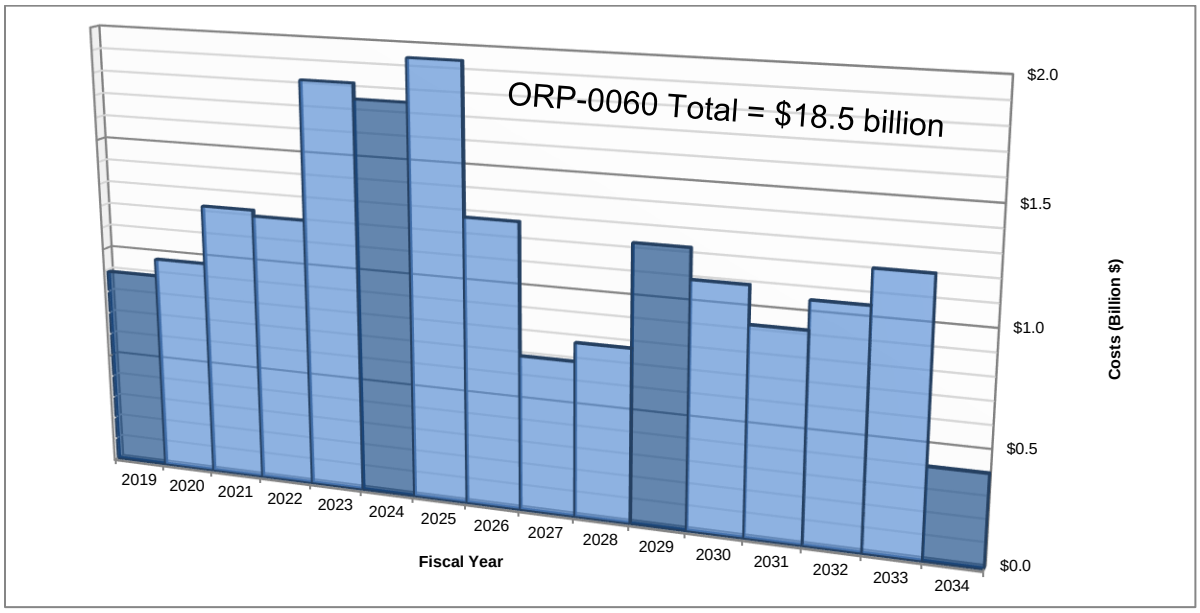

Figure 5-4. Major Construction – Waste Treatment and Immobilization Plant (PBS ORP-0060) Low-Range Remaining Estimated Costs by Fiscal Year.

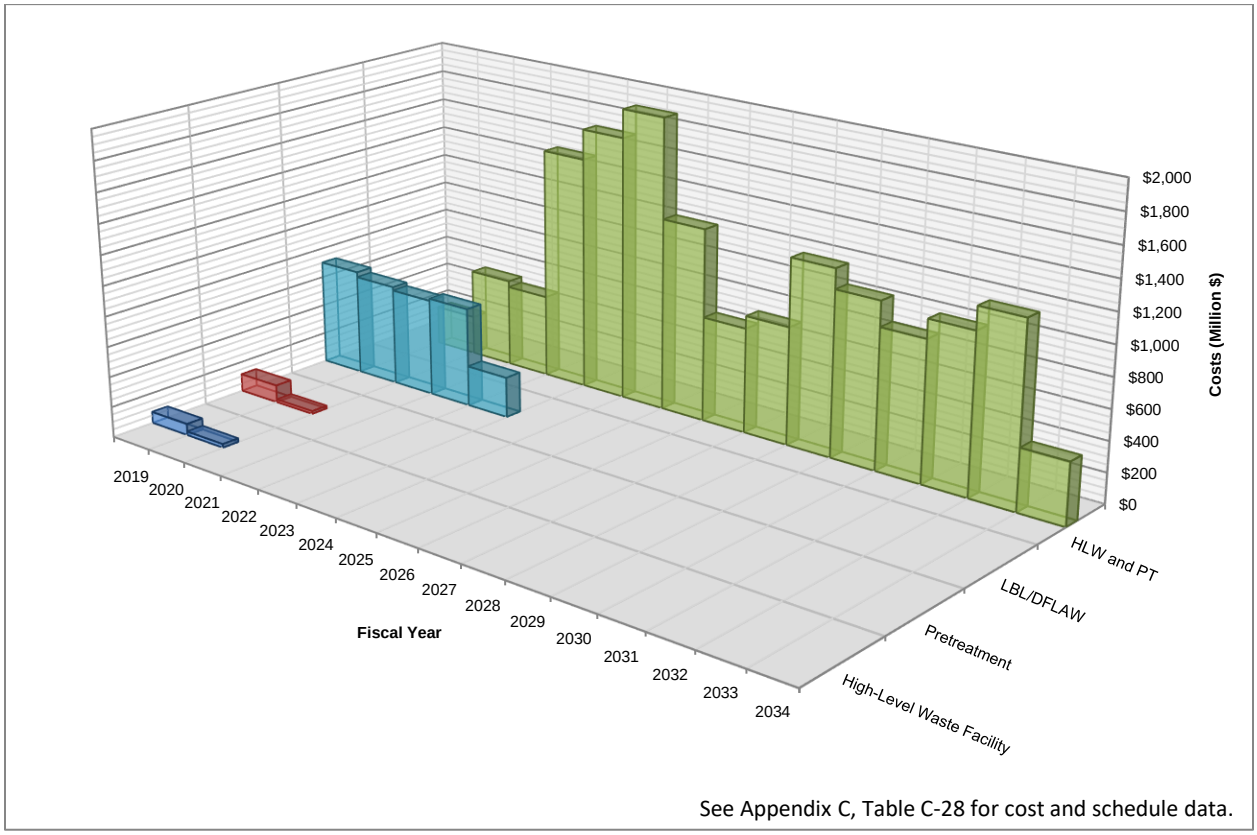

Figure 5-5. Major Construction – Waste Treatment and Immobilization Plant (PBS ORP-0060) Low-Range Remaining Estimated Costs by Work Element.

5.3 WASTE TREATMENT PLANT OPERATIONS (PBS ORP-0070)

Waste Treatment Plant Operations (PBS ORP-0070) will support the treatment of tank wastes in the WTP including the implementation of the strategy of the DFLAW approach. This includes the operational scope for the Low-Activity Waste Facility, the Analytical Laboratory, and the Balance of Facilities starting with hot commissioning but after project completion (Critical Decision 4) for those facilities. The WTP operational costs for this project are currently included within PBS ORP-0014 and will be shown in ORP-0070 in furture reports. The FY 2019 and FY2020 budget for this project is $30 million.

5.4 TANK WASTE CLEANUP ASSUMPTIONS AND UNCERTAINTIES

The scope of the baseline case (low-range estimate) is underpinned by a hierarchy of assumptions, which are detailed in ORP-11242, Appendix A. These assumptions include the following:

- Treatment facility start dates and processing rates align with the Amended Consent Decree (DOE and Ecology 2016).
- DFLAW operates before the PT Facility and HLW Facility startup.
- Timely approval is assumed to be received to support full closure of each SST tank farm after all tanks in that farm are closed.
- The DSTs will remain fully operational for the duration of the waste treatment mission, except for DST AY-102, which will remain out of service after completion of waste retrieval.
- The retrieval of the SSTs will be sequenced using a staggered, overlapping farm-by-farm approach with the goal to minimize the waste treatment mission duration.
- The 242-A Evaporator will be available, as needed, to support the SST retrievals.
- The LAWPS will be the only long-term source of LAW feed to the LAW Facility until the PT Facility begins operation (DFLAW will be achieved during the first five years using the temporary TSCR system, which will subsequently be replaced by LAWPS for long-term operations); then it will serve as an auxiliary source of LAW feed for the LAW supplemental treatment facility for the remainder of the mission.
- The TWCS capability consists of six 500,000-gallon tanks used to stage HLW feed for delivery to the PT Facility.
- The WTP is assumed to be operable for as long as required. Upgrades are assumed to be performed as necessary to maintain operability, potentially beyond the 40-year design life.
- One HLW melter and one LAW meter are assumed to be replaced every 2.5 years on average. The LAW spent melters[7] will be managed and disposed of at the IDF as mixed low-level waste (MLLW).
- The WTP EMF will operate only during DFLAW. When the PT Facility begins operations, the WTP EMF will be shut down.
- LAW supplemental treatment capacity is assumed to be provided by a LAW supplemental treatment facility, located adjacent to the WTP, although no particular treatment technology is assumed.
- The supplemental waste treatment and packaging system for tanks containing non-high-level radioactive waste consistent with TRU waste will first be located near B tank farm then moved to

[7]No final disposal location has been selected for the spent and failed HLW melters. The alternatives discussed in the TC & WM EIS assume that these spent HLW melters will be packaged in an overpack and stored at IHS until the melters can be removed for disposition and final disposal. For planning purposes, the final disposition of HLW melters is assumed to be at the IDF. Plans will be updated, as needed, after a ROD that addresses HLW melter disposal is published. Appendix E of the TC & WM EIS provides additional information (DOE/EIS-0391).

T tank farm. The drummed waste will be stored onsite at the CWC until final disposition of the waste has been determined.

- The capacities and capability of the ETF, LERF, SALDS, and 200 Area Treated Effluent Disposal Facility (TEDF) will be driven by the needs of the waste treatment mission and are assumed to be available when needed.
- The IHS Facility will receive and temporarily store canisters of immobilized HLW, pending the availability of a final disposal alternative. It will provide interim storage for a minimum of 4,000 IHLW canisters and will be expandable in increments of 2,000 canisters up to a maximum of 16,000 canisters, if needed, to mitigate the risk associated with the availability of offsite geologic storage.
- Before the third IHS module is needed, a decision is assumed to be made either to continue to build additional canister storage modules or to construct the HSF, which will provide the capability for shipping HLW canisters to a potential national repository.
- The final disposal alternative for HLW glass canisters will be at an unidentified offsite national repository. The final disposal alternative is assumed to have the same waste acceptance criteria as the Yucca Mountain national repository waste acceptance criteria, so that the HLW canisters will meet the waste acceptance criteria of the final disposal alternative.
- The IDF is assumed to be operational when needed and will provide permanent disposal for the immobilized LAW, other MLLW, and low-level waste, and can be expanded as needed.
- The cesium and strontium capsules are assumed to be dispositioned outside of the WTP and tank farm facilities by DOE-RL.
- Permitting and operational requirements to accept the Hanford non-high-level radioactive waste consistent with TRU waste that is planned to be disposed of at the WIPP will not affect the schedule's critical path.
- The activities described for the RPP are assumed to be consistent with, and encompassed by, the outcome of the NEPA process.

There are substantial uncertainties associated with the high-range estimate for Radioactive Liquid Tank Waste Stabilization and Disposition including, but not limited to, the following:

- Mission Extension Results in Need for Facility Replacements and Major Upgrades – Partial or full replacement of TWCS and the WTP HLW Facility are considered very likely. WTP LAW, HLW, and PT facilities have 40-year design lives. Each facility is planned to operate between 35 and 40 years. Life extension programs can effectively extend their safe operation for an additional 20 years, potentially. However, if the mission extends beyond this timeframe owing to issues such as funding constraints, lower operating efficiency, increased maintenance requirements, and/or lower waste oxide loading, these facilities may have to be completely replaced at significant cost.
- WTP LAW Facility Throughput Rate Does Not Meet Plan – There is a high likelihood that the throughput rate in the WTP LAW Facility will not meet the planned 70% operating efficiency, thereby extending the mission duration.
- WTP PT Facility Throughput Rate Does Not Meet Plan – There is also a high likelihood that the WTP PT process will not operate at the 70% operating efficiency, thereby extending the mission duration.
- WTP PT Facility is Rendered Inoperable due to Major Black Cell System Failures – If the WTP PT Facility cannot sustain operations due to irreparable system failure, then a replacement facility may be needed. The WTP PT Facility includes technically complex systems (e.g., Pulse Jet Mixer [PJM] tanks) in black cells and supporting ancillary systems that cannot be replaced. If solids

build up or major component failure occurs, the facility may have to be completely replaced to complete the mission.

- WTP HLW Facility Throughput Rate Does Not Meet Plan – It is considered highly likely that the WTP HLW Facility will not operate at the 70% operating efficiency.
- SST Retrieval Systems Performance Does Not Meet Requirements Due to Unexpected Conditions – It is considered highly likely that the waste retrieval rates needed to meet the baseline case cannot be met owing to resource limitations, equipment downtime, and administrative hold points related to safety basis re-analysis.
- DST Availability to Perform Mission Functions – Additional DSTs could leak, which could have impacts on the retrieval mission.
- 242-A Evaporator Availability – It is highly likely that the 242-A Evaporator Facility will fail and will have to be replaced at some point over the RPP mission.
- Facilities and Equipment Become Obsolete – The RPP mission may last for several decades beyond the design life of RPP mission facilities and equipment.
- WTP PT Facility Radioactive Secondary Solid Waste Not Able to be Treated or Disposed as Planned – It is considered highly likely that the PT Facility will generate remote-handled or TRU waste that currently has no path to disposal. Costs will include the storage, treatment and disposal of such secondary wastes.
- WTP PT Hot Commissioning is Delayed – There is a high likelihood that PT will be delayed. The uncertainty is how long it will be delayed, as well as the actual PT configuration and capabilities required. Direct feed HLW could delay the start of PT even further.

Other risks identified with less potential impacts to the Radioactive Liquid Tank Waste Stabilization and Disposition mission costs and schedule include: LAWPS hot commissioning is delayed; 222-S laboratory availability is less than adequate; cross-site transfer system startup is delayed; the waste feed delivery (WFD) system does not meet the WTP PT Facility waste acceptance criteria (WAC); availability of Hanford Site infrastructure, utilities and services (inside the waste management areas) is less than adequate; and WTP LAW radioactive solid secondary waste is not able to be treated or disposed as planned.

In addition to an assessment of the potential risk impacts, the high-range estimate also reflects an assessment of inherent cost estimate uncertainty. An allowance for cost estimate uncertainty is included by assigning an expected cost estimate accuracy range, based on accepted industry guidelines, to the various cost elements that comprise the Radioactive Liquid Tank Waste Stabilization and Disposition mission. Those ranges were then used as inputs to a Monte Carlo analysis and the resultant additional allowance is based on an 80% probability that actual costs will be less than the total estimated cost including that allowance.

These risks and their associated cost and schedule impacts, in addition to estimate uncertainty, comprise the high-range estimate.

For the WTP planning case (low-range estimate), the assumptions include the following:

- The Amended Consent Decree milestone dates are theoretically achievable at the cost profile presented in this report, assuming the project can support the aggressive schedule.
- Percent complete for HLW and PT facilities was reduced because of strategic change and project revision.
- The HLW and PT engineering percent complete performance will not gain at a rate higher than the rate sustained by the LAW Facility for the remaining engineering effort.
- Resources are available or easily accessible for deployment to the WTP project.

- The costs for the BOF and Lab modifications to support HLW and PT work are included.

The risks associated with completion and commissioning of the full LBL/DFLAW portions of the WTP are well understood and are actively being mitigated. There are still some remaining technical uncertainties, but these are generally addressed. However, both the HLW and PT facilities still represent significant technical risk. These projects have been in standby since 2012 while the technical issues were being addressed. Although significant modeling, analysis, and testing have been conducted, recognized technical risk still exists with these facilities. The combined effects of both technical and programmatic challenges could significantly delay full completion and startup of the WTP complex. The uncertainty with HLW and PT facilities comprise the high-range cost estimate associated with WTP construction.

6.0 MISSION SUPPORT

The mission support function is service oriented and provides key infrastructure, utility, resource, and other Hanford Sitewide cleanup support. DOE has responsibilities to protect personnel, nuclear material, and physical property on the Hanford Site. These activities are performed under Safeguards and Security (PBS RL-0020). DOE works closely with the regulatory agencies and community to support Hanford cleanup through Richland Community and Regulatory Support (PBS RL-0100).

A number of infrastructure-related mission support activities are in place to support cleanup of the Hanford Site. These mission support activities are managed under Hanford Sitewide Services (PBS RL-0201). Following cleanup efforts at the Hanford Site, DOE will have ongoing activities to maintain the protectiveness of the cleanup actions and support transition to future land uses. This period is referred to as LTS and is covered by PBS RL-LTS.

6.1 SAFEGUARDS AND SECURITY (PBS RL-0020)

The scope of this PBS includes one primary work element: Safeguards and Security. Table 6-1 describes the work scope. Safeguards and Security will be required until cleanup is complete, then protection of human health and the environment transfers to PBS RL-LTS.

Table 6-1. Safeguards and Security (PBS RL-0020) Level 2 Scope Summary.

Work Element	Scope Description
Safeguards and Security	This work element includes management, training, and equipment for staff; physical protective systems, such as intrusion protection, Hanford Site access, and badging; information and cyber security; personnel security; material control and accountability; and security program management.

PBS = project baseline summary. RL = DOE, Richland Operations Office.

Figure 6-1 presents the low-range remaining estimated costs for Safeguards and Security (PBS RL-0020) by FY.

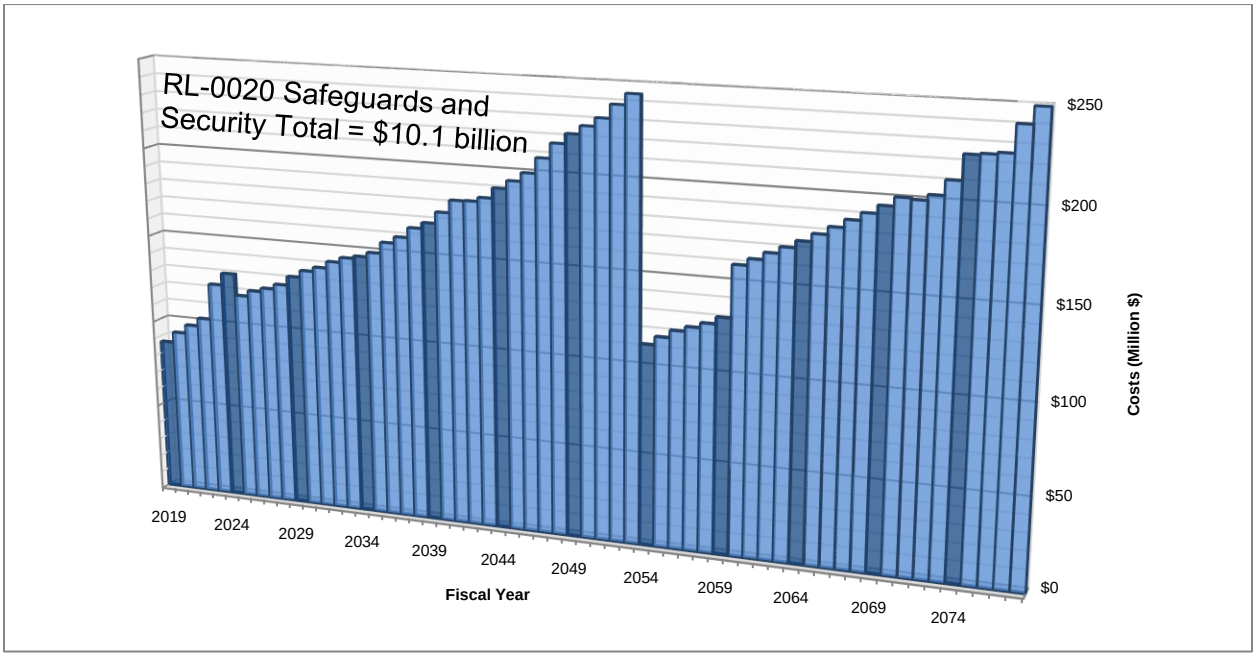

Figure 6-1. Safeguards and Security (PBS RL-0020)
Low-Range Remaining Estimated Costs by Fiscal Year.

The operational tempo and associated costs represented in the low-range estimate (baseline/planning case) for PBS RL-0020 are to a certain extent dependent upon the success in advancing the cleanup mission. For instance, removal of material at risk may result in a lowering of the site security posture with a corresponding reduction in yearly operational costs. An example of this is illustrated in Figure 6-1,which depicts a step change decrease in annual safeguards and security expenditures beginning in 2054. This reduction is predicated on the enabling assumption that the national repository is available to accept spent nuclear fuel shipments from Hanford beginning in approximately 2048.

Another area of uncertainty relates to a potential extension to the tank waste cleanup mission. Under this scenario, the site would be required to sustain the requisite level of safeguards and security beyond that assumed in the baseline planning case. Similar to the availability of the national repository, this uncertainty is also reflected in the high-range estimate.

6.2 RICHLAND COMMUNITY AND REGULATORY SUPPORT (PBS RL-0100)

This PBS covers support to community activities and various agencies and boards. The scope of work is summarized in Table 6-2.

Table 6-2. Richland Community and Regulatory Support (PBS RL-0100) Level 2 Scope Summary.

Work Element	Scope Description
Richland Community and Regulatory Support	Includes RL support to community activities and various boards, such as the Hanford Advisory Board, the Oregon Department of Energy and other entities through grants and fees. Includes studies for Natural Resource Damage Assessment but does not include significant restoration of natural resources to resolve any liability of the United States for Natural Resource Damage Assessment and Restoration.
PBS = project baseline summary.	RL = DOE, Richland Operations Office.

Figure 6-2 presents the low-range remaining estimated costs for Richland Community and Regulatory Support (PBS RL-0100) by FY.

The scope of work for Richland Community and Regulatory Support does not include any additional measurable costs for estimate uncertainty nor are there any discrete event risks. The Richland Community and Regulatory Support estimates are estimated with a high degree of certainty. The area of greatest uncertainty is the impact of extended WTP operations. The longer WTP operates, the longer support to community activities and various boards will be required. The high-range estimate accounts for the potential of WTP operations being extended.

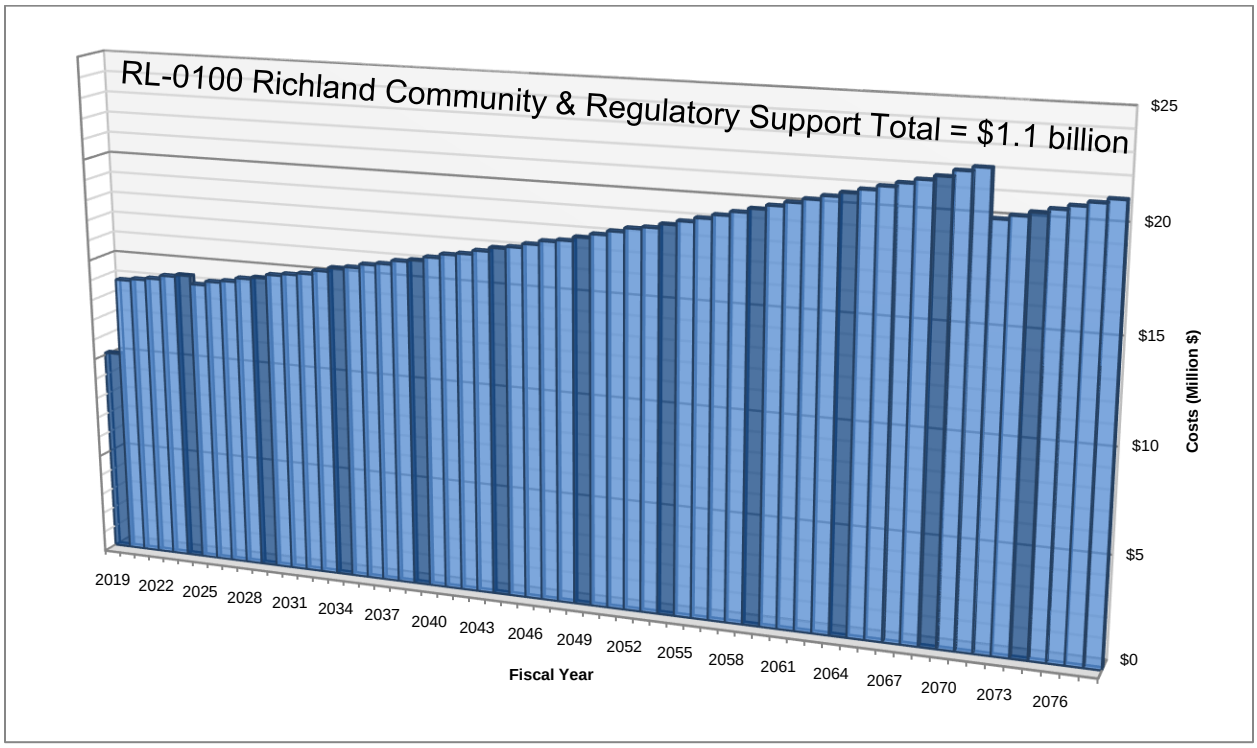

Figure 6-2. Richland Community and Regulatory Support (PBS RL-0100) Low-Range Remaining Estimated Costs by Fiscal Year.

6.3 HANFORD SITEWIDE SERVICES (PBS RL-0201)

Hanford Sitewide Services plays a key role in completing the cleanup mission. In previous LCRs these costs were allocated to several RL PBSs, but in this report these costs are consolidated and presented as PBS RL-0201, Hanford Sitewide Services.

Hanford Sitewide Services (PBS RL-0201) provides essential services ranging from the basic to highly specialized services that reflect the complexity and scale of the environmental cleanup mission. This project provides direct operations support to RL, ORP, and their contractors with cost-effective infrastructure and Site services integral and necessary to accomplish the environmental cleanup mission. The scope consists of five primary functions: safety, security, and environment; Site infrastructure and services; Site business management; information resources and content management; and portfolio management.

Under the safety, security, and environment function, Safeguards and Security (PBS RL-0020) is funded as a separate project. Other PBS RL-201 work elements under this function consist of fire and emergency response services, emergency operations, Site safety standards, the Radiological Assistance Program, environmental regulatory management, public safety and resource protection, and radiological site services.

The work elements under the Site infrastructure and services function consists of biological control, facility services, transportation, railroad services, roads and grounds, utilities (water, electricity), sewer systems, and sanitary waste management and disposal.

The work elements under the Site business management function consists of real property asset management; property systems/acquisition and materials management; sponsorship, management, and administration of employee pension and other benefits plans; *Energy Employees Occupational Illness Compensation Program Act* (Silver and Wilson 2005)/workers compensation; external affairs and other interactions; mail services; and reproduction, correspondence control, and multi-media.

As part of real property asset management, RL has established the LTS program to provide planning and interim execution of LTS for portions of the Hanford Site as they are cleaned up and before they are transferred to the DOE Office of Legacy Management (LM). The current LTS program is part of PBS RL-0201 until it is transferred to LM. This future LTS program under LM is referred to as PBS RL-LTS in this report. The scope of the current and future LTS program is described in section 6.4.

The work elements under the information resources and content management function consist of strategic planning and program management, telecommunications, information systems, and content (records) management.

The work elements under the portfolio management function consist of Hanford portfolio planning, analysis and performance assessment; project acquisition and support; and independent analysis and assessments.

Other work elements include management and oversight for B Reactor facility activities, including planning, directing, and providing technical support to maintain, upgrade, and preserve the B Reactor facility in a safe condition, and operations and maintenance activities at the Volpentest HAMMER Federal Training Center in support of the Hanford Site and other training programs.

Infrastructure work elements consist of reliability projects to repair and replace infrastructure systems and provide capital upgrades to the infrastructure, including larger scale expense projects. Also included are construction and capital equipment expenditures associated with replacements for biological control, crane and rigging, electrical system, facilities, Hanford Fire Department, network and telecommunications, studies and estimates, transportation, water and sewer utilities, and other infrastructure reliability projects.

This PBS also consists of a variety of support contracts, grants, permits and fees including those for electrical power (Bonneville Power Administration), building services and rent, cleanup baseline, contract audit and closeout, information technology, land transfers, laundry services, janitorial services, legal, Natural Resource Trustee Council, occupational medicine, steam systems, Tribal Nation support, Ecology and Washington State Department of Health.

The scope description for these work elements is provided in Table 6-3.

Table 6-3. Hanford Sitewide Services (PBS RL-0201) Level 2 Scope Summary.

Work Element	Scope Description
Hanford Sitewide Services	Covers costs for Site services and infrastructure. This work element consists of emergency services (fire and emergency response, emergency management), environmental integration services (Sitewide safety standards, environmental integration, public safety and resource protection, radiological site services, and offsite laboratory sample analysis), information management (information management planning and controls, information systems, content and records management, infrastructure/cyber security, information resources/content management, and information support services), Site infrastructure and utilities/logistics and transportation (roads and grounds, biological services, electrical services, water/sewer services, facility services, transportation, mail, property systems/acquisitions, railroad services, technical services, energy management, work management, land and facilities management), support functions (business operations, human resources, safety, health and quality), and portfolio management (portfolio planning, analysis and performance, project acquisition and support, and independent assessment and analysis). • Covers contracted technical services in key areas such as audit, regulatory analysis, cost and risk analysis and estimating. Also covers mission-critical support services to DOE and its contractors in key areas such as occupational medicine, information and telecommunications, janitorial, laundry services, electrical power, steam service and facilities rentals; critical independent legal counsel and litigation services in support of DOE and its contractors; and other mission-critical support services to DOE and its contractors in key areas such as land transfers, acquisition and contract closeout, energy conservation and management, natural resource trusteeship, Tribal Nation support, Washington State Departments of Ecology and Health, and other small contracts, permits, and payment of fees • Covers management and oversight for B Reactor facility activities, including planning, directing, and providing technical support to maintain, upgrade, and preserve the B Reactor facility in a safe condition • Covers operations and maintenance activities at the HAMMER facility in support of the Hanford Site and other training programs • Covers reliability projects to repair and replace infrastructure systems and provides capital upgrades to the infrastructure, including larger scale expense projects. Also covers construction and capital equipment expenditures associated with replacements for biological control, crane and rigging, electrical system, facilities, Hanford Fire Department, network and telecommunications, studies and estimates, transportation, water and sewer utilities and other infrastructure reliability projects.

DOE = U.S. Department of Energy.
HAMMER = Volpentest HAMMER Federal Training Center.
PBS = project baseline summary.
RL = DOE, Richland Operations Office.

Figure 6-3 presents the low-range remaining estimated costs for Hanford Sitewide Services (PBS RL-0201) by FY.

The Hanford Sitewide Services work scope includes the continued delivery of mission critical programs and services to ensure a safe, secure, and compliant work environment for DOE and its contractors. While not a determination of importance, the range of services represented in this PBS are primarily level of effort driven by the mission duration. Any scenario that results in an extension in the mission will increase expenses within this PBS. This uncertainty is accounted for in the high-range estimate.

Similarly, an extension in the mission duration could impact the serviceability of the utility infrastructure. Despite the fact the low-range estimate includes expenses to accommodate infrastructure reliability projects in the future, the amount estimated may be insufficient to overcome a catastrophic failure in a key utility system, particularly considering (1) the age of the infrastructure; and (2) the time-scale of the cleanup mission. This uncertainty is also reflected in the high-range estimate.

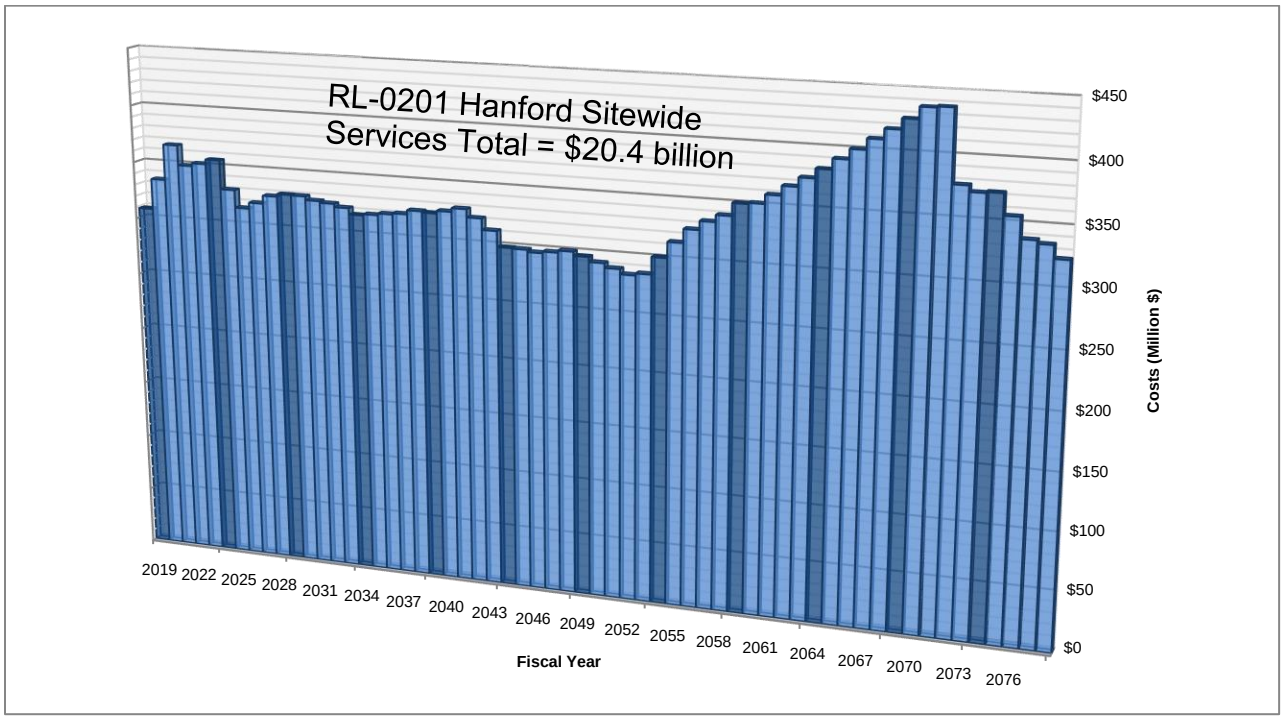

Figure 6-3. Hanford Sitewide Services (PBS RL-0201)
Low-Range Remaining Estimated Costs by Fiscal Year.

6.4 LONG-TERM STEWARDSHIP (PBS RL-LTS)

Following the completion of Hanford cleanup actions, the disposal facilities and their areas will require long-term management. Administration of the institutional controls activities will be required for portions of the Hanford Site to ensure protection of human health and the environment. As portions of the Site are cleaned up, they are managed in accordance with the Hanford Site Long-Term Stewardship Program, as described in DOE/RL-2010-35, *Hanford Long-Term Stewardship Program Plan,* under PBS RL-0201 Hanford Sitewide Services. When all the cleanup actions defined by decision documents are completed, the Hanford Site will be turned over to DOE LM. This PBS element pertains to the LM activities at the Hanford Site.

LTS refers to all activities necessary to ensure protection of human health and the environment following completion of cleanup, disposal, or stabilization at a site or a portion of a site. LTS includes engineered and institutional controls designed to contain or to prevent exposures to residual contamination and waste, such as surveillance activities, recordkeeping activities, inspections, groundwater monitoring, ongoing pump-and-treat activities, cap repair, maintenance of entombed buildings or facilities, maintenance of other barriers and containment structures, access control, and posting signs. LTS begins when cleanup is completed and the selected remedy cleanup objectives and goals are met, as defined by the applicable CERCLA or RCRA decision documents, or when long-term remediation systems are constructed and operating as intended (e.g., groundwater pump-and-treat systems).

The current Hanford Site LTS Program manages the geographic areas for which cleanup has been completed in accordance with the post-cleanup requirements specified in the associated decision documents. These decisions include, but are not limited to, the CERCLA RODs and RCRA post-closure plans. In addition to managing the post-cleanup completion obligations, the LTS Program manages Hanford's natural and cultural resources through the framework of DOE/EIS-0222-F and 64 FR 61615, "Record of Decision: Hanford Comprehensive Land Use Plan Environmental Impact Statement (HCP EIS)," and in accordance with Federal laws, executive orders, Tribal Nation treaties, DOE directives, and Hanford Site procedures. The planning basis for the Hanford Site LTS Program

scope integrates stewardship and institutional controls elements into the program from present day to 2078.

The scope, schedule and costs of LTS and institutional controls, to the extent predictable, have been included in this LCR for the period from 2079 to 2095. The Federal Government will have a presence at Hanford well beyond 2095 – especially in the Inner Area of the Central Plateau – to ensure that the cleanup remedies remain protective of people and the environment. As cleanup decisions are made and LTS requirements and institutional controls are refined, more specific information will be included in the LCR.

Table 6-4 provides a summary of the scope. Figure 6-4 shows low-range remaining estimated costs for PBS RL-LTS by FY.

Table 6-4. Long-Term Stewardship (PBS RL-LTS) Level 2 Scope Summary.

Work Element	Scope Description
Long-Term Stewardship	Covers operation and maintenance of Hanford Site infrastructure following cleanup activities, environmental monitoring of groundwater, soil, vadose zone, and monitoring for public safety and resource protection, planning, land management, and surveillance and maintenance activities to ensure environmental compliance and protection, payment in lieu of taxes, and management and administration.

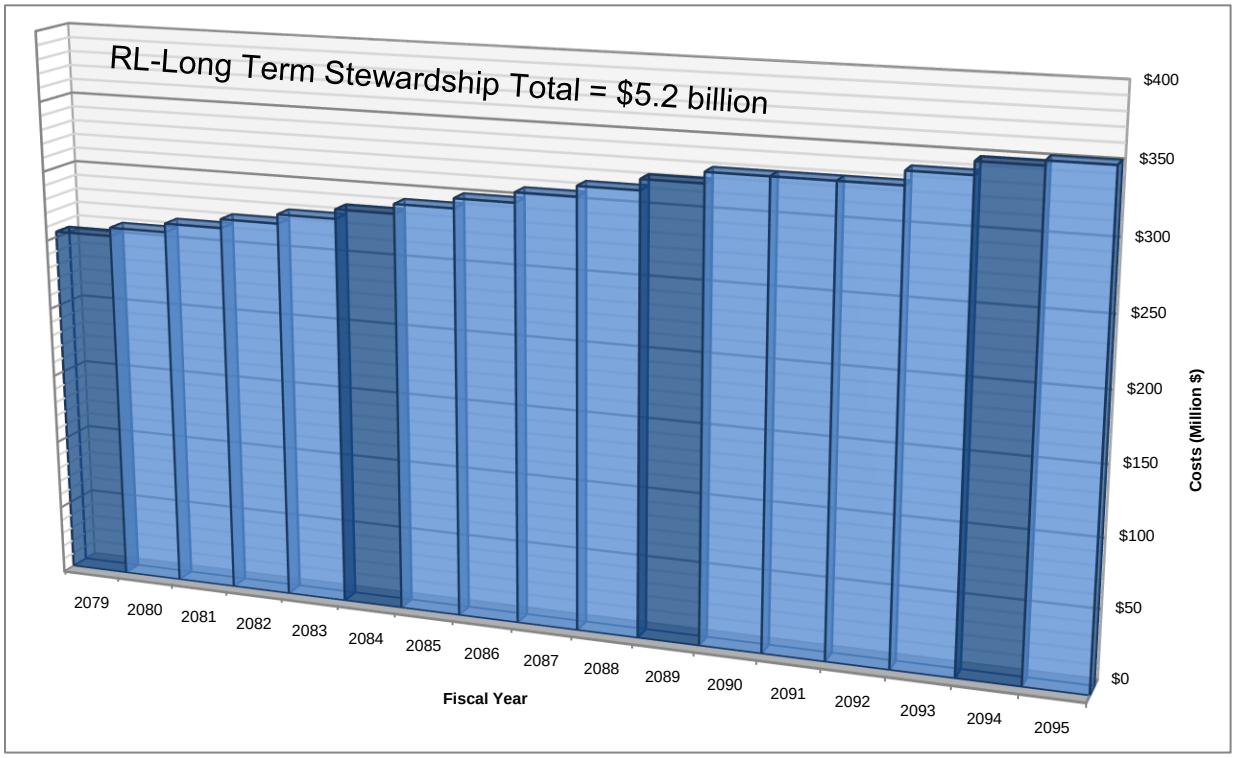

Figure 6-4. Long-Term Stewardship (PBS RL-LTS)
Low-Range Remaining Estimated Costs by Fiscal Year.

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7.0 REPORT LIMITATIONS

7.1 SCHEDULE AND COST LIMITATIONS

The LCR is based on an annual compilation of estimated scope, schedule, and cost information. To finish preparing the LCR, it is necessary to select a deadline each year when the scope, schedule, and cost information used to prepare the report will be "locked down."

For the 2019 LCR, August 31, 2018, serves as the cutoff date. Unless noted otherwise, changes in the TPA and other applicable requirements, budget requests, appropriations, program funding allocations, and other scope, schedule, and cost changes after the cutoff date are not reflected in the 2019 LCR.

7.2 OTHER LIMITATIONS

Some of the activities described in the LCR are subject to the analysis and decision-making requirements of CERCLA, RCRA, or other applicable statutes and regulations. The information included in the LCR is for planning purposes only, not for regulatory decision making, which will be conducted following the applicable statutory and regulatory programs.

The LCR does not include resources that may be required to accomplish significant restoration of natural resources related to any liability of the United States for NRDAR.

Several non-DOE entities operate and manage property on the Hanford Site, typically under lease agreements with DOE, for example:

- Energy Northwest, a consortium of public utility companies that oversees the Columbia Generating Station nuclear power reactor.
- Laser Interferometer Gravitational Wave Observatory, operated by a consortium of the California Institute of Technology and the Massachusetts Institute of Technology.
- Washington State, which in turn leases land to US Ecology, Inc., a private firm that operates burial grounds for commercial low-level radioactive waste.

Operation, maintenance, and any subsequent future cleanup associated with activities at these facilities are subject to the terms and conditions of the leases (and/or other agreements) in place between the operating entities and DOE. Potential environmental liabilities for these and similar non-DOE operations are not currently considered to be part of the Hanford Site cleanup, and so are not included in the DOE EM program. Consequently, lifecycle scope, schedule, and cost for these non-DOE operations are not included in the LCR.

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8.0 REFERENCES

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APPENDIX A

HANFORD SITE EXISTING CLEANUP DECISIONS

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CONTENTS

TABLES

TERMS

AM	Action Memorandum
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CFR	*Code of Federal Regulations*
CCN	correspondence control number
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
D&D	decontamination and decommissioning
D4	deactivation, decontamination, decommissioning, and demolition
DOE	U.S. Department of Energy
DST	double-shell tank
Ecology	Washington State Department of Ecology
EE/CA	engineering evaluation/cost analysis
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ERA	expedited response action
ERDF	Environmental Restoration Disposal Facility
ESD	explanation of significant differences
HCP IES	Hanford Comprehensive Land-Use Plan Environmental Impact Statement
HLW	high-level waste
IC	institutional controls
INL	Idaho National Laboratory
ISRM	in situ redox manipulation
ISS	interim safe storage
LCR	Lifecycle Report
MCL	maximum contaminant level
NPL	National Priorities List
NTCRA	non-time-critical removal action
OU	operable unit
P&T	pump-and-treat
PCB	polychlorinated biphenyl
PFP	Plutonium Finishing Plant
PRG	preliminary remediation goal
PRZ	prewetted zone
RCRA	*Resource Conservation and Recovery Act of 1976*
RDR/RAWP	remedial design report/remedial action work plan
ROD	record of decision
RTD	remove, treat, and dispose of
SNF	Spent Nuclear Fuel
SST	single-shell tank
TCRA	time critical removal action
TPA	Tri-Party Agreement
Tri-Party agencies	U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology,
TRU	transuranic
TSD	treatment, storage, and disposal
USDOE	U.S. Department of Energy
WIDS	Waste Information Data System
WIPP	Waste Isolation Pilot Plant
WTP	Waste Treatment and Immobilization Plant

APPENDIX A
HANFORD SITE EXISTING CLEANUP DECISIONS

Pursuant to the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989), commonly referred to as the Tri-Party Agreement (TPA), Milestone M-036-01 requires the U.S. Department of Energy (DOE) to prepare an annual *Hanford Lifecycle Scope, Schedule and Cost Report* (Lifecycle Report [LCR]). The LCR is expected to reflect all actions necessary for DOE to meet all applicable environmental obligations as it completes the Hanford cleanup mission. These environmental obligations are established in accordance with various decision-making processes that DOE, the U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology) (Tri-Party agencies), and other agencies conduct under Federal and State regulatory programs.

Many decisions regarding the Hanford cleanup have been made since the TPA was signed in 1989, and actions implementing these decisions have been completed, are underway, or will soon be initiated. Many other decisions, however, cannot be made yet, are in preliminary planning stages, or are under development. The absence of final decisions is addressed in TPA M-036-01:

> *In circumstances where final cleanup decisions have not yet been made, the report shall be based upon the reasonable upper bound of the range of plausible alternatives or may set forth a range of alternative costs including such a reasonable upper bound.*

This appendix provides current information about decisions that affect cleanup and when these decisions might become final for LCR purposes.

- **Section A.1** provides a general overview of the principal processes employed at the Hanford Site to reach decisions about future cleanup actions.
- **Section A.2** describes in more detail the Federal and State decisions that can affect Hanford cleanup, the legal and/or regulatory authorities on which the decision making is based, and the types of documents used to embody and formalize these decisions.
- **Section A.3** summarizes current decisions that, for purposes of this LCR, are considered to be cleanup decisions and which cleanup decisions can be identified as final cleanup decisions.

This appendix will be updated to reflect new and changed final cleanup decisions.

A.1 PRINCIPAL HANFORD CLEANUP DECISION-MAKING PROCESSES

To implement the cleanup mission, the Tri-Party agencies reach decisions about what actions need to be performed to protect the public,workers, and the environment. Cleanup decisions are based on a variety of legal and regulatory authorities such as the *Comprehensive Environmental Response, Compensation and Liability Act of 1980* (CERCLA) (42 USC 9601) and the *Resource Conservation and Recovery Act of 1976* (RCRA) (42 USC 6901) that require the consideration of various alternatives before decisions are made. In some cases, the agencies develop interim or partial decisions that enable cleanup work to proceed pending final decisions.

The TPA is the primary legal framework that DOE, EPA and Ecology use to achieve Hanford cleanup. Cleanup decisions made under the TPA integrate the following regulatory processes:

- CERCLA processes support remedial decision making for most past-practice waste sites, canyon facilities, and structures that contain radioactive contamination or other hazardous substances. The TPA identifies a subset of waste sites as RCRA past-practice sites. Consistent with EPA directives and guidance, the TPA establishes the expectation that either a RCRA

corrective action or a CERCLA remedial action will lead to an equivalent cleanup result. In practice, this expectation becomes complicated when radioactive materials are present because RCRA authority does not extend to radionuclides.

- RCRA closure processes are generally used to reach final decisions for the closure of active RCRA treatment, storage, and disposal (TSD) facilities. RCRA corrective action processes also are applicable when RCRA wastes from past hazardous waste practices must be cleaned up. EPA has delegated implementation of the RCRA program to Washington State. Ecology implements the program via RCRA-equivalent state regulations and through facility-specific permits. RCRA closure and post-closure requirements are contained in the Hanford Site RCRA Permit (WA7890008967, *Hanford Facility Resource Conservation* a*nd Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste*).

The clear intent of the TPA is to minimize duplication and overlap of regulatory authorities while ensuring compliance with applicable requirements. As already noted, RCRA authority does not extend to the cleanup of radionuclides. The TPA states that the cleanup process selected for a RCRA operable unit (OU) will be sufficiently comprehensive to satisfy the technical requirements of both RCRA and CERCLA.

In addition to RCRA and CERCLA, DOE is responsible for regulating the radioactive materials that it manages, including setting standards that affect cleanup decisions for radionuclides. DOE Order 435.1, *Radioactive Waste Management*, establishes additional requirements and processes that apply to cleaning up radioactive facilities and media. DOE develops and implements cleanup decisions under this order.

Land use also is an important factor in making cleanup decisions because remedial action objectives must support reasonably anticipated future land uses. These future land-use assumptions allow risk assessments and feasibility studies to focus on developing practical and cost-effective remedial alternatives. DOE is responsible for designating land uses on the Hanford Site and for identifying future land uses that will guide risk assessments and cleanup decisions. Pursuant to a record of decision (ROD) published on November 2, 1999 (64 FR 61615, "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS)") and an amended ROD published on September 26, 2008 (73 FR 55824, "Amended Record of Decision for the Hanford Comprehensive Land-Use Plan Environmental Impact Statement"), DOE has established a comprehensive land-use plan for the Hanford Site. As DOE stated in the first ROD:

> *The purpose of this land-use plan and its implementing policies and procedures is to facilitate decision making about the site's uses and facilities over at least the next 50 years. The Department's decision seeks to balance the Department's continuing land-use needs at Hanford with its desire to preserve important ecological and cultural values of the site and allow for economic development in the area.* (64 FR 61615 - 61616)

To cleanup an area as large and complex as the Hanford Site requires an extraordinary number of regulatory decisions. While many cleanup decisions have been made, only some of these decisions are considered to be final; many are either interim decisions or decisions that laid the groundwork for future final decisions. The rest of this appendix provides a more extensive discussion of the decisions that have been made. It also includes several tables that summarize the effects of these decisions.

A.2 CLEANUP DECISIONS

A.2.1 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 DECISIONS

CERCLA, as modified by the *Superfund Amendments and Reauthorization Act 1986* (42 USC 103), established the Federal program to cleanup uncontrolled or abandoned waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. Under 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," DOE is the lead agency with lead responsibilities by the National Contingency Plan and Executive Order 12580, *Superfund Implementation*. EPA is the lead regulatory agency under the TPA and oversees the cleanup activities conducted under Title 40 *Code of Federal Regulations* (CFR) Part 300, "National Oil and Hazardous Substances Pollution Contingency Plan." EPA also has certain oversight authorities granted through CERCLA and the TPA. The most common documentation used to implement cleanup decisions under CERCLA includes:

- **CERCLA ROD.** The CERCLA ROD is a public document, developed from information generated during the remedial investigation/feasibility study that explains which remediation alternatives will be used to clean up a site. A ROD contains information about the site's history, description, and characteristics; community participation; enforcement activities; past and present activities; contaminated media; the contaminants present; scope and role of response action; and the remedy selected for cleanup. RODs can be final or interim; interim RODs allow cleanup actions to proceed until a final decision can be reached.
- **Explanation of Significant Differences and ROD Amendment.** Documents used to modify or clarify an existing ROD. The explanation of significant difference is used when changes to a component of a remedy do not fundamentally alter the overall cleanup approach. The amendment is used when there are fundamental changes, or a number of significant changes, that together have the effect of a fundamental change to the remedy selected in the ROD.
- **Action Memorandum.** A public document used to exercise the CERCLA removal authority and enable cleanup action to proceed where a site presents a relatively time-sensitive, non-complex problem that can and should be readily addressed.

Several CERCLA documents have been completed that have resulted in cleanup decisions. These CERCLA documents and summaries of the relevant cleanup decisions are listed in Section A.3.

A.2.2 PERMITS, LICENSES, AND OTHER REGULATORY PROGRAM APPROVALS

RCRA, as modified by the *Hazardous and Solid Waste Amendments of 1984*, gave EPA authority to control the generation, transportation, storage, and disposal of hazardous waste. The amendments expanded the scope of RCRA to require corrective actions for certain releases of hazardous constituents to the environment from RCRA facilities (similar to CERCLA remedial actions). Unlike CERCLA, EPA may delegate authority for implementing RCRA to the states, and in Washington State, Ecology has lead authority for most elements of RCRA. Principal documents used to implement Hanford cleanup decisions under RCRA include:

- **Final Status Permit.** A final status permit includes explicit descriptions of the conditions and requirements that must be met by a facility that manages hazardous waste (or "dangerous waste" in Washington State). A TSD facility may receive a final status permit even though it is closed and not operating, if ongoing caretaking activities must be maintained after closure (i.e., during the post-closure care period). At Hanford, a single final status permit covers the entire Site, but is being issued in phases because of the number of TSD facilities. The final status permit includes decisions

about how Federal and State statutes, regulations, and guidance have been interpreted and applied to specific activities conducted at each TSD facility.

- **Closure/Post-Closure Plan.** Some TSD facilities have closed or may close before they are covered under the final status permit. In such cases, a closure plan must be prepared to describe the activities necessary to close the TSD facility and address any remaining dangerous wastes. If dangerous waste will remain after closure, a post-closure plan is required to address residual contamination. Ecology must approve closure/post-closure plans before they are implemented and, in the process, decisions will be made and included in the closure/post-closure plans about how to close the TSD facility and, where required, conduct post-closure care.
- **Corrective Action**. Corrective actions to cleanup releases from RCRA TSD facilities may be required before a final status permit is issued. Decisions about degree/methods for cleanup will be made and implemented through a corrective action plan approved by Ecology.

In addition to RCRA, several other programs authorized under existing Federal and State statutes require permits, licenses, and other approvals that can affect cleanup at Hanford. These other decision documents establish, among other conditions, limits on emissions of radionuclides and other hazardous constituents to the air, water, and ground. Section A.3 lists the various permits, licenses, and other types of approvals authorized under applicable regulatory and statutory programs that include or have resulted in decisions affecting Hanford cleanup.

A.2.3 TRI-PARTY AGREEMENT DECISIONS

Among other functions, the TPA helps define how CERCLA and RCRA programs will be implemented when they have overlapping authorities. The TPA is used to determine which decision-making process (e.g., CERCLA ROD, RCRA permit) will be used to establish cleanup decisions for the waste sites and facilities at Hanford. These may include TPA provisions that set specific waste retrieval objectives and technology performance standards for certain types of cleanup actions. These TPA-based decisions are listed in Section A.3.

A.2.4 OTHER FEDERAL AND STATE DECISIONS

A variety of other decisions are embodied in executive, legislative, and judicial documents that can affect cleanup at Hanford. Section A.3 lists executive orders, presidential proclamations, federal statutes, and judicial decisions that may affect cleanup.

A.3 SUMMARY OF HANFORD CLEANUP DECISIONS – FINAL AND NOT YET FINAL

The statutory and regulatory authorities discussed in Section A.2 resulted in a multitude of decisions across numerous projects and programs. Some of these decisions establish environmental obligations that affect the cleanup mission and are summarized in this section.

While some decisions more clearly affect Hanford than others, care has been taken to include decisions that have indirect effects on cleanup. Examples of such indirect decisions include those that define national standards for risk-based exposure limits, enable offsite activities that contribute contaminants to Hanford environmental media, or constrain the ability to disposition materials or wastes at or from the Hanford Site. As stated earlier, the LCR is required to consider cleanup alternatives “where final cleanup decisions have not yet been made” (TPA M-036-01, third paragraph). Some cleanup decisions may appear to be final but are not.

- They may be “interim” remedies until a final cleanup decision can be made.
- They may be “partial” actions within a much larger cleanup effort.

Even where final decisions have been made, legal mandates require periodic reviews to ensure that selected remedies continue to be effective; new decisions may be needed depending on how well cleanup actions are working. For purposes of this LCR, a cleanup decision is deemed to be final if either of the following is true.

- The decision is embodied in a statutory orregulatory document that is titled final (e.g., final permit, final ROD).
- The decision is explicitly represented as final in a document, and such representation is consistent with the statutory or regulatory authority on which it is based.

Hanford cleanup decisions summarized in the following tables indicate whether the decision is considered to be final by placing the word **FINAL** after the decision title. In addition to decisions that have been made, whether final or not, many cleanup decisions are yet to be made. By definition, the absence of a decision means a final cleanup decision has not been made. It would be very difficult to develop an exhaustive list of all the decisions that still need to be made to complete Hanford cleanup. However, as these decisions are reached, they will be incorporated into this section of the LCR.

Table A-1. CERCLA Records of Decision and Associated Changes. (9 pages)

Record of Decision			
Title: *Record of Decision, USDOE Hanford 1100 Area* (EPA/ROD/R10-93/063) **FINAL** **ROD Type:** CERCLA Final ROD **Area:** 1100 **Date Approved:** Sep-93 **Initial Decision:** Cap Horn Rapids Landfill; offsite disposal of PCB-contaminated soils; offsite incineration of bis (2-ethylhexyl) phthalate contaminated soils; monitored natural attenuation of groundwater contamination. The 1100 Area was deleted from the National Priorities List on September 30, 1996 (61 FR 51019).			
Revision Title	**Type**	**Date**	**Revised Decision**
Explanation of Significant Differences for the Record of Decision for the USDOE Hanford 1100 Area Benton County, Washington (EPA 2010a)	ESD	Sep-10	Documents significant differences to the selected remedies in the ROD. This ESD clarifies the IC requirements for the Horn Rapids Landfill.
Record of Decision			
Title: *Declaration of the Record of Decision for the Environmental Restoration Disposal Facility* (EPA/ROD/R10-95/100) **FINAL** **ROD Type:** CERCLA Final ROD **Area:** 200 West **Date Approved:** Jan-95 **Initial Decision:** Initial construction of two cells; maximum size of 1.6 mi^2; landfill construction in accordance with RCRA; capped at completion.			
Revision Title	**Type**	**Date**	**Revised Decision**
USDOE Environmental Restoration Disposal Facility, Hanford Site, Benton County, Washington, Explanation of Significant Difference (ESD) (EPA/ESD/R10-96/145)	ESD	Jul-96	Allow disposal of investigation-derived waste and RCRA past-practice waste to ERDF; allow disposal of nonprocess inactive TSD waste to ERDF; allow use of ERDF leachate for dust suppression/compaction activities at ERDF.
U.S. Department of Energy, Environmental Restoration Disposal Facility, Hanford Site – 200 Area, Benton County, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary, (EPA/AMD/R10-97/101)	Amended ROD	Sep-97	Authorizes two additional disposal cells and the option of treating waste as needed by containerization and encapsulation at ERDF instead of at the OU.

Table A-1. CERCLA Records of Decision and Associated Changes. (9 pages)

U.S. Department of Energy, Environmental Restoration Disposal Facility, Hanford Site – 200 Area, Benton County, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary, (EPA/AMD/R10-99/038)	Amended ROD	Mar-99	Establishes conditional approval for delisting of the ERDF leachate.
U.S. Department of Energy, Environmental Restoration Disposal Facility, Hanford Site – 200 Area, Benton County, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary, (EPA/AMD/R10-02/030)	Amended ROD	Jan-02	Authorizes four additional disposal cells and the option of staging waste at ERDF pending treatment and/or disposal.
U.S. Department of Energy, Environmental Restoration Disposal Facility, Hanford Site-200 Area, Benton County, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary (EPA 2007)	Amended ROD	May-07	Allows specific waste (e.g., waste associated with surveillance and maintenance of Hanford facilities, environmental research/development activities, sample analyses, liquid effluent waste treatment, infrastructure support, and environmental monitoring programs) to be disposed at ERDF; identifies a plug-in approach for ERDF disposal of additional similar Hanford cleanup waste generated in support of RCRA/CERCLA cleanup actions.
Declaration: U.S. Department of Energy, Environmental Restoration Disposal Facility, Hanford Site - 200 Area, Benton County, Washington (09-AMRC-0179)	Amended ROD and ESD	Aug-09	Allows for ERDF expansion of an area equal to 4 cells or 2 super cells; updates cell design to allow super cell concept and allows for ERDF expansion via EPA approval and fact sheets rather than ROD amendments.
Explanation of Significant Differences For the U.S. Department of Energy Environmental Restoration Disposal Facility Hanford Site - 200 Area Benton County, Washington (EPA 2015)	ESD	Oct-15	Allows the onsite 200 West Area Pump-and-Treat Facility to be used as an option for the treatment of ERDF leachate. This change would allow either the ETF or the 200 West Area Pump-and-Treat Facility to be used for treatment of ERDF leachate, depending upon availability.
Declaration of the Amendment to Record of Decision for the USDOE Hanford Environmental Restoration Disposal Facility (Ecology 2015)	Amended ROD	Dec-15	Waives the 40 CFR 268.45(a) and WAC 173-303-140(2)(a) prohibition on placing hazardous waste in a land disposal unit before completing required land disposal restriction treatment for certain long, large and/or heavy hazardous waste items.
Record of Decision			
Title: *Declaration of the Interim Record of Decision for the 200-ZP-1 Operable Unit* (EPA/ROD/R10-95/114) **ROD Type:** CERCLA Interim Action ROD **Area:** 200 West; 200-ZP-1 OU **Date Approved:** May-95 **Initial Decision:** P&T to address carbon tetrachloride, chloroform, and trichloroethylene; treatment with air stripping and vapor-phase activated carbon; interim action to continue until final action instituted; reinjection of treated water.			

Table A-1. CERCLA Records of Decision and Associated Changes. (9 pages)

<table>
<tr><th colspan="4">Record of Decision</th></tr>
<tr><td colspan="4">Title: Record of Decision, Hanford 200 Area, 200-ZP-1 Operable Unit Superfund Site, Benton County, Washington (EPA 2008) FINAL
ROD Type: CERCLA Final ROD
Area: 200 West; 200-ZP-1 OU
Date Approved: Sep-08
Initial Decision: P&T to address carbon tetrachloride, nitrate, chromium, trichloroethylene, I-129, Tc-99, and tritium; monitored natural attenuation; flow-path control through injection of treated water; and ICs.</td></tr>
<tr><th colspan="4">Record of Decision</th></tr>
<tr><td colspan="4">Title: Declaration of the Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington (EPA/ROD/R10-95/126)
ROD Type: CERCLA Interim Action ROD
Area: 100; 100-BC-1, 100-DR-1, and 100-HR-1 OUs
Date Approved: Sep-95
Initial Decision: Remove contaminated soil, structures and debris using observational approach; treatment, by thermal desorption to remove organics and/or soil washing for volume reduction, or as needed to meet waste disposal criteria; disposal of contaminated materials at ERDF; backfill excavated areas followed by revegetation.</td></tr>
<tr><th>Revision Title</th><th>Type</th><th>Date</th><th>Revised Decision</th></tr>
<tr><td>Amendment to the Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington (EPA/AMD/R10-97/044)</td><td>Amended ROD</td><td>Apr-97</td><td>Incorporates 34 additional waste sites into the ROD; refines remedial cost estimate for original 37 sites and additional 34 sites based on actual data, streamlining, and lessons learned; eliminates the soil washing treatment option before disposal.</td></tr>
<tr><th colspan="4">Record of Decision</th></tr>
<tr><td colspan="4">Title: Declaration of the Record of Decision for the 100-IU-1, 100-IU-3, 100-IU-4, and 100-IU-5 Operable Units, Hanford Site, Benton County, Washington (EPA/ROD/R10-96/151) FINAL
ROD Type: CERCLA Final ROD
Area: 100; 100-IU-1, 100-IU-3, 100-IU-4, and 100-IU-5 OUs
Date Approved: Feb-96
Initial Decision: No action.
Partial deletion of the 100 Area (specifically the 100-IU-1 and 100-IU-3 OU waste areas) from the National Priorities List was published on July 8, 1998 (63 FR 36861).</td></tr>
<tr><th colspan="4">Record of Decision</th></tr>
<tr><td colspan="4">Title: 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, Benton County, Washington (EPA and DOE, 2018) FINAL
ROD Type: CERCLA Final ROD
Area: 100; 100-D, 100-H
Date Approved: Jul-18
Initial Decision: Supersedes the cleanup levels selected in 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 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). Selected remedies for waste sites are no action, removal, treatment (as needed) and disposal, pipeline end-capping, backfill, contouring, revegetation and institutional controls. Selected remedies for groundwater are expansion and optimization of the interim pump and treat remedy, ion exchange to remove hexavalent chromium, reinject treated effluent, monitored natural attenuation for nitrate and strontium-90, and institutional controls until cleanup levels are achieved.</td></tr>
</table>

Table A-1. CERCLA Records of Decision and Associated Changes. (9 pages)

Record of Decision			
Title: *Declaration of the Record of Decision for the 100-HR-3 and 100-KR-4 Operable Units, Hanford Site, Benton County, Washington* (EPA/ROD/R10-96/134) **ROD Type:** CERCLA Interim Action ROD **Area:** 100; 100-H, 100-K **Date Approved:** Mar-96 **Initial Decision:** Interim action to remove hexavalent chromium from groundwater; 30 extraction wells; ion exchange treatment; reinject treated effluent; monitor; institute ICs.			
Revision Title	**Type**	**Date**	**Revised Decision**
U.S. Department of Energy Hanford Site – 100 Area, Benton County, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary (EPA/AMD/R10-00/122)	Amended ROD	Oct-99	Implements In Situ Redox Manipulation (ISRM) barrier for second chromium plume in 100-HR-3 OU; existing P&Ts remain in operation.
Explanation of Significant Difference for the 100-HR-3 Operable Unit Record of Decision (EPA/ESD/R10-03/606)	ESD	Apr-03	Provides justification for increased schedule/cost from the 1999 Amendment associated with a greater number of wells and aquifer thickness that affected implementation of the ISRM barrier.
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 (EPA 2009a)	ESD	Aug-09	Provides justification for increased cost and location of reinjection wells from the 1999 Amendment associated with operation beyond initial 5-year estimate and need to control plume migration.
Non-Significant Change for the 100-HR-3 and 100-KR-4 Operable Units Interim Action Record of Decision (11-AMCP-0002)	Non-significant change	Oct-10	Indicates that the ISRM barrier would no longer be actively maintained; this shifted the groundwater remedy at the ISRM barrier to the P&T system.
Record of Decision			
Title: *Declaration of the Record of Decision for the 300-FF-1 and 300-FF-5 Operable Units, Hanford Site, Benton County, Washington*, (EPA/ROD/R10-96/143) Note: The ROD is only **FINAL** for the 300-FF-1 OU; it is an interim action for 300-FF-5 OU. **ROD Type:** CERCLA Final ROD **Area:** 300; 300-FF-1 and 300-FF-5 OUs **Date Approved:** Jul-96 **Initial Decision:** 300-FF-1: Remove contaminated soil and debris; dispose at ERDF; backfill and recontouring; ICs. 300-FF-5: Monitoring and ICs for groundwater.			
Revision Title	**Type**	**Date**	**Revised Decision**
USDOE Hanford 300 Area, 300-FF-1 Operable Unit, Hanford Site, Benton County, Washington Explanation of Significant Difference (ESD) (EPA/ESD/R10-00/505)	ESD	Jan-00	Provides a site-specific land disposal restriction treatability variance for lead contamination found in the 628-4 waste site (Landfill 1D).
Explanation of Significant Difference for the 300-FF-5 Record of Decision (EPA/ESD/R10-00/524)	ESD	Jun-00	Expanded scope of 300-FF-5 ROD to include groundwater in 300 Area, including 300-FF-2 sites and any sites plugged into 300-FF-1 ROD.
Record of Decision			
Title: *Declaration of the Interim Record of Decision for the 300-FF-2 Operable Unit* (EPA/ROD/R10-01/119) **ROD Type:** CERCLA Interim Action ROD **Area:** 300; 300-FF-2 OU **Date Approved:** Apr-01 **Initial Decision:** Remove contaminated soil, structures, and debris; treat as needed; dispose at ERDF, WIPP, or other; backfill and revegetate; establish ICs; continued groundwater monitoring; and define plug-in approach.			

Table A-1. CERCLA Records of Decision and Associated Changes. (9 pages)

Revision Title	Type	Date	Revised Decision
Explanation of Significant Differences for the 300-FF-2 Operable Unit Record of Decision (EPA 2004b)	ESD	May-04	Modified uranium soil cleanup level from 350 to 267 pCi/g based on engineering study to ensure protectiveness of the groundwater and river; modified land-use assumption for 8 outlying waste sites from industrial to unrestricted, changed cleanup levels for these sites to those consistent with 100 Area cleanup.
Explanation of Significant Differences for the 300-FF-2 Operable Unit Interim Action Record of Decision, Hanford Site, Benton County, Washington (EPA 2009a)	ESD	Aug-09	Incorporates 14 plug-in sites into the ROD and subsequent ESDs; incorporates 2 newly discovered sites into the ROD and subsequent ESDs; allows future newly discovered sites to be incorporated into the ROD and ESDs as long as cost impacts are within specified limits.
TPA Fact Sheet: "300-FF-2 "Plug-In" Waste Sites for Fiscal 2010." (DOE, EPA and Ecology 2010)	-	Oct-10	The 2010 list of waste sites plugged into the RTD remedy in the 2001 interim action ROD for the 300-FF-2 OU.
Explanation of Significant Differences, Hanford 300 Area, 300-FF-2 Operable Unit, 618-10 Burial Ground (EPA 2011a)	ESD	Aug-11	Modified remedy to allow necessary treatment of liquid waste in bottles, up to 1 gal/bottle, to occur in trays within the excavation area in accordance with an approved work plan.
Record of Decision			
Title: *Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1 Hanford Site, Benton County, Washington* (EPA and DOE 2013) **FINAL** **ROD Type:** CERCLA Final ROD **Area:** 300; 300-FF-1, 300-FF-2 and 300-FF-5 **Date Approved:** Nov-13 **Initial Decision:** This ROD selects a remedy for the waste sites in 300-FF-2, a remedy for the groundwater in 300-FF-5 and amends the remedy for three 300-FF-1 waste sites. The interim action remedy for 300-FF-5, selected in 1996 and the interim action remedy for 300-FF-2 selected in 2001 are replaced with this final action remedy. The remedy for 300-FF-1 selected in 1996 is amended for additional remedial action of uranium from three sites. Contaminated buildings are being removed in accordance with CERCLA action memoranda and are not part of the OUs addressed by this ROD. The major components of the selected remedy for the 300-FF-2 OU are the following: • Remove, treat and dispose of (RTD) at waste sites • Erect temporary surface barriers and fill pipeline voids • Enhanced attenuation of uranium using sequestration in the vadose zone, periodically rewetted zone (PRZ) and top of the aquifer • ICs, including the requirement that DOE prevent the development and use of property that does not meet residential cleanup levels at the 300 Area Industrial Complex and 618-11 for other than industrial uses, including use of property for residential housing, elementary and secondary schools, childcare facilities, and playgrounds. The major components of the selected remedy for the 300-FF-5 OU are the following: • Monitored natural attenuation • Groundwater monitoring • Enhanced attenuation of uranium at the top of the aquifer • ICs. The major component of the amended remedy for 300-FF-1 is enhanced attenuation of uranium using sequestration in the vadose zone, PRZ and top of the aquifer.			

Table A-1. CERCLA Records of Decision and Associated Changes. (9 pages)

Revision Title	Type	Date	Revised Decision
Explanation of Significant Differences for the Hanford Site 300 Area Record of Decision for the 300-FF-2 and 300-FF-5 Operable Units, and Record of Decision Amendment for the 300-FF-1 Operable Unit (15-AMRP-0259)	ESD and Amended ROD	Sep-15	Adds two 300-FF-2 OU wastes sites. The remedy for waste site 600-393 is RTD and no additional action is needed for waste site 600-386.
Explanation of Significant Differences #2 for the Hanford Site 300 Area Record of Decision for the 300-FF-2 and 300-FF-5 Operable Units, and Record of Decision Amendment for the 300-FF-1 Operable Unit (16-AMRP-0097)	ESD	Apr-16	Adds one waste site to the 300-FF-2 OU and modifies the remedy for another waste site. The remedy for waste site 600-403 is RTD and the remedy for waste site 300-288:2 is RTD without backfill, to allow its use as a borrow pit.
Record of Decision			
Title: *Record of Decision, Hanford 200 Area, Superfund Site 200-CW-5 and 200-PW-1, 200-PW-3 and 200-PW-6 Operable Units Hanford Site, Benton County, Washington* (EPA 2011b) **FINAL** **ROD Type:** CERCLA Final ROD **Area:** 200 East and 200 West **Date Approved:** Sep-11 **Initial Decision:** RTD of soil and debris to specified depths or cleanup levels for plutonium-contaminated soils and subsurface structures/debris. Soil vapor extraction at three 200-PW-1 waste sites will continue until vadose zone cleanup levels are met. Soil covers will be used to a depth of at least 15 ft over cesium-contaminated soils. Removal of sludge followed by tank stabilization for two tanks. No action for two waste sites. ICs and long-term monitoring for waste sites where contamination is left in place and an unrestricted land use is precluded.			
Record of Decision			
Title: *Declaration of the Record of Decision, USDOE Hanford 200 Area, Hanford Site, Benton County, Washington* (EPA/ROD/R10-97/048) **ROD Type:** CERCLA Interim Action ROD **Area:** 200 West; 200-UP-1 OU **Date Approved:** Feb-97 **Initial Decision:** Extract groundwater from high concentration zone of uranium and Tc-99 plumes and treat at Effluent Treatment Facility.			
Revision Title	**Type**	**Date**	**Revised Decision**
Explanation of Significant Differences for the Interim Action Record of Decision for the 200-UP-1 Groundwater Operable Unit, Hanford Site, Benton County, Washington (EPA 2009b)	ESD	Feb-09	Adds National MCL of 30 µg/L for uranium as ARAR for treating extracted water; replaces 190 gal/min pumping with a pumping requirement from existing and new wells consistent with approved RDR/RAWP until uranium and Tc-99 concentrations are less than 10 times the MCL for 4 consecutive quarters; adds sampling requirements and updates cost estimates and IC requirements.
Record of Decision for Interim Remedial Action Hanford 200 Area Superfund Site 200-UP-1 Operable Unit (EPA 2012)	Interim Action ROD	Sep-12	Supersedes previous interim action ROD (Feb-97) and ESD (Feb-09). Includes groundwater extraction/treatment (with flow path control through injection of treated water) in combination with monitored natural attenuation for Tc-99, uranium, chromium (total and hexavalent), nitrate, carbon tetrachloride, and tritium; hydraulic containment and further treatment technology evaluation for I-129; remedy performance monitoring and ICs.

Table A-1. CERCLA Records of Decision and Associated Changes. (9 pages)

Record of Decision			
Title: *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* (EPA/ROD/R10-99/039) **ROD Type:** CERCLA Interim Action ROD **Area:** 100, 200 North **Date Approved:** Jul-99 **Initial Decision:** Requires RTD for 46 sites; adds the plug-in approach for the RTD remedy for remaining 100 Area and 200 North sites and for newly identified 100 Area sites added by ESD; disposal of debris from B, D, H, and K reactors to ERDF; provides decision framework for leaving waste in place, generally below 15-ft depth.			
Revision Title	**Type**	**Date**	**Revised Decision**
Explanation of Significant Difference for the 100 Area Remaining Sites ROD, USDOE Hanford 100 Area, 100-IU-6 Operable Unit, Hanford Site, Benton County, Washington (EPA/ESD/R10-00/045)	ESD	Jun-00	Plugs in 600-23 and JA Jones #1 waste sites to the Remaining Sites ROD.
Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision (EPA 2004b)	ESD	Feb-04	Adds 28 sites to ROD; adds 10 CFR 1022 and 40 CFR 6, Appendix A as ARARs to ROD; revises annual ICs report date to be coincident with the due date for the Sitewide ICs Plan for Hanford CERCLA Response Actions.
Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington (EPA 2009c)	ESD	Aug-09	Authorizes adding 200-CW-3 OU wastes sites, 99 newly discovered waste sites, and 87 candidate sites using the plug-in approach in the ROD and any newly discovered waste sites that will be documented in the Administrative Record and in an annual fact sheet.
TPA Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites For Fiscal Year 2010 (DOE, EPA and Ecology 2011)	-	Mar-11	The annual listing of candidate waste sites for confirmatory sampling and waste sites plugged into the RTD remedy in the 1999 interim action ROD for the 100 Area Remaining Sites.
TPA Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites For Calendar Year 2012 (DOE, EPA and Ecology 2013)	-	Jan-13	The annual listing of candidate waste sites for confirmatory sampling and waste sites plugged into the RTD remedy in the 1999 interim action ROD for the 100 Area Remaining Sites.
TPA Fact Sheet: 100 Area "Plug-In" Waste Sites For Calendar Year 2017 (DOE, EPA and Ecology 2018)	-	Mar-18	The annual listing of waste sites plugged into the RTD remedy in the 1999 interim action ROD for the 100 Area Remaining Sites.
Record of Decision			
Title: *Record of Decision Hanford 100 Area Superfund Site 100-FR-1, 100-FR-2, 100-FR-3, 100-IU-2, and 100-IU-6 Operable Units* (EPA 2014) **FINAL** **ROD Type:** CERCLA Final ROD **Area:** 100 Area **Date Approved:** Sep-14 **Initial Decision:** RTD at 91 waste sites, ICs at 15 waste sites, no additional action due to interim remedial actions completed at 198 waste sites, monitored natural attenuation to address nitrate, hexavalent chromium, trichloroethene, and strontium-90 in 100-FR-3 groundwater and ICs.			
Record of Decision			
Title: *Declaration of the Record of Decision for the 100-KR-2 Operable Unit, Hanford Site, Benton County, Washington* (EPA/ROD/R10-99/059) **ROD Type:** CERCLA Interim Action ROD **Area:** 100-K			

Table A-1. CERCLA Records of Decision and Associated Changes. (9 pages)

Date Approved: Sep-99 **Initial Decision:** Remove spent nuclear fuel from basins; remove sludge from basins; treat and remove water from the basins; remove debris from the basins; deactivate the basins; and institute ICs.			
Revision Title	**Type**	**Date**	**Revised Decision**
Interim Remedial Action Record of Decision Amendment, U.S. Department of Energy; 100 K Area K Basins, Hanford Site - 100 Area, Benton County, Washington (EPA 2005a)	Amended ROD	Jun-05	Modifies remedy for sludge by including sludge treatment prior to interim storage and shipment to a national repository; modifies remedy for debris by including grouting in place some of the basin debris followed by removal along with the removal of the basins.
Explanation of Significant Differences for the Hanford Site 100 K Area K Basins Interim Remedial Action Record of Decision (16-AMRP-0173)	ESD	May-16	Modifies the amended ROD by removing the requirement that sludge be treated prior to interim storage, provided the sludge is stored at T Plant in Cells 3L, 8R, 9L, 10L, 13L 14R, and 15L. The sludge remains subject to the requirement that it be treated and packaged for disposal, and shipped off-Hanford to a national repository.
Record of Decision			
Title: *Interim Remedial Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington* (EPA/ROD/R10-99/112) **ROD Type:** CERCLA Interim Action ROD **Area:** 100-N **Date Approved:** Sep-99 **Initial Decision:** ICs for shoreline site; in situ and RTD with ex situ bioremediation for petroleum sites; RTD for remainder of sites in 100-NR-1; maintain ERA P&T for 100-NR-2.			
Revision Title	**Type**	**Date**	**Revised Decision**
Explanation of Significant Difference for the 100-NR-1 Operable Unit Treatment, Storage, and Disposal Interim Action Record of Decision and 100-NR-1/100-NR-2 Operable Unit Interim Action Record of Decision (EPA/ESD/R10-03/605)	ESD	May-03	Removes July 31 annual ICs reporting requirements, consolidates reporting with the site-wide IC annual report; eliminates requirement to evaluate applying 30 in. of irrigation water to determine if remaining contaminants will impact groundwater; identifies need for additional ICs to preclude access to contaminated groundwater for 116-N-1 which will be incorporated into site-wide IC document.
U.S. Department of Energy, 100-NR-1 and NR-2 Operable Units, Hanford Site - 100 Area, Benton County, Washington, Amended Record of Decision, Decision Summary and Responsiveness Summary (EPA 2010b)	Amended ROD	Sep-10	Deploys the apatite sequestration technology for remediating Sr-90 in the 100-NR-2 OU by extending existing apatite permeable reactive barrier to ~2,500 ft, allows for deployment of the apatite sequestration technology elsewhere in the 100-NR-2 OU in accordance with an Ecology approved work plan, and includes decommissioning the treatment components of the existing P&T system.
Explanation of Significant Differences for the 100-NR-1 and 100-NR-2 Operable Units Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington (EPA 2011a)	ESD	Mar-11	Adds 45 additional waste sites in the 100-NR-1 OU for remediation by RTD (characterized per the 100-N Area sampling and analysis plan) and increases the total cost 38% to $67,510,386.

Table A-1. CERCLA Records of Decision and Associated Changes. (9 pages)

Explanation of Significant Difference for the 100-NR-1 and 100-NR-2 Operable Units Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington (EPA 2013)	ESD	Aug-13	Adds 2 additional waste sites in the 100-NR-1 OU for remediation by RTD and increases the total cost by $401,500.
Record of Decision			
Title: *Interim Remedial Action Record of Decision Declaration, U.S. Department of Energy 100 Area, 100-NR-1 Operable Unit, Hanford Site, Benton County, Washington* (EPA/ROD/R10-00/120) **ROD Type:** CERCLA Interim Action ROD for 2 RCRA TSDs and an associated site **Area:** 100-N **Date Approved:** Jan-00 **Initial Decision:** RTD of 116-N-1 and 116-N-3 Cribs with ERDF disposal; backfill and revegetate; any pipelines will be removed or sampled and left in place based on sample results.			
Revision Title	**Type**	**Date**	**Revised Decision**
Explanation of Significant Difference for the 100-NR-1 Operable Unit Treatment, Storage, and Disposal Interim Action Record of Decision and 100-NR-1/100-NR-2 Operable Unit Interim Action Record of Decision (EPA/ESD/R10-03/605)	ESD	May-03	Removes July 31 annual ICs requirement and consolidates reporting with the site-wide IC annual report; eliminates requirement to evaluate applying 30 in. of irrigation water to determine if remaining contaminants will impact groundwater; identifies need for additional ICs to preclude access to contaminated groundwater for 116-N-1 which will be incorporated into site-wide IC document.
Record of Decision			
Title: *Declaration of the Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2 and the 100-KR-2 Operable Units* (EPA/ROD/R10-00/121) **ROD Type:** CERCLA Interim Action ROD **Area:** 100 Area Burial Grounds **Date Approved:** Sep-00 **Initial Decision:** Remove contaminated soil, structures, and debris; treat as needed; dispose at ERDF; backfill and revegetate. Applies to 45 burial grounds in 100 Area.			
Revision Title	**Type**	**Date**	**Revised Decision**
Explanation of Significant Difference for the Interim 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 (100 Area Burial Grounds) (08-AMRC-0033)	ESD	Nov-07	Established limit of RTD excavation at the 118-B-1 Burial Ground considering the balancing factors in the ROD and required additional ICs for protection of groundwater and the Columbia River.
Record of Decision			
Title: *Record of Decision 221-U Facility (Canyon Disposition Initiative), Hanford Site, Washington* (EPA 2005b) **FINAL** **ROD Type:** CERCLA Final ROD **Area:** 200 West **Date Approved:** Oct-05 **Initial Decision:** Remove waste from vessels and equipment in the facility with levels of transuranic isotopes greater than 100 nCi/g and eventual disposal at WIPP; removal of liquids from the facility or treatment to remove liquids; partial removal of contaminated equipment and piping from the gallery side of the facility and dispose at ERDF; demolition and subsequent stabilization of the railroad tunnel, 271-U, 276-U, 291-U, and 292-U structures and 291-U-1 and 296-U-10 stacks and dispose at ERDF; construct an engineered barrier; planting semiarid-adapted vegetation on the barrier; ICs; post-closure care; and ongoing barrier performance and groundwater monitoring.			

ARAR = applicable or relevant and appropriate requirement.
CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*.
OU = operable unit.
P&T = pump-and-treat.
PCB = polychlorinated biphenyl.
PRZ = Periodically Rewetted Zone.

Table A-1. CERCLA Records of Decision and Associated Changes. (9 pages)

EPA	= U.S. Environmental Protection Agency.	RCRA	= *Resource Conservation and Recovery Act of 1976*.
ERA	= expedited response action.	RD/RAWP	= remedial design/remedial action work plan.
ERDF	= Environmental Restoration Disposal Facility.	ROD	= record of decision.
ESD	= explanation of significant difference.	RTD	= remove, treat, and dispose.
IC	= institutional controls.	TSD	= treatment, storage, and disposal.
ISRM	= in situ redox manipulation.	WIPP	= Waste Isolation Pilot Plant.
MCL	= maximum contaminant limit.		

Unless otherwise noted in Table A-2, decisions made through action memoranda (AM) are considered final and are available in the TPA Administrative Record (http://pdw.hanford.gov/arpir/). These decisions focus mainly on the deactivation, decontamination, decommissioning, and demolition (D4) of buildings and generally are considered final actions because buildings are demolished and the waste disposed of at approved facilities; or remove, treat, and dispose of (RTD) contaminated soil from waste sites, which are generally considered final actions for individual waste sites. Slabs and contaminated soils underlying the buildings may require additional decision making as part of appropriate source OUs. Similarly, waste sites that undergo RTD as a removal action will likely have a final ROD covering the decision, even though no additional cleanup activities are anticipated.

Table A-2. CERCLA Action Memoranda. (7 pages)

Title	Date	Action	Removal Action/Decision
"618-9 Burial Ground Project Plan" (91-ERB-039)	Feb-91	TCRA	Provides for trench excavation and removal of drummed liquid wastes from 618-9 Burial Ground. Treatment and/or disposal of liquids and contaminated soils (if present) is considered part of the Phase 2 activities and is not considered time critical.
"Action Memorandum Approval: 316-5 Process Trenches, USDOE Hanford Site, Richland, WA" (CCN 9103432)	Jul-91	ERA	Provides for excavation of soil from the 316-5 process trenches and interim stabilization pending further remedial action as part of the 300-FF-1 OU. This AM initially was not a final action; however, the ROD for 300-FF-1 OU, which covers these trenches, is a final CERCLA action.
"Action Memorandum: Expedited Response Action Proposal for 200 West Area Carbon Tetrachloride Plume" (CCN 9200423)	Jan-92	ERA	Identifies installing a soil vapor extraction system with granular activated carbon recovery and offsite granular activated carbon regeneration at 216-Z-1A followed by systems at 216-Z-18 and 216-Z-9. While this ERA is not a final decision; a final decision has been made through the CERCLA remedial process for the 200-PW-1 OU.
"Action Memorandum Approval: Sodium Dichromate Barrel Landfill, USDOE Hanford Site, Richland, WA" (CCN 9307470)	Mar-93	ERA	Identifies excavation and disposal of drums and homestead debris from the landfill and sampling any other wastes encountered during excavation; the expedited response would result in cleanup of the landfill to unrestricted levels.
"Action Memorandum: Expedited Response Action Proposal; Riverland Site, USDOE Hanford Site, Richland, WA" (CCN 9305567)	Jun-93	ERA	Provides for cleanup of the Riverland Site, part of the 100-IU-1 OU, through excavation to address pesticide and hydrocarbon contamination, ordnance survey and removal, and sandblasting to decontaminate concrete.

Table A-2. CERCLA Action Memoranda. (7 pages)

Title	Date	Action	Removal Action/Decision
"Action Memorandum: North Slope (Wahluke Slope) Expedited Response Action Cleanup Plan, USDOE Hanford Site, Richland, WA" (Ecology and EPA 1994a)	Mar-94	ERA	Provides for mitigation of physical hazards, excavation of the worst-case landfill, characterization of other landfills, and, if needed, excavation of other landfills based on characterization results; includes investigation and as needed, mitigation of ordinance burial pits. As stated in the AM, the intent is to provide for the final removal action taken at the 100-IU-3 OU (the Wahluke Slope).
"Action Memorandum; N Springs Expedited Response Action Cleanup USDOE Hanford Site, Richland, WA" (Ecology and EPA 1994b)	Sep-94	ERA	Identifies a P&T system combined with a vertical barrier for implementation at N Springs. These systems are a component of overall cleanup of N Springs but were also intended to provide additional information to the ongoing CERCLA and RCRA processes. This ERA is not a final decision.
"Action Memorandum: Expedited Response Action Proposal; 100-BC-1 Demonstration Project; USDOE Hanford Site; Richland, Washington" (EPA and Ecology 1995)	Jun-95	ERA	Allows contaminated soil from 116-B-4, 116-B-5, and 116-C-1 to be excavated and temporarily stored pending start of ERDF operations; actions under this AM would provide additional information to support remedial design, including cost information, for 100-BC-1 OU. The ERA was not intended as a final decision; 100-BC-1 OU has been incorporated into an interim ROD and is undergoing a final ROD process.
"Action Memorandum, 183-H Solar Evaporation Basin Waste Expedited Response Action Cleanup Plan" (CCN 040739)	Nov-96	ERA	Identifies ERDF as the disposal location for 183-H solar evaporation basin waste generated through cleanup activities.
"Action Memorandum, N Area Waste Expedited Response Action Cleanup Plan" (CCN 038546)	Nov-96	ERA	Identifies ERDF as the disposal location for contaminated sediment and debris from the emergency dump basin, facility deactivation waste, and environmental investigation waste from the 100-N Area.
"Action Memorandum; 100-B/C Area Ancillary Facilities and the 108-F Building Removal Action, USDOE Hanford Site, Richland, WA" (EPA 1997)	Jan-97	NTCRA	Identifies D4 with ERDF disposal for facilities in 100-B and 100-F Areas: 111-B, 115-B, 118-C-4, 119-B, 105-C reactor waste, and 108-F building. The B Reactor and ISS of 105-C Reactor are not included in the AM. This action is considered final for ancillary facilities and demolished portions of the reactor. Additional decisions are expected on the reactor core that is in ISS.
"Action Memorandum: Removal Action at the 233-S Plutonium Concentration Facility, USDOE Hanford Site, Benton County, WA" (DOE and EPA 1997)	Mar-97	NTCRA	Identifies D&D as the preferred alternative for 233-S and 233-SA buildings, including subsurface systems and structures to a depth of 3 ft (further actions beyond the 3-ft depth would be deferred to the associated source OU). Waste meeting the criteria would be disposed of at ERDF; other waste would be disposed of as appropriate.
"Action Memorandum, USDOE Hanford 100 Area NPL, 100-IU-3 Operable Unit (Wahluke Slope), Hanford Site, Adams, Grant, and Franklin Counties, WA" (Ecology and DOE, 1997)	Jul-97	TCRA	Addresses contaminated soils/drums at the 2,4-D burial ground in 100-IU-3 OU. Removal action includes excavating dioxin-contaminated soil for offsite disposal; bioremediation of 2,4-D contaminated soil; and excavating, cleaning, and disposing of drums at ERDF. In the 1994 AM for Wahluke Slope, only 2,4-D burial ground was identified for sampling. Subsequently, additional contamination was found, prompting another AM. Completing this AM action allows continuation of the process of deleting the OU from the NPL.

Table A-2. CERCLA Action Memoranda. (7 pages)

Title	Date	Action	Removal Action/Decision
"Action Memorandum: USDOE Hanford 100 Area National Priorities List, 105-F and 105-DR Reactor Buildings and Ancillary Facilities, Hanford Site, Benton County, WA" (CCN 059689)	Jul-98	NTCRA	Identifies ISS for 105-F and 105-DR reactor cores and D&D for reactor components up to the cores and for 116-D, 116-DR, 117-DR, and 119-DR ancillary facilities. Demolition will extend generally to 3 ft bgs; however, substructures and/or soil beneath the facilities that exceed cleanup levels will be excavated. This action is considered final for the ancillary facilities and demolished portions of reactors. Additional decisions are expected on the reactor cores in ISS.
"Action Memorandum: USDOE Hanford 100 Area National Priorities List, 100-N Area Ancillary Facilities; Hanford Site, Benton County, WA" (DOE et al. 1998)	Dec-98	NTCRA	Provides for D&D of the inactive contaminated ancillary facilities in 100-N Area, facilities in the buffer zone, Hanford Generating Plant, and solid waste management units inside Hanford Generating Plant support facilities (D&D of 105-N and 109-N are excluded from the AM). Contaminated soils under the facilities would be addressed through 100-N Area decision documents for waste sites.
"Action Memorandum: USDOE, Hanford 300 Area National Priorities List (NPL), 331-A Virology Laboratory Building, Hanford Site, Benton County, WA" (DOE and EPA 2000)	Feb-00	NTCRA	Per the AM, the walls and floors of the 331-A building would be demolished and the concrete slab would be scraped to remove physical hazards; wastes would be disposed of at ERDF. The concrete slab and underlying soils would remain in place.
"Action Memorandum: USDOE Hanford 100 Area National Priorities List (NPL); 105-D and 105-H Reactor Facilities and Ancillary Facilities; Hanford Site; Benton County, WA" (DOE and Ecology 2000)	Dec-00	NTCRA	Identifies D&D for a portion of the 105-D and 105-H Reactor facilities and D&D for the 103-D unirradiated fuel element storage building, the 190-DR process water pumphouse, the 1713-H warehouse, and the 1720-HA arsenal. Subsurface structures and contaminated soil would be characterized and evaluated at the time of D&D. Soils and subsurface structures that exceed cleanup levels would be excavated with waste disposal primarily at ERDF and those meeting cleanup levels would be left in place and covered with 1 m of clean fill. The reactor cores would be placed in ISS for up to 75 years. This action is considered final for the ancillary facilities and demolished portions of the reactors. Additional decisions are expected on the reactors cores in ISS.
"Action Memorandum; USDOE, Hanford 100 Area National Priorities List, 105-B Reactor Facility, Hanford Site, Benton County, WA" (DOE and EPA 2001)	Dec-01	NTCRA	Identifies appropriate actions at B Reactor to mitigate the threat to site workers, public health or welfare or the environment by removing hazardous substances from the facility; these actions are consistent with increased public access to the reactor building; surveillance and maintenance activities would continue. Any wastes generated during the mitigation activities would be disposed at ERDF.
"Action Memorandum; 200 West Area, Central Waste Complex, 183-H Solar Evaporation Basin Waste, Hanford Site, Benton County, WA" (DOE et al. 2003)	Jun-03	NTCRA	Allows for the treatment and disposal to ERDF of wastes generated during the RCRA closure of 183-H basin.

Table A-2. CERCLA Action Memoranda. (7 pages)

Title	Date	Action	Removal Action/Decision
"Action Memorandum; USDOE, 200 Area, Burial Ground 218-W-4C Waste Retrieval, Hanford Site, Benton County, WA" (DOE et al. 2004)	Apr-04	TCRA	Provides for the treatment and disposal of low-level and mixed low-level waste at ERDF from the M-091 TRU retrieval activities at the 218-W-4C burial ground. TRU is excluded from the AM.
"Action Memorandum: Request for Time Critical Response for Treatment and Disposal of Sludge from the 105-K East North Loadout Pit, USDOE Hanford Site" (DOE and EPA 2004)	Jun-04	TCRA	Requires treatment of 105-K East North Loadout Pit waste prior to temporary storage at Hanford and ultimate disposal at WIPP.
"Action Memorandum for the Non-Time-Critical Removal Action for the 224-B Plutonium Concentration Facility" (DOE/RL-2004-36)	Jun-04	NTCRA	Provides for removing nonradiological and radiological hazardous substances from the 224-B facility, removing equipment and associated piping, decontaminating structure and stabilizing contamination, demolishing structure to slab, disposing of waste generated, and stabilizing area. Samples will be used to determine the need for additional cleanup of the remaining slab and any subsurface soils. These cleanup actions are not included in the AM, but deferred to future activities.
"Comprehensive Environmental Response, Compensation and Liability Act Non-Time-Critical Removal Action Memorandum for Removal of the 232-Z Contaminated Waste Recovery Process Facility from the Plutonium Finishing Plant" (CCN 0093881)	Nov-04	NTCRA	Provides for the remaining contaminated equipment to be removed and the building decontaminated, stabilized, and dismantled leaving the building slab, which will be addressed under a future CERCLA action.
"Action Memorandum for the Non-Time-Critical Removal Action for the U Plant Ancillary Facilities" (DOE/RL-2004-67)	Dec-04	NTCRA	Provides for removing nonradiological and radiological hazardous substances from U Plant ancillary facilities, removing equipment/associated piping, decontaminating structures and stabilizing contamination, demolishing structures to slab, disposing the waste generated, and stabilizing the area around U Plant. The AM includes the specific facilities. Slabs and underlying soils will be addressed as needed through future CERCLA actions.
"Action Memorandum #1 for the 300 Area Facilities" (DOE and EPA 2005a)	Jan-05	NTCRA	Provides for D4 of 72 buildings/structures in the northern part of the 300 Area, disposing D4 waste at ERDF. An additional 10 buildings/structures were included in the EE/CA that supports the AM; however, those buildings/structures were demolished and had no hazardous materials prior to the AM.
"Action Memorandum; USDOE, 100 Area, 105-N Reactor Facility and 109-N Heat Exchanger Building, Hanford Site, Benton County, WA" (DOE and Ecology 2005)	Mar-05	NTCRA	Provides for D&D of portions of 105-N and 109-N facilities and constructing a protective cover over the 105-N Reactor block, 109-N steam generator cells and pipe gallery, placing them into ISS, and waste generally disposed of at ERDF. Final D&D of these facilities would be done in the future to allow decay of radionuclides in the reactor block. Identifies ISS as 64 years. This action is considered final for demolished portions of the reactor and heat exchange building. Additional decisions are expected on the reactor core and buildings in ISS.

Table A-2. CERCLA Action Memoranda. (7 pages)

Title	Date	Action	Removal Action/Decision
"Action Memorandum for the Plutonium Finishing Plant, Above-Grade Structures Non-Time-Critical Removal Action" (DOE/RL-2005-13)	May-05	NTCRA	Provides for removing nonradiological and radiological hazardous substances from PFP above-grade structures, removing equipment/associated piping, decontaminating structures and stabilizing contamination, demolishing structures to slab, disposing the waste generated, and stabilizing and covering the area around PFP. Lists the specific structures. Slabs and underlying soils would be addressed as needed through future CERCLA actions.
"Action Memorandum for the Non-Time-Critical Removal Action for the 100-K Area Ancillary Facilities" (DOE and EPA 2005b)	Jun-05	NTCRA	Provides for D4 of 27 buildings/structures in northern part of 100-K Area with D4 waste going to ERDF. In general, slabs and subsurface structures would be removed with about 1 m of surrounding soil; however, on a case-by-case basis, the slabs, below-grade structures and soils can be deferred to CERCLA actions associated with 100-KR-1 and 100-KR-2 source OUs.
"Action Memorandum for the Non-Time-Critical Removal Action for the 224-T Plutonium Concentration Facility" (DOE/RL-2004-68)	Jun-05	NTCRA	Provides for removing nonradiological and radiological hazardous substances from the 224-T Facility, removing equipment/associated piping, decontaminating structure and stabilizing contamination, demolishing structure to slab, disposing of the waste generated, and stabilizing the area. Samples will determine the need for additional cleanup of the remaining slab and any subsurface soils. These cleanup actions are not included in the AM, but deferred to future activities.
"Action Memorandum for the Time-Critical Removal Action for Support Activities to 200-UW-1 Operable Unit" (DOE/RL-2005-71)	Sep-05	TCRA	Provides activities to support U Plant canyon barrier construction, including removing part of the 200-W-42 pipeline, rerouting Treated Effluent Disposal Facility line and stabilizing/removing wastewater line; complete or partial removal of concrete slab; remove and seal three vent risers; and relocate various markers/utilities. The TCRA accelerated work consistent with weather conditions and to take advantage of available specialized resources. The action is not considered final; the decision process is ongoing for U Plant waste sites. The U Plant barrier ROD is considered final.
"Action Memorandum #2 for the 300 Area Facilities" (DOE and EPA 2006a)	May-06	NTCRA	Provides for D4 of the 324 and 327 buildings and ancillary facilities in the 300 Area with D4 waste going to ERDF. The AM provides a list of the ancillary facilities. In general, slabs and subsurface structures would be removed along with about 1 m of surrounding soil; however, on a case-by-case basis, the slabs and/or below-grade structures and soils can be deferred to CERCLA actions associated with the 300-FF-2 OU.
"Action Memorandum #3 for the 300 Area Facilities" (DOE and EPA 2006b)	Nov-06	NTCRA	Provides for D4 of 110 buildings/structures in southern part of the 300 Area with D4 waste going to ERDF. An additional 30 buildings/structures were included in the EE/CA that supports the AM; however, those buildings/structures are not included in the AM because DOE identified alternative uses for them.
"Action Memorandum for the Non-Time-Critical Removal Action for the 105-KE and 105-KW Reactor Facilities and Ancillary Facilities" (DOE and EPA 2007)	Jan-07	NTCRA	Identifies ISS for 105-KE and 105-KW reactor cores, D&D of reactor components up to the cores and for remaining buildings and structures in 100-K Area. Subsurface structures will be removed 3 ft bgs; substructures and soil beneath facilities that exceed cleanup levels will be evaluated through source OU cleanup activities that are considered final for the ancillary facilities and demolished portions of the reactors. Further decisions are expected on reactor cores in ISS.

Table A-2. CERCLA Action Memoranda. (7 pages)

Title	Date	Action	Removal Action/Decision
"Action Memorandum for the Non-Time-Critical Removal Action for the Northern Part of the BC Controlled Area (UPR-200-E-83) "(DOE/RL-2008-21)	May-08	NTCRA	Provides removal, treatment as needed, and disposal, generally to ERDF, of UPR-200-E-83 Zone A soils to a depth of 6 in., or until PRGs are met, and Zone B soils in areas of elevated radioactivity above PRGs. Excavation activities must consider old growth vegetation, avoiding destruction of existing plant life.
"Action Memorandum for the Non-Time-Critical Removal Action for the 212-N, -P and -R Facilities" (DOE/RL-2008-80)	May-09	NTCRA	Provides for removing nonradiological and radiological hazardous substances from 212-N, -P, and -R facilities equipment and associated piping; decontaminating structures, stabilizing contamination, demolishing basins and underlying soils to 1 m depth, disposing of waste generated, and stabilizing surrounding area. Samples will be collected from underlying soils to evaluate the need for additional cleanup activities.
"Action Memorandum for Non-Time-Critical Removal Action for 11 Waste Sites in 200-MG-1 Operable Unit" (DOE/RL-2009-48)	Jul-09	NTCRA	Provides for cleanup of 11 waste sites in the 100-MG-1 OU using either a confirmatory sampling/no further action alternative (8 sites) or RTD alternative (3 sites). Cleanup levels will be consistent with existing 100 Area cleanup levels. If confirmatory sites do not meet cleanup levels, they will be addressed by the RTD alternative.
"Investigation-Derived Waste Purgewater Management Action Memorandum" (DOE/RL-2009-39)	Aug-09	NTCRA	Provides for additional purge water management capacity by relining an existing unit and installing up to 3 new units, each with leak-detection systems. The purge water management units will be operated according to requirements, monitored during operations, and disassembled and dispositioned to appropriate requirements following the operational period.
"Action Memorandum for Non-Time-Critical Removal Action for 200-MG-2 Operable Unit" (DOE/RL-2009-37)	Oct-09	NTCRA	Provides for cleanup of 34 waste sites in the 200-MG-2 OU using a confirmatory sampling/no further action alternative (16 sites) or an RTD alternative (18 sites). If the confirmatory sites do not meet cleanup levels, they will be addressed by the RTD alternative. The remaining 200-MG-2 OU sites are not included because contamination may extend beyond 15 ft bgs; they will be addressed through the CERCLA remedial process.
"Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit" (DOE/RL-2009-86)	Apr-10	NTCRA	Provides for cleanup of 37 waste sites in 100-MG-1 OU using a confirmatory sampling/no further action alternative (21 sites) or RTD alternative (16 sites). Cleanup levels will be consistent with existing 100 Area cleanup levels. If confirmatory sites do not meet cleanup levels, they will be addressed by the RTD alternative. Remaining 200-MG-1 OU sites are not included because contamination may extend beyond 15 ft bgs; they will be addressed through the CERCLA remedial process.
"Action Memorandum for the Non-Time-Critical Removal Action for the 212-N, 212-P, and 212-R Facilities, Addendum 1: Disposition of Railcars" (DOE/RL-2008-80-ADD1)	Dec-10	NTCRA	Provides for D4 of 16 railcars located in 200 North Area with disposal to ERDF and includes an option to evaluate some of the cars for movement to the B Reactor for preservation. The AM identifies a pathway for addressing contaminated soils either by removal at the time of D4 or transfer to another OU for continued CERCLA action.

Table A-2. CERCLA Action Memoranda. (7 pages)

Title	Date	Action	Removal Action/Decision
"Action Memorandum for Decontamination, Deactivation, Decommissioning, and Demolition (D4) Activities for 200 East Tier 2 Buildings/Structures" (DOE/RL-2010-102)	Feb-11	NTCRA	Established D4 to slab-on-grade for 57 Tier 2 buildings/ structures in 200 East Area; plug or grout below-grade piping and drains; remove equipment; remove and fill below-grade voids; send waste to ERDF or other approved facility for treatment and disposal; characterize nature and extent of remaining hazardous substances for future decisions; initiate waste site evaluation through WIDS for sites that may require further work; stabilize area as needed.
"Action Memorandum for General Hanford Site Decommissioning Activities" (DOE/RL-2010-22)	Jul-13	NTCRA	Establishes D4 for excess industrial buildings/structures and cleanup of various debris; provides for removing contaminated soil or evaluating contaminated soils for inclusion as a waste site through WIDS; identifies ERDF as the preferred location for wastes meeting ERDF disposal criteria; allows the possibility of using certain wastes in other remedial actions, such as fill material under barriers; and for incorporating additional, similar buildings and structures in the AM.
"Action Memorandum for 200-DV-1 Operable Unit Perched Water Pumping / Pore Water Extraction" (DOE/RL-2014-34)	Dec-14	NTCRA	Provides for extraction of perched water from the 200-DV-1 OU (B tank farm complex in the 200 East Area) and transfer of the water by tanker truck or pipeline to the 200 West P&T, where it is treated and injected into the aquifer below the 200 West Area.
"Action Memorandum for 200-BP-5 Operable Unit Groundwater Extraction" (DOE/RL-2016-41)	Nov-16	NTCRA	Provides for extraction of groundwater with elevated uranium and technetium-99 concentrations from the B Complex area of the 200-BP-5 OU, conveyance of the water by pipeline to the 200 West P&T, where it is treated and injected into the aquifer below the 200 West Area.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq.
Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq.

AM	= Action Memorandum.	NTCRA	= non-time-critical removal action.
bgs	= below ground surface.	OU	= operable unit.
CCN	= correspondence control number.	P&T	= pump-and-treat.
CERCLA	= *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*.	PFP	= Plutonium Finishing Plant.
		PRG	= preliminary remediation goal.
D4	= deactivation, decontamination, decommissioning, and demolition.	RCRA	= *Resource Conservation and Recovery Act of 1976*.
		ROD	= record of decision.
D&D	= decontamination and decommissioning.	RTD	= remove, treat, and dispose.
EE/CA	= engineering evaluation/cost analysis.	TCRA	= time critical removal action.
ERA	= expedited response action.	TRU	= transuranic.
ERDF	= Environmental Restoration Disposal Facility.	WIDS	= Waste Information Data System.
ISS	= interim safe storage.	WIPP	= Waste Isolation Pilot Plant.

Table A-3. Permits, Licenses, and Other Statutory/Regulatory Program Decisions Affecting Hanford Site Cleanup. (3 pages)

Document	Summary
Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste (WA7890008967). **FINAL** Ecology issued a Draft Hanford Facility Dangerous Waste Permit, Rev. 9, for public review and comment from May 1, 2012, through October 22, 2012. Until Ecology reaches a final decision, Rev. 8C Permit remains in effect.	This dangerous waste permit for the TSD of dangerous waste at the Hanford Site is the RCRA Permit for the Hanford Facility. The permit allows a step-wise permitting process to ensure the proper implementation of the TPA. To accomplish this, the permit has six parts: • Part I, Standard Conditions • Part II, General Facility Conditions • Part III, Unit-Specific Conditions for Final Status Operations • Part IV, Unit-Specific Conditions for Corrective Action • Part V, Unit-Specific Conditions for Units Undergoing Closure • Part VI, Unit-Specific Conditions for Units in Post-Closure.
Hanford Site Prevention of Significant Deterioration Permit (Permit PSD-X80-14), issued to RL by the EPA, Region 10. **FINAL**	Covers emission of NOx to the atmosphere from the Plutonium Uranium Extraction Plant and the Uranium-Trioxide Plant. No expiration date.
"Record of Decision: Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington" (58 FR 48509) **FINAL**	In December 1992, DOE issued the *Final Environmental Impact Statement on Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, WA* (DOE/EIS-0119F). The final EIS analyzed alternatives for decommissioning 8 water-cooled, graphite-moderated plutonium-production reactors located along the Columbia River. The 8 reactors (B, C, D, DR, F, H, KE and KW) operated between 1944 and 1971 and are retired from service. The alternatives analyzed in the EIS included no action, immediate one-piece removal, safe storage followed by deferred one-piece removal, safe storage followed by deferred dismantlement, and in situ decommissioning alternatives. The ROD was signed September 10, 1993 (58 FR 48509). The ROD documented the DOE decision for safe storage followed by deferred one-piece removal of the 8 surplus reactors. DOE prepared a supplemental analysis to the EIS in July 2010 (*Supplement Analysis, Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington* [DOE/EIS-0119F-SA-01]) to broaden the possible decommissioning approach, retaining the one-piece removal option and including the option for immediate dismantlement. DOE determined that the proposed action is not a substantial change to the alternatives previously analyzed in the EIS so a supplement to DOE/EIS-0119F or new EIS is not needed.
"Record of Decision: Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington" (78 FR 75913) **FINAL**	In December 2013, DOE issued the first in a series of RODs pursuant to the *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* (TC&WM EIS, DOE/EIS–0391, December 2012). In this ROD DOE announced several decisions, including: to implement Tank Closure Alternative 2B, ''Expanded WTP Vitrification and Landfill Closure,'' without supplemental treatment at WTP and without technetium-99 removal in the WTP Pretreatment facility; to implement FFTF Alternative 2 Entombment; and to implement Waste Management Alternative 2.
"Amended Record of Decision for the Management of Cesium and Strontium Capsules at the Hanford Site, Richland, Washington" (83 FR 23270) **FINAL**	This amendment to DOE's ROD for the TC&WM EIS issued in December 2013 announced DOE's decision to move the cesium and strontium capsules from wet storage at the Waste Encapsulation and Storage Facility (WESF) to a new dry storage facility. It does not include any decisions on treatment or final disposition of the capsules.

Table A-3. Permits, Licenses, and Other Statutory/Regulatory Program Decisions Affecting Hanford Site Cleanup. (3 pages)

Document	Summary
Hanford Site Air Operating Permit 00-05-006, Renewal 2, Rev. A **FINAL**	Covers operations on the Hanford Site having a potential to emit airborne emissions. The permit provides a compilation of applicable *Clean Air Act of 1977* (42 USC 7401) requirements for radioactive and nonradioactive emissions at Hanford. It will be implemented through Federal and State programs. Effective May 1, 2014, through March 31, 2018. • Attachment 1 contains Ecology's permit terms and conditions. • Attachment 2 contains the State of Washington Department of Health Radioactive Air Emissions License (FF-01) as permit terms and conditions. • Attachment 3 contains the Benton Clean Air Agency permit terms and conditions applicable to the regulations of open burning and asbestos.
Permit WA-002591-7, *Clean Water Act of 1977 – National Pollutant Discharge Elimination System Permit* **FINAL**	Authorizes discharge of water from 100 Area facilities to the Columbia River from Outfall 004 in accordance with discharge point, effluent limitations, monitoring requirements and other conditions. Effective December 1, 2009 through July 31, 2014.
Permit WAR10B90F, *Clean Water Act of 1977 – National Pollutant Discharge Elimination System General Permit* **FINAL**	Authorizes storm water discharges associated with construction activities from the Hanford Site to the Columbia River in accordance with a Storm Water Pollution Prevention Plan. No expiration date is specified; the estimated project completion date identified in the most recent Notice of Intent is May 27, 2014.
Permit CR-IU005, *City of Richland Industrial Wastewater Discharge Permit* **FINAL**	Allows wastewater from the Environmental Molecular Sciences Laboratory to be discharged to the city of Richland's wastewater treatment facility.
Permit ST-0004500, Washington State Department of Ecology – State Wastewater Permit **FINAL**	Allows treated wastewater from the Effluent Treatment Facility to be discharged to the State-Approved Land Disposal Site. Effective January 1, 2015 through December 31, 2019.
Permit ST-0004502, Washington State Department of Ecology – State Wastewater Permit **FINAL**	Allows treated effluent from the 200 East and 200 West Areas to be discharged to the 200 Area Treated Effluent Disposal Facility. This permit revised and replaced Permit ST-4502 and will remain in effect from July 1, 2012 to June 30, 2017.
Permit ST-0004511, Washington State Department of Ecology – State Wastewater Permit **FINAL**	This Categorical State Waste Discharge Permit authorizes the discharge of wastewater from maintenance, construction, and hydrotesting activities and allows for cooling water, condensate, and industrial storm water discharges at the Hanford Site. Effective January 1, 2014 through December 31, 2019.
Permit ST0045514, Washington State Department of Ecology – State Wastewater Permit **FINAL**	Allows domestic wastewater to be treated in a non-discharging, lined evaporative lagoon located northeast of the 200 West Area. Effective July 1, 2012 through June 30, 2017.
Permit WAG-50-5180, Washington State Department of Ecology – State Sand and Gravel General Permit **FINAL**	Permit for wastewater discharges associated with handling sand and gravel for the Concrete Batch Plant in the 200 East Area. Effective October 1, 2010 through October 1, 2015.
Permit WAG-50-5181, Washington State Department of Ecology – State Sand and Gravel General Permit **FINAL**	Permit for wastewater discharges associated with Pit 30 Quarry operations in the 200 East Area. Effective October 1, 2010 through October 1, 2015.

Table A-3. Permits, Licenses, and Other Statutory/Regulatory Program Decisions Affecting Hanford Site Cleanup. (3 pages)

Document	Summary
Large Onsite Sewage Systems (LOSS) "Permit to Operate" HAN099 **FINAL**	Lists systems in the various areas.
Underground Injection Control (UIC) Wells	Hanford has a number of UIC wells – storm water, non-storm water and septic systems. The Mission Support Contractor maintains the inventory and locations of active and inactive wells.

Table A-4. Tri-Party Agreement Decisions Affecting Hanford Cleanup.

TPA Documentation	Summary of Decision
• M-045-00 • Appendix I	Closure will follow retrieval of as much tank waste as technically possible, with tank waste residues not to exceed 360 ft^3 in each of the 100-series tanks, 30 ft^3 in each of the 200-series tanks, or the limit of waste retrieval technology capability, whichever is less.

Table A-5. Executive Orders, Statutes and Judicial Decisions Affecting Hanford Site Cleanup. (5 pages)

Executive Orders, Statutes and Judicial Decisions	Summary of Decision
Executive Order 11514, *Protection and Enhancement of Environmental Quality*, as amended by Executive Order 11991	This order requires Federal agencies to continually monitor and control their activities to protect and enhance the quality of the environment and develop procedures to ensure the fullest practicable provision of timely public information and understanding of Federal plans and programs that may have potential environmental impacts so that interested parties can submit their views. DOE issued regulations 10 CFR 1021, "National Environmental Policy Act Implementing Procedures" and DOE O 451.1B, *National Environmental Policy Act Compliance Program*, for compliance with this order.
Executive Order 12088, *Federal Compliance with Pollution Control Standards*	This order directs Federal agencies to comply with applicable administrative and procedural pollution control standards established by, but not limited to *Clean Air Act of 1977* (42 USC 7401); *Noise Control Act of 1972* (42 USC 4901); *Clean Water Act of 1977* (33 USC 1251); *Safe Drinking Water Act of 1974* (42 USC 300); *Toxic Substances Control Act of 1976* (15 USC 2601); and RCRA (42 USC 6901).
Executive Order 12580, *Superfund Implementation*	This order delegates a number of Federal departments and agencies, including the Department of Energy, the authority and responsibility to implement certain provisions of CERCLA as lead agency under the National Contingency Plan. Policies and procedures for implementing these responsibilities (e.g., response actions and fulfilling natural resource trusteeship responsibilities) are provided in the National Contingency Plan.
Federal Facilities Compliance Act of 1992. **FINAL**	This act amended RCRA, Section 6961, and other sections and requires DOE to prepare plans that develop treatment capacity for mixed waste stored or generated at each facility, except for those facilities subject to a permit that establishes a schedule for treatment of such waste or an existing agreement or order governing the treatment of such waste to which the State is a party. The host state and/or EPA must approve each plan. Washington State, EPA, and DOE had the TPA, which addressed compliance with the storage prohibition for mixed waste at the time this law was enacted and was not required to develop a new plan.

Table A-5. Executive Orders, Statutes and Judicial Decisions Affecting Hanford Site Cleanup.
(5 pages)

Executive Orders, Statutes and Judicial Decisions	Summary of Decision
Nuclear Waste Policy Act of 1982 (42 USC 10101). **FINAL**	This act directed DOE to characterize and evaluate the Yucca Mountain site for suitability as a potential repository for disposal of commercial SNF and HLW. The act directed the President to evaluate the need for a separate repository for HLW resulting from atomic energy defense activities. On April 30, 1985, President Reagan completed this evaluation. The result was that HLW from atomic energy defense activities may be disposed of in the proposed repository along with SNF. After passage by the U.S. House of Representatives and U.S. Senate, on July 23, 2002, President Bush signed House Joint Resolution 87 approving the site at Yucca Mountain for developing a repository for disposal of HLW and SNF, pursuant to the *Nuclear Waste Policy Act of 1982*. As indicated in the Obama administration's FY2010 budget request, the administration intended to terminate the Yucca Mountain program while developing nuclear waste disposal alternatives. Notwithstanding the decision to terminate the Yucca Mountain program, DOE remains committed to meeting its obligations to manage and dispose of HLW and SNF. The Obama administration directed establishing the Blue Ribbon Commission on America's Nuclear Future (Commission) to evaluate alternative approaches for meeting these obligations. The Commission submitted its final report to the Secretary of Energy in January 2012. The Commission did not evaluate Yucca Mountain or any other location and recommended an 8-element waste management approach to resolve the current impasse: • A new consent-based approach to siting future nuclear waste management facilities. • A new organization dedicated solely to implementing the waste management program and empowered with the authority and resources to succeed. • Access to the funds nuclear utility ratepayers are providing for the purpose of nuclear waste management. • Prompt efforts to develop one or more geologic disposal facilities. • Prompt efforts to develop one or more consolidated storage facilities. • Prompt efforts to prepare for eventual large-scale transport of SNF and HLW to consolidated storage/disposal facilities when such facilities become available. • Support continued U.S. innovation in nuclear energy technology and workforce development. • Active U.S. leadership in international efforts to address safety, waste management, non-proliferation, and security concerns. In January 2013, DOE responded to the Blue Ribbon Commission's final report in the *Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste* (DOE 2013). This policy document proposes a framework for moving toward a sustainable program to deploy an integrated system capable of transporting, storing, and disposing of SNF and HLW from civilian nuclear power generation, defense, national security, and other activities. The Strategy endorses a waste management system containing a pilot interim storage facility by 2021 with an initial focus on accepting used nuclear fuel from shut-down reactor sites; a larger, full-scale interim storage facility by 2025 that will have sufficient capacity to provide flexibility in the waste management system and allows for acceptance of enough used nuclear fuel to reduce expected government liabilities; and the siting and characterization of repository sites to facilitate the availability of a geologic repository by 2048.

Table A-5. Executive Orders, Statutes and Judicial Decisions Affecting Hanford Site Cleanup.
(5 pages)

Executive Orders, Statutes and Judicial Decisions	Summary of Decision
U.S. Department of Interior Announcement, National Historic Landmark, August 19, 2008_.	Hanford's B Reactor was designated a National Historic Landmark by the U.S. Department of Interior. Since then, efforts have continued to include B Reactor in a new National Historical Park.
Carl Levin and Howard P. "Buck" McKeon National Defense Authorization Act for Fiscal Year 2015, Public Law 113-291.	President Obama signed the 2015 National Defense Authorization Act into law on December 19, 2014, authorizing the Manhattan Project National Historical Park. B Reactor as the world's first production reactor is a signature facility of the Manhattan Project National Historical Park.
Waste Isolation Pilot Plant Land Withdrawal Act (Public Law 102-579). **FINAL**	The act withdrew land from the public domain for purposes of creating and operating WIPP, the geologic repository in New Mexico designated as the national disposal site for defense TRU waste. In addition to establishing the location for the facility, the WIPP Land Withdrawal Act defines the characteristics and amount of waste that will be disposed of at the facility. Amendments to the WIPP Land Withdrawal Act exempt waste designated by the Secretary of Energy for disposal at WIPP from the RCRA land disposal restrictions. However, these amendments do not exempt mixed TRU waste from other RCRA requirements. WIPP does have a RCRA permit and can accept mixed TRU waste. On May 15, 2003, EPA Region 6 approved DOE's request to dispose of TRU and mixed TRU waste containing PCBs at WIPP subject to certain "conditions of approval."
Spent Fuel Settlement Agreement (No. CV-91-0035-S-EJL and No. CV-91-0054-S-EJL), October 17, 1995	This agreement allows INL to receive SNF and mixed waste from offsite and establishes schedules for the treatment of existing HLW, TRU waste, mixed waste, and removal of SNF from the State.
Consent Decree for Stabilization of SSTs at Hanford Site between U.S. Department of Energy and Washington State Department of Ecology (No. CT-99-5076-EFS) September 29, 1999. **FINAL**	This consent decree established a court-enforceable, technically sound schedule for pumping liquid nuclear waste from the remaining 29 unstabilized SSTs. The following were the key elements of the consent decree: • Pumping the tanks that pose the greatest environmental risk first, thus providing additional protection for the Columbia River and public health. • Accelerating the schedule for pumping so that 98% of approximately 6.2 million gallons of remaining pumpable liquid is removed by September 30, 2003, with the final 2% scheduled to be removed by September 30, 2004 (this was completed). • Increasing DOE funding to a level that supports successful execution of the new schedule for tank stabilization. • Work under the consent decree has been completed and the court has terminated the consent decree.
Presidential Proclamation 7319, *Establishment of the Hanford Reach National Monument* (June 9, 2000). **FINAL**	This proclamation set apart and reserved the Hanford Reach National Monument to protect all lands and interests in lands owned or controlled by the U.S. Government within the boundaries of the monument area. The lands reserved consist of approximately 195,000 acres, and are appropriated and withdrawn from all forms of entry, location, selection, sale, or leasing or other disposition under the public land laws. The monument is to be managed by the U.S. Fish and Wildlife Service under existing agreements with DOE. DOE retains its responsibilities under applicable environmental laws, including the remediation of hazardous substances or the restoration of natural resources at the Hanford Site.

Table A-5. Executive Orders, Statutes and Judicial Decisions Affecting Hanford Site Cleanup.
(5 pages)

Executive Orders, Statutes and Judicial Decisions	Summary of Decision
Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments* (November 6, 2000). **FINAL**	This order supplements "Government-to-Government Relations with Native American Tribal Governments" (59 FR 22951), and states that each executive department and agency shall consult, to the greatest extent practicable and to the extent permitted by law, with Tribal Nations prior to taking actions that affect Federally recognized tribal governments. This order also states that each executive department and agency shall assess the impact of Federal government plans, projects, programs, and activities on tribal trust resources and ensure that tribal government rights and concerns are considered during the development of such plans, projects, programs, and activities.
Memorandum of Agreement Between the U.S. Department of the Interior and the U.S. Department of Energy for the Manhattan Project National Historical Park (November 10, 2015) (DOI and DOE 2015)	The Memorandum of Agreement defines the roles and responsibilities of the two agencies in managing the Manhattan Project National Historical Park which includes facilities at all three of the original Manhattan Project locations – Oak Ridge, Tennessee; Los Alamos, New Mexico; and the Hanford Site. At the Hanford Site, the B Reactor National Historic Landmark, the Bruggemann Warehouse, the 1908 Hanford Irrigation District Pump House, the White Bluffs Bank, and the Hanford High School from the Town of Hanford and Hanford Construction Camp historic district are included in the Park.
Consent Decree in *State of Washington v. Department of Energy*, Case No. CV-08-5085-FVS (E.D. Wa. October 25, 2010)	The Consent Decree imposes milestones for the construction and initial operation of the WTP, as well as retrieval of waste from certain SSTs. The Consent Decree also covers reporting requirements for waste retrievals from SSTs, regulatory coordination, and a process to resolve disputes between the agencies.
Amended Consent Decree Between Department of Energy and State of Washington, Case No. 2:08-CV-5085-RMP (E.D. Wa. March 11, 2016)	The Amended Consent Decree generally continued the existing milestones from the 2010 Consent Decree but extended the milestone dates and added additional reporting requirements. One new milestone of note is B-3, which requires DOE retrieve at least 5 of the Consent Decree SSTs by December 31, 2020.
Second Amended Consent Decree Between Department of Energy and State of Washington, Case No. 2:08-CV-5085-RMP (E.D. Wa. April 12, 2016)	Parties agreed-to modifications of the Amended Consent Decree concerning the purchase and availability of a spare reboiler for the 242-A Evaporator, and associated reporting requirements.
Third Amended Consent Decree Between Department of Energy and State of Washington, Case No. 2:08-CV-5085-RMP (E.D. Wa. Oct. 12, 2018)	The court extended the B-2 and B-3 tank retrieval milestones. The B-2 milestone was extended by two-and-a-half years (i.e., from March 31, 2024, to September 30, 2026), and the B-3 milestone was extended by six months (i.e., from December 31, 2020, to June 30, 2021).

Table A-5. Executive Orders, Statutes and Judicial Decisions Affecting Hanford Site Cleanup.
(5 pages)

Executive Orders, Statutes and Judicial Decisions	Summary of Decision
Settlement Agreement between the State of Washington and the U.S. Department of Energy (No. 2:03CV-05018-AAM January 6, 2006). **FINAL**	Prior to the issuance of the *Final Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement, Richland, Washington* (HSW EIS) (DOE/EIS-0286F) and record of decision (69 FR 39449, "Record of Decision for the Solid Waste Program, Hanford Site, Richland, WA: Storage and Treatment of Low-Level Waste and Mixed Low-Level Waste; Disposal of Low-Level Waste and Mixed Low-Level Waste, and Storage, Processing, and Certification of Transuranic Waste for Shipment to the Waste Isolation Pilot Plant"), the State initiated litigation on issues related to the importation, treatment, and disposal of radioactive and hazardous waste generated off the Hanford Site as a result of nuclear defense and research activities. The court enjoined shipment of offsite TRU waste to Hanford for processing and storage pending shipment to WIPP located near Carlsbad, New Mexico. DOE, Washington State, and the U.S. Department of Justice signed a Settlement Agreement ending the litigation on January 6, 2006. The agreement is intended to resolve the State's concerns about HSW EIS (DOE/EIS-0286F) groundwater and other analyses. The agreement specifies that when the *Draft Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington* (DOE/EIS-0391) is complete, it will supersede the HSW EIS. Until that time, DOE will not rely on HSW EIS groundwater analyses for decision-making and will not import offsite waste to Hanford with certain limited exemptions as specified in the agreement. The Tank Closure –Waste Management Environmental Impact Statement is now complete. DOE continues to prohibit the importation of waste from off the Hanford Site at least until the Waste Treatment Plant is operating.

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980.*
DOE = U.S. Department of Energy.
DST = double-shell tank.
EPA = U.S. Environmental Protection Agency.
HLW = high-level waste.
HSW EIS = *Final Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement, Richland, Washington.*
INL = Idaho National Laboratory.
PCB = polychlorinated biphenyl.
RCRA = *Resource Conservation and Recovery Act of 1976.*
SNF = spent nuclear fuel.
SST = single-shell tank.
TPA = Tri-Party Agreement.
TRU = transuranic.
WIPP = Waste Isolation Pilot Plant.
WTP = Waste Treatment Plant.

A.4 REFERENCES

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Superfund Amendments and Reauthorization Act of 1986, 42 USC 103, et seq.

Toxic Substances Control Act of 1976, 15 USC 2601, et seq.

Third Amended Consent Decree, *State of Washington v. Department of Energy*, Case No. 2:08-CV-5085-RMP (E.D. Wa. October 12, 2018)

WA-0025910-7, 2009, *Clean Water Act of 1977 – National Pollutant Discharge Elimination System Permit*, Washington State Department of Ecology, Richland, Washington.

WA7890008967, 2013, *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste*, Washington State Department of Ecology, Nuclear Waste Program, Richland, Washington, September 30.

WAG-50-5180,

WAG-50-5181,

WAR10B90F, 2014, Clean Water Act of 1977 – National Pollutant Discharge Elimination System General Permit, Washington State Department of Ecology, Richland, Washington.

Waste Isolation Pilot Plant Land Withdrawal Act, 1992, Public Law 102-579, October 30, 106 Stat.4777.

APPENDIX B

FUTURE CLEANUP ACTIONS AND ALTERNATIVE ANALYSES

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TABLES

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TERMS

2013 LCR	DOE/RL-2012-13, *2013 Hanford Lifecycle Scope, Schedule and Cost Report*
ABAR	aggregate barrier
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CSNA	confirmatory sampling to support no further cleanup action
D&D	decontamination and decommissioning
D4	deactivation, decontamination, decommissioning, and demolition
DOE	U.S. Department of Energy
DST	double-shell tank
DWMU	dangerous waste management unit
Ecology	Washington State Department of Ecology
EE/CA	engineering evaluation/cost analysis
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ESD	explanation of significant differences
ETF	Effluent Treatment Facility
FBSR	fluidized bed steam reforming
FFTF	Fast Flux Test Facility
FY	fiscal year
HLW	high-level waste
IBAR	individual barrier
IC	institutional controls
IDF	Integrated Disposal Facility
IHLW	immobilized high-level waste
ILAW	immobilized low-activity waste
INL	Idaho National Laboratory
ISS	interim safe storage
LAW	low-activity waste
LCR	Lifecycle Report
LERF	Liquid Effluent Retention Facility
LTS	long-term stewardship
MESC	maintain existing soil cover
MNA	monitored natural attenuation
N/A	not applicable
NEPA	*National Environmental Policy Act of 1969*
NRDWL	Nonradioactive Dangerous Waste Landfill
OU	operable unit
P&T	pump-and-treat
PFP	Plutonium Finishing Plant
PNNL	Pacific Northwest National Laboratory
PUREX	Plutonium Uranium Extraction (Plant)
PRB	permeable reactive barrier
RAO	remedial action objective
RCRA	*Resource Conservation and Recovery Act of 1976*
REDOX	Reduction-Oxidation Facility (S Plant)
RI/FS	remedial investigation/feasibility study
ROD	record of decision
RTD	remove, treat, and dispose
SALDS	State-Approved Land Disposal Site

S&M	surveillance and maintenance
SSE	safe storage enclosure
SST	single-shell tank
STAD	standardized transportation, aging, and disposal (canister system)
SWL	solid waste landfill
TBD	to be determined
TC&WM EIS	*Tank Closure and Waste Management Environmental Impact Statement*
TI	technical impracticability
TPA	Tri-Party Agreement
TPH-D	total petroleum hydrocarbon-diesel
Tri-Party Agencies	U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington State Department of Ecology
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRU	transuranic
TSD	treatment, storage, and disposal
WAC	*Washington Administrative Code*
WESF	Waste Encapsulation and Storage Facility
WRAP	Waste Receiving and Processing Plant
WTP	Waste Treatment and Immobilization Plant

APPENDIX B

FUTURE CLEANUP ACTIONS AND ALTERNATIVE ANALYSES

In accordance with the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989), commonly referred to as the Tri-Party Agreement (TPA) Milestone M-036-01 requires that where final cleanup decisions have not yet been made, the *Hanford Lifecycle Scope, Schedule and Cost Report* (Lifecycle Report [LCR]) may consider ranges of alternatives and present a reasonable upper bound:

> *"In circumstances where final cleanup decisions have not yet been made, the report shall be based upon the reasonable upper bound of the range of plausible alternatives or may set forth a range of alternative costs including such a reasonable upper bound."*

The TPA milestone specifies that when making assumptions (e.g., about alternative cleanup actions), the U.S. Department of Energy (DOE) is to take into account the views of the U.S. Environmental Protection Agency (EPA) and Washington State Department of Ecology (Ecology), as well as the values expressed by affected Tribal Governments and Hanford stakeholders.

Cleanup decisions are made so that DOE can implement future cleanup actions at the Hanford Site. As discussed in Section B.1, the LCR has grouped remaining Hanford Site cleanup work into approximately 33 separate cleanup actions.

Because final cleanup decisions have not yet been made for many of the remaining Hanford cleanup actions, the LCR may consider the range of plausible alternatives (or alternative costs) and present a reasonable upper bound. DOE has decided that information about the range of plausible alternatives, rather than just a range of alternative costs, would be most useful for the LCR. DOE also believes that, in most cases, cost estimates include allowances for uncertainties in current planning that encompass a wide range of potential alternatives. Section B.2 includes information about the range of plausible alternatives for each future cleanup action.

Because many final decisions remain to be made, a reasonable upper bound will need to be defined, along with schedule and costs, for a number of remaining cleanup actions. To give each action a sufficient level of analysis and detail, DOE has decided to take a methodical and planned approach to developing in-depth analyses of cleanup action alternatives, including definition of reasonable upper bound schedules and costs.

Section B.3 proposes a rationale and schedule for when different cleanup actions may undergo in-depth alternatives analyses in the LCR.

Information provided in this appendix has been developed for the sole purpose of preparing the LCR and fulfilling the requirements of TPA M-036-01; the LCR is not a decision-making document. Cleanup actions and decisions discussed in this appendix are still undergoing formal development, review, and eventual approval pursuant to procedures established in the TPA and applicable Federal and State requirements. Information in this appendix does not presume nor is it intended to prejudice the outcome of the requirements that must be followed by the Tri-Party agencies (DOE, Ecology, and EPA). Any errors or discrepancies in this appendix will be superseded by the results of the legally applicable decision-making processes.

B.1 IDENTIFYING FUTURE CLEANUP ACTIONS FOR THE HANFORD SITE

The term "cleanup action" is used to conceptually describe work that enables cleanup to proceed for common or related contaminants that occur in a relatively well-defined environmental medium (or waste management system) within a generally contiguous geographic area.

This cleanup action concept is consistent with the operable unit (OU) cleanup approach taken in the TPA and enables future cleanup actions and alternatives to be addressed in a manner consistent with the way cleanup decisions are being made for Hanford. This approach also provides a reasonable middle ground for looking at cleanup work performed on Site.

The Tri-Party agencies developed a set of cleanup actions for the LCR. Table B-1 lists the future cleanup actions for which final cleanup decisions do not yet exist.

Table B-1. Future Cleanup Actions for which Final Decisions Have Not Been Made.

River Corridor Cleanup Actions
• Disposition N Reactor
• Disposition 100 Area K West Basin
• Remediate 100 Area Contaminated Soil Sites
• Restore 100-BC-5 Groundwater OU to Beneficial Use
• Restore 100-KR-4 Groundwater OU to Beneficial Use
• Restore 100-NR-2 Groundwater OU to Beneficial Use
• Disposition 300 Area Facilities Retained by Pacific Northwest National Laboratory
• Disposition 100 Area former Orchard Contaminated Soil Sites (100-OL-1 OU)
Central Plateau Cleanup Actions
• Disposition Remaining Outer Area Buildings and Facilities (200-OA-1 OU)
• Remediate Remaining Outer Area Contaminated Soil Sites (200-OA-1, 200-CW-1, and 200-CW-3 OUs)
• Disposition Below-Grade Portions of Plutonium Finishing Plant
• Disposition B Plant Canyon Building/Associated Waste Sites (200-CB-1 OU)
• Disposition PUREX Canyon Building/Associated Waste Sites (200-CP-1 OU)
• Disposition PUREX Storage Tunnels (200-CP-1 OU)
• Disposition REDOX Canyon Building/Associated Waste Sites (200-CR-1 OU)
• Disposition T Plant Canyon Building/Associated Waste Sites
• Disposition Cesium/Strontium Capsules
• Remediate Solid Waste Landfill and Non-Radioactive Dangerous Waste Landfill (200-SW-1 OU)
• Disposition Remaining Liquid Waste Disposal Facilities
• Disposition Remaining Waste Treatment, Storage, and Disposal Facilities
• Remediate Pipelines, Pits, Diversion Boxes and Associated Tanks (200-IS-1 OU)
• Remediate Land Disposal Units (200-SW-2 OU)
• Remediate Remaining 200 West Inner Area Contaminated Soil Sites (200-WA-1 OU)
• Remediate Remaining 200 East Inner Area Contaminated Soil Sites (200-EA-1 OU)
• Disposition Remaining Inner Area Buildings and Facilities
• Remediate Contaminated Deep Vadose Zone (200-DV-1 OU)
• Restore 200 West Groundwater to Beneficial Use (200-UP-1 OU)
• Restore 200 East Groundwater to Beneficial Use (200-PO-1 and 200-BP-5 OUs)
Tank Waste Cleanup Actions
• Tank Retrieval and Single-Shell Tank Farm Closure
• Tank Waste Treatment
• Secondary Waste Treatment
• Double-Shell Tank Closure
• Waste Treatment and Immobilization Plant Closure
OU = operable unit. REDOX = Reduction-Oxidation Facility (S Plant). PUREX = Plutonium Uranium Extraction (Plant).

Cleanup work at Hanford can be complex and extend over long periods. Frequently, interim decisions are made and incremental cleanup steps are taken, followed by improved decisions as more is learned and other, better alternatives become available. Even relatively simple cleanup actions can encompass many sequenced activities and a substantial amount of work lasting several years. Thus, many of the cleanup actions discussed in the LCR will evolve over time and may have a different scope in future reports as progress is made in completing Hanford cleanup.

B.2 IDENTIFYING RANGES OF PLAUSIBLE ALTERNATIVES AND ANALYZING ALTERNATIVES FOR FUTURE CLEANUP ACTIONS

The LCR provides information about ranges of plausible alternatives for future cleanup actions. Alternatives are included based on current understandings among the Tri-Party agencies, the status of existing and forthcoming cleanup decisions, and whether current planning adequately encompasses the range of plausible alternatives. The Tri-Party agencies developed and maintain the range of plausible alternatives presented in Section B.2.1.

As discussed further in Section B.2.2, a more in-depth analyses of the alternatives for individual future cleanup actions will be performed to describe a reasonable upper bound for the scope and costs of a specific cleanup action. The Tri-Party agencies have agreed to take a graded approach and to consider analyzing alternatives and develop a reasonable upper bound scope and cost estimate as a sensitivity analysis for a limited set of future cleanup actions in each annual LCR. The main reasons for this approach include the following:

- Developing and analyzing alternatives for every separate cleanup action in every annual edition of the LCR would be resource intensive and inefficient
- Final cleanup decisions are expected soon for a number of cleanup actions, and the decision process will produce thorough and detailed analyses of potential alternatives
- Many interim cleanup actions are under way, the results of which will improve the ability to analyze alternatives in future LCRs.

In lieu of analyzing alternatives for all cleanup actions every year, the LCR proposes a schedule and rationale for when different cleanup actions may be considered to undergo in-depth analyses. Section B.3 provides this information.

B.2.1 Range of Plausible Alternatives

The range of plausible alternatives for each future cleanup action was originally developed through a series of working sessions involving the Tri-Party agencies' subject matter experts applying their knowledge of Hanford Site cleanup work and best professional judgment. Each range of plausible alternatives, in the opinion of the agency experts, has alternatives that include a maximum cleanup effort (e.g., a likely upper bound) for that cleanup action. In addition, the ranges of plausible alternatives exclude alternatives that could not be part of a reasonable upper bound (e.g., no action). Determining the range of plausible alternatives and likely upper bounding cleanup effort took into account, among other factors, current requirements under the TPA and other environmental obligations, and the status of alternatives being considered under existing and forthcoming cleanup decisions. The range of plausible alternatives for each cleanup action was intended to encompass the most current planning assumptions with respect to that cleanup action. The Tri-Party agencies update this list in each LCR.

Tables B-2, B-3, and B-4 list and are organized by the identified future cleanup actions for the River Corridor, Central Plateau, and tank waste. These tables include the following information for each cleanup action:

- A summary of the current cleanup decisions that have been made pursuant to the TPA and other environmental obligations with a list of relevant cleanup decision documents
- A list that encompasses the likely range of plausible alternatives.

Table B-2. Summary of Future Cleanup Actions and Plausible Alternatives – River Corridor. (5 pages)

CLEANUP ACTION:	RC-1a[1] River Corridor – Disposition N Reactor
Cleanup Decision Summary and Relevant Decision Documents In September 1993, DOE issued 58 FR 48509, "Record of Decision: Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, WA," which implements the recommendation for safe storage followed by deferred one-piece removal of the surplus reactors. N Reactor was not included in the EIS because the reactor was not available for decommissioning at the time of the NEPA EIS and ISS was approved through the CERCLA removal action process (DOE and Ecology 2005). Final disposition of N Reactor will be determined by a subsequent NEPA or CERCLA decision process. • DOE and Ecology 2005, "Action Memorandum; United States Department of Energy, 100 Area, 105-N Reactor Facility and 109-N Heat Exchanger Building, Hanford Site, Benton County, Washington," U.S. Department of Energy, Richland Operations Office, and Washington State Department of Ecology, Nuclear Waste Program, Richland, Washington, March 10.	
Range of Plausible Alternatives • Demolish the reactor block in ISS and transport the reactor block intact on a tractor transporter from the present 100 Area location to the 200 West Area for disposal. • Safe storage for a period of up to 75 years of surveillance, monitoring, and maintenance; at the end of the safe storage period, demolition of the reactor block and transport of the reactor block intact on a tractor transporter from the present 100 Area location to the 200 West Area for disposal. • Safe storage for a period of up to 75 years of surveillance, monitoring, and maintenance; at the end of the safe storage period, demolition of the reactor buildings and piece-by-piece dismantlement of the reactor core and transport of radioactive waste to the 200 West Area for burial. Demolition of the reactor buildings and SSE and filling voids beneath and around the reactor block; covering the reactor block, adjacent shield walls, and the spent fuel storage basin together with the contained radioactivity, gravel, and grout to a depth of at least 5 meters with a mound containing earth and gravel.	
CLEANUP ACTION:	**RC-2 River Corridor – Disposition 100 Area K West Basin**
Cleanup Decision Summary and Relevant Decision Documents An interim ROD, ROD amendment, and action memorandum are in place for the removal, treatment, and interim onsite storage of spent nuclear fuel and sludge from the K Basins. • EPA/ROD/R10-99/059, 1999, *Declaration of the Record of Decision for the 100-KR-2 Operable Unit, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. • DOE and EPA, 2004, *Action Memorandum: Request for Time Critical Response for Treatment and Disposal of Sludge from the 105-K East North Loadout Pit, USDOE Hanford Site*, U.S. Department of Energy, Richland Operations Office and U.S. Environmental Protection Agency, Richland, Washington, June 4. • EPA, 2005, *Interim Remedial Action Record of Decision Amendment, Declaration, U.S. Department of Energy, 100 K Area K Basins, Hanford Site - 100 Area, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.	
Range of Plausible Alternatives • Remove, treat, and transfer sludge for interim storage at T Plant; transfer fuel scrap for interim storage at Canister Storage Building; D4 K West Basin and ancillary structures; remediate below-grade portions consistent with 100 Area contaminated soil sites.* *May require removing K Reactors to access below-grade contaminated soils. K East Basin was demolished in 2009.	

Table B-2. Summary of Future Cleanup Actions and Plausible Alternatives – River Corridor. (5 pages)

CLEANUP ACTION:	RC-3 River Corridor – Remediate 100 Area Contaminated Soil Sites

Cleanup Decision Summary and Relevant Decision Documents

Interim RODs, ROD amendments, ESDs, and annual fact sheets (100 Area "Plug-In" and Candidate Waste Sites for fiscal year [FY] 2010) are in place to remove contaminated soil, structures, debris, and burial grounds using the observational and plug-in approaches with onsite disposal at ERDF.

- EPA, 2004, *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- 08-AMRC-0033, *Explanation of Significant Difference for the Interim 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 (100 Area Burial Grounds)*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA, 2009a, *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA, 2011, *Explanation of Significant Differences for the 100-NR-1 and 100-NR-2 Operable Units Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA**,** 2013, *Explanation of Significant Difference for the 100-NR-1 and 100-NR-2 Operable Units Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington,* U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA/ROD/R10-95/126, 1995, *Declaration of the Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA/AMD/R10-97/044, 1997, *Amendment to the Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA/ROD/R10-99/039, 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*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA/ROD/R10-99/112, 1999, *Interim Remedial Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA/ESD/R10-00/045, 2000, *Explanation of Significant Difference for the 100 Area Remaining Sites ROD, USDOE Hanford 100 Area, 100-IU-6 Operable Unit, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA/ROD/R10-00/120, 2000, *Interim Remedial Action Record of Decision for the 100-NR-1 Operable Unit, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA/ESD/R10-03/605, 2003, *Explanation of Significant Difference for the 100-NR-1 Operable Unit Treatment, Storage, and Disposal Interim Action Record of Decision and 100-NR-1/100-NR-2 Operable Unit Interim Action Record of Decision*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA/ROD/R10-00/121, 2000, *Declaration of the Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, 100-KR-2 Operable Units*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- *Resource Conservation and Recovery Act of 1976*, (42 USC 6901), et seq.

Table B-2. Summary of Future Cleanup Actions and Plausible Alternatives – River Corridor. (5 pages)

Range of Plausible Alternatives

- RTD contaminated soil sites to achieve RAOs* and applicable closure performance standards**; backfill, contour, and revegetate excavations.

Note: The 100 Area interim RODs for waste sites will be covered by the final RODs for the River Corridor currently being worked through the RI/FS process.

If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

* In accordance with applicable interim action RODs.

** Closure of several 100-N facilities will be according to approved RCRA closure plans.

CLEANUP ACTION:	RC-4.1 River Corridor – Restore 100-BC-5 Groundwater OU to Beneficial Use

Cleanup Decision Summary and Relevant Decision Documents

Although no cleanup decisions have been made for this OU the initial draft of the Proposed Plan was submitted in November 2016. Groundwater monitoring and annual reporting continue to track groundwater contamination in this OU.

- DOE/RL-2016-43, 2016, *Proposed Plan for Remediation of the 100-BC-1, 100-BC-2, and 100-BC-5 Operable Units*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- WAC 173-340, "Model Toxics Control Act -- Cleanup," *Washington Administrative Code*, Olympia, Washington.
  - WAC 173-340-720, "Groundwater Cleanup Standards."

Range of Plausible Alternatives

- Natural attenuation with institutional controls (IC), RTD, and no action for waste sites; and monitored natural attenuation (MNA) with ICs for groundwater.
- Natural attenuation with ICs, RTD, and no action for waste sites; and P&T and MNA with ICs for groundwater.
- Natural attenuation with ICs, aggressive RTD, and no action for waste sites; and P&T and MNA with ICs for groundwater.
- Natural attenuation with ICs, RTD, and no action for waste sites; and hexavalent chromium (Cr[VI]) source treatment with P&T, and MNA with ICs for groundwater.
- Natural attenuation with ICs, aggressive RTD, and no action for waste sites; and Cr(VI) source treatment with P&T, and MNA with ICs for groundwater

If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

CLEANUP ACTION:	RC-4.2 River Corridor – Restore 100-KR-4 Groundwater OU to Beneficial Use

Cleanup Decision Summary and Relevant Decision Documents

An interim ROD and ESD are in place to clean up hexavalent chromium in the groundwater using P&T.

- EPA, 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*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA/ROD/R10-96/134, 1996, *Declaration of the Record of Decision for the 100-HR-3 and 100-KR-4 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- WAC 173-340, "Model Toxics Control Act -- Cleanup," *Washington Administrative Code*, Olympia, Washington.
  - WAC 173-340-720, "Groundwater Cleanup Standards."

Range of Plausible Alternatives

- Expand the P&T system in 100-KR-4; transition to S&M for post-treatment groundwater monitoring.
- Continue operation of P&T system with incorporation of bioremediation for chromium.
- Allow monitored natural attenuation to proceed under LTS with institutional controls.

If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

Table B-2. Summary of Future Cleanup Actions and Plausible Alternatives – River Corridor. (5 pages)

CLEANUP ACTION:	RC-4.3 River Corridor – Restore 100-NR-2 Groundwater OU to Beneficial Use

Cleanup Decision Summary and Relevant Decision Documents

An action memorandum, interim ROD, ROD amendment and ESD are in place to clean up strontium-90 in the groundwater using P&T and physical barriers. An in situ apatite permeable reactive barrier (PRB) is being evaluated for use in the cleanup of strontium-90 in groundwater. The initial draft of the Proposed Plan was submitted in June 2013.

- DOE/RL-2012-68, 2013, *Proposed Plan for Remediation of the 100-NR-1 and 100-NR-2 Operable Units*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- EPA, 2010, *Amended Record of Decision, Decision Summary and Responsiveness Summary U.S. Department of Energy 100-NR-1 and NR-2 Operable Units, Hanford Site – 100 Area, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA/ESD/R10-03/605, 2003, *Explanation of Significant Difference for the 100-NR-1 Operable Unit Treatment, Storage, and Disposal Interim Action Record of Decision and 100-NR-1/100-NR-2 Operable Unit Interim Action Record of Decision*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA/ROD/R10-99/112, 1999, *Interim Remedial Action Record of Decision for the 100-NR-1 and 100-NR-2 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- Ecology and EPA, 1994, "Action Memorandum; N Springs Expedited Response Action Cleanup U.S. Department of Energy Hanford Site, Richland, WA" (letter to R. Izatt, U.S. Department of Energy, Richland Operations Office from R.F. Smith, U.S. Environmental Protection Agency and D. Butler, Washington State Department of Ecology), U.S. Environmental Protection Agency, Richland, Washington, September 23.
- WAC 173-340, "Model Toxics Control Act -- Cleanup," *Washington Administrative Code*, Olympia, Washington.
  - WAC 173-340-720, "Groundwater Cleanup Standards."

Range of Plausible Alternatives

- RTD at waste sites, apatite PRB for near-shore strontium-90, technical impractibility (TI) waiver for upland strontium-90, bioventing for total petroleum hydrocarbon-diesel (TPH-D) in vadose zone, MNA for TPH-D in groundwater, groundwater monitoring, and ICs.
- RTD at waste sites, apatite PRB for near-shore strontium-90, TI waiver for upland strontium-90, bioventing and biosparging for TPH-D, groundwater monitoring, and ICs.
- RTD at waste sites, apatite PRB for near-shore strontium-90, TI waiver for upland strontium-90, bioventing and biosparging for TPH-D, in situ biological treatment for nitrate, groundwater monitoring, and ICs.
- RTD at waste sites, apatite PRB for near-shore strontium-90, apatite treatment and TI waiver for upland strontium-90; bioventing and biosparging for TPH-D, in situ biological treatment for nitrate, groundwater monitoring, and ICs.

If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

Table B-2. Summary of Future Cleanup Actions and Plausible Alternatives – River Corridor. (5 pages)

CLEANUP ACTION:	RC-5 River Corridor – Disposition 300 Area Facilities Retained By PNNL

Cleanup Decision Summary and Relevant Decision Documents

Action memoranda are in place for the remaining 300 Area buildings and facilities, and DOE anticipates extending those cleanup decisions to include the PNNL-retained facilities once their operations end. DOE considers D&D of buildings and other structures to be final cleanup decisions if the facility is removed in accordance with an applicable action memorandum. The removal action work plan will need to be modified to address PNNL-retained facilities once PNNL declares the facilities as surplus. Alternatives do not need to be considered where such D&D has been completed. Decision documents for D&D of 300 Area buildings and facilities that may have future application for the PNNL-retained facilities are listed here.

- DOE and EPA, 2005, *Action Memorandum #1 for the 300 Area Facilities*, U.S. Department of Energy, Richland Operations Office and U.S. Environmental Protection Agency, Richland, Washington, January 20.
- DOE and EPA, 2006a, *Action Memorandum #2 for the 300 Area Facilities*, U.S. Department of Energy, Richland Operations Office and U.S. Environmental Protection Agency, Richland, Washington, May 16.
- DOE and EPA, 2006b, *Action Memorandum #3 for the 300 Area Facilities*, U.S. Department of Energy, Richland Operations Office and U.S. Environmental Protection Agency, Richland, Washington, November 30.
- 16-PNSO-0057, 2015, *Need for the Pacific Northwest National Laboratory (PNNL) Occupied/Operated 300 Area Environmental Management (EM) Facilities Anticipated to Extend Through 2045*, Memorandum from R.E. Snyder, U.S Department of Energy Pacific Northwest Site Office to S.L. Charboneau, U.S Department of Energy Richland Operations Office, November 25.

Range of Plausible Alternatives

- Following end of PNNL facilities' operational period (no earlier than 2045), D4 all buildings and facilities; remediate consistent with 300 Area contaminated soil sites if needed.

CLEANUP ACTION:	RC-6 River Corridor – Disposition 100 Area former Orchard Contaminated Soil Sites (100-OL-1 OU)

Cleanup Decision Summary and Relevant Decision Documents

No cleanup decisions have been made for the 100 Area former Orchard Contaminated Soil Sites (100-OL-1 OU).

- TBD – No decision documents currently available.

Range of Plausible Alternatives

- RTD contaminated soil sites from residual lead arsenate pesticide to achieve RAOs, backfill, contour, and revegetate excavations.
- Cover contaminated soil sites with clean soil (depth TBD) and establish institutional controls.

If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

D4 = deactivation, decontamination, decommissioning, and demolition.
D&D = decontamination and decommissioning.
DOE = U.S. Department of Energy.
EIS = environmental impact statement.
ERDF = Environmental Restoration Disposal Facility.
ESD = explanation of significant differences.
FFTF = Fast Flux Test Facility.
ISS = interim safe storage.
LTS = long-term stewardship.
NEPA = *National Environmental Policy Act of 1969*.
OU = operable unit.
P&T = pump-and-treat.
PNNL = Pacific Northwest National Laboratory.
RAO = remedial action objective.
RCRA = *Resource Conservation and Recovery Act*.
RI/FS = remedial investigation/feasibility study.
ROD = record of decision.
RTD = remove, treat, and dispose.
S&M = surveillance and maintenance.
SSE = safe storage enclosure.
WAC = *Washington Administrative Code*.

[1] RC-1 River Corridor – Disposition 100 Area Reactors (Except B Reactor) was removed from the LCR in response to comments that the 1993 National Environmental Policy Act ROD is considered a final action (see Appendix A, Table A-3)

Table B-3. Summary of Future Cleanup Actions and Plausible Alternatives – Central Plateau. (9 pages)

Cleanup Action:	**CP-1 Central Plateau – Disposition Remaining Outer Area Buildings and Facilities**
Cleanup Decision Summary and Relevant Decision Documents Action memoranda are in place to D4 buildings and facilities to slab-on-grade and evaluate below-grade portions for contamination. Future cleanup decisions for remaining buildings and facilities will be included in decision documents (e.g., action memoranda, RODs). DOE considers D&D of buildings and other structures to be final cleanup decisions if all regulated contaminants have been removed in accordance with an applicable action memorandum. Alternatives do not need to be considered where such D&D has been completed. • DOE/RL-2008-80, 2009, *Action Memorandum for the Non-Time-Critical Removal Action for the 212-N, -P and –R Facilities*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. • DOE/RL-2008-80-ADD1, 2010, *Action Memorandum for the Non-Time Critical Removal Action for the 212-N, 212-P, and 212-R Facilities, Addendum 1: Disposition of Railcars*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. • DOE/RL-2010-22, 2013, *Action Memorandum for General Hanford Site Decommissioning Activities*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.	
Range of Plausible Alternatives • D4 all buildings and facilities to slab-on-grade; evaluate below-grade portions for residual contamination; if needed, remediate below-grade portions consistent with Central Plateau Outer Area contaminated soil sites.	
Cleanup Action:	**CP-2 Central Plateau – Remediate Remaining Outer Area Contaminated Soil Sites (200-OA-1, 200-CW-1, and 200-CW-3 OUs)**
Cleanup Decision Summary and Relevant Decision Documents An interim ROD, ESD, and action memoranda are in place to remove contaminated soil, structures, and debris with disposal at ERDF. Future cleanup decisions for remaining soil sites will be included in decision documents (e.g., action memoranda, RODs). • EPA/ROD/R10-99/039, 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*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. • EPA, 2009a, *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. • DOE/RL-2009-48, 2009, *Action Memorandum for Non-Time-Critical Removal Action for 11 Waste Sites in 200-MG-1 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. • DOE/RL-2009-37, 2009, *Action Memorandum for Non-Time-Critical Removal Action for 200-MG-2 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. • DOE/RL-2009-86, 2010, *Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.	
Range of Plausible Alternatives • RTD contaminated soil sites to achieve RAOs comparable to 100 Areas; backfill, contour, and revegetate excavations. • RTD all sites except ponds; allow monitored natural attenuation for large pond sites with presence of existing vegetated soil covers. • Allow monitored natural attenuation to proceed for all sites with appropriate institutional controls. If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.	

Table B-3. Summary of Future Cleanup Actions and Plausible Alternatives – Central Plateau. (9 pages)

Cleanup Action:	**CP-3 Central Plateau – Disposition Below-Grade Portions of Plutonium Finishing Plant**
Cleanup Decision Summary and Relevant Decision Documents A non-time critical action memorandum is in place, associated TPA milestone decision documents are approved, and D4 activities are being implemented for above-grade structures of PFP*. Final decisions and cleanup actions have not been made for below-grade structures/contaminated areas and are not identified in the action memorandum. • DOE/RL-2005-13, 2005, *Action Memorandum for the Plutonium Finishing Plant, Above-Grade Structures Non-Time Critical Removal Action*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. *Below-grade rooms (e.g., basements, tunnels, vaults) of above-grade structures are included but sub-grade items (e.g., buried piping) are excluded.	
Range of Plausible Alternatives • Evaluate below-grade portions for residual contamination; leave remaining below-grade structures and contaminated areas in place and transition to LTS with appropriate institutional controls. • RTD all PFP below-grade structures and contaminated areas; backfill and revegetate. If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.	
Cleanup Action:	**CP-4 Central Plateau – Disposition B Plant Canyon Building/Associated Waste Sites (200-CB-1 OU)**
Cleanup Decision Summary and Relevant Decision Documents The draft EE/CA for B Plant was submitted in June 2016. Future cleanup decisions for remaining buildings and waste sites will be included in decision documents (e.g., action memoranda, RODs). • DOE/RL-2016-14, 2016, *Engineering Evaluation/Cost Analysis for the B Plant Complex*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.	
Range of Plausible Alternatives • Remove all contents and D4 B Plant canyon building, including below-grade foundation; remove all contaminated materials, associated waste sites, and contaminated soils to achieve RAOs; dispose of all waste and debris at approved facility. • Condition contents for placement in spaces below canyon deck level; stabilize and fill voids; remove contaminated wastes and soils from associated waste sites and dispose of at approved facility; partially demolish building to canyon deck level; place engineered barrier over demolished structure; maintain institutional controls and perform post-closure monitoring and caretaking. • Condition contents, retrieve associated waste site contaminated soils and debris, and place in B Plant canyon for entombment; stabilize and fill voids; surround with clean fill and place an engineered barrier over the canyon building; maintain institutional controls and perform post-closure monitoring and caretaking. • Same as preceding (entombment) alternative, with addition of disposal capability to allow receipt of wastes from cleanup activities. If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.	
Cleanup Action:	**CP-5 Central Plateau – Disposition PUREX Canyon Building/Associated Waste Sites (200-CP-1 OU)**
Cleanup Decision Summary and Relevant Decision Documents An action memorandum includes one waste site (UPR-200-E-17) that was moved into this OU. Future cleanup decisions for remaining buildings and waste sites will be included in decision documents (e.g., action memoranda, RODs). • DOE/RL-2009-37, 2009, *Action Memorandum for Non-Time-Critical Removal Action for 200-MG-2 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.	

Table B-3. Summary of Future Cleanup Actions and Plausible Alternatives – Central Plateau. (9 pages)

Range of Plausible Alternatives

- Remove all contents and D4 PUREX canyon building including below-grade foundation; remove all contaminated materials, associated waste sites and contaminated soils to achieve RAOs; dispose of all waste and debris at approved facility.
- Condition contents to place in spaces below canyon deck level; stabilize and fill voids; remove contaminated wastes and soils from associated waste sites and dispose of at approved facility; partially demolish building to canyon deck level; place engineered barrier over demolished structure; maintain institutional controls and perform post-closure monitoring and caretaking.
- Condition contents, retrieve associated waste site contaminated soils and debris, and place in PUREX canyon for entombment; stabilize and fill voids; surround with clean fill and place an engineered barrier over the canyon building; maintain institutional controls and perform post-closure monitoring and caretaking.
- Same as preceding (entombment) alternative, with addition of disposal capability to allow receipt of wastes from cleanup activities.

If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

Note: Cleanup decisions affecting disposition of the PUREX canyon building/associated waste sites and disposition of PUREX storage tunnels should be aligned and cleanup actions should be coordinated and integrated as much as practical.

Cleanup Action:	**CP-6 Central Plateau – Disposition PUREX Storage Tunnels (200-CP-1 OU)**

Cleanup Decision Summary and Relevant Decision Documents

Although no cleanup decisions have been made for the PUREX storage tunnels, following the discovery of subsidence at PUREX Tunnel #1 on May 9, 2017, DOE took actions to stabilize and void-fill this tunnel with engineered grout by November 11, 2017. Because a structural integrity evaluation identified a potential high risk of localized collapse of PUREX Tunnel #2, DOE intends to stabilize and void-fill this tunnel with engineered grout.

- 17-AMRP-0174, "15-Day Report for the May 9, 2017, Discovery of Subsidence at PUREX Tunnel #1," letter from D. Shoop, U.S. Department of Energy to A. Smith, Washington State Department of Ecology, May 23, 2017.
- 17-AMRP-0180, "Continued Response Actions to Partial Collapse of PUREX Tunnel 1," letter from D. Shoop, U.S. Department of Energy to A. Smith, Washington State Department of Ecology, May 31, 2017.
- 18-AMRP-0023, "Continued Response Actions at the PUREX Storage Tunnels – Completion of Tunnel 1 Stabilization and Path Forward for Tunnel 2," letter from D. Shoop, U.S. Department of Energy to A. Smith, Washington State Department of Ecology, December 5, 2017.

Range of Plausible Alternatives

- Maintain grout fill placed as part of the interim stabilization measures of both tunnels, install surface barrier that meets RCRA landfill cover requirements, and conduct post-closure monitoring.
- Railcars and grout in both tunnels could be remotely retrieved after excavation of the tunnel by cutting and removal using water jets, wire saws, excavation equipment, or other technologies. Waste material could be moved from the tunnels to the PUREX Plant canyon deck area or an alternate plant location for disposal within the plant. Waste such as empty railcars that could not be placed in the PUREX Plant for disposal (e.g., insufficient space) could be removed for final disposition at other approved disposal facilities.
- In addition to moving waste materials from the tunnels to the PUREX Plant, characterize, size-reduce, and package waste materials as needed. Size reduction could be performed through various technologies that include but are not limited to flame cutting, water jet cutting, and sawing. Final disposition of the processed waste material could be either on or off Site.
- Construct a new facility that is either mobile or stationary to remove and treat waste material stored in the tunnels. The facility could be constructed in a manner consistent with the retrieval and handling requirements for large, contaminated waste material. Retrieval of the waste and grout from the tunnels could involve cutting and removal using water jets, wire saws, excavation equipment, or other technologies. Final disposition of the processed waste material could be either onsite or offsite.

Table B-3. Summary of Future Cleanup Actions and Plausible Alternatives – Central Plateau. (9 pages)

If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.
Note: Cleanup decisions affecting disposition of PUREX storage tunnels and disposition of PUREX canyon building/associated waste sites should be aligned and cleanup actions should be coordinated and integrated as much as practical.

Cleanup Action:	**CP-7 Central Plateau – Disposition REDOX Canyon Building/Associated Waste Sites (200-CR-1 OU)**

Cleanup Decision Summary and Relevant Decision Documents
The EE/CA for REDOX was submitted in November 2016 and the draft action memorandum for REDOX was submitted in June 2018. Future cleanup decisions for remaining buildings and waste sites will be included in decision documents (e.g., action memoranda, RODs).

- DOE/RL-2016-52, 2018, *Action Memorandum for the Reduction-Oxidation Facility Complex*, Draft C, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- DOE/RL-2016-16, 2016, *Engineering Evaluation/Cost Analysis for the REDOX Complex*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Range of Plausible Alternatives

- Remove all contents and D4 REDOX canyon building including below-grade foundation; remove all contaminated materials, associated waste sites, and contaminated soil to achieve RAOs; dispose of all waste and debris at approved facility.
- Condition contents for placement in spaces below canyon deck level; stabilize and fill voids; remove contaminated waste and soil from associated waste sites and dispose of at approved facility; partially demolish building to canyon deck level; place engineered barrier over demolished structure; maintain institutional controls and perform post-closure monitoring and caretaking.
- Condition contents, retrieve associated waste site contaminated soil and debris, and place in REDOX canyon for entombment; stabilize and fill voids; surround with clean fill and place an engineered barrier over the canyon building; maintain institutional controls and perform post-closure monitoring and caretaking.
- Same as preceding (entombment) alternative, with addition of disposal capability to allow receipt of wastes from cleanup activities.

If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

Cleanup Action:	**CP-8 Central Plateau – Disposition T Plant Canyon Building/Associated Waste Sites**

Cleanup Decision Summary and Relevant Decision Documents
No cleanup decisions have been made for the T Plant canyon building and associated waste sites.
Current expectations are that T Plant will continue to be used to support other remediation and waste management work beyond 2030.

- TBD – No decision documents currently available.

Range of Plausible Alternatives

- Continue ongoing operations until no longer needed; transition to D4; fulfill hazardous waste facility closure obligations consistent with RCRA permit.
- Remove all contents and D4 T Plant canyon building including below-grade foundation; remove all contaminated materials, associated waste sites and contaminated soil to achieve RAOs; dispose of all waste and debris at approved facility.
- Condition contents for placement in spaces below canyon deck level; stabilize and fill voids; remove contaminated wastes and soils from associated waste sites and dispose of at approved facility; partially demolish building to canyon deck level; place engineered barrier over demolished structure; maintain institutional controls and perform post-closure monitoring and caretaking.
- Condition contents, retrieve associated waste site contaminated soil and debris, and place in T Plant canyon for entombment; stabilize and fill voids; surround with clean fill and place an engineered barrier over the canyon building; maintain institutional controls and perform post-closure monitoring and caretaking.

Table B-3. Summary of Future Cleanup Actions and Plausible Alternatives – Central Plateau. (9 pages)

- Same as preceding (entombment) alternative, with addition of disposal capability to allow receipt of waste from cleanup activities.

If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

Cleanup Action:	CP-9 Central Plateau – Disposition Cesium/Strontium Capsules

Cleanup Decision Summary and Relevant Decision Documents

No cleanup decisions have been made for final disposition of the cesium/strontium capsules. DOE amended the ROD for the TC&WM EIS and has proposed updating the Hanford Dangerous Waste Permit to construct and operate a proposed capsule storage area that would provide interim dry storage of the cesium and strontium capsules until a final capsule disposal decision is made.

- 83 FR 23270, 2018, "Amended Record of Decision for the Management of Cesium and Strontium Capsules at the Hanford Site, Richland, Washington," *Federal Register*, May 18.

Range of Plausible Alternatives

- Package and transport capsules from WESF to dry storage; store capsules pending final disposition; direct dispose of capsules at a geologic repository.
- Package capsules in standardized transportation, aging, and disposal (STAD) canister systems; store at Hanford Site pending development of a national interim fuel storage facility; transport and store at an interim fuel storage facility pending transport and disposal at a geologic repository.
- Incorporate capsules into immobilized high-level waste glass at WTP.
- Store capsules at Hanford Site for 300 years (approximately 10 half-lives); after natural decay, direct dispose of capsules as mixed low-level radioactive waste.

Cleanup Action:	CP-10 Central Plateau – Remediate Solid Waste Landfill and Non-Radioactive Dangerous Waste Landfill (200-SW-1 OU)

Cleanup Decision Summary and Relevant Decision Documents

Although a closure/postclosure plan was submitted in July 2010, no cleanup decisions have been made for the 200-SW-1 OU.

- DOE/RL-90-17, 2010, *Nonradioactive Dangerous Waste Landfill/Solid Waste Landfill Closure/Postclosure Plan*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Range of Plausible Alternatives

The following alternatives are being considered as part of DOE/EA-1707D, *Environmental Assessment Closure of Nonradioactive Dangerous Waste Landfill (NRDWL) and Solid Waste Landfill (SWL)*; these alternatives are not intended to presume the outcome of the ongoing environmental assessment process:

- Install an evapotranspiration barrier over both landfills; upgrade monitoring and infrastructure systems; perform post-closure monitoring and caretaking.
- Partial RTD with removal of waste material from both landfills and impacted soil as deep as 10 feet below the waste material; backfill and revegetate; if necessary (e.g., contaminated residues remain), perform post-closure monitoring and caretaking.
- Remove all waste material from both landfills; excavate and RTD all contaminated soil to groundwater, if necessary; backfill and revegetate.

If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

Cleanup Action:	CP-11 Central Plateau – Disposition Remaining Liquid Waste Disposal Facilities*

Cleanup Decision Summary and Relevant Decision Documents

No cleanup decisions have been made for the remaining liquid waste disposal facilities.

TBD – No decision documents currently available.

Table B-3. Summary of Future Cleanup Actions and Plausible Alternatives – Central Plateau. (9 pages)

Range of Plausible Alternatives

- Closure of facilities will be according to approved operating plans and closure plans.
- If needed, may remediate contaminated soil under zone closure; may include partial RTD with various capping alternatives; monitoring and institutional controls after closure may be required.
- RTD all contaminated soil; backfill and revegetate.
- Allow monitored natural attenuation to proceed under LTS with appropriate institutional controls.

If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

* Includes state-approved land disposal site; state waste discharge permit sites; 100-N Sewage Lagoon; onsite sewage systems; national pollutant discharge elimination system outfalls; and underground injection control well sites.

Cleanup Action:	**CP-12 Central Plateau – Disposition Remaining Waste Treatment, Storage and Disposal Facilities***

Cleanup Decision Summary and Relevant Decision Documents

No cleanup decisions have been made for the remaining waste treatment, storage, and disposal facilities.

- TBD – No decision documents currently available.

Range of Plausible Alternatives

- Closure of facilities will be according to approved operating plans and closure plans (e.g., RCRA closure plans); consequently, cleanup actions will be determined and accomplished in accordance with applicable regulatory and permit/license requirements. No other alternatives are being considered.

* Includes LERF/ETF, WESF, WRAP, 222-S Laboratory, IDF, and Inert Waste Landfill/Pit 9.

Cleanup Action:	**CP-13 Central Plateau – Remediate Pipelines, Pits, Diversion Boxes and Associated Tanks 200-IS-1 OU**

Cleanup Decision Summary and Relevant Decision Documents

The 200-IS-1 OU waste sites include tanks (except those in the tank farms), pipelines, pits, diversion boxes, and associated ancillary equipment. Several pipelines are being addressed (in part) by 200-MG-1 removal actions; final remediation decisions will be addressed in RODs; TSD ancillary equipment will be addressed in future RCRA closure plans; other media may be addressed via CERCLA process.

- TBD – No decision documents currently available.

Range of Plausible Alternatives

- RTD all contaminated equipment, materials, debris, and soil to a depth determined by the Tri-Party agencies to be protective of human health and ecological resources (depth TBD); backfill and revegetate.
- RTD all contaminated equipment, materials, debris, and soil; backfill and revegetate.
- Stabilize select equipment in place using technologies yet to be determined.
- Leave everything in place; maintain under LTS with appropriate institutional controls.

If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

Cleanup Action:	**CP-14 Central Plateau – Remediate Land Disposal Units (200-SW-2 OU)**

Cleanup Decision Summary and Relevant Decision Documents

No cleanup decisions have been made to remediate the 200-SW-2 OU. (Note that this OU is not a single contaminated site, but comprises a large number of land disposal units.)

- TBD – No decision documents currently available.

Range of Plausible Alternatives

- Excavation, treatment (as necessary), and disposal of all waste from within individual landfills.
- Excavation, treatment (as necessary), and disposal of waste from selected sections of individual landfills followed by capping of remaining waste; includes continued cap maintenance and monitoring.
- Capping of individual landfills; includes continued cap maintenance and monitoring.
- In situ treatment/stabilization (e.g., vitrification or grouting) of portions of individual landfills followed by capping; includes continued cap maintenance and monitoring.

If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

Table B-3. Summary of Future Cleanup Actions and Plausible Alternatives – Central Plateau. (9 pages)

Cleanup Action:	**CP-15 Central Plateau – Remediate Remaining 200 West Inner Area Contaminated Soil Sites (200-WA-1 OU)**
Cleanup Decision Summary and Relevant Decision Documents Several action memoranda are in place to remove contaminated soil, structures, and debris from 200 West Inner Area soil sites with disposal at ERDF. Future cleanup decisions for remaining waste sites will be included in decision documents (e.g., action memoranda, RODs). • DOE/RL-2009-37, 2009, *Action Memorandum for Non-Time-Critical Removal Action for 200-MG-2 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. • DOE/RL-2009-86, 2010, *Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.	
Range of Plausible Alternatives • RTD approximately half of waste sites and cap remainder. • RTD all waste sites; backfill and revegetate. • Cap and maintain under LTS with monitoring and appropriate institutional controls. If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.	
Cleanup Action:	**CP-16 Central Plateau – Remediate Remaining 200 East Inner Area Contaminated Soil Sites (200-EA-1 OU)**
Cleanup Decision Summary and Relevant Decision Documents Several action memoranda are in place to remove contaminated soil, structures, and debris from 200 East Inner Area soil sites with disposal at ERDF. Future cleanup decisions for remaining waste sites will be included in decision documents (e.g., action memoranda, RODs). • DOE/RL-2009-37, 2009, *Action Memorandum for Non-Time-Critical Removal Action for 200-MG-2 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. • DOE/RL-2009-86, 2010, *Action Memorandum for Non-Time-Critical Removal Action for 37 Waste Sites in the 200-MG-1 Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.	
Range of Plausible Alternatives • RTD approximately half of waste sites and cap remainder. • RTD all waste sites; backfill and revegetate. • Cap and maintain under LTS with monitoring and appropriate institutional controls. If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.	
Cleanup Action:	**CP-19[1] Central Plateau –Disposition Remaining Inner Area Buildings and Facilities**
Cleanup Decision Summary and Relevant Decision Documents Cleanup decisions have been made for D&D of some of the remaining Inner Area buildings and facilities, and the applicable action memorandum is expected to cover future D&D activities. DOE considers D&D of buildings and other structures to be final cleanup decisions if all regulated contaminants have been removed in accordance with an applicable action memorandum. Alternatives do not need to be considered where such D&D has been completed. (Note that cleanup decisions have been or will be made for the canyon buildings and associated waste sites; see separate cleanup actions for these facilities.) • DOE/RL-2010-22, 2013, *Action Memorandum for General Hanford Site Decommissioning Activities*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. • DOE/RL-2010-102, 2011, *Action Memorandum for Decontamination, Deactivation, Decommissioning, and Demolition (D4) Activities for 200 East Tier 2 Buildings/Structures*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.	
Range of Plausible Alternatives • D4 all buildings and facilities to slab-on-grade; evaluate below-grade portions for residual contamination; if needed, remediate below-grade portions consistent with contiguous contaminated soil sites. • Leave structures in place and transition to LTS with appropriate institutional controls.	

Table B-3. Summary of Future Cleanup Actions and Plausible Alternatives – Central Plateau. (9 pages)

Cleanup Action:	**CP-20 CENTRAL PLATEAU – REMEDIATE CONTAMINATED DEEP VADOSE ZONE (200-DV-1 OU)**

Cleanup Decision Summary and Relevant Decision Documents

An action memorandum provides for extraction of perched water from the 200-DV-1 OU (B tank farm complex in the 200 East Area) and transfer of the water by tanker truck or pipeline to the 200 West pump and treat, where it is treated and injected into the aquifer below the 200 West Area. Future cleanup decisions for other deep vadose zone areas will be included in decision documents (e.g., action memoranda, RODs).

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

Range of Plausible Alternatives

- Implement results of treatability testing in accordance with CERCLA and/or RCRA final decisions.
- RTD all contaminated soils to groundwater if necessary and technically practical; backfill and revegetate.
- In place treatment to destroy, immobilize, or capture, treat and dispose of contaminants.
- Soil flushing with P&T or pore water removal.
- Install surface barriers.
- Allow monitored natural attenuation to proceed under LTS with appropriate institutional controls.

Cleanup Action:	**CP-21 Central Plateau – Restore 200 West Groundwater To Beneficial Use (200-UP-1 OU)**

Cleanup Decision Summary and Relevant Decision Documents

An interim ROD for 200-UP-1 OU was issued in September 2012 that superseded the previous remedy decisions for this OU and a final ROD is in place for the adjacent 200-ZP-1 OU to address all contaminants.

- EPA, 2012, *Record of Decision for Interim Remedial Action Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- EPA, 2008, *Record of Decision Hanford 200 Area 200-ZP-1 Superfund Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington.
- WAC 173-340, "Model Toxics Control Act -- Cleanup," *Washington Administrative Code*, Olympia, Washington.
  - WAC 173-340-720, "Groundwater Cleanup Standards."

Range of Plausible Alternatives

- Expand 200-ZP-1 extraction, treatment and injection capacity; install extraction and transfer system for 200-UP-1; operate P&T system to achieve RAOs; continue monitoring.
- Allow monitored natural attenuation to proceed under LTS with appropriate institutional controls.
- Hydraulic containment of the iodine-129 groundwater plume.
- Groundwater monitoring and institutional controls.

Cleanup Action:	**CP-22 Central Plateau – Restore 200 East Groundwater to Beneficial Use (200-PO-1 and 200-BP-5 OUs)**

Cleanup Decision Summary and Relevant Decision Documents

An action memorandum provides for extraction of groundwater with elevated uranium and technetium-99 concentrations from the B complex area of the 200-BP-5 OU, conveyance of the water by pipeline to the 200 West P&T, where it is treated and injected into the aquifer below the 200 West Area. No other cleanup decisions have been made for 200 East groundwater.

- DOE/RL-2016-41, 2016, *Action Memorandum for 200-BP-5 Operable Unit Groundwater Extraction*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- WAC 173-340, "Model Toxics Control Act -- Cleanup," *Washington Administrative Code*, Olympia, Washington.
  - WAC 173-340-720, "Groundwater Cleanup Standards."

Table B-3. Summary of Future Cleanup Actions and Plausible Alternatives – Central Plateau. (9 pages)

Range of Plausible Alternatives

- Install P&T system for 200-BP-5 OU; implement monitored natural attenuation for 200-PO-1 OU; perform well support and maintenance activities.
- Allow monitored natural attenuation to proceed under LTS with appropriate institutional controls.
- Install P&T system for 200-BP-5 and selective P&T for 200-PO-1 hot spots.

Note: 400 Area groundwater cleanup actions are included as part of 200-PO-1 OU.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq.
Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq.
WAC 173-340, "Model Toxics Control Act -- Cleanup," *Washington Administrative Code*, Olympia, Washington.
WAC 173-340-720, "Groundwater Cleanup Standards," *Washington Administrative Code*, Olympia, Washington.

CERCLA	= *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*.	OU	= operable unit.
		P&T	= pump-and-treat.
D&D	= decontamination and decommissioning.	PFP	= Plutonium Finishing Plant.
D4	= deactivation, decontamination, decommissioning, and demolition.	PUREX	= Plutonium-Uranium Extraction (Plant).
		RAO	= remedial action objective.
DOE	= U.S. Department of Energy.	RCRA	= *Resource Conservation and Recovery Act of 1976*.
EE/CA	= engineering evaluation/cost analysis.	REDOX	= Reduction-Oxidation Facility (S Plant).
ERDF	= Environmental Restoration Disposal Facility.	ROD	= record of decision.
ESD	= explanation of significant difference.	RTD	= remove, treat, and dispose.
ETF	= Effluent Treatment Facility.	SWL	= solid waste landfill.
FFTF	= Fast Flux Test Facility.	TBD	= to be determined.
IDF	= Integrated Disposal Facility.	TPA	= Tri-Party Agreement.
IHLW	= immobilized high-level waste.	TSD	= treatment, storage, and disposal.
INL	= Idaho National Laboratory.	WAC	= *Washington Administrative Code*.
LERF	= Liquid Effluent Retention Facility.	WESF	= Waste Encapsulation and Storage Facility.
LTS	= long-term stewardship.	WRAP	= Waste Receiving and Processing Plant.
NRDWL	= Nonradioactive Dangerous Waste Landfill.	WTP	= Waste Treatment and Immobilization Plant.

[1]CP-17 Central Plateau – Disposition Fast Flux Test Facility (FFTF) Complex and CP-18 Central Plateau – Disposition Remaining Buildings and Facilities in FFTF Complex were removed since the "Record of Decision: Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington" (78 FR 75913) is a final decision for these cleanup actions.

Table B-4. Summary of Future Cleanup Actions and Plausible Alternatives – Tank Waste. (2 pages)

Cleanup Action:	TW-1 Tank Waste – Tank Retrieval and Single-Shell Tank Farm Closure
Cleanup Decision Summary and Relevant Decision Documents In the February 26, 1997 *Federal Register*, DOE decided to retrieve and treat tank waste (62 FR 8693). DOE's preferred alternative of those evaluated in the TC&WM EIS (DOE/EIS-0391) was published in the December 13, 2013 *Federal Register* (78 FR 75913).	
Range of Plausible Alternatives • DOE has decided to implement Tank Closure Alternative 2B, "Expanded WTP Vitrification and Landfill Closure," without supplemental treatment at WTP and without technetium-99 removal in the WTP Pretreatment Facility, including the following major activities: retrieval of 99% of the tank waste by volume; use of liquid-based retrieval systems; leak detection monitoring and routine maintenance; new waste receiver facilities, as needed; additional storage facilities for canisters; operations and necessary maintenance, waste transfers and associated operations such as use of the ''hose-in-hose'' transfer lines or installation of new transfer lines, where needed; and upgrades to existing DST and SST systems, including piping and other ancillary equipment as needs are identified. Tank waste treatment includes pretreatment of all tank waste, with separation into LAW and HLW. New evaporation capacity, upgrades to the ETF, new transfer lines and processing of both vitrified LAW and secondary waste for disposal are included in this decision. Disposal activities include disposal of LAW on Site and construction of enough IHLW interim storage modules to store all the IHLW generated by WTP treatment prior to disposal. SST closure operations include filling the tanks and ancillary equipment with grout to immobilize the residual waste. Disposal of contaminated equipment and soil will occur on Site. The tanks will be grouted and contaminated soil may be removed. The SSTs will be landfill-closed, which means they will be stabilized and an engineered modified RCRA Subtitle C barrier put in place followed by postclosure care. • As stated in the March 11, 2013 *Federal Register* (78 FR 15358), DOE prefers to retrieve, treat, package, characterize and certify the tank wastes that are properly and legally classified as mixed TRU waste for disposal at WIPP. If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.	
Cleanup Action:	**TW-2 Tank Waste – Tank Waste Treatment**
Cleanup Decision Summary and Relevant Decision Documents In the February 26, 1997 *Federal Register*, DOE decided to retrieve, separate, vitrify, and dispose of the tank waste (62 FR 8693). The ILAW would be prepared for onsite disposal and the vitrified HLW would be placed in interim storage pending future disposal at a national geologic repository. DOE's preferred alternative of those evaluated in the TC&WM EIS (DOE/EIS-0391) was published in the December 13, 2013 *Federal Register* (78 FR 75913).	
Range of Plausible Alternatives • See discussion of DOE's preferred alternative under cleanup action TW-1 Tank Waste – Tank Retrieval and Single-Shell Tank Farm Closure.	
Cleanup Action:	**TW-3 Tank Waste – Secondary Waste Treatment**
Cleanup Decision Summary and Relevant Decision Documents No cleanup decisions have been made. See Chapter 7 and Appendix M of the TC&WM EIS (DOE/EIS-0391) for discussion, sensitivity analysis, and potential mitigation strategies for the treatment and disposal of the secondary waste. Decisions have been deferred to future decision-making processes. • TBD – No decision documents currently available.	
Range of Plausible Alternatives • Recycle liquid waste streams in WTP; manage residual liquid waste at LERF/ETF/SALDS; treat solid waste from WTP and ETF and dispose at IDF; manage and disposition other secondary waste (e.g., failed melters). Other plausible alternatives will be determined at a later date. **Note**: Any radioactive HLW will be stored and eventually shipped to a geologic repository.	

Table B-4. Summary of Future Cleanup Actions and Plausible Alternatives – Tank Waste. (2 pages)

Cleanup Action:	**TW-4 Tank Waste – Double-Shell Tank Closure**
Cleanup Decision Summary and Relevant Decision Documents No cleanup decisions have been made. Decisions have been deferred to future decision-making processes.	
Range of Plausible Alternatives • Retrieve DST wastes consistent with TPA and the RCRA permit; achieve designated retrieval objectives or limits of technology, remediate structures and soil and install cover/cap to meet closure performance standards, maintain post-closure care and monitoring consistent with RCRA permit. Other plausible alternatives will be determined at a later date.	
Cleanup Action:	**TW-5 Tank Waste – WTP Closure**
Cleanup Decision Summary and Relevant Decision Documents The RCRA Hanford Dangerous Waste Permit, Operable Unit-10, Chapter 11 states "Clean closure is the goal for the WTP permitted DWMUs." The closure plan will be revised if efforts to achieve the clean closure standards for the WTP structures or soil are unsuccessful. The "modified closure" approach may be followed if feasible, as provided in Condition II.K.3 of the Hanford RCRA Permit. It also may be closed as a landfill, as provided in Condition II.K.4 of the Hanford RCRA Permit, if the clean closure standards are not technically or economically feasible. The revised closure plan will be accompanied by a written request for modification of the permit. Further decisions have been deferred to future decision-making processes. • WA7890008967, 2013, *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste*, Washington State Department of Ecology, Nuclear Waste Program, Richland, Washington, September 30.	
Range of Plausible Alternatives • Demolish ancillary facilities/structures to the primary containment structure, seal containment structure and construct a soil-based environmental barrier over the containment structure, remediate structures and soils, maintain post-closure care and monitoring consistent with RCRA Permit. • D4 all buildings and facilities to slab-on-grade; evaluate below-grade portions for residual contamination; if needed, remediate below-grade portions. • Perform clean closure of WTP and all ancillary facilities/structures. • Leave structures in place and transition to LTS with appropriate institutional controls. If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.	

D4	= deactivation, decontamination, decommissioning, and demolition.	LTS	= long-term stewardship.
		RCRA	= *Resource Conservation and Recovery Act of 1976*.
DOE	= U.S. Department of Energy.	RTD	= remove, treat, and dispose.
DST	= double-shell tank.	SALDS	= State-Approved Land Disposal Site.
DWMU	= dangerous waste management unit	SST	= single-shell tank.
ETF	= Effluent Treatment Facility.	TBD	= to be determined.
HLW	= high-level waste.	TC&WM EIS	= *Tank Closure and Waste Management Environmental Impact Statement*.
IDF	= Integrated Disposal Facility.		
ILAW	= immobilized low-activity waste.	TPA	= Tri-Party Agreement.
LAW	= low-activity waste.	WTP	= Waste Treatment and Immobilization Plant.
LERF	= Liquid Effluent Retention Facility.		

B.2.2 DOE's Approach for Analyzing Alternatives and Describing the Reasonable Upper Bound

TPA M-036-01 refers to a "reasonable upper bound" with respect to presenting information about cleanup alternatives, but the milestone does not include a ready definition for "reasonable upper bound." To ensure the LCR provides information that meets the requirement and intent of the milestone, DOE has relied on a conceptual framework as described in DOE/RL-2012-13, *2013 Hanford Lifecycle Scope, Schedule and Cost Report* (2013 LCR), Appendix A, section A.2.2.

B.3 RATIONALE FOR ANNUAL SELECTION OF FUTURE CLEANUP ACTIONS TO BE ANALYZED

DOE will consider recommendations from EPA and Ecology, government-to-government consultations (e.g., Tribal Nations, State of Oregon), Hanford Advisory Board advice, input from Hanford stakeholders, and public comments received on previous LCRs when selecting the future cleanup actions to be analyzed in the LCR. The 2013 LCR, Appendix A, section A.3, contains additional details about the rationale used to select these cleanup actions.

B.4 COMPLETED CLEANUP ACTION ALTERNATIVES

The cleanup actions that have been analyzed in-depth in LCRs are summarized in Table B-5. For details about the cost estimate alternative analysis of any of these cleanup actions, see the specific LCR cited in Table B-5.

Table B-5. Summary of Completed Cleanup Action Alternatives. (2 pages)

Cleanup Action	Cost Estimate Alternative Analysis (Million $)	Final Decision Reference
2011 HANFORD LIFECYCLE SCOPE, SCHEDULE AND COST REPORT (DOE/RL-2010-25)		
River Corridor–Disposition 100 Area Reactors	Reactors Remain in Place - $0 Remove Reactors - $676	Record of Decision; Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, WA (58 FR 48509)
Central Plateau–Remediate 200-SW-2 OU	Barriers - $823 Remove, Treat, Dispose of Waste - $16,614	TBD
2012 HANFORD LIFECYCLE SCOPE, SCHEDULE AND COST REPORT (DOE/RL-2011-93)		
Tank Waste Cleanup Action–Tank Retrieval and Single-Shell Tank Farm Closure	1 – Baseline Case - $59,900 2 – TRU Waste to WTP - $61,600 3 – FBSR for supplemental treatment - $58,100 4 – WTP delay with +10% vitrification capacity - $66,000 5 – 2020 Vision One System - $58,000 6 – WTP delay with new DST farm - $68,700 7 – Enhanced tank waste strategy - $57,300 8 – Accelerated SST retrievals - $62,800 9 – Early U Farm closure - $59,600 10 – Slow SST retrievals - $60,800	TBD
Tank Waste Cleanup Action–Tank Waste Treatment		TBD
Tank Waste Cleanup Action–Secondary Waste Treatment		TBD
2013 HANFORD LIFECYCLE SCOPE, SCHEDULE AND COST REPORT (DOE/RL-2012-13)		
Central Plateau-Remediate Remaining Outer Area Contaminated Soil Sites (200-OA-1, 200-CW-1, and 200-CW-3 OUs)	The DOE planning-case cleanup remedies for the 190 waste sites evaluated includes RTD - $98.3 CSNA - $4.9 MESC/MNA/IC - $3.2 IBAR - $19.2 ABAR - $19.8 **Total** - $145.4	TBD
Central Plateau-Remediate Remaining 200 West Inner Area Contaminated Soil Sites (200-WA-1 OU)		TBD
2014 HANFORD LIFECYCLE SCOPE, SCHEDULE AND COST REPORT (DOE/RL-2013-02)		
None selected for 2014	N/A	N/A

Table B-5. Summary of Completed Cleanup Action Alternatives. (2 pages)

Cleanup Action	Cost Estimate Alternative Analysis (Million $)	Final Decision Reference
2015 HANFORD LIFECYCLE SCOPE, SCHEDULE AND COST REPORT (DOE/RL-2014-11**)**		
None selected for 2015	N/A	N/A
2016 HANFORD LIFECYCLE SCOPE, SCHEDULE AND COST REPORT (DOE/RL-2015-10**)**		
None selected for 2016	N/A	N/A
2019 HANFORD LIFECYCLE SCOPE, SCHEDULE AND COST REPORT (DOE/RL-2018-45)[1]		
None selected for 2019	N/A	N/A

[1]There were no LCRs for 2017 and 2018 in accordance with TPA Change Control Forms M-36-16-02 and M-36-17-01.

ABAR = aggregate barrier.
CSNA = confirmatory sampling to support no further cleanup action.
DOE = U.S. Department of Energy.
DST = double-shell tank.
FBSR = fluidized bed steam reformer.
IBAR = individual barrier.
IC = institutional controls.
MESC = maintain existing soil cover.
MNA = monitored natural attenuation.
N/A = not applicable.
OU = operable unit.
RTD = remove, treat and dispose.
SST = single-shell tank.
TBD = to be determined.
TRU = transuranic.
WTP = Waste Treatment and Immobilization Plant.

Considering the criteria described earlier and cleanup actions analyzed in previous LCRs, DOE developed an anticipated schedule for performing in-depth analyses of plausible alternatives for each remaining future cleanup action. Table B-6 presents this schedule and explains the rationale for analyzing alternatives in the recommended LCR year.

Table B-6. Anticipated Schedule for Detailed Analyses of Future Cleanup Action Alternatives.
(3 pages)

Cleanup Action	Alternative
• Central Plateau–Disposition B Plant Canyon Building/Associated Waste Sites (200-CB-1 OU) • Central Plateau–Disposition PUREX Canyon Building/Associated Waste Sites (200-CP-1 OU) • Central Plateau–Remediate Contaminated Deep Vadose Zone (200-DV-1 OU)	The RI/FS work plan is due for 200-CB-1 by September 30, 2019, (TPA M-085-70) and for 200-CP-1 by September 30, 2020, (TPA M-085-80). The corrective measures study and feasibility study report and proposed plan/proposed corrective action decision for 200-DV-1 are due by September 30, 2023 (TPA M-015-110B). It may be reasonable to develop alternatives after 2021 that could benefit future planning and budget requests.
• Central Plateau–Restore 200 East Groundwater to Beneficial Use (200-PO-1 and 200-BP-5 OUs)	TPA M-015-21A requires a feasibility study report and proposed plan by March 31, 2019. Analysis of alternatives is not likely to contribute useful information because the CERCLA decision process will inform future planning and budget requests.
• Central Plateau– Remediate Pipelines, Pits, Diversion Boxes and Associated Tanks (200-IS-1 OU) • Central Plateau–Remediate Remaining 200 East Inner Area Contaminated Soil Sites (200-EA-1 OU)	The RCRA facility investigation/corrective measures study and remedial investigation/feasibility study report and proposed corrective action decision/proposed plan are due for 200-IS-1 by March 31, 2023, (TPA M-015-92C) and for 200-EA-1 by November 30, 2022 (TPA M-015-92B). It may be reasonable to develop alternatives after 2021 that could benefit future planning and budget requests.
• Central Plateau–Disposition Below-Grade Portions of PFP • Central Plateau–Remediate Solid Waste Landfill and Non-Radioactive Dangerous Waste Landfill (200-SW-1 OU)	The remedial investigation of PFP-related waste sites is due by December 31, 2019 (TPA M-015-99). A closure/ postclosure plan was submitted in July 2010 for 200-SW-1. It may be reasonable to develop alternatives for the PFP waste sites after 2021 that could benefit future planning and budget requests. However, analysis of alternatives for 200-SW-1 is not likely to contribute useful information that could benefit future planning and budget requests.
• River Corridor–Disposition 100 Area former orchard contaminated soil sites (100-OL-1 OU)	The RI report (Draft A) was submitted September 7, 2017 (TPA M-015-96). It may be reasonable to develop alternatives after 2020 (depending on the date for completing the FS) that could benefit future planning and budget requests.
• Central Plateau–Disposition REDOX Canyon Building/Associated Waste Sites (200-CR-1 OU)	The RI/FS work plan is due for 200-CR-1 by September 30, 2021 (TPA M-085-90). It may be reasonable to develop alternatives after 2023 that could benefit future planning and budget requests.
• Central Plateau–Disposition Cesium/Strontium Capsules	TPA M-092-20 requires DOE to determine a disposition pathways evaluation for the cesium/strontium capsules by March 31, 2022, and every 4 years thereafter. DOE has proposed updating the Hanford Dangerous Waste Permit to construct and operate a proposed capsule storage area that would provide interim dry storage of the cesium and strontium capsules until a final capsule disposal decision is made. Analysis of alternatives is not likely to contribute useful information for out-year budget planning.
• Central Plateau–Restore 200 West Groundwater to Beneficial Use (200-UP-1 OU)	An interim action ROD was issued in September 2012 that superseded the previous 200-UP-1 OU decisions. It may be reasonable to develop alternatives after 2020 that could benefit future planning and budget requests.

Table B-6. Anticipated Schedule for Detailed Analyses of Future Cleanup Action Alternatives.
(3 pages)

Cleanup Action	Alternative
• River Corridor–Disposition 300 Area Facilities Retained by PNNL	Facilities in the 300 Area will be maintained operational by PNNL through 2045. Earlier analysis of alternatives would be premature and not needed for out-year budget planning.
• Central Plateau (Outer Area)–Disposition Remaining Outer Area Buildings and Facilities (200-OA-1 OU)	Over 200 active facilities are not covered by existing decisions, including TEDF, purge water ponds, ETF/LERF, laydown yards, warehouses, mobile offices, pump-and-treat facilities, WSCF, shops and the CWC complex. These facility operations are integral to the long-term cleanup mission and will continue well after 2020. Cleanup actions can be implemented by modifying existing action memoranda. Analysis of alternatives is not likely to contribute useful information for out-year budget planning.
• Central Plateau–Disposition PUREX Storage Tunnels (200-CP-1 OU)	DOE took actions to stabilize and void-fill PUREX Tunnel #1 with engineered grout by November 11, 2017, and intends to stabilize and void-fill PUREX Tunnel #2 with engineered grout beginning by the end of FY 2018. The RI/FS work plan is due for 200-CP-1 by September 30, 2020 (TPA M-085-80). It may be reasonable to develop alternatives after 2022 that could benefit future planning and budget requests.
• Central Plateau–Disposition T Plant Canyon Building/Associated Waste Sites • Central Plateau–Disposition Remaining Liquid Waste Disposal Facilities • Central Plateau–Disposition Remaining Waste Treatment, Storage and Disposal Facilities	These facility operations are integral to the long-term cleanup mission and will continue well after 2020. Any likely cleanup actions are not expected for at least 20+ years in the future so earlier analyses would be premature and not needed for out-year budget planning.
• Central Plateau–Disposition Any Remaining Inner Area Buildings and Facilities	Over 150 active and inactive facilities are not covered by other cleanup actions or decisions, including laydown yards, storage, mobile offices and facilities, pump-and-treat facilities, CSB, 222S lab, telecommunications, sirens and electrical facilities. The active facilities are integral to the long-term cleanup mission and will continue well after 2020. Cleanup actions can be implemented by modifying existing action memoranda. Analysis of alternatives is not likely to contribute useful information for out-year budget planning.
• Tank Waste–Double-Shell Tank Closure • Tank Waste–WTP Closure	DST closure is not expected to begin before 2063 and WTP closure before 2066. Earlier analyses would be premature and not needed for out-year budget planning.
CLEANUP ACTIONS FOR WHICH ALTERNATIVES WOULD NOT BE ANALYZED	
River Corridor–B Reactor Preservation - B Reactor is designated a National Historic Landmark and is a signature facility of the newly established Manhattan Project National Historical Park so no cleanup actions are anticipated. Minor conditioning/maintenance activities will be performed consistent with National Park Service decision making under the *National Environmental Policy Act* (42 USC 4321) and/or *National Historic Preservation Act* (16 USC 470).	
River Corridor-Disposition Remaining 100 Area Buildings/Facilities and Disposition Remaining 300 Area Buildings/Facilities (except facilities retained for use by PNNL) - Although cleanup actions are mostly completed for these buildings/facilities, excess buildings/facilities in the 100 and 300 Areas are expected to undergo D&D according to applicable action memoranda. DOE considers D&D of buildings/structures to be final cleanup decisions if all regulated contaminants are removed in accordance with an action memorandum so alternatives do not need to be analyzed.	

Table B-6. Anticipated Schedule for Detailed Analyses of Future Cleanup Action Alternatives.
(3 pages)

Cleanup Action	Alternative
River Corridor–Remediate Remaining Contaminated Sites Within Hanford Reach National Monument - National Monument remediation is being implemented to fulfill obligations under a presidential proclamation that establishes a *de facto* final decision. RTD and decontamination in the Monument areas were substantially completed in 2012 (some residual cleanup in the 100 Area portions of the Monument is expected to be complete within the next few years as part of the River Corridor or Central Plateau cleanup projects).	
River Corridor - Disposition 100 Area K West Basin **River Corridor - Remediate 100 Area Contaminated Soil Sites** **River Corridor - Restore 100-BC-5 Groundwater OU to Beneficial Use** **River Corridor - Restore 100-KR-4 Groundwater OU to Beneficial Use** **River Corridor - Restore 100-NR-2 Groundwater OU to Beneficial Use** The Tri-Party agencies agreed that for cleanup actions close to having final decisions there would be little value in presenting a cost estimate alternatives analysis in the LCR. Because K West Basin cleanup action was limited to only one alternative (see Table B-2), the agencies agreed to remove it from the alternatives analysis in the LCR.	
Central Plateau–Disposition U Plant (Canyon Building/Associated Waste Sites) - U Plant remediation was approved according to a CERCLA Final ROD. If performed, further analysis of alternatives should be done as part of the process under which the current final cleanup decisions were made.	
Central Plateau–Manage ERDF - ERDF was approved according to a CERCLA Final ROD and closure and post-closure care are part of the operating documentation. Alternatives need not be analyzed, unless future decisions are made that modify the current final ERDF decisions.	
Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq. *National Environmental Policy Act of 1969*, 42 USC 4321, et seq. *National Historic Preservation Act of 1966*, 16 USC 470, et seq. *Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq.	
CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*. D&D = decontamination and decommissioning. DOE = U.S. Department of Energy. DST = double-shell tank. ERDF = Environmental Restoration Disposal Facility. FFTF = Fast Flux Test Facility. FS = feasibility study. LCR = Lifecycle Report. OU = operable unit.	PFP = Plutonium Finishing Plant. PNNL = Pacific Northwest National Laboratory. PUREX = Plutonium-Uranium Extraction (Plant). RCRA = *Resource Conservation and Recovery Act of 1976*. REDOX = Reduction-Oxidation Facility. RI/FS = remedial investigation/feasibility study. ROD = record of decision. RTD = remove, treat, and dispose. TPA = Tri-Party Agreement. WTP = Waste Treatment and Immobilization Plant.

B.5 REFERENCES

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APPENDIX C

HANFORD ESTIMATED SCHEDULE AND COST STATUS

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CONTENTS

TABLES

TERMS

ACRW	alpha caisson waste retrieval
BOF	Balance of Facilities
CCP	Central Characterization Project
CENRTC	capital equipment not related to construction
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CH	contact-handled
CSB	Canister Storage Building
CWC	Central Waste Complex
D&D	decontamination and decommissioning
D4	deactivation, decontamination, decommissioning, and demolition
DOE	U.S. Department of Energy
DST	double-shell tank
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ESH&Q	environmental safety, health and quality
ETF	Effluent Treatment Facility
FFTF	Fast Flux Test Facility
FY	fiscal year
GRP	Groundwater Remediation Project
HAMMER	Volpentest HAMMER Federal Training Center
HLW	high-level waste
IA	implementation area
IDF	Integrated Disposal Facility
IFW	Integrated Field Work
ISMS	Integrated Safety Management System
LAW	low-activity waste
LAWPS	LAW Pretreatment System
LCR	Lifecycle Report
LDR	land disposal restriction
LERF	Liquid Effluent Retention Facility
LLBG	low-level (waste) burial ground
LLW	low-level waste
LOE	level of effort
LTS	Long-Term Stewardship
MCSC	management of cesium and strontium capsules
MLLW	mixed low-level waste
O&M	operations and maintenance
ORP	U.S. Department of Energy, Office of River Protection
OU	operable unit
PBS	project baseline summary
PFP	Plutonium Finishing Plant
PRC	Plateau Remediation Contract
PT	pretreatment
PUREX	Plutonium Uranium Extraction (Plant)
RH	remote-handled
RCRA	*Resource Conservation and Recovery Act of 1976*
REDOX	Reduction-Oxidation Facility (S Plant)
RI/FS	remedial investigation/feasibility study
RL	U.S. Department of Energy, Richland Operations Office

ROD	record of decision
RTD	remove, treat, and dispose
S&M	surveillance and maintenance
SNF	spent nuclear fuel
SST	single-shell tank
TOC	Tank Operations Contract
TPA	Tri-Party Agreement
TRU	transuranic
TSD	treatment, storage, and disposal
TWCSF	Tank Waste Characterization and Staging Facility
WIPP	Waste Isolation Pilot Plant
WESF	Waste Encapsulation and Storage Facility
WRAP	Waste Receiving and Processing (Facility)
WTP	Waste Treatment and Immobilization Plant

APPENDIX C

HANFORD ESTIMATED SCHEDULE AND COST STATUS

As directed in the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989), also referred to as the Tri-Party Agreement (TPA)[1], M-036-01, additional schedule and cost details are provided in this appendix. The schedules and costs are provided by project baseline summary (PBS) and reflect the scope discussed in Chapters 3.0 through 6.0 of this *Hanford Lifecycle Scope, Schedule and Cost Report* (LCR), additional scope information at Level 3 is provided, if available.

The schedules and costs provided in this appendix present the low-range estimate of the baseline planning case with allowances for schedule and cost uncertainty. The schedules and costs provided in this appendix are reported to Level 2 for the entire PBS lifecycle and to Level 3 for the execution year (fiscal year [FY] 2019) and a period of approximately 5 more years. Because of the complexity of the Level 3 schedules, the information is reported in table format with costs by year. The start and finish of each Level 3 work element is reflected by the initial and final years that include costs. Information for each PBS is provided in the following subsections as a series of tables:

- A scope table that summarizes the Level 3 work elements. In some instances, the scope descriptions have been developed only to Level 2. In these cases, the information has been presented in the main chapters of the report and is not repeated here.
- A cost and schedule table for the remaining lifecycle is presented at Level 2 by fiscal year. The costs are escalated and include cost and/or schedule uncertainty. Costs are presented from FY2019 through the final year of the lifecycle for all PBSs. PBS RL-LTS extends from FY 2079 through FY 2095.
- A near-term cost and schedule table at Level 3 by fiscal year that extends for about 5 years.

Risk management is an essential function of project management. Cost and schedule uncertainty are included in the development of the total project cost and the approved U.S. Department of Energy (DOE) planning case. Information provided in this LCR includes estimates for both cost and schedule uncertainty based on risk analysis methods that comply with DOE guidelines and orders. These estimates are identified as "cost and/or schedule uncertainty" in the tables. Additional information about uncertainty and project risk is included in section 1.6.2.

C.1 RICHLAND OPERATIONS OFFICE PROJECT BASELINE SUMMARY INFORMATION

The DOE, Richland Operations Office (RL) manages their assigned cleanup mission through the following PBSs (at Level 1):

- Solid Waste Stabilization and Disposition–200 Area, PBS RL-0013C
- Safeguards and Security, PBS RL-0020
- Soil and Water Remediation–Groundwater/Vadose Zone, PBS RL-0030
- Nuclear Facility D&D–Remainder of Hanford, PBS RL-0040
- Nuclear Facility D&D–River Corridor Cleanup Project, PBS RL-0041
- Nuclear Facility D&D–Fast Flux Test Facility Project, PBS RL-0042
- Richland Community and Regulatory Support, PBS RL-0100
- Hanford Sitewide Services, PBS RL-0201
- Long-Term Stewardship, PBS RL-LTS
- Final Reactor Disposition.

[1] Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington, as amended.

C.1.1 SOLID WASTE STABILIZATION AND DISPOSITION–200 AREA (PBS RL-0013C) SCHEDULE AND COST DETAILS

Table C-1. Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) Level 3 Scope Summary. (3 pages)

Level 2 Work Element	Level 3 Work Element	Scope Summary
Project Management	Solid Waste Program Management	Provides overall management function in support of the waste management mission, including waste program support, safety documentation, radiation protection, regulatory and environmental compliance, occupational and industrial safety, and beryllium program management.
Waste Encapsulation Storage Facility (WESF)	WESF Upgrades	Includes activities to safely store cesium/strontium capsules in the WESF pool cells; operate and maintain WESF facilities and associated waste sites, structures, operating systems and equipment, and monitoring systems within the authorization envelope; prepare and package waste streams for disposition as required, dispose of as appropriate; and maintain systems necessary for environmental compliance, radiological control, personnel safety, and capsule integrity; and transition of WESF for final D&D.
	WESF Transition	
	WESF Min Safe	
	WESF During Transition Min Safe	
Canister Storage Building (CSB)	Canister Storage Building	Includes activities to safely store SNF (primarily from K Basins) while awaiting final disposition at a national repository. Includes operation and maintenance of CSB facilities and associated structures, operating systems and equipment, and monitoring systems. Also includes various corrective maintenance tasks, facility modifications, or capital projects necessary to continue safe, cost-effective, and compliant operations throughout the operating life of the facility.
	Canister Storage Building Min Safe	
Mixed Low-Level Waste (MLLW) Trenches	MLLW Ready-to-Serve	Provides for operation of the mixed waste disposal trenches in a safe, compliant, and cost-effective manner, including emergency preparedness, assessments and surveillances, environmental monitoring and sampling, fire protection, engineering, training, receipt and disposal of compliant MLLW packages, design, construction and other activities necessary to add operational layers and for placing temporary caps on the trenches before turnover to PBS RL-0040 for final closure.
	MLLW Upgrades	
	MLLW Leachate Management	
	MLLW Min Safe	
Transuranic (TRU) Waste Retrieval	CH Waste Retrieval	Provides for retrieval, designation, and transfer to a TSD facility of CH suspect TRU waste from LLBGs 218-W-3A, 218-W-4B, 218-W-4C, and 218-E-12B.
	Alpha Caisson Waste Retrieval	Provides for retrieval, designation, and transfer to a TSD facility of RH suspect TRU waste from LLBGs 218-W-3A, 218-W-4B, 218-W-4C, and 218-E-12B.
TRU Repackaging	TRU Repackaging	Provides for WIPP production, TRU repacking operations at T Plant and WRAP, TRU program support for repack, TRUM processing, and RH/large packaging capabilities. It includes staffing, contracts, and consumables directly related to operations.
Waste Receiving and Processing Facility (WRAP)	WRAP Ready-to-Serve	Provides for operations and maintenance of the WRAP facility to support shipping and receiving activities associated with WIPP shipments.
	WRAP Transition	Following operations, WRAP will be transitioned to a condition ready for D&D.
	WRAP Min Safe	Provides for operation of the WRAP facility in a safe, compliant, and cost-effective manner, including activities such as emergency preparedness, assessments and surveillances, environmental monitoring and sampling, engineering, and training.
T Plant	T Plant Ready-to-Serve	Provides for services necessary to maintain the T Plant Complex in a ready-to-serve status for waste processing operations.
	T Plant Upgrades	Provides for upgrades to waste processing equipment, systems components, and computer interface equipment, including physical upgrades to T Plant facility.
	T Plant Transition	Following operations, T Plant will be transitioned to a condition ready for D&D.
	T Plant Min Safe	Provides for operation of the T Plant facility in a safe, compliant, and cost-effective manner, including activities such as emergency preparedness, assessments and surveillances, environmental monitoring and sampling, engineering and training.

Table C-1. Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) Level 3 Scope Summary. (3 pages)

Level 2 Work Element	Level 3 Work Element	Scope Summary
Central Waste Complex (CWC)	CWC Ready-to-Serve	Provides for services necessary to maintain CWC in a ready-to-serve status (base operations) for interim storage of LLW, MLLW, TRU waste and waste receipts from RL approved generators.
	CWC Upgrades	Provides for upgrades to waste processing equipment, systems components, and computer interface equipment, including physical upgrades to the CWC.
	CWC CENRTC	Provides for upgrades and replacement of capital equipment not related to construction (CENTRC).
	CWC Transition	Following operations, CWC will be transitioned to a condition ready for D&D.
	CWC Min Safe	Provides for operation of the CWC in a safe, compliant, and cost-effective manner, including emergency preparedness, assessments and surveillances, environmental monitoring and sampling, engineering, and training.
Environmental Restoration Disposal Facility (ERDF)	ERDF Cell Expansion	Provides for expansion of ERDF by one supercell (two normal cells) to support Site cleanup efforts, including relocation of groundwater monitoring wells.
	ERDF Ready-to-Serve	Includes ERDF operations-related activities such as leachate management, waste receipt and disposal, waste transport to ERDF, equipment and road maintenance, air monitoring, and groundwater well sampling and analysis.
	ERDF Interim Cover	Provides for placement of interim covers over ERDF cells as they are filled.
Integrated Disposal Facility (IDF)	IDF Startup and Testing	Includes staff ramp-up, operational readiness review, and regulatory documentation.
	IDF Ready-to-Serve	Provides for operation of the IDF in a safe, compliant, and cost-effective manner, including emergency preparedness, assessments and surveillances, environmental monitoring and sampling, fire protection, engineering, training, and receipt and disposal of ILAW and other solid waste from the WTP.
	IDF Upgrades	Includes upgrades to trailers, parking, utilities, and other infrastructure needed for IDF occupancy as well as upgrades to the waste receiving interface area.
TRU Disposition	TRU Disposition	Provides for resources to develop and maintain an interface with Hanford Site generators and CCP to perform TRU certification activities. Includes support for generators of TRU waste to define CH and RH waste volumes and packaging requirements and resources to perform WIPP closeout activities to the current Hanford WIPP Program. Provides for TRU CH shipping capabilities and establishing RH shipping capabilities, including all capital funded activities.
Spent Nuclear Fuel (SNF) Disposition	Fuel Prep Facility	Includes design, construction, and turnover to operations of a fuel preparation facility to repackage fuel stored at the 200 Area interim storage area into DOE standard canisters that satisfy repository acceptance requirements. The facility will include a shielded hot cell and remote welding capabilities.
	Offsite SNF Disposition	Includes activities to facilitate final disposition of Hanford SNF inventories at a national repository, including compliance document review, technical and programmatic interface with the cognizant DOE office and/or programs that have responsibility for management and disposition of SNF, SNF data package compliance, and planning for SNF disposition.
Low Level Waste Burial Grounds	Low Level Waste Burial Grounds Min Safe	Provides for operation of the Low-Level Waste Burial Grounds in a safe, compliant and cost-effective manner, including surveillance, maintenance, environmental monitoring and sampling, engineering, training, work control, and radiation protection.
Sludge Treatment Phase 2	Sludge Treatment Phase 2 Design and Construction	Includes documentation for project approval, development and approval of conceptual, preliminary and final designs, project management, procurement, construction and operational readiness completion needed to stabilize and package sludge from 105-KW Basin for final disposition to WIPP or another disposal facility.
	Sludge Treatment Phase 2 Operation	Includes operations needed to package and ship the treated sludge to WIPP and deactivation of process systems.

Table C-1. Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) Level 3 Scope Summary. (3 pages)

Level 2 Work Element	Level 3 Work Element	Scope Summary
	Sludge Treatment Phase 2 Project Closeout	Includes shutdown of process systems, management, and support.
Management of Cesium and Strontium Capsules (MCSC)	MCSC Other Project Costs	Provides for construction of WESF modifications and the capsule storage area (CSA), management and other project costs.
Capsule Interim Storage Operations	Capsule Transfer Startup and Operations	Provides for design and fabrication of the Cask Storage System (CSS), retrieval of cesium/strontium capsules from the WESF pool cells and packaging, transportation, and placement of the CSS into dry storage at the CSA.
General Debris and Excess Cleanup	Disposition Decision and Disposal	Includes a disposition decision, cleanup and disposal of general debris and excess material on the Hanford Site.

NOTE: See Tables C-2 and C-3 for schedule and budget information.

CCP = Central Characterization Project.
CENRTC = capital equipment not related to construction.
CH = contact-handled.
CSB = Canister Storage Building.
CWC = Central Waste Complex.
D&D = decontamination and decommissioning.
ERDF = Environmental Restoration Disposal Facility.
ETF = Effluent Treatment Facility.
IDF = Integrated Disposal Facility.
LDR = land disposal restriction.
LERF = Liquid Effluent Retention Facility.
LLBG = Low-Level Burial Grounds.
LLW = low-level waste.
MLLW = mixed low-level waste.
PBS = project baseline summary.
RH = remote-handled.
SNF = spent nuclear fuel.
TRU = transuranic.
TSD = treatment, storage, and disposal.
WESF = Waste Encapsulation Storage Facility.
WIPP = Waste Isolation Pilot Plant.
WRAP = Waste Receiving and Processing (Facility).
WTP = Waste Treatment and Immobilization Plant.

Table C-2. Solid Waste Stabilization and Disposition –200 Area (PBS RL-0013C) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000 Escalated). (6 pages)

Fiscal Year	2019	2020	2021	2022	2023	2024	2025	2026
Project Management	11,100	11,400	11,600	11,800	12,100	12,400	12,300	12,700
Waste Encapsulation Storage Facility (WESF)	9,300	9,500	9,700	9,800	9,300	18,600	19,100	0
Canister Storage Building (CSB)	6,300	6,500	6,600	6,700	6,900	7,100	7,300	7,500
MLLW Trenches	1,000	1,100	1,100	1,700	1,700	2,000	1,800	2,100
TRU Waste Retrieval	10,500	60,400	62,200	63,500	64,300	65,900	67,800	69,800
TRU Repackaging	11,300	71,700	68,800	73,600	80,700	61,000	62,800	64,600
WRAP	10,200	10,600	9,700	13,300	16,600	17,000	17,500	18,000
T Plant	33,200	56,500	66,100	67,400	186,900	193,400	222,800	100,800
Central Waste Complex (CWC)	16,500	16,300	17,700	17,300	17,500	18,400	10,500	12,200
ERDF	11,100	31,200	34,600	32,300	33,000	34,000	35,000	37,400
Integrated Disposal Facility (IDF)	2,800	16,500	10,000	13,000	7,000	7,200	7,400	7,600
TRU Disposition	8,200	8,400	8,600	8,700	17,200	23,300	24,000	24,700
Spent Nuclear Fuel (SNF) Disposition	3,500	3,600	3,600	3,700	3,800	3,900	7,000	7,200
Low-Level Waste Burial Grounds	1,500	1,600	1,600	1,600	1,700	1,700	1,800	1,800
Sludge Treatment, Phase 2	0	92,600	42,500	58,700	44,700	26,000	27,600	23,900
Management of Cesium/Strontium Capsules (MCSC)	18,400	12,200	5,200	600	0	0	0	0
Capsule Interim Storage Operations	0	28,100	29,300	7,700	7,800	5,200	0	0
General Debris and Excess Cleanup	0	700	700	700	700	700	700	800
Cost and/or Schedule Uncertainty	6,100	39,700	55,400	49,100	78,200	59,500	66,600	43,400
Level 2 Total	**161,000**	**478,600**	**445,000**	**441,200**	**590,100**	**557,300**	**592,000**	**434,500**
Fiscal Year	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**
Project Management	12,800	13,100	13,600	14,100	14,300	14,800	15,100	15,200
Waste Encapsulation Storage Facility (WESF)	10,300	10,500	0	0	0	0	0	0
Canister Storage Building (CSB)	7,600	7,800	8,100	8,400	8,600	8,800	9,000	9,100
MLLW Trenches	2,100	2,100	2,200	2,300	1,400	1,400	1,500	1,500
TRU Waste Retrieval	45,800	45,400	42,800	0	0	0	0	0
TRU Repackaging	66,400	67,600	69,400	67,900	62,600	63,700	65,600	66,900
WRAP	18,300	18,800	19,600	20,200	8,200	0	0	0
T Plant	39,800	40,700	42,600	43,800	16,500	16,900	17,200	17,300
Central Waste Complex (CWC)	11,800	12,400	12,600	13,300	10,300	10,200	10,400	10,400
ERDF	60,300	61,500	0	0	0	0	0	0

Table C-2. Solid Waste Stabilization and Disposition –200 Area (PBS RL-0013C) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000 Escalated). (6 pages)

Integrated Disposal Facility (IDF)	7,700	7,900	8,300	8,500	8,700	8,900	9,100	9,200
TRU Disposition	25,100	25,700	26,900	27,800	28,200	29,100	29,700	29,900
Spent Nuclear Fuel (SNF) Disposition	7,300	7,500	7,800	8,100	8,200	8,400	0	0
Low-Level Waste Burial Grounds	1,800	1,900	2,000	2,000	2,100	2,100	2,200	2,200
Sludge Treatment, Phase 2	29,000	39,500	28,100	14,400	38,600	41,800	42,600	41,300
Management of Cesium/Strontium Capsules (MCSC)	0	0	0	0	0	0	0	0
Capsule Interim Storage Operations	0	0	0	0	0	0	0	0
General Debris and Excess Cleanup	800	800	800	0	0	0	0	0
Cost and/or Schedule Uncertainty	97,900	85,800	71,100	78,500	85,400	89,300	56,700	43,100
Level 2 Total	**444,800**	**449,000**	**355,900**	**309,300**	**293,100**	**295,400**	**259,100**	**246,100**
Fiscal Year	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**
Project Management	15,400	16,200	16,500	17,200	17,500	18,200	19,000	19,000
Waste Encapsulation Storage Facility (WESF)	0	0	0	0	0	0	0	0
Canister Storage Building (CSB)	9,200	9,600	9,900	10,300	10,500	10,900	11,400	11,300
MLLW Trenches	1,500	1,600	1,600	1,600	1,700	1,800	1,800	1,800
TRU Waste Retrieval	0	0	0	0	0	0	0	0
TRU Repackaging	67,400	68,600	71,800	50,200	0	0	0	0
WRAP	0	0	0	0	0	0	27,700	0
T Plant	17,700	41,300	42,200	0	0	0	0	0
Central Waste Complex (CWC)	11,100	11,100	11,400	11,800	12,100	12,500	13,100	13,100
ERDF	0	0	0	0	0	0	0	0
Integrated Disposal Facility (IDF)	19,700	9,800	10,000	10,400	10,600	11,000	11,500	11,500
TRU Disposition	30,400	31,800	28,600	13,300	13,500	14,100	400	0
Spent Nuclear Fuel (SNF) Disposition	0	0	0	0	0	0	0	0
Low-Level Waste Burial Grounds	2,200	2,300	2,400	2,500	2,500	2,600	2,800	2,700
Sludge Treatment, Phase 2	41,800	11,600	1,500	1,500	1,600	1,600	1,700	1,800
Management of Cesium/Strontium Capsules (MCSC)	0	0	0	0	0	0	0	0
Capsule Interim Storage Operations	0	0	0	0	0	0	0	0
General Debris and Excess Cleanup	0	0	0	0	0	0	0	0
Cost and/or Schedule Uncertainty	42,300	39,500	48,500	52,600	64,300	76,000	79,000	61,200
Level 2 Total	**258,700**	**243,400**	**244,400**	**171,400**	**134,300**	**148,700**	**168,400**	**122,400**

Table C-2. Solid Waste Stabilization and Disposition –200 Area (PBS RL-0013C) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000 Escalated). (6 pages)

Fiscal Year	2043	2044	2045	2046	2047	2048	2049	2050
Project Management	19,400	20,100	20,500	21,000	22,000	23,000	23,600	24,000
Waste Encapsulation Storage Facility (WESF)	0	0	0	0	0	0	0	0
Canister Storage Building (CSB)	11,600	12,000	12,200	12,600	13,100	13,700	14,100	14,400
MLLW Trenches	1,900	1,900	2,000	2,100	2,100	2,200	2,300	2,300
TRU Waste Retrieval	0	0	0	0	0	0	0	0
TRU Repackaging	0	0	0	0	0	0	0	0
WRAP	0	0	0	0	0	0	0	0
T Plant	0	0	0	0	0	0	0	0
Central Waste Complex (CWC)	13,400	13,800	14,100	14,500	15,100	15,800	16,300	16,600
ERDF	0	0	0	0	0	5,200	5,200	0
Integrated Disposal Facility (IDF)	11,800	12,100	12,400	12,700	13,300	13,900	14,300	14,600
TRU Disposition	0	0	0	0	0	0	0	0
Spent Nuclear Fuel (SNF) Disposition	100	35,900	54,200	55,500	7,600	26,500	27,200	27,800
Low-Level Waste Burial Grounds	2,800	2,900	3,000	3,000	3,200	3,300	3,400	3,500
Sludge Treatment, Phase 2	1,800	1,800	1,900	1,900	2,000	2,100	2,100	2,200
Management of Cesium/Strontium Capsules (MCSC)	0	0	0	0	0	0	0	0
Capsule Interim Storage Operations	0	0	0	0	0	0	0	0
General Debris and Excess Cleanup	0	0	0	0	0	0	0	0
Cost and/or Schedule Uncertainty	46,900	38,700	24,500	26,800	23,200	16,700	10,100	17,100
Level 2 Total	**109,700**	**139,200**	**144,800**	**150,100**	**101,600**	**122,400**	**118,600**	**122,500**
Fiscal Year	**2051**	**2052**	**2053**	**2054**	**2055**	**2056**	**2057**	**2058**
Project Management	24,500	25,400	26,000	23,700	25,000	26,200	26,700	27,300
Waste Encapsulation Storage Facility (WESF)	0	0	0	0	0	0	0	0
Canister Storage Building (CSB)	14,600	16,300	22,400	16,400	0	0	0	0
MLLW Trenches	2,400	2,400	2,600	1,700	0	0	0	0
TRU Waste Retrieval	0	0	0	0	0	0	0	0
TRU Repackaging	0	0	0	0	0	0	0	0
WRAP	0	0	0	0	0	0	0	0
T Plant	0	0	0	0	0	0	0	0
Central Waste Complex (CWC)	17,000	17,500	18,000	19,200	20,200	21,100	21,700	22,000
ERDF	0	0	0	0	0	0	0	0
Integrated Disposal Facility (IDF)	15,000	15,400	15,800	16,900	17,800	18,600	19,100	19,400

Table C-2. Solid Waste Stabilization and Disposition –200 Area (PBS RL-0013C) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000 Escalated). (6 pages)

TRU Disposition	0	0	0	0	0	0	0	0
Spent Nuclear Fuel (SNF) Disposition	28,300	29,300	29,900	0	0	0	0	0
Low-Level Waste Burial Grounds	3,500	3,700	3,800	4,000	0	0	0	0
Sludge Treatment, Phase 2	2,200	2,300	2,300	2,400	2,700	2,800	2,800	2,900
Management of Cesium/Strontium Capsules (MCSC)	0	0	0	0	0	0	0	0
Capsule Interim Storage Operations	0	0	0	0	0	0	0	0
General Debris and Excess Cleanup	0	0	0	0	0	0	0	0
Cost and/or Schedule Uncertainty	17,900	15,400	15,300	13,100	21,900	17,700	17,200	14,500
Level 2 Total	**125,400**	**127,700**	**136,100**	**97,400**	**87,600**	**86,400**	**87,500**	**86,100**
Fiscal Year	**2059**	**2060**	**2061**	**2062**	**2063**	**2064**	**2065**	**2066**
Project Management	28,300	33,400	34,200	35,000	35,800	36,600	37,500	38,300
Waste Encapsulation Storage Facility (WESF)	0	0	0	0	0	0	0	0
Canister Storage Building (CSB)	0	0	0	0	0	0	0	0
MLLW Trenches	0	0	0	0	0	0	0	0
TRU Waste Retrieval	0	0	0	0	0	0	0	0
TRU Repackaging	0	0	0	0	0	0	0	0
WRAP	0	0	0	0	0	0	0	0
T Plant	0	0	0	0	0	0	0	0
Central Waste Complex (CWC)	22,800	23,100	23,600	24,200	24,700	25,300	25,900	26,500
ERDF	0	0	0	0	0	0	0	0
Integrated Disposal Facility (IDF)	20,100	20,300	20,800	21,300	21,700	22,200	22,800	23,300
TRU Disposition	0	0	0	0	0	0	0	0
Spent Nuclear Fuel (SNF) Disposition	0	0	0	0	0	0	0	0
Low-Level Waste Burial Grounds	0	0	0	0	0	0	0	0
Sludge Treatment, Phase 2	3,000	400	0	0	0	0	0	0
Management of Cesium/Strontium Capsules (MCSC)	0	0	0	0	0	0	0	0
Capsule Interim Storage Operations	0	0	0	0	0	0	0	0
General Debris and Excess Cleanup	0	0	0	0	0	0	0	0
Cost and/or Schedule Uncertainty	11,500	13,600	27,400	24,400	23,000	20,400	18,800	18,200
Level 2 Total	**85,700**	**90,800**	**106,000**	**104,900**	**105,200**	**104,500**	**105,000**	**106,300**
Fiscal Year	**2067**	**2068**	**2069**	**2070**	**2071**	**2072**	**2073**	**2074**
Project Management	39,300	40,100	41,000	42,000	41,900	42,500	44,200	47,000
Waste Encapsulation Storage Facility (WESF)	0	0	0	0	0	0	0	0

Table C-2. Solid Waste Stabilization and Disposition –200 Area (PBS RL-0013C) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000 Escalated). (6 pages)

Canister Storage Building (CSB)	0	0	0	0	0	0	0	0
MLLW Trenches	0	0	0	0	0	0	0	0
TRU Waste Retrieval	0	0	0	0	0	0	0	0
TRU Repackaging	0	0	0	0	0	0	0	0
WRAP	0	0	0	0	0	0	0	0
T Plant	0	0	0	0	0	0	0	0
Central Waste Complex (CWC)	27,100	27,700	28,300	29,000	28,900	38,800	0	0
ERDF	0	0	0	0	0	0	0	0
Integrated Disposal Facility (IDF)	23,900	24,400	24,900	25,500	25,500	0	0	0
TRU Disposition	0	0	0	0	0	0	0	0
Spent Nuclear Fuel (SNF) Disposition	0	0	0	0	0	0	0	0
Low-Level Waste Burial Grounds	0	0	0	0	0	0	0	0
Sludge Treatment, Phase 2	0	0	0	0	0	0	0	0
Management of Cesium/Strontium Capsules (MCSC)	0	0	0	0	0	0	0	0
Capsule Interim Storage Operations	0	0	0	0	0	0	0	0
General Debris and Excess Cleanup	0	0	0	0	0	0	0	0
Cost and/or Schedule Uncertainty	15,100	15,500	14,600	13,900	13,000	7,900	8,200	6,900
Level 2 Total	**105,400**	**107,700**	**108,800**	**110,400**	**109,300**	**89,200**	**52,400**	**53,900**

Fiscal Year	**2075**	**2076**	**2077**	**2078**	**Total**
Project Management	47,100	47,300	50,400	52,300	**1,540,000**
Waste Encapsulation Storage Facility (WESF)	0	0	0	0	**106,100**
Canister Storage Building (CSB)	0	0	0	0	**378,800**
MLLW Trenches	0	0	0	0	**66,300**
TRU Waste Retrieval	0	0	0	0	**598,400**
TRU Repackaging	0	0	0	0	**1,282,600**
WRAP	0	0	0	0	**225,700**
T Plant	0	0	0	0	**1,263,100**
Central Waste Complex (CWC)	0	0	0	0	**966,200**
ERDF	0	0	0	0	**380,800**
Integrated Disposal Facility (IDF)	0	0	0	0	**774,100**
TRU Disposition	0	0	0	0	**477,600**
Spent Nuclear Fuel (SNF) Disposition	0	0	0	0	**405,900**
Low-Level Waste Burial Grounds	0	0	0	0	**89,700**

Table C-2. Solid Waste Stabilization and Disposition –200 Area (PBS RL-0013C) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000 Escalated). (6 pages)

Sludge Treatment, Phase 2	0	0	0	0	**694,000**	
Management of Cesium/Strontium Capsules (MCSC)	0	0	0	0	**36,400**	
Capsule Interim Storage Operations	0	0	0	0	**78,100**	
General Debris and Excess Cleanup	0	0	0	0	**7,400**	
Cost and/or Schedule Uncertainty	5,800	5,300	4,400	4,600	**2,078,700**	
Level 2 Total	**52,900**	**52,600**	**54,800**	**56,900**	**11,449,900**	

ERDF = Environmental Restoration Disposal Facility
MLLW = mixed low-level waste.
PBS = project baseline summary.
TRU = transuranic.
WRAP= Waste Receiving and Processing Facility.

Table C-3. Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) Near-Term Schedule and Costs, Level 3, by Fiscal Year ($1,000, Escalated). (3 pages)

Schedule Level	Scope	2019	2020	2021	2022	2023	2024	Total
1	**Solid Waste Stabilization and Disposition – 200 Area**	**161,000**	**478,600**	**445,000**	**441,200**	**590,100**	**557,300**	**2,673,200**
2	**Project Management**	**11,100**	**11,400**	**11,600**	**11,800**	**12,100**	**12,400**	**70,400**
3	Solid Waste Program Management	11,100	11,400	11,600	11,800	12,100	12,400	70,400
2	**Waste Encapsulation Storage Facility (WESF)**	**9,300**	**9,500**	**9,700**	**9,800**	**9,300**	**18,600**	**66,200**
3	Waste Encapsulation Storage Facility Upgrades	700	700	700	700	0	0	2,800
3	Waste Encapsulation Storage Facility Transition	0	0	0	0	0	9,000	9,000
3	Waste Encapsulation Storage Facility Min Safe	8,600	8,800	9,000	9,100	9,300	9,600	54,400
2	**Canister Storage Building (CSB)**	**6,300**	**6,500**	**6,600**	**6,700**	**6,900**	**7,100**	**40,100**
3	Canister Storage Building Min Safe	6,300	6,500	6,600	6,700	6,900	7,100	40,100
2	**MLLW Trenches**	**1,000**	**1,100**	**1,100**	**1,700**	**1,700**	**2,000**	**8,600**
3	Mixed Low Level Waste Trenches Ready-to-Serve	0	0	0	600	600	600	1,800
3	Mixed Low Level Waste Upgrades	0	0	0	0	0	300	300
3	Mixed Low Level Waste Leachate Management	400	400	400	400	400	400	2,400
3	Mixed Low Level Waste Trenches Min Safe	600	700	700	700	700	700	4,100
2	**TRU Waste Retrieval**	**10,500**	**60,400**	**62,200**	**63,500**	**64,300**	**65,900**	**326,800**
3	Trench Retrieval (CH and RH)	10,500	22,900	23,600	24,100	24,400	25,000	130,500
3	Alpha Caisson Waste Retrieval (ACWR)	0	37,500	38,600	39,400	39,900	40,900	196,300
2	**TRU Repackaging**	**11,300**	**71,700**	**68,800**	**73,600**	**80,700**	**61,000**	**367,100**
3	TRU Repackaging	11,300	71,700	68,800	73,600	80,700	61,000	367,100
2	**Waste Receiving and Processing Facility (WRAP)**	**10,200**	**10,600**	**9,700**	**13,300**	**16,600**	**17,000**	**77,400**

Table C-3. Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) Near-Term Schedule and Costs, Level 3, by Fiscal Year ($1,000, Escalated). (3 pages)

Schedule Level	Scope	2019	2020	2021	2022	2023	2024	Total
3	WRAP Ready-to-Serve	4,200	4,400	3,400	6,900	10,000	10,200	39,100
3	WRAP Min Safe	6,000	6,200	6,300	6,400	6,600	6,800	38,300
2	**T Plant**	**33,200**	**56,500**	**66,100**	**67,400**	**186,900**	**193,400**	**603,500**
3	T Plant Ready-to-Serve	22,300	45,300	54,600	55,800	175,000	181,100	534,100
3	T Plant Min Safe	10,900	11,200	11,500	11,600	11,900	12,300	69,400
2	**Central Waste Complex (CWC)**	**16,500**	**16,300**	**17,700**	**17,300**	**17,500**	**18,400**	**103,700**
3	Central Waste Complex Ready-to-Serve	8,500	8,100	9,100	8,900	8,900	9,500	53,000
3	Central Waste Complex Upgrades	700	700	700	700	700	800	4,300
3	CWC CENRTC	0	0	300	0	0	0	300
3	CWC Min Safe	7,300	7,500	7,600	7,700	7,900	8,100	46,100
2	**Environmental Restoration Disposal Facility (ERDF)**	**11,100**	**31,200**	**34,600**	**32,300**	**33,000**	**34,000**	**176,200**
3	ERDF Ready-to-Serve	11,100	31,200	31,800	32,300	33,000	34,000	173,400
3	ERDF Interim Cover	0	0	2,800	0	0	0	2,800
2	**Integrated Disposal Facility (IDF)**	**2,800**	**16,500**	**10,000**	**13,000**	**7,000**	**7,200**	**56,500**
3	IDF Startup and Testing	2,800	16,500	10,000	11,800	0	0	41,100
3	IDF Ready-to-Serve	0	0	0	1,200	7,000	7,200	15,400
2	**TRU Disposition**	**8,200**	**8,400**	**8,600**	**8,700**	**17,200**	**23,300**	**74,400**
3	TRU Disposition	8,200	8,400	8,600	8,700	17,200	23,300	74,400
2	**Spent Nuclear Fuel (SNF) Disposition**	**3,500**	**3,600**	**3,600**	**3,700**	**3,800**	**3,900**	**22,100**
3	Offsite SNF Disposition	3,500	3,600	3,600	3,700	3,800	3,900	22,100
2	**Low-Level Waste Burial Grounds**	**1,500**	**1,600**	**1,600**	**1,600**	**1,700**	**1,700**	**9,700**
3	Low Level Waste Burial Grounds Min Safe	1,500	1,600	1,600	1,600	1,700	1,700	9,700
2	**Sludge Treatment, Phase 2**	**0**	**92,600**	**42,500**	**58,700**	**44,700**	**26,000**	**264,500**
3	Sludge Treatment Phase Two Design and Construction	0	11,700	14,600	56,700	44,500	25,800	153,300
3	Sludge Treatment Phase Two Operation	0	80,800	20,000	1,100	0	0	101,900
3	Sludge Treatment Phase Two Project Closeout	0	100	7,900	900	200	200	9,300
2	**Management of Cesium/Strontium Capsules (MCSC)**	**18,400**	**12,200**	**5,200**	**600**	**0**	**0**	**36,400**
3	Management of Cs/Sr Capsules, Other Project Costs	18,400	12,200	5,200	600	0	0	36,400
2	**Capsule Interim Storage Operations**	**0**	**28,100**	**29,300**	**7,700**	**7,800**	**5,200**	**78,100**
3	Capsule Transfer Startup and Operations	0	28,100	29,300	7,700	7,800	5,200	78,100
2	**General Debris and Excess Cleanup**	**0**	**700**	**700**	**700**	**700**	**700**	**3,500**
3	Disposition Decision and Disposal	0	700	700	700	700	700	3,500

Table C-3. Solid Waste Stabilization and Disposition–200 Area (PBS RL-0013C) Near-Term Schedule and Costs, Level 3, by Fiscal Year ($1,000, Escalated). (3 pages)

Schedule Level	Scope	2019	2020	2021	2022	2023	2024	Total
2	**Cost and/or Schedule Uncertainty**	**6,100**	**39,700**	**55,400**	**49,100**	**78,200**	**59,500**	**288,000**
	Total	**161,000**	**478,600**	**445,000**	**441,200**	**590,100**	**557,300**	**2,673,200**

CH = contact-handled.
CSB = Canister Storage Building.
CWC = Central Waste Complex.
ERDF = Environmental Restoration Disposal Facility.
IDF = Integrated Disposal Facility.
MLLW = mixed low-level waste.
PBS = project baseline summary.
RH = remote-handled.
SNF = spent nuclear fuel.
TRU = transuranic.
WESF = Waste Encapsulation Storage Facility.
WRAP = Waste Receiving and Processing (Facility)

C.1.2 SAFEGUARDS AND SECURITY (PBS RL-0020) SCHEDULE AND COST DETAILS

Scope information for Safeguards and Security, PBS RL-0020, is presented in Table C-4. This PBS is not broken down to Level 3 details, so no additional scope is presented.

Table C-4. Safeguards and Securities (PBS RL-0020) Level 2 Scope Summary.

Work Element	Scope Description
Safeguards and Security	Includes management, training, and equipment for staff; physical protective systems, such as intrusion protection, Hanford Site access, and badging; information and cyber security; personnel security; material control and accountability; and security program management.

NOTE: See Table C-5 for schedule and budget information.
PBS = project baseline summary.
RL = U.S. Department of Energy, Richland Operations Office.

Table C-5. Safeguards and Security (PBS RL-0020) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000 Escalated).

Fiscal Year	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Safeguards and Security	86,700	92,900	97,900	102,600	123,300	130,300	118,200	121,600	123,800
Fiscal Year	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**
Safeguards and Security	126,700	131,900	135,900	138,500	142,400	145,300	146,800	149,500	155,800
Fiscal Year	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
Safeguards and Security	159,500	165,200	168,600	175,000	182,100	182,400	184,700	190,400	194,900
Fiscal Year	**2046**	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**	**2053**	**2054**
Safeguards and Security	199,700	208,200	216,500	222,000	226,600	231,200	238,700	244,700	112,700
Fiscal Year	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**	**2061**	**2062**	**2063**
Safeguards and Security	117,400	121,600	124,300	127,100	131,000	159,600	163,300	167,200	170,800
Fiscal Year	**2064**	**2065**	**2066**	**2067**	**2068**	**2069**	**2070**	**2071**	**2072**
Safeguards and Security	174,600	178,900	183,100	187,400	191,500	195,800	200,600	199,900	202,900
Fiscal Year	**2073**	**2074**	**2075**	**2076**	**2077**	**2078**	**Total**		
Safeguards and Security	210,900	224,200	225,000	226,000	240,600	249,600	**10,146,500**		

PBS = project baseline summary.
RL = U.S. Department of Energy, Richland Operations Office.

C.1.3 SOIL AND WATER REMEDIATION–GROUNDWATER / VADOSE ZONE (PBS RL-0030) SCHEDULE AND COST DETAILS

Table C-6. Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030) Level 3 Scope Summary. (3 pages)

Level 2 Work Element	Level 3 Work Element	Scope Summary
Groundwater Program Management	Groundwater Program Management	Includes program management oversight, integrated field work, training, well access roads, strategic integration, groundwater management plan, technical support and evaluations, project control, performance assessment, remediation decision support, sample management and reporting, environmental databases, and CERCLA 5-year review.
	Integration and Assessments	
Groundwater Monitoring	Geophysical Sciences and Logging	Includes geophysical borehole logging; groundwater laboratory analysis and sample data management; groundwater sample collection; purgewater truck and operation and maintenance of the Hanford Geotechnical Sample Library; groundwater data evaluation and reporting including the annual CERCLA, RCRA, and pump-and-treat operations reports; well maintenance, monitoring, and reporting; RCRA well drilling per TPA[2] M-024 milestones; miscellaneous well decommissioning and operation; maintenance, sampling; and dismantlement of the Modutanks.
	Groundwater Lab Analysis and Data Management	
	Groundwater Sample Collection	
	Groundwater Data Evaluation and Reporting	
	Well Maintenance, Monitoring and Reporting	
	RCRA Well Drilling (M-024)	
	Miscellaneous Well Decommissioning	
	Modutanks	
200-WA-1 Operable Unit	200-WA-1 Decision Documents	For the 200 West Area waste sites, includes implementing the RI/FS process though field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparation of the remedial design/remedial action work plan.
200-EA-1 Operable Unit	200-EA-1 Decision Documents	For the 200 East Area waste sites, includes implementing the CERCLA/RCRA process though field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparation of the remedial design/remedial action work plan.
200-OA-1 Operable Unit	200-OA-1 Decision Documents	For the Outer Area waste sites, includes implementing the RI/FS process though field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparation of the remedial design/remedial action work plan.
200-IS-1 Operable Unit	200-IS-1 Decision Documents	For the 200 Area pipelines, includes implementing the CERCLA/RCRA process though field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparing the remedial design/remedial action work plan.
200-SW-2 Operable Unit	200-SW-2 Decision Documents	For the 200 Area land disposal units, includes implementing the CERCLA/RCRA process though field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparing the remedial design/remedial action work plan.

Table C-6. Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030)
Level 3 Scope Summary. (3 pages)

Level 2 Work Element	Level 3 Work Element	Scope Summary
100-BC-5 Operable Unit	100-BC-5 Project Management	For 100-BC groundwater, includes completing the CERCLA[1] process and preparing regulatory decision documents leading to a final ROD, then implementing and monitoring the remedial action to completion, including final reporting and well decommissioning.
	100-BC-5 Decision Documents	
	100-BC-5 Remedial/Removal Action Implementation	
	100-BC-5 Monitoring and Reporting	
100-KR-4 Operable Unit	100-KR-4 Project Management	For 100-KR groundwater, includes completing the CERCLA process and preparing regulatory decision documents leading to a final ROD, then implementing and monitoring the remedial action to completion, including well drilling and decommissioning, pump-and-treat operations, maintenance, and monitoring, final reporting and remedy D&D.
	100-KR-4 Decision Documents	
	100-KR-4 Remedial/Removal Action Implementation	
	100-KR-4 Monitoring and Reporting	
100-NR-2 Operable Unit	100-NR-2 Project Management	For 100-NR groundwater, includes completing the CERCLA process and preparing regulatory decision documents leading to a final ROD, then implementing and monitoring the remedial action to completion, including final reporting, well drilling and decommissioning, and remedy D&D.
	100-NR-2 Decision Documents	
	100-NR-2 Remedial/Removal Action Implementation	
	100-NR-2 Monitoring and Reporting	
100-HR-3 Operable Unit	100-HR-3 Project Management	For 100-HR groundwater, includes implementing and monitoring the remedial action to completion, including well drilling and decommissioning, pump-and-treat operations, maintenance and monitoring, final reporting, and remedy D&D.
	100-HR-3 Remedial/Removal Action Implementation	
	100-HR-3 Monitoring and Reporting	
100-FR-3 Operable Unit	100-FR-3 Project Management	For 100-FR groundwater, includes implementing and monitoring the remedial action to completion, including final reporting and well drilling and decommissioning.
	100-FR-3 Remedial/Removal Action Implementation	
	100-FR-3 Monitoring and Reporting	
200-BP-5 Operable Unit	200-BP-5 Project Management	For 200-BP groundwater, includes completing the CERCLA process and preparing regulatory decision documents (including for the 200-PO-1 OU) leading to a final ROD, then implementing and monitoring the remedial action to completion, including final reporting and well drilling and decommissioning.
	200-BP-5 Decision Documents	
	200-BP-5 Remedial/Removal Action Implementation	
	200-BP-5 Monitoring and Reporting	
200-PO-1 Operable Unit	200-PO-1 Project Management	For 200-PO groundwater, includes implementing and monitoring the remedial action to completion, including final reporting and well drilling and decommissioning.
	200-PO-1 Remedial/Removal Action Implementation	
	200-PO-1 Monitoring and Reporting	
200-UP-1 Operable Unit	200-UP-1 Project Management	For 200-UP groundwater, includes implementing and monitoring the remedial action to completion, including treatability testing, tracer study, well drilling and decommissioning, pump-and-treat operations, maintenance, and monitoring, final reporting, and remedy D&D.
	200-UP-1 Decision Documents	
	200-UP-1 Remedial/Removal Action Implementation	
	200-UP-1 Monitoring and Reporting	
200-ZP-1 Operable Unit	200-ZP-1 Project Management	For 200-ZP groundwater, includes implementing and monitoring the remedial action to completion, including well drilling and decommissioning, pump-and-treat operations, maintenance and monitoring, final reporting, and remedy D&D.
	200-ZP-1 Remedial/Removal Action Implementation	
	200-ZP-1 Monitoring and Reporting	

Table C-6. Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030)
Level 3 Scope Summary. (3 pages)

Level 2 Work Element	Level 3 Work Element	Scope Summary
200-CB-1 Operable Unit	200-CB-1 Decision Documents	For the B Plant canyon and waste sites, includes implementing the RI/FS process though field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparing the remedial design/remedial action work plan.
200-CP-1 Operable Unit	200-CP-1 Decision Documents	For the PUREX canyon and waste sites (including the PUREX tunnels), includes implementing the RI/FS process though field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparing the remedial design/remedial action work plan.
200-CR-1 Operable Unit	200-CR-1 Decision Documents	For the REDOX canyon and waste sites, includes implementing the RI/FS process though field investigations, sampling and analysis, and preparing regulatory decision documents leading to a final ROD, then preparing the remedial design/remedial action work plan.
300-FF-5 Operable Unit	300-FF-5 Project Management	For 300-FF groundwater, includes implementing and monitoring the remedial action to completion, including final reporting, and well drilling and decommissioning.
	300-FF-5 Remedial/Removal Action Implementation	
	300-FF-5 Monitoring and Reporting	
200-DV-1 Operable Unit	200-DV-1 Project Management	For the deep vadose zone, includes completing the CERCLA/RCRA[2] process and preparing regulatory decision documents leading to a final ROD, then preparing the remedial design/remedial action work plan.
	200-DV-1 Decision Documents	

NOTE: See Tables C-7 and C-8 for schedule and budget information.

[1]*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601, et seq.

[2]Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

[3]*Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq.

CENRTC = capital equipment not related to construction.
CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980.*
D&D = deactivation and decommissioning.
GRP = Groundwater Remediation Project.
IFW = Integrated Field Work.
OU = operable unit.
PBS = project baseline summary.
RI/FS = remedial investigation/feasibility study.
RCRA = *Resource Conservation and Recovery Act of 1976.*
TPA = Tri-Party Agreement.

Table C-7. Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated). (6 pages)

Fiscal Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Groundwater Program Management	27,600	55,800	55,700	43,200	38,000	38,500	40,000	38,600	39,500	34,900
Groundwater Monitoring	22,200	31,100	29,500	29,900	19,800	31,600	32,300	33,400	33,700	23,400
200-WA-1 Operable Unit	0	1,200	9,300	10,800	6,000	700	800	600	1,800	0
200-EA-1 Operable Unit	0	22,700	10,700	1,500	1,500	500	800	1,900	0	0
200-OA-1 Operable Unit	0	2,000	9,800	4,500	1,100	1,100	500	1,800	0	0
200-IS-1 Operable Unit	0	31,800	32,700	18,300	3,000	3,000	3,100	500	2,500	0
200-SW-2 Operable Unit	0	6,400	6,600	6,900	3,400	1,400	1,400	1,800	1,100	1,200
100-BC-5 Operable Unit	2,100	1,900	900	900	900	200	200	200	200	200
100-KR-4 Operable Unit	11,700	22,100	19,100	8,100	7,600	6,700	6,500	6,700	6,800	5,800
100-NR-2 Operable Unit	4,500	3,100	4,800	6,000	5,500	7,200	3,100	700	200	1,700
100-HR-3 Operable Unit	10,600	18,000	20,500	7,200	8,200	9,200	8,200	8,600	8,700	7,700
100-FR-3 Operable Unit	500	500	400	400	900	400	400	400	400	2,600
200-BP-5 Operable Unit	14,700	3,700	3,700	4,800	2,400	200	300	200	200	2,100
200-PO-1 Operable Unit	1,100	2,200	3,700	3,000	4,700	0	0	0	0	2,000
200-UP-1 Operable Unit	4,000	21,500	23,200	5,100	4,400	2,200	2,400	2,400	2,500	4,600
200-ZP-1 Operable Unit	30,500	82,200	80,000	32,500	35,400	34,200	40,200	36,300	36,900	40,200
200-CB-1 Decision Documents	0	1,400	14,400	14,500	14,700	15,100	16,500	2,100	2,200	900
200-CP-1 Decision Documents	0	700	700	13,500	13,500	13,800	14,300	15,200	1,200	1,200
200-CR-1 Decision Documents	0	700	700	9,500	9,600	9,900	10,200	10,500	10,600	11,900
300-FF-5 Operable Unit	1,900	1,400	400	400	1,000	400	500	500	500	1,200
200-DV-1 Operable Unit	1,300	1,300	1,300	1,300	1,300	1,800	2,300	600	500	500
Cost and/or Schedule Uncertainty	-300	54,300	63,500	67,200	75,500	53,200	48,000	58,800	41,900	35,100
Level 2 Total	**132,400**	**366,000**	**391,600**	**289,500**	**258,400**	**231,300**	**232,000**	**221,800**	**191,400**	**177,200**
Fiscal Year	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**
Groundwater Program Management	36,500	38,000	28,400	29,500	29,800	30,000	31,100	29,600	30,400	31,500
Groundwater Monitoring	39,000	30,900	33,800	31,100	27,100	26,100	25,200	26,400	27,000	21,900
200-WA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-EA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-OA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-IS-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-SW-2 Operable Unit	0	0	0	0	0	0	0	0	0	0
100-BC-5 Operable Unit	200	200	200	200	200	200	200	200	200	200

Table C-7. Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated). (6 pages)

100-KR-4 Operable Unit	2,700	2,800	2,800	2,900	4,500	3,500	3,600	300	300	2,100
100-NR-2 Operable Unit	200	200	200	200	1,700	200	200	100	100	1,900
100-HR-3 Operable Unit	2,900	3,000	3,100	3,100	4,700	4,400	4,600	300	300	2,000
100-FR-3 Operable Unit	500	500	500	500	1,200	500	500	500	500	1,400
200-BP-5 Operable Unit	200	200	3,600	3,700	6,000	3,800	3,800	4,100	300	2,800
200-PO-1 Operable Unit	0	0	0	0	2,300	0	0	3,400	3,500	6,200
200-UP-1 Operable Unit	2,600	2,700	2,700	2,800	5,200	2,800	3,000	3,100	2,000	3,600
200-ZP-1 Operable Unit	39,500	46,400	41,500	42,800	46,400	43,900	50,900	46,800	46,400	9,000
200-CB-1 Decision Documents	2,200	200	0	0	0	0	0	0	0	0
200-CP-1 Decision Documents	1,300	1,300	1,000	2,400	200	0	0	0	0	0
200-CR-1 Decision Documents	2,300	2,400	1,000	2,400	100	0	0	0	0	0
300-FF-5 Operable Unit	500	500	600	700	1,400	700	700	700	700	1,200
200-DV-1 Operable Unit	500	500	500	500	500	500	600	600	0	0
Cost and/or Schedule Uncertainty	47,800	48,300	46,300	35,100	27,500	27,400	23,500	20,700	24,000	39,600
Level 2 Total	**178,900**	**178,100**	**166,200**	**157,900**	**158,800**	**144,000**	**147,900**	**136,800**	**135,700**	**123,400**
Fiscal Year	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**	**2046**	**2047**	**2048**
Groundwater Program Management	32,100	34,000	35,000	34,800	34,500	35,400	36,800	37,100	38,000	39,700
Groundwater Monitoring	28,900	26,800	27,900	27,800	22,200	29,400	29,600	30,200	31,800	25,900
200-WA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-EA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-OA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-IS-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-SW-2 Operable Unit	0	0	0	0	0	0	0	0	0	0
100-BC-5 Operable Unit	200	200	200	200	200	200	200	200	200	200
100-KR-4 Operable Unit	300	300	300	300	2,400	400	400	400	400	2,800
100-NR-2 Operable Unit	200	200	200	200	2,100	200	200	200	200	2,500
100-HR-3 Operable Unit	300	300	300	300	2,200	400	400	400	400	2,700
100-FR-3 Operable Unit	600	600	600	600	1,600	600	700	700	700	1,800
200-BP-5 Operable Unit	300	300	300	300	3,100	300	300	300	300	3,700
200-PO-1 Operable Unit	3,700	3,800	4,000	0	3,000	0	0	0	0	3,500
200-UP-1 Operable Unit	6,500	500	6,300	6,300	6,200	9,500	400	400	400	400
200-ZP-1 Operable Unit	5,900	6,800	6,300	6,300	18,700	15,500	4,700	4,800	5,100	9,600

Table C-7. Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated). (6 pages)

200-CB-1 Decision Documents	0	0	0	0	0	0	0	0	0	0
200-CP-1 Decision Documents	0	0	0	0	0	0	0	0	0	0
200-CR-1 Decision Documents	0	0	0	0	0	0	0	0	0	0
300-FF-5 Operable Unit	400	400	500	500	1,500	500	500	500	500	1,600
200-DV-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
Cost and/or Schedule Uncertainty	44,800	37,900	38,900	35,000	31,300	22,400	22,900	17,600	21,000	17,800
Level 2 Total	**124,200**	**112,100**	**120,800**	**112,600**	**129,000**	**114,800**	**97,100**	**92,800**	**99,000**	**112,200**
Fiscal Year	**2049**	**2050**	**2051**	**2052**	**2053**	**2054**	**2055**	**2056**	**2057**	**2058**
Groundwater Program Management	40,700	41,500	42,300	43,900	45,000	47,900	50,600	52,800	53,900	55,200
Groundwater Monitoring	35,100	34,500	39,100	36,400	34,800	45,800	49,500	51,700	52,800	36,800
200-WA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-EA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-OA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-IS-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-SW-2 Operable Unit	0	0	0	0	0	0	0	0	0	0
100-BC-5 Operable Unit	200	200	200	200	200	300	300	300	400	400
100-KR-4 Operable Unit	400	400	400	400	3,200	500	500	500	500	4,000
100-NR-2 Operable Unit	200	200	200	200	2,800	200	300	300	300	3,500
100-HR-3 Operable Unit	400	400	400	500	3,100	500	500	500	600	3,800
100-FR-3 Operable Unit	700	700	900	900	2,100	900	1,000	1,000	1,000	2,600
200-BP-5 Operable Unit	400	400	400	400	4,200	400	500	500	500	5,200
200-PO-1 Operable Unit	0	0	0	0	4,000	0	0	0	0	4,900
200-UP-1 Operable Unit	4,100	400	400	400	400	4,900	500	500	500	500
200-ZP-1 Operable Unit	5,400	5,600	1,000	1,000	5,900	1,100	1,200	1,200	1,200	7,300
200-CB-1 Decision Documents	0	0	0	0	0	0	0	0	0	0
200-CP-1 Decision Documents	0	0	0	0	0	0	0	0	0	0
200-CR-1 Decision Documents	0	0	0	0	0	0	0	0	0	0
300-FF-5 Operable Unit	500	600	3,800	3,900	5,300	600	700	700	700	2,300
200-DV-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
Cost and/or Schedule Uncertainty	17,800	11,000	13,200	9,200	10,100	8,500	4,600	5,200	4,200	5,100
Level 2 Total	**105,900**	**95,900**	**102,300**	**97,400**	**121,100**	**111,600**	**110,200**	**115,200**	**116,600**	**131,600**

Table C-7. Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated). (6 pages)

Fiscal Year	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068
Groundwater Program Management	57,200	57,700	59,100	60,500	61,800	63,200	64,700	66,200	67,800	69,300
Groundwater Monitoring	48,600	49,100	50,200	51,400	41,300	53,700	55,100	56,300	57,700	46,300
200-WA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-EA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-OA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-IS-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-SW-2 Operable Unit	0	0	0	0	0	0	0	0	0	0
100-BC-5 Operable Unit	800	400	400	400	400	400	400	400	400	400
100-KR-4 Operable Unit	1,000	600	600	600	600	600	700	700	700	700
100-NR-2 Operable Unit	700	0	0	0	0	0	0	0	0	0
100-HR-3 Operable Unit	1,000	600	600	600	600	700	700	700	700	700
100-FR-3 Operable Unit	1,500	1,100	1,100	1,200	2,900	1,200	1,200	1,300	1,300	3,300
200-BP-5 Operable Unit	900	500	500	500	600	600	600	600	600	600
200-PO-1 Operable Unit	0	0	0	0	5,500	0	0	0	0	6,200
200-UP-1 Operable Unit	6,200	600	600	600	700	6,400	700	700	700	700
200-ZP-1 Operable Unit	1,800	1,300	1,400	1,400	8,100	1,500	1,500	1,500	1,600	9,100
200-CB-1 Decision Documents	0	0	0	0	0	0	0	0	0	0
200-CP-1 Decision Documents	0	0	0	0	0	0	0	0	0	0
200-CR-1 Decision Documents	0	0	0	0	0	0	0	0	0	0
300-FF-5 Operable Unit	1,200	800	800	800	2,600	800	800	900	900	2,900
200-DV-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
Cost and/or Schedule Uncertainty	6,500	31,300	53,900	51,200	45,800	43,200	34,400	29,800	26,100	23,300
Level 2 Total	**127,400**	**144,000**	**169,200**	**169,200**	**170,900**	**172,300**	**160,800**	**159,100**	**158,500**	**163,500**
Fiscal Year	**2069**	**2070**	**2071**	**2072**	**2073**	**2074**	**2075**	**2076**	**2077**	**2078**
Groundwater Program Management	70,800	72,600	72,300	73,400	76,300	81,100	81,400	81,800	87,000	90,300
Groundwater Monitoring	60,200	61,700	61,500	62,400	51,000	69,000	69,200	69,500	74,000	60,400
200-WA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-EA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-OA-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-IS-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
200-SW-2 Operable Unit	0	0	0	0	0	0	0	0	0	0

Table C-7. Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated). (6 pages)

100-BC-5 Operable Unit	400	400	400	400	500	500	500	500	500	600
100-KR-4 Operable Unit	700	700	700	700	800	800	800	800	900	900
100-NR-2 Operable Unit	0	0	0	0	0	0	0	0	0	0
100-HR-3 Operable Unit	700	800	800	800	800	800	800	800	900	900
100-FR-3 Operable Unit	1,400	1,400	1,400	1,400	3,600	1,600	1,600	1,600	1,700	4,300
200-BP-5 Operable Unit	600	700	600	700	700	700	700	700	800	800
200-PO-1 Operable Unit	0	0	0	0	6,800	0	0	0	0	8,100
200-UP-1 Operable Unit	7,200	800	800	800	800	8,200	900	900	900	1,000
200-ZP-1 Operable Unit	1,600	1,700	1,700	1,700	10,000	1,900	1,900	1,900	2,000	11,900
200-CB-1 Decision Documents	0	0	0	0	0	0	0	0	0	0
200-CP-1 Decision Documents	0	0	0	0	0	0	0	0	0	0
200-CR-1 Decision Documents	0	0	0	0	0	0	0	0	0	0
300-FF-5 Operable Unit	900	900	900	1,000	3,200	1,100	1,100	1,100	1,100	3,800
200-DV-1 Operable Unit	0	0	0	0	0	0	0	0	0	0
Cost and/or Schedule Uncertainty	20,500	18,900	16,900	18,400	15,000	12,700	16,800	10,300	10,600	11,200
Level 2 Total	**165,000**	**160,600**	**158,000**	**161,700**	**169,500**	**178,400**	**175,700**	**169,900**	**180,400**	**194,200**

Fiscal Year	**Total**
Groundwater Program Management	**2,972,300**
Groundwater Monitoring	**2,421,000**
200-WA-1 Operable Unit	**31,200**
200-EA-1 Operable Unit	**39,600**
200-OA-1 Operable Unit	**20,800**
200-IS-1 Operable Unit	**94,900**
200-SW-2 Operable Unit	**30,200**
100-BC-5 Operable Unit	**23,500**
100-KR-4 Operable Unit	**160,000**
100-NR-2 Operable Unit	**56,900**
100-HR-3 Operable Unit	**168,700**
100-FR-3 Operable Unit	**69,900**
200-BP-5 Operable Unit	**95,900**
200-PO-1 Operable Unit	**85,600**
200-UP-1 Operable Unit	**192,500**
200-ZP-1 Operable Unit	**1,042,100**

Table C-7. Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated). (6 pages)

200-CB-1 Decision Documents	**84,200**
200-CP-1 Decision Documents	**80,300**
200-CR-1 Decision Documents	**81,800**
300-FF-5 Operable Unit	**69,500**
200-DV-1 Operable Unit	**16,400**
Cost and/or Schedule Uncertainty	**1,712,700**
Level 2 Total	**9,550,000**

Table C-8. Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030) Near-Term Schedule and Costs, Level 3, by Fiscal Year ($1,000, Escalated). (3 pages)

Schedule Level	Scope	2019	2020	2021	2022	2023	2024	Total
1	**Soil and Water Remediation - Groundwater/Vadose Zone**	**132,400**	**366,000**	**391,600**	**289,500**	**258,400**	**231,300**	**1,669,200**
2	**Groundwater Program Management**	**27,600**	**55,800**	**55,700**	**43,200**	**38,000**	**38,500**	**258,800**
3	Groundwater Program Management	8,800	25,400	26,000	22,100	22,700	23,300	128,300
3	Integration and Assessments	18,800	30,400	29,700	21,100	15,300	15,200	130,500
2	**Groundwater Monitoring**	**22,200**	**31,100**	**29,500**	**29,900**	**19,800**	**31,600**	**164,100**
3	Geophysical Sciences and Logging	1,300	700	700	700	700	800	4,900
3	Groundwater Lab Analysis and Data Management	4,300	4,400	4,500	4,500	4,700	4,800	27,200
3	Groundwater Sample Collection	6,000	6,100	6,500	6,600	6,700	6,900	38,800
3	Groundwater Data Evaluation and Reporting	4,200	4,300	4,400	4,500	4,600	4,700	26,700
3	Well Maintenance, Monitoring and Reporting	0	4,900	2,500	2,500	2,600	2,600	15,100
3	RCRA Well Drilling (M-024)	5,900	10,200	10,400	10,600	0	11,200	48,300
3	Modutanks	500	500	500	500	500	600	3,100
2	**200-WA-1 Operable Unit**	**0**	**1,200**	**9,300**	**10,800**	**6,000**	**700**	**28,000**
3	200-WA-1 Decision Documents	0	1,200	9,300	10,800	6,000	700	28,000
2	**200-EA-1 Operable Unit**	**0**	**22,700**	**10,700**	**1,500**	**1,500**	**500**	**36,900**
3	200-EA-1 Decision Documents	0	22,700	10,700	1,500	1,500	500	36,900
2	**200-OA-1 Operable Unit**	**0**	**2,000**	**9,800**	**4,500**	**1,100**	**1,100**	**18,500**
3	200-OA-1 Decision Documents	0	2,000	9,800	4,500	1,100	1,100	18,500

Table C-8. Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030) Near-Term Schedule and Costs, Level 3, by Fiscal Year ($1,000, Escalated). (3 pages)

Schedule Level	Scope	2019	2020	2021	2022	2023	2024	Total
2	**200-IS-1 Operable Unit**	**0**	**31,800**	**32,700**	**18,300**	**3,000**	**3,000**	**88,800**
3	200-IS-1 Decision Documents	0	31,800	32,700	18,300	3,000	3,000	88,800
2	**200-SW-2 Operable Unit**	**0**	**6,400**	**6,600**	**6,900**	**3,400**	**1,400**	**24,700**
3	200-SW-2 Decision Documents	0	6,400	6,600	6,900	3,400	1,400	24,700
2	**100-BC-5 Operable Unit**	**2,100**	**1,900**	**900**	**900**	**900**	**200**	**6,900**
3	100-BC-5 Project Management	100	100	100	100	100	100	600
3	100-BC-5 Decision Documents	500	1,000	0	0	0	0	1,500
3	100-BC-5 Remedial/Removal Action Implementation	1,400	700	700	700	700	0	4,200
3	100-BC-5 Monitoring and Reporting	100	100	100	100	100	100	600
2	**100-KR-4 Operable Unit**	**11,700**	**22,100**	**19,100**	**8,100**	**7,600**	**6,700**	**75,300**
3	100-KR-4 Project Management	400	400	400	400	400	400	2,400
3	100-KR-4 Decision Documents	1,700	2,000	100	0	0	0	3,800
3	100-KR-4 Remedial/Removal Action Implementation	9,300	19,400	18,600	7,700	7,200	6,300	68,500
3	100-KR-4 Monitoring and Reporting	300	300	0	0	0	0	600
2	**100-NR-2 Operable Unit**	**4,500**	**3,100**	**4,800**	**6,000**	**5,500**	**7,200**	**31,100**
3	100-NR-2 Project Management	200	200	200	200	200	200	1,200
3	100-NR-2 Decision Documents	1,600	100	400	1,500	0	0	3,600
3	100-NR-2 Remedial/Removal Action Implementation	2,600	2,700	4,100	4,200	4,200	7,000	24,800
3	100-NR-2 Monitoring and Reporting	100	100	100	100	1,100	0	1,500
2	**100-HR-3 Operable Unit**	**10,600**	**18,000**	**20,500**	**7,200**	**8,200**	**9,200**	**73,700**
3	100-HR-3 Project Management	400	400	400	400	400	400	2,400
3	100-HR-3 Remedial/Removal Action Implementation	9,700	17,100	20,100	6,800	7,800	8,800	70,300
3	100-HR-3 Monitoring and Reporting	500	500	0	0	0	0	1,000
2	**100-FR-3 Operable Unit**	**500**	**500**	**400**	**400**	**900**	**400**	**3,100**
3	100-FR-3 Project Management	400	400	300	300	300	300	2,000
3	100-FR-3 Monitoring and Reporting	100	100	100	100	600	100	1,100
2	**200-BP-5 Operable Unit**	**14,700**	**3,700**	**3,700**	**4,800**	**2,400**	**200**	**29,500**
3	200-BP-5 Project Management	200	200	200	200	200	200	1,200
3	200-BP-5 Decision Documents	300	200	400	1,900	100	0	2,900
3	200-BP-5 Remedial/Removal Action Implementation	14,200	3,300	1,700	0	0	0	19,200
3	200-BP-5 Monitoring and Reporting	0	0	1,400	2,700	2,100	0	6,200

Table C-8. Soil and Water Remediation–Groundwater/Vadose Zone (PBS RL-0030) Near-Term Schedule and Costs, Level 3, by Fiscal Year ($1,000, Escalated). (3 pages)

Schedule Level	Scope	2019	2020	2021	2022	2023	2024	Total
2	**200-PO-1 Operable Unit**	**1,100**	**2,200**	**3,700**	**3,000**	**4,700**	**0**	**14,700**
3	200-PO-1 Remedial/Removal Action Implementation	0	0	1,500	1,600	200	0	3,300
3	200-PO-1 Monitoring and Reporting	1,100	2,200	2,200	1,400	4,500	0	11,400
2	**200-UP-1 Operable Unit**	**4,000**	**21,500**	**23,200**	**5,100**	**4,400**	**2,200**	**60,400**
3	200-UP-1 Project Management	300	300	300	300	300	300	1,800
3	200-UP-1 Decision Documents	800	2,000	1,100	800	200	0	4,900
3	200-UP-1 Remedial/Removal Action Implementation	1,700	19,000	19,400	1,800	1,900	1,900	45,700
3	200-UP-1 Monitoring and Reporting	1,200	200	2,400	2,200	2,000	0	8,000
2	**200-ZP-1 Operable Unit**	**30,500**	**82,200**	**80,000**	**32,500**	**35,400**	**34,200**	**294,800**
3	200-ZP-1 Project Management	800	900	900	900	900	900	5,300
3	200-ZP-1 Remedial/Removal Action Implementation	29,500	80,900	78,900	31,400	32,100	33,100	285,900
3	200-ZP-1 Monitoring and Reporting	200	400	200	200	2,400	200	3,600
2	**200-CB-1 Decision Documents**	**0**	**1,400**	**14,400**	**14,500**	**14,700**	**15,100**	**60,100**
3	200-CB-1 Decision Documents	0	1,400	14,400	14,500	14,700	15,100	60,100
2	**200-CP-1 Decision Documents**	**0**	**700**	**700**	**13,500**	**13,500**	**13,800**	**42,200**
3	200-CP-1 Decision Documents	0	700	700	13,500	13,500	13,800	42,200
2	**200-CR-1 Decision Documents**	**0**	**700**	**700**	**9,500**	**9,600**	**9,900**	**30,400**
3	200-CR-1 Decision Documents	0	700	700	9,500	9,600	9,900	30,400
2	**300-FF-5 Operable Unit**	**1,900**	**1,400**	**400**	**400**	**1,000**	**400**	**5,500**
3	300-FF-5 Project Management	400	400	400	400	400	400	2,400
3	300-FF-5 Remedial/Removal Action Implementation	1,500	1,000	0	0	0	0	2,500
3	300-FF-5 Monitoring and Reporting	0	0	0	0	600	0	600
2	**200-DV-1 Operable Unit**	**1,300**	**1,300**	**1,300**	**1,300**	**1,300**	**1,800**	**8,300**
3	200-DV-1 Project Management	400	400	400	400	400	400	2,400
3	200-DV-1 Decision Documents	900	900	900	900	900	1,400	5,900
2	**Cost and/or Schedule Uncertainty**	**-300**	**54,300**	**63,500**	**67,200**	**75,500**	**53,200**	**313,400**
	Total	**132,400**	**366,000**	**391,600**	**289,500**	**258,400**	**231,300**	**1,669,200**

PBS = performance baseline summary.
RCRA = *Resource Conservation and Recovery Act of 1976.*

C.1.4 NUCLEAR FACILITY D&D–REMAINDER OF HANFORD (PBS RL-0040) SCHEDULE AND COST DETAILS

Table C-9. Nuclear Facility D&D–Remainder of Hanford (PBS RL-0040) Level 3 Scope Summary. (2 pages)

Level 2 Work Element	Level 3 Work Element	Scope Summary
Regulatory Decisions and Closure Integration	Central Plateau Project Management	Provides for overall management function in support of the nuclear facility D&D mission on the Central Plateau.
	Central Plateau Engineering Studies	Provides for crosscutting engineering and technical studies and trade-off evaluations necessary to optimize design and execution for Central Plateau facility and waste site remediation/restoration with consideration of groundwater and vadose zone remediation and ongoing operations.
	Emergency Response for Facility/Waste Site ESH&Q or Remediation	Includes the tasks necessary to address aging facility or waste site conditions that are above and beyond anticipated operational and maintenance plans. Activities may include hazard removal, RTD, stabilization, or increased S&M of waste sites; or D&D or increased S&M of buildings. Activities are focused on unplanned or unforeseen facility or waste site conditions affecting safety, human health, or environment (e.g., major equipment failure, spread of contamination, structural failure) and steam line removal.
	CERCLA Documentation	Covers the preparation of the CERCLA[1] 5-year review documents to evaluate the implementation and performance of each remedy to determine whether the remedy is or will be protective of human health and the environment.
Remediation of Geographic Areas	For each implementation area, provides remediation definition, remediation of pipelines, installation of barriers, utility relocations, post-ROD confirmatory sampling, S&M/O&M of installed barriers, and area closure activities. Potential waste site remediation range includes no action, in situ treatment (e.g., grouting), monitored natural attenuation, capping, RTD, or combinations of these techniques. Buildings and structures are assumed to undergo D4 activities, including demolition to slab-on-grade. Below-grade portions will be addressed through the waste site cleanup process. Actual remedial actions will be determined through the appropriate decision process and applied through a geographical implementation strategy. The remediation and demolition scope has been organized into the following 25 Implementation Areas (each is a Level 3 work element): • 100 Area • 600 Area • 300 Area • 400 Area • Outer Area • PFP Implementation Area • U Plant Implementation Area • 200 East Landfills 3 Implementation Area • Balance of West Implementation Area • Balance of East Implementation Area • 200 East Landfills 1 Implementation Area • B Plant Implementation Area • 200 East Landfills 2 Implementation Area • 200 West Landfills Implementation Area • PUREX Implementation Area • T Plant Implementation Area • REDOX Implementation Area • C Farm Implementation Area • U Farm Implementation Area • A Farm Implementation Area • B Farm Implementation Area • T Farm Implementation Area • S Farm Implementation Area • ERDF Implementation Area • WTP Implementation Area	

Table C-9. Nuclear Facility D&D–Remainder of Hanford (PBS RL-0040)
Level 3 Scope Summary. (2 pages)

Level 2 Work Element	Level 3 Work Element	Scope Summary
Central Plateau Maintain Safe and Compliant Facilities and Waste Sites	Central Plateau Waste Sites Min Safe	Includes minimum safe oversight and support, radiation surveillances, tumbleweed collection, surface contamination treatment, sign replacement, surveillance, canyon, and nuclear facilities minimum safe, and general-purpose facilities minimum safe.
	Central Plateau Nuclear Facilities Min Safe	
	Central Plateau General Purpose Facilities Min Safe	
	ORP Support to PRC Inactive Waste Sites	Includes surveillance and maintenance by ORP at inactive waste sites located within ORP occupied areas, but that contractually belong to the Plateau Remediation Contract.

NOTE: See Tables C-10 and C-11 for schedule and budget information.

[1]*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601, et seq.

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*.
D&D = decontamination and decommissioning.
D4 = deactivation, decommissioning, decontamination, and demolition.
ERDF = Environmental Restoration Disposal Facility.
ESH&Q = Environment, Safety, Health, and Quality.
IA = implementation area.
ISMS = Integrated Safety Management System.
O&M = operation and maintenance.
ORP = U.S. Department of Energy, Office of River Protection.
PBS = project baseline summary.
PFP = Plutonium Finishing Plant.
PUREX = Plutonium Uranium Extraction (Plant).
REDOX = Reduction-Oxidation (Plant).
RL = U.S. Department of Energy, Richland Operations Office.
ROD = record of decision.
RTD = remove, treat, dispose.
S&M = surveillance and maintenance.
WTP = Waste Treatment and Immobilization Plant.

Table C-10. Nuclear Facility D&D–Remainder of Hanford (PBS RL-0040) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated) (2 pages)

Fiscal Year	2019	2020	2021	2022	2023	2024	2025	2026	2027
Regulatory Decisions and Closure Integration	18,100	19,000	15,700	15,200	15,600	16,600	17,300	17,900	17,300
Remediation of Geographic Areas	52,200	48,000	170,800	326,800	286,600	251,300	174,700	201,900	374,900
Central Plateau Maintain Safe and Compliant Facilities and Waste Sites	14,200	14,000	14,300	14,500	17,600	15,200	14,800	17,000	15,600
Cost and/or Schedule Uncertainty	5,200	334,900	259,900	97,400	68,300	43,600	65,200	65,100	228,100
Level 2 Total	**89,700**	**415,900**	**460,700**	**453,900**	**388,100**	**326,700**	**272,000**	**301,900**	**635,900**
Fiscal Year	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**
Regulatory Decisions and Closure Integration	17,700	19,000	20,000	20,300	20,000	20,400	21,200	21,900	23,000
Remediation of Geographic Areas	374,000	182,200	156,900	197,100	156,900	166,300	172,500	160,400	239,900
Central Plateau Maintain Safe and Compliant Facilities and Waste Sites	19,300	16,700	17,300	17,600	18,100	22,400	18,700	19,000	21,900
Cost and/or Schedule Uncertainty	131,700	84,800	26,400	24,000	30,300	37,100	32,300	75,000	87,000
Level 2 Total	**542,700**	**302,700**	**220,600**	**259,000**	**225,300**	**246,200**	**244,700**	**276,300**	**371,800**
Fiscal Year	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
Regulatory Decisions and Closure Integration	22,300	23,300	24,400	25,800	27,200	25,800	26,400	28,000	29,100
Remediation of Geographic Areas	247,300	304,300	407,100	282,300	166,800	400,100	414,500	360,500	322,000
Central Plateau Maintain Safe and Compliant Facilities and Waste Sites	19,600	24,900	20,700	21,500	22,300	21,800	25,700	20,900	21,500
Cost and/or Schedule Uncertainty	86,200	119,200	169,300	163,300	206,000	268,200	368,900	261,000	312,800
Level 2 Total	**375,400**	**471,700**	**621,500**	**492,900**	**422,300**	**715,900**	**835,500**	**670,400**	**685,400**
Fiscal Year	**2046**	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**	**2053**	**2054**
Regulatory Decisions and Closure Integration	30,000	29,900	31,100	32,800	34,200	34,800	34,400	35,300	38,700
Remediation of Geographic Areas	322,500	268,400	153,700	150,600	186,900	181,200	165,700	132,100	167,700
Central Plateau Maintain Safe and Compliant Facilities and Waste Sites	24,600	23,000	30,000	24,500	24,400	41,600	41,400	42,200	44,900
Cost and/or Schedule Uncertainty	413,400	174,600	122,700	150,100	266,600	343,000	246,900	174,700	105,200
Level 2 Total	**790,500**	**495,900**	**337,500**	**358,000**	**512,100**	**600,600**	**488,400**	**384,300**	**356,500**
Fiscal Year	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**	**2061**	**2062**	**2063**
Regulatory Decisions and Closure Integration	41,500	43,500	42,400	43,300	46,200	47,500	48,600	47,500	48,500
Remediation of Geographic Areas	98,400	43,800	42,400	45,900	40,200	14,500	14,700	15,100	15,500
Central Plateau Maintain Safe and Compliant Facilities and Waste Sites	47,400	49,500	50,600	51,700	33,600	22,800	23,300	23,900	24,400
Cost and/or Schedule Uncertainty	111,900	67,100	38,600	45,100	62,200	130,200	136,800	160,700	164,000

Table C-10. Nuclear Facility D&D–Remainder of Hanford (PBS RL-0040) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated) (2 pages)

Level 2 Total	**299,200**	**203,900**	**174,000**	**186,000**	**182,200**	**215,000**	**223,400**	**247,200**	**252,400**
Fiscal Year	**2064**	**2065**	**2066**	**2067**	**2068**	**2069**	**2070**	**2071**	**2072**
Regulatory Decisions and Closure Integration	51,000	53,300	54,500	53,200	54,400	57,200	59,700	59,500	57,600
Remediation of Geographic Areas	16,000	16,300	16,700	17,000	17,400	17,700	18,200	151,900	201,000
Central Plateau Maintain Safe and Compliant Facilities and Waste Sites	24,900	25,500	26,100	26,800	27,300	28,000	28,600		28,900
Cost and/or Schedule Uncertainty	114,300	58,800	40,500	22,100	13,000	7,900	6,800	4,800	6,900
Level 2 Total	**206,200**	**153,900**	**137,800**	**119,100**	**112,100**	**110,800**	**113,300**	**216,200**	**294,400**
Fiscal Year	**2073**	**2074**	**2075**	**2076**	**2077**	**2078**	**Total**		
Regulatory Decisions and Closure Integration	59,900	65,500	67,000	67,300	68,300	70,900	**2,178,000**		
Remediation of Geographic Areas	191,200	92,700	194,700	295,700	168,600	138,800	**10,211,500**		
Central Plateau Maintain Safe and Compliant Facilities and Waste Sites	27,600	300	0	0	0	0	**1,374,900**		
Cost and/or Schedule Uncertainty	6,900	5,300	5,500	5,600	5,500	5,700	**6,874,600**		
Level 2 Total	**285,600**	**163,800**	**267,200**	**368,600**	**242,400**	**215,400**	**20,639,000**		

PBS = project baseline summary.

Table C-11. Nuclear Facility D&D–Remainder of Hanford (PBS RL-0040) Near-Term Schedule and Costs, Level 3, by Fiscal Year ($1,000, Escalated).

Schedule Level	Scope	2019	2020	2021	2022	2023	2024	Total
1	**Nuclear Facility D&D-Remainder of Hanford**	**89,700**	**415,900**	**460,700**	**453,900**	**388,100**	**326,700**	**2,135,000**
2	**Regulatory Decisions and Closure Integration**	**18,100**	**19,000**	**15,700**	**15,200**	**15,600**	**16,600**	**100,200**
3	Central Plateau Project Management	7,400	7,600	7,700	7,800	8,000	8,300	46,800
3	Central Plateau Engineering Studies	0	100	100	100	100	100	500
3	Emergency Response for Facility/Waste Site ESH&Q or Remediation - FY 2014 - FY 2048	10,300	10,600	7,200	7,300	7,500	7,700	50,600
3	CERCLA Documentation	400	700	700	0	0	500	2,300
2	**Remediation of Geographic Areas**	**52,200**	**48,000**	**170,800**	**326,800**	**286,600**	**251,300**	**1,135,700**
3	600 Area Implementation Area	0	0	0	900	1,000	2,900	4,800
3	Outer Area Implementation Area	10,300	19,300	79,700	84,000	21,400	1,200	215,900
3	PFP Implementation Area	3,300	7,200	45,600	194,500	221,700	223,100	695,400
3	U Plant Implementation Area	5,500	1,100	29,800	38,800	38,900	21,100	135,200
3	Balance of West Implementation Area	300	0	0	0	0	0	300
3	Balance of East Implementation Area	2,600	15,200	15,700	8,600	3,600	1,100	46,800
3	B Plant Implementation Area	600	600	0	0	0	0	1,200
3	PUREX Implementation Area	29,100	1,200	0	0	0	1,900	32,200
3	T Plant Implementation Area	100	100	0	0	0	0	200
3	REDOX Implementation Area	400	3,300	0	0	0	0	3,700
2	**Central Plateau Maintain Safe and Compliant Facilities and Waste Sites**	**14,200**	**14,000**	**14,300**	**14,500**	**17,600**	**15,200**	**89,800**
3	Central Plateau Waste Sites Min Safe	3,200	3,200	3,300	3,400	3,400	3,500	20,000
3	Central Plateau Nuclear Facilities Min Safe	9,000	9,300	9,500	9,600	12,700	10,100	60,200
3	Central Plateau General Purpose Facilities Min Safe	1,800	1,300	1,300	1,300	1,300	1,400	8,400
3	ORP Support to PRC Inactive Waste Sites	200	200	200	200	200	200	1,200
2	**Cost and/or Schedule Uncertainty**	**5,200**	**334,900**	**259,900**	**97,400**	**68,300**	**43,600**	**809,300**
	Total	**89,700**	**415,900**	**460,700**	**453,900**	**388,100**	**326,700**	**2,135,000**

D&D = decontamination and decommissioning.
ESH&Q = environment, safety, health, and quality.
FY = fiscal year.
ORP = DOE, Office of River Protection.
PBS = project baseline summary.
PFP = Plutonium Finishing Plant.
PRC = Plateau Remediation Contract.
PUREX = Plutonium Uranium Extraction (Plant.).
REDOX = Reduction-Oxidation (Plant).

C.1.5 NUCLEAR FACILITY D&D-RIVER CORRIDOR CLOSURE PROJECT (PBS RL-0041) SCHEDULE AND COST DETAILS

Table C-12. Nuclear Facility D&D-River Corridor Closure Project (PBS RL-0041) Level 3 Scope Summary.

Level 2 Work Element	Level 3 Work Element	Scope Summary
River Corridor Cleanup	100 Area Implementation Area	Includes work remaining to complete 100-K Area and 100-N Area remediation, including project management, demolition of K East and K West Basins, disposition of K East and K West Reactors, remediation of the 618-11 burial ground and waste site 300-296 (the contaminated soil below the 324 building B hot cell), D4 of support structures, waste site closeout sampling and documentation, and waste site backfill and revegetation.
	600 Area Implementation Area	
	300 Area Implementation Area	
River Corridor Maintain Safe and Compliant Facilities and Waste Sites	River Corridor Inactive Waste Sites Min Safe	Includes radiation surveys, surface contamination treatment, sign replacement, tumbleweed collection and spraying, inactive waste sites min safe support, min safe for nuclear facilities (K West Basin and 324 Building), and min safe for general purpose facilities.
	River Corridor Nuclear Facilities Min Safe	
	River Corridor General Purpose Facilities Min Safe	
NOTE: See Tables C-13 and C-14 for schedule and budget information.		
PBS = project baseline summary.		

Table C-13. Nuclear Facility D&D–River Corridor Closure Project (PBS RL-0041), Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated).

Fiscal Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
River Corridor Cleanup	64,300	127,400	126,500	186,100	52,400	24,000	200	0	0	0
River Corridor Maintain Safe and Compliant Facilities & Waste Sites	39,600	47,000	7,400	7,400	7,600	7,900	8,100	8,600	8,500	8,700
Cost and/or Schedule Uncertainty	0	43,100	24,900	22,800	24,600	12,200	3,700	300	300	400
Level 2 Total	**103,900**	**217,500**	**158,800**	**216,300**	**84,600**	**44,100**	**12,000**	**8,900**	**8,800**	**9,100**
Fiscal Year	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**
River Corridor Cleanup	0	0	0	27,700	28,100	206,000	329,100	50,400	25,300	15,400
River Corridor Maintain Safe and Compliant Facilities & Waste Sites	0	0	0	0	0	0	0	0	0	0
Cost and/or Schedule Uncertainty	0	0	0	2,100	3,900	51,800	66,200	28,100	37,700	17,100
Level 2 Total	**0**	**0**	**0**	**29,800**	**32,000**	**257,800**	**395,300**	**78,500**	**63,000**	**32,500**
Fiscal Year	**2039**	**2040**	**2041**	**Total**						
River Corridor Cleanup	0	0	0	**1,262,900**						
River Corridor Maintain Safe and Compliant Facilities & Waste Sites	0	0	0	**150,800**						
Cost and/or Schedule Uncertainty	21,900	6,700	200	**368,000**						
Level 2 Total	**21,900**	**6,700**	**200**	**1,781,700**						

PBS = project baseline summary.

Table C-14. Nuclear Facility D&D-River Corridor Closure Project (PBS RL-0041), Near-Term Schedule and Costs, Level 3, by Fiscal Year ($1,000, Escalated).

Schedule Level	Scope	2019	2020	2021	2022	2023	2024	Total
1	**Nuclear Facility D&D-River Corridor Closure Project**	**103,900**	**217,500**	**158,800**	**216,300**	**84,600**	**44,100**	**825,200**
2	**River Corridor Cleanup**	**64,300**	**127,400**	**126,500**	**186,100**	**52,400**	**24,000**	**580,700**
3	100 Area Implementation Area	14,100	63,100	56,800	115,300	47,800	24,000	**321,100**
3	300 Area Implementation Area	50,200	64,300	69,700	70,800	4,600	0	**259,600**
2	**River Corridor Maintain Safe and Compliant Facilities & Waste Sites**	**39,600**	**47,000**	**7,400**	**7,400**	**7,600**	**7,900**	**116,900**
3	River Corridor Inactive Waste Sites Min Safe	2,800	3,800	3,900	3,900	4,000	4,200	**22,600**
3	River Corridor Nuclear Facilities Min Safe	33,500	39,800	0	0	0	0	**73,300**
3	River Corridor General Purpose Facilities Min Safe	3,300	3,400	3,500	3,500	3,600	3,700	**21,000**
2	**Cost and/or Schedule Uncertainty**	**0**	**43,100**	**24,900**	**22,800**	**24,600**	**12,200**	**127,600**
	Total	**103,900**	**217,500**	**158,800**	**216,300**	**84,600**	**44,100**	**825,200**

D&D = decontamination and decommissioning.
PBS = project baseline summary.

C.1.6 NUCLEAR FACILITY D&D–FAST FLUX TEST FACILITY PROJECT (PBS RL-0042) SCHEDULE AND COST DETAILS

Table C-15. Nuclear Facility D&D–Fast Flux Test Facility Project (PBS RL-0042) Level 3 Scope Summary.

Level 2 Work Element	Level 3 Work Element	Scope Summary
FFTF Program Management	FFTF Program Management	Annual project management and closure services.
FFTF Cleanup	400 Area Implementation Area	The ROD for closure of the FFTF (78 FR 75913[1]) published in December 2013 includes the following: - Demolition of all structures within the 400 Area Protected Area, except for reactor containment, to at least 3 feet below grade followed by backfill and revegetation; decommissioning waste would be disposed of at appropriate disposal facilities - Removal and disposition of the above-grade containment dome - Grouting of the below-grade portion of the reactor containment building and the reactor vessel - Installing a RCRA[2]-compliant engineered barrier over the grouted area - Post-closure care would include long-term monitoring of air, groundwater, and the vadose zone.
FFTF Sodium	Manage and Disposition FFTF Sodium	Includes management, disposition, and removal of sodium residuals in FFTF equipment, maintain sodium storage facility operations, and waste transportation and disposal.
Sodium Reaction Facility	Design and Construct Sodium Reaction Capability	Provide design, construction, and turnover to operations of a new facility in the Hanford 400 Area to convert FFTF sodium for use as caustic feed to the Waste Treatment Plant.
Maintain Safe and Compliant FFTF Complex	FFTF Min Safe Operations	Includes preventative and scheduled maintenance, corrective maintenance, supervision, work control and training for the FFTF Complex.
	400 Area Potable/Fire Water System	Includes preventative and scheduled maintenance, corrective maintenance, supervision, work control and training for the 400 Area Potable/Fire Water System.

NOTE: See Tables C-16 and C-17 for schedule and budget information.

[1]78 FR 75913, 2013, "Record of Decision: Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington," *Federal Register* (December 13, 2013).

[2] *Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq.

D&D = decontamination and decommissioning
FFTF = Fast Flux Test Facility.
PBS = project baseline summary.
RCRA = *Resource Conservation and Recovery Act of 1976*.
RL = U.S. Department of Energy, Richland Operations Office.

Table C-16. Nuclear Facility D&D–Fast Flux Test Facility Project (PBS RL-0042) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated). (2 pages)

Fiscal Year	2019	2020	2021	2022	2023	2024	2025	2026	2027
FFTF Program Management	0	0	0	0	0	0	0	0	0
FFTF Cleanup	0	0	0	0	0	0	0	0	0
FFTF Sodium	0	0	0	0	0	0	0	0	0
Sodium Reaction Facility	0	0	0	0	0	0	0	0	0
Maintain Safe and Compliant FFTF Complex	2,200	2,300	2,400	3,100	2,600	2,600	3,400	2,700	2,800
Cost and/or Schedule Uncertainty	0	100	100	00	200	100	0	200	100
Level 2 Total	2,200	2,400	2,500	3,100	2,800	2,700	3,400	2,900	2,900
Fiscal Year	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**
FFTF Program Management	0	0	0	8,400	8,600	8,800	8,900	9,000	9,500
FFTF Cleanup	0	0	0	13,000	13,700	13,700	28,500	15,600	27,500
FFTF Sodium	0	0	0	29,300	37,400	39,800	36,900	26,900	46,200
Sodium Reaction Facility	0	0	0	18,500	18,300	11,700	0	0	0
Maintain Safe and Compliant FFTF Complex	3,600	3,100	3,100	3,900	3,000	3,100	4,200	3,200	3,300
Cost and/or Schedule Uncertainty		200	700	22,200	21,900	17,200	23,900	23,900	24,800
Level 2 Total	3,600	3,300	3,800	95,300	102,900	94,300	102,400	78,600	111,300
Fiscal Year	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
FFTF Program Management	9,700	10,100	10,300	10,700	11,200	9,300	0	0	0
FFTF Cleanup	55,100	41,400	22,000	900	4,400	400	0	0	0
FFTF Sodium	45,900	14,100	700	0	0	0	0	0	0
Sodium Reaction Facility	0	0	0	0	0	0	0	0	0
Maintain Safe and Compliant FFTF Complex	4,500	3,200	2,900	4,100	2,900	0	0	0	0
Cost and/or Schedule Uncertainty	19,600	38,200	33,600	28,600	13,000	10,800	6,700	4,400	2,800
Level 2 Total	**134,800**	**107,000**	**69,500**	**44,300**	**31,500**	**20,500**	**6,700**	**4,400**	**2,800**
Fiscal Year	**2046**	**2047**	**2048**	**Total**					
FFTF Program Management	0	0	0	**114,500**					
FFTF Cleanup	0	0	0	**236,200**					
FFTF Sodium	0	0	0	**277,200**					
Sodium Reaction Facility	0	0	0	**48,500**					
Maintain Safe and Compliant FFTF Complex	0	0	0	**72,200**					
Cost and/or Schedule Uncertainty	1,400	600	0*	**295,300**					
Level 2 Total	**1,400**	**600**	**0***	**1,043,900**					

Table C-16. Nuclear Facility D&D–Fast Flux Test Facility Project (PBS RL-0042) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated). (2 pages)

*Cost is less than $100,000 rounding limit.
D&D = decontamination and decommissioning. FFTF = Fast Flux Test Facility. PBS = project baseline summary.

Table C-17. Nuclear Facility D&D-Fast Flux Test Facility Project (PBS RL-0042), Near-Term Schedule and Costs, Level 3, by Fiscal Year ($1,000, Escalated).

Schedule Level	Scope	2019	2020	2021	2022	2023	2024	Total
1	**Nuclear Facility D&D-Fast Flux Test Facility Project**	**2,200**	**2,400**	**2,500**	**3,100**	**2,800**	**2,700**	**15,700**
2	**Maintain Safe and Compliant FFTF Complex**	**2,200**	**2,300**	**2,400**	**3,100**	**2,600**	**2,600**	**15,200**
3	FFTF Min-Safe Operations	900	1,700	1,800	1,700	1,900	1,900	9,900
3	400 Area Potable/Fire Water System	1,300	600	600	1,400	700	700	5,300
2	**Cost and/or Schedule Uncertainty**	**0**	**100**	**100**	**0**	**200**	**100**	**500**
	Total	**2,200**	**2,400**	**2,500**	**3,100**	**2,800**	**2,700**	**15,700**

D&D = decontamination and decommissioning.
FFTF = Fast Flux Test Facility.
PBS = project baseline summary.

C.1.7 RICHLAND COMMUNITY AND REGULATORY SUPPORT (PBS RL-0100) SCHEDULE AND COST DETAILS

Table C-18. Richland Community and Regulatory Support (PBS RL-0100) Level 2 Scope Summary.

Level 2 Work Element	Level 3 Work Element	Scope Summary
Richland Community and Regulatory Support	Richland Community and Regulatory Support	Includes RL support to community activities and various boards, such as the Hanford Advisory Board, the Oregon Department of Energy, and other entities through grants and fees. Includes studies for natural resource damage assessment, but does not include significant restoration of natural resources to resolve any liability of the United States for natural resource damage assessment and restoration.
NOTE: See Table C-19 for schedule and budget information.		
PBS = project baseline summary. RL = U.S. Department of Energy, Richland Operations Office.		

Table C-19. Richland Community and Regulatory Support (PBS RL-0100) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000 Escalated).

Fiscal Year	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Richland Community and Regulatory Support	10,100	13,900	14,000	14,100	14,300	14,400	14,000	14,200	14,300
Fiscal Year	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**
Richland Community and Regulatory Support	14,500	14,600	14,800	14,900	15,000	15,200	15,400	15,500	15,700
Fiscal Year	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
Richland Community and Regulatory Support	15,800	16,000	16,100	16,300	16,500	16,600	16,800	17,000	17,100
Fiscal Year	**2046**	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**	**2053**	**2054**
Richland Community and Regulatory Support	17,300	17,500	17,600	17,800	18,000	18,200	18,400	18,500	18,700
Fiscal Year	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**	**2061**	**2062**	**2063**
Richland Community and Regulatory Support	18,900	19,100	19,300	19,500	19,700	19,900	20,100	20,300	20,500
Fiscal Year	**2064**	**2065**	**2066**	**2067**	**2068**	**2069**	**2070**	**2071**	**2072**
Richland Community and Regulatory Support	20,700	20,900	21,100	21,300	21,500	21,700	22,000	22,200	20,000
Fiscal Year	**2073**	**2074**	**2075**	**2076**	**2077**	**2078**	**Total**		
Richland Community and Regulatory Support	20,200	20,400	20,600	20,800	21,000	21,200	**1,062,000**		

PBS = project baseline summary.

C.1.8 HANFORD SITEWIDE SERVICES (PBS RL-0201) SCHEDULE AND COST DETAILS

Table C-20. Hanford Sitewide Services (PBS RL-0201) Level 3 Scope Summary.

Level 2 Work Element	Level 3 Work Element	Scope Summary
Hanford Sitewide Services	Hanford Sitewide Services	Includes costs for Site services and infrastructure. This work element includes emergency services (fire and emergency response, emergency management), environmental integration services (Sitewide safety standards, environmental integration, public safety and resource protection, radiological site services, and offsite laboratory sample analysis), information management (information management planning and controls, information systems, content and records management, infrastructure/cyber security, information resources/content management, and information support services), Site infrastructure and utilities/logistics and transportation (roads and grounds, biological services, electrical services, water/sewer services, facility services, transportation, mail, property systems/acquisitions, railroad services, technical services, energy management, work management, land and facilities management), support functions (business operations, human resources, safety, health and quality), and portfolio management (portfolio planning, analysis and performance, project acquisition and support, and independent assessment and analysis). Includes contracted technical services in key areas such as audit, regulatory analysis, cost and risk analysis and estimating. Also includes mission critical support services to DOE and its contractors in key areas such as occupational medicine, information and telecommunications, janitorial, radiological laundry, electrical power and facilities rentals; critical independent legal counsel and litigation services in support of DOE and its contractors; and other mission critical support services to DOE and its contractors in key areas such as land transfers, acquisition and contract closeout, acquisition of natural gas utility services, energy conservation and management (including steam), natural resource trusteeship, Tribal Nation support, Washington Department of Ecology, Washington Department of Health and other small contracts, permits, and payment of fees. Includes management and oversight for B Reactor facility activities, including planning, directing, and providing technical support to maintain, upgrade, and preserve the B Reactor facility in a safe condition. Includes operations and maintenance activities at the Volpentest HAMMER Federal Training Center in support of the Hanford Site and other training programs. Includes reliability projects to repair and replace infrastructure systems and provides capital upgrades to the infrastructure, including larger scale expense projects. Also includes construction and capital equipment expenditures associated with replacements for biological control, crane and rigging, electrical system, facilities, Hanford Fire Department, network and telecommunications, studies and estimates, transportation, water and sewer utilities and other infrastructure reliability projects.
NOTE: See Table C-21 for schedule and budget information.		
DOE = U.S. Department of Energy. PBS = project baseline summary.		

Table C-21. Hanford Sitewide Services (PBS RL-0201) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000 Escalated).

Fiscal Year	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Hanford Sitewide Services	308,200	335,000	366,300	348,900	351,500	355,600	330,400	315,100	320,400
Fiscal Year	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**
Hanford Sitewide Services	327,500	329,800	329,600	326,400	325,000	322,200	316,800	318,000	319,600
Fiscal Year	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
Hanford Sitewide Services	320,700	324,300	323,300	325,700	329,000	322,000	312,300	298,800	298,400
Fiscal Year	**2046**	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**	**2053**	**2054**
Hanford Sitewide Services	296,500	298,000	299,900	296,500	292,300	288,400	284,100	285,900	300,800
Fiscal Year	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**	**2061**	**2062**	**2063**
Hanford Sitewide Services	314,400	326,100	333,700	339,600	350,400	351,400	359,100	367,100	374,800
Fiscal Year	**2064**	**2065**	**2066**	**2067**	**2068**	**2069**	**2070**	**2071**	**2072**
Hanford Sitewide Services	382,700	391,600	400,100	409,200	417,700	426,600	436,500	437,400	377,400
Fiscal Year	**2073**	**2074**	**2075**	**2076**	**2077**	**2078**	**Total**		
Hanford Sitewide Services	372,300	373,200	355,500	338,100	335,400	324,600	**20,338,100**		

PBS = project baseline summary.

C.1.9 LONG-TERM STEWARDSHIP (PBS RL-LTS) SCHEDULE AND COST DETAILS

Scope information for long-term stewardship (LTS), PBS RL-LTS, is presented in Table C-22. This PBS is not broken down to Level 3 scope, and no near-term cost details are available for this PBS because of when the work is planned to begin.

Table C-22. Long-Term Stewardship (PBS RL-LTS) Level 2 Scope Summary.

Work Element	Scope Description
Long-Term Stewardship	Includes operation and maintenance of Hanford Site infrastructure following cleanup activities; environmental monitoring of groundwater, soil, and vadose zone; and monitoring for public safety and resource protection; planning; land management; and surveillance and maintenance activities to ensure environmental compliance and protection, payment in lieu of taxes, and management and administration.
NOTE: See Table C-23 for schedule and budget information.	

Table C-23. Long-Term Stewardship (PBS RL-LTS) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated).

Fiscal Year	**2079**	**2080**	**2081**	**2082**	**2083**	**2084**	**2085**	**2086**	**2087**
Long-Term Stewardship	254,000	260,100	266,300	272,700	279,300	286,000	292,900	299,900	307,100
Fiscal Year	**2088**	**2089**	**2090**	**2091**	**2092**	**2093**	**2094**	**2095**	**Total**
Long-Term Stewardship	314,400	322,000	329,700	329,700	329,700	339,300	348,200	351,500	**5,182,800**

C.1.10 FINAL REACTOR DISPOSITION SCHEDULE AND COST DETAILS

Scope information for final reactor disposition is presented in Table C-24. This work is not broken down to Level 3 details, so no additional scope is presented and no near-term cost details are available because of when the work is planned to begin.

Table C-24. Final Reactor Disposition Level 2 Scope Summary.

Work Element	Scope Description
Final Reactor Disposition	Includes final reactor disposition of the 100 Area surplus production reactors (except for B Reactor which is part of the newly established Manhattan Project National Historical Park). Following a safe storage period of up to 75 years, final reactor disposition would include demolition of the interim safe storage enclosure and transport of each of the eight reactor blocks intact on a tractor-transporter from its present location in the 100 Areas to the Central Plateau Inner Area for disposal. Following reactor removal, the site formerly occupied by each reactor would be backfilled, graded, and seeded. Although the final end state of N Reactor has not been determined, the planning case is to disposition it in the same manner as the other reactors.
NOTE: See Table C-25 for schedule and budget information.	

Table C-25. Final Reactor Disposition Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated).

Fiscal Year	**2054**	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**
Final Reactor Disposition	18,800	37,600	37,600	56,400	94,100	94,100	131,700
Fiscal Year	**2061**	**2062**	**2063**	**2064**	**2065**	**2066**	**2067**
Final Reactor Disposition	282,200	282,200	282,200	188,100	188,100	94,100	56,400
Fiscal Year	**2068**						
Final Reactor Disposition	37,600						
Total	**1,881,200**						

C.2 OFFICE OF RIVER PROTECTION PROJECT BASELINE SUMMARY INFORMATION

The DOE, Office of River Protection (ORP), manages their assigned cleanup mission through the following PBSs (at Level 1):

- Radioactive Liquid Tank Waste Stabilization and Disposition, PBS ORP-0014
- Major Construction – Waste Treatment and Immobilization Plant, PBS ORP-0060
- Waste Treatment Plant Operations, PBS ORP-0070

Scope information for PBS ORP-0014, PBS ORP-0060 and PBS ORP-0070 is presented in Chapter 5.0 of the LCR. No additional scope is presented here. The estimated costs for PBSs ORP-0014 and ORP-0060 are presented in Tables C-26 to C-28.

Table C-26. Radioactive Liquid Tank Waste Stabilization and Disposition (PBS-ORP-0014) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated). (3 pages)

Fiscal Year	2019	2020	2021	2022	2023	2024	2025	2026	2027
Base Operations	390,800	431,700	425,100	439,800	457,800	494,400	479,000	484,700	493,100
Retrieve and Close SSTs	125,900	200,300	148,700	103,900	103,300	53,700	73,000	165,900	400,000
Waste Feed Delivery/Treatment Planning/DST Retrieval/Closure	116,900	121,100	106,100	121,900	133,400	161,000	194,100	270,300	410,400
Supplemental Treatment	0	0	0	0	1,400	10,300	12,500	77,500	267,500
Treat Waste	2,800	1,700	135,200	132,100	81,600	345,500	478,400	575,200	605,900
Facility Closures	0	0	0	0	0	0	0	7,200	15,800
TOC - ORP Project Support	79,600	87,200	91,500	109,500	116,200	135,700	147,500	167,100	200,200
Cost and/or Schedule Uncertainty	25,100	29,500	31,800	31,800	31,300	42,100	48,500	61,300	83,900
Level 2 Total	**741,100**	**871,500**	**938,400**	**939,000**	**925,000**	**1,242,700**	**1,433,000**	**1,809,200**	**2,476,800**
Fiscal Year	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**
Base Operations	514,800	519,700	528,500	498,900	527,300	544,400	546,900	555,600	574,100
Retrieve and Close SSTs	330,800	238,200	229,900	278,200	370,100	402,900	452,900	265,900	272,100
Waste Feed Delivery/Treatment Planning/DST Retrieval/Closure	497,500	514,600	428,700	390,500	414,000	387,700	342,800	302,100	264,000
Supplemental Treatment	478,000	844,100	1,807,300	1,875,100	1,936,800	622,600	210,500	510,000	640,100
Treat Waste	623,200	638,500	659,400	730,500	754,600	773,100	1,340,000	1,678,100	1,862,800
Facility Closures	6,000	1,000	9,600	25,300	52,300	10,100	3,500	1,500	1,400
TOC - ORP Project Support	215,800	233,300	281,800	291,400	307,500	244,300	254,800	278,700	298,000
Cost and/or Schedule Uncertainty	93,500	104,800	138,300	143,400	153,000	104,700	110,500	125,900	137,200
Level 2 Total	**2,759,600**	**3,094,200**	**4,083,500**	**4,233,300**	**4,515,600**	**3,089,800**	**3,261,900**	**3,717,800**	**4,049,700**
Fiscal Year	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
Base Operations	598,300	617,600	633,000	648,800	713,500	705,800	746,600	753,400	755,100
Retrieve and Close SSTs	389,400	451,300	415,800	528,200	623,500	625,600	811,800	823,300	804,500
Waste Feed Delivery/Treatment Planning/DST Retrieval/Closure	228,000	234,800	247,500	251,900	293,900	290,900	303,100	318,700	328,400
Supplemental Treatment	624,100	627,800	645,800	661,600	683,200	702,800	722,900	746,500	761,800
Treat Waste	1,936,300	1,991,600	2,048,600	2,098,800	2,167,400	2,229,400	2,293,100	2,368,200	2,416,600
Facility Closures	1,900	3,000	2,600	7,500	14,100	6,500	3,100	4,000	2,900
TOC - ORP Project Support	309,000	319,900	326,800	340,000	359,300	366,400	386,300	397,700	403,400

Table C-26. Radioactive Liquid Tank Waste Stabilization and Disposition (PBS-ORP-0014) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated). (3 pages)

Cost and/or Schedule Uncertainty	143,300	148,900	151,500	159,100	170,200	172,800	184,700	189,800	191,900
Level 2 Total	**4,230,300**	**4,394,900**	**4,471,600**	**4,695,900**	**5,025,100**	**5,100,200**	**5,451,600**	**5,601,600**	**5,664,600**
Fiscal Year	**2046**	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**	**2053**	**2054**
Base Operations	770,600	812,800	815,400	853,500	834,500	811,100	815,100	869,200	793,100
Retrieve and Close SSTs	843,600	725,600	845,700	769,100	750,300	802,800	793,200	610,900	428,300
Waste Feed Delivery/Treatment Planning/DST Retrieval/Closure	319,500	312,000	337,400	360,400	380,600	393,100	426,400	463,500	528,200
Supplemental Treatment	783,600	809,200	835,600	856,100	880,600	902,200	931,700	958,300	978,400
Treat Waste	2,485,700	2,567,000	2,650,900	2,716,000	2,793,600	2,862,100	2,955,700	3,029,300	3,070,700
Facility Closures	2,500	3,800	2,500	1,700	9,500	7,300	5,300	2,600	2,100
TOC - ORP Project Support	414,500	420,800	438,900	446,400	455,800	466,500	479,800	485,400	484,100
Cost and/or Schedule Uncertainty	197,000	198,100	207,800	210,500	214,000	219,000	224,600	225,100	220,400
Level 2 Total	**5,817,000**	**5,849,300**	**6,134,200**	**6,213,700**	**6,318,900**	**6,464,100**	**6,631,800**	**6,644,300**	**6,505,300**
Fiscal Year	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**	**2061**	**2062**	**2063**
Base Operations	860,800	825,900	829,700	786,000	790,000	754,600	633,500	549,400	550,700
Retrieve and Close SSTs	438,600	437,400	364,800	347,500	297,200	163,500	47,700	5,800	6,000
Waste Feed Delivery/Treatment Planning/DST Retrieval/Closure	619,200	721,900	766,800	742,300	657,200	777,500	726,700	788,300	900,000
Supplemental Treatment	1,004,400	1,033,500	1,058,700	1,092,900	1,124,100	1,160,900	1,189,300	1,218,500	1,253,400
Treat Waste	3,154,700	3,244,900	3,324,500	3,433,200	3,531,400	3,646,800	3,736,300	3,827,900	3,937,300
Facility Closures	8,400	18,900	40,100	37,400	12,800	27,600	27,900	10,600	5,900
TOC - ORP Project Support	503,900	519,400	529,500	539,200	544,100	557,200	554,400	562,300	581,800
Cost and/or Schedule Uncertainty	231,000	238,500	242,400	244,700	243,900	248,500	242,500	244,100	253,700
Level 2 Total	**6,821,000**	**7,040,400**	**7,156,500**	**7,223,200**	**7,200,700**	**7,336,600**	**7,158,300**	**7,206,900**	**7,488,800**

Fiscal Year	**2064**	**2065**	**2066**	**2067**	**2068**	**2069**	**Total**
Base Operations	315,300	304,700	304,700	266,500	152,700	3,900	**30,382,400**
Retrieve and Close SSTs	6,200	6,400	6,600	6,700	7,000	300	**18,400,300**
Waste Feed Delivery/Treatment Planning/DST Retrieval/Closure	670,300	457,600	399,300	301,800	181,300	8,300	**19,913,900**
Supplemental Treatment	1,000,000	937,300	684,800	0	0	0	**36,163,700**
Treat Waste	1,672,400	1,011,600	739,100	0	0	0	**91,359,700**

Table C-26. Radioactive Liquid Tank Waste Stabilization and Disposition (PBS-ORP-0014) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated). (3 pages)

Facility Closures	214,900	95,100	90,200	32,700	8,000	0	**847,100**	
TOC - ORP Project Support	352,000	250,800	222,900	140,100	131,700	6,200	**16,836,600**	
Cost and/or Schedule Uncertainty	148,300	107,400	85,800	26,200	16,800	700	**7,499,800**	
Level 2 Total	**4,379,400**	**3,170,900**	**2,533,400**	**774,000**	**497,500**	**19,400**	**221,403,500**	

DST = double-shell tank.
ORP = U.S. Department of Energy, Office of River Protection.
PBS = project baseline summary.
SST = single-shell tank.
TOC = Tank Operations Contract.

Table C-27. Radioactive Liquid Tank Waste Stabilization and Disposition (PBS-ORP-0014), Near-Term Schedule and Costs, Level 3, by Fiscal Year ($1,000, Escalated). (2 pages)

Schedule Level	Scope	2019	2020	2021	2022	2023	2024	Total
1	**Radioactive Liquid Tank Waste Stabilization and Disposition**	**741,100**	**871,500**	**938,400**	**939,000**	**925,000**	**1,242,700**	**5,657,700**
2	**Base Operations**	**390,800**	**431,700**	**425,100**	**439,800**	**457,800**	**494,400**	**2,639,600**
3	Base Operations	177,300	187,700	192,500	198,400	203,500	211,400	1,170,800
3	DST Space Management	21,400	25,700	25,000	24,500	27,200	22,700	146,500
3	TOC Facility Operations	49,200	53,000	56,200	59,100	60,800	86,400	364,700
3	Tank Farm Upgrades	37,200	61,400	44,800	48,000	53,600	57,400	302,400
3	Project Support	105,700	103,900	106,600	109,800	112,700	116,500	655,200
2	**Retrieve and Close SSTs**	**125,900**	**200,300**	**148,700**	**103,900**	**103,300**	**53,700**	**735,800**
3	Retrieval/Closure Program	34,600	66,500	51,200	37,900	39,300	39,900	269,400
3	SST Retrieval East Area	16,900	77,200	73,900	51,500	10,300	700	230,500
3	SST Retrieval West Area	0	0	0	7,600	50,100	9,400	67,100
3	Closure Program	4,200	4,400	4,500	3,500	3,600	3,700	23,900
3	SST Closure	2,900	12,800	17,100	3,400	0	0	36,200
3	AX-Farm Retrieval	67,300	39,400	2,000	0	0	0	108,700
2	**Waste Feed Delivery/Treatment Planning/DST Retrieval/Closure**	**116,900**	**121,100**	**106,100**	**121,900**	**133,400**	**161,000**	**760,400**
3	WTP Feed Delivery Program	32,400	33,500	34,400	35,400	36,300	37,500	209,500
3	Construct DST Systems	21,300	22,200	7,000	18,800	27,600	27,600	124,500

Table C-27. Radioactive Liquid Tank Waste Stabilization and Disposition (PBS-ORP-0014), Near-Term Schedule and Costs, Level 3, by Fiscal Year ($1,000, Escalated). (2 pages)

Schedule Level	Scope	2019	2020	2021	2022	2023	2024	Total
3	Tank Waste Characterization and Staging Facility (TWCSF)	0	0	0	0	100	7,400	7,500
3	Immobilization Program	11,300	11,700	6,300	6,500	6,600	26,800	69,200
3	WTP Operational Readiness	4,100	4,300	7,700	8,900	9,200	5,900	40,100
3	Secondary Waste Treatment/ETF	33,100	34,200	35,100	36,200	37,100	38,700	214,400
3	Strategic Planning and Technology	14,700	15,200	15,600	16,100	16,500	17,100	95,200
2	**Supplemental Treatment**	**0**	**0**	**0**	**0**	**1,400**	**10,300**	**11,700**
2	**Treat Waste**	**2,800**	**1,700**	**135,200**	**132,100**	**81,600**	**345,500**	**698,900**
3	LAW Pretreatment System (LAWPS)	2,800	1,600	104,800	91,700	20,400	25,800	247,100
3	Remaining Treat Waste	0	100	30,400	40,400	61,200	319,700	451,800
2	**Tank Operations Contract - ORP Project Support**	**79,600**	**87,200**	**91,500**	**109,500**	**116,200**	**135,700**	**619,700**
2	**Cost and/or Schedule Uncertainty**	**25,100**	**29,500**	**31,800**	**31,800**	**31,300**	**42,100**	**191,600**
	Total	**741,100**	**871,500**	**938,400**	**939,000**	**925,000**	**1,242,700**	**5,657,700**

DST = double-shell tank.
ETF = Effluent Treatment Facility.
LAWPS = Low Activity Waste Pretreatment System.
ORP = U.S. Department of Energy, Office of River Protection.
PBS = project baseline summary.
SST = single-shell tank.
TFC = Tank Farm Contractor.
TOC = Tank Operations Contract.
TWCSF = Tank Waste Characterization and Staging Facility.
WTP = Waste Treatment and Immobilization Plant

Table C-28. Major Construction – Waste Treatment and Immobilization Plant (PBS-ORP-0060) Remaining Lifecycle Schedule and Costs, Level 2, by Fiscal Year ($1,000, Escalated).

Fiscal Year	2019	2020	2021	2022	2023	2024	2025	2026	2027
LBL/DFLAW	701,755	667,625	644,545	659,234	267,886	0	0	0	0
High-Level Waste Facility (HLW)	74,211	23,584	0	0	0	0	0	0	0
Pretreatment (PT)	115,265	18,481	0	0	0	0	0	0	0
HLW and PT	0	259,310	586,455	545,766	1,551,114	1,751,000	1,940,000	1,278,000	695,000
Level 2 Total	**891,231**	**969,000**	**1,231,000**	**1,205,000**	**1,819,000**	**1,751,000**	**1,940,000**	**1,278,000**	**695,000**
Fiscal Year	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**Total**	
LBL/DFLAW	0	0	0	0	0	0	0	**2,941,045**	
High-Level Waste Facility (HLW)	0	0	0	0	0	0	0	**97,795**	
Pretreatment (PT)	0	0	0	0	0	0	0	**133,746**	
HLW and PT	778,000	1,229,000	1,095,000	928,000	1,055,000	1,208,000	409,769	**15,309,414**	
Level 2 Total	**778,000**	**1,229,000**	**1,095,000**	**928,000**	**1,055,000**	**1,208,000**	**409,769**	**18,482,000**	

PBS = project baseline summary.

APPENDIX D

HANFORD QUANTITATIVE CONTINGENCY RESULTS

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CONTENTS

TABLES

TERMS

CB	Oracle Crystal Ball software application
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CH	contact-handled
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DST	double-shell tank
ENW	Energy Northwest
ERDF	Environmental Restoration Disposal Facility
ETF	Effluent Treatment Facility
EU	estimate uncertainty
FFTF	Fast Flux Test Facility
HLW	high-level waste
ILAW	immobilized low-activity waste
LAW	low-activity waste
LAWPS	Low-Activity Waste Pretreatment System
LTS	long-term stewardship
MOA	memorandum of agreement
ORP	U.S. Department of Energy, Office of River Protection
PBS	project baseline summary
PRA	Oracle Primavera Risk Analysis software application
PT	pretreatment
RCRA	*Resource Conservation and Recovery Act of 1976*
RFI/CMS	RCRA Facility Investigations/Corrective Measures Studies
RI/FS	remedial investigation/feasibility study
RL	U.S. Department of Energy, Richland Operations Office
ROD	record of decision
S&M	surveillance and maintenance
SHPO	State Historic Preservation Officer
TRU	transuranic
TSCR	tank-side cesium removal
TSD	treatment, storage, and disposal
USACE	U.S. Army Corps of Engineers
VPU	vertical pipe unit
WAC	waste acceptance criteria
WBS	work breakdown structure
WFD	waste feed delivery
WIR	waste incidental to reprocessing
WTP	Waste Treatment and Immobilization Plant

APPENDIX D

HANFORD QUANTITATIVE CONTINGENCY RESULTS

Appendix D provides descriptions of the risk analysis methodologies, key risks, estimating uncertainties (EU), and quantitative contingency results used to support identification of the upper bound of the cost ranges for Hanford PBSs set forth in this report. Existing RL and ORP risk models were used when available and revisions to existing EU assessments and risk registers were only made when supported by a reasonable basis specific to high cost range development. Excluded from the results are the impacts on RL PBSs associated with the potential WTP extension of operations. These impacts were modeled and quantified separately and included in the high range estimates.

Table D-1 provides an overview of high cost range development methodologies and the following pages provide additional methodology descriptions and quantitative risk analysis results for each PBS identified in the table.

Table D-1. Summary of Risk Analysis Methodologies for High Cost Ranges. (2 pages)

PBS	Title	Risk Analysis Methodology
RL-0013C	Solid Waste Stabilization and Disposition–200 Area	**Base Risk Model**: Existing PRA model developed by RL. **EU**: Cost and schedule duration uncertainty revisions for high range. **Risks**: No risk additions or revisions for high range.
RL-0020	Safeguards and Security	**Base Risk Model**: CB-based risk model developed for high range. **EU**: Cost uncertainty developed for high range. **Risks**: One new event risk identified for high range.
RL-0030	Soil and Water Remediation–Groundwater/Vadose Zone	**Base Risk Model**: Existing PRA model developed by RL. **EU**: Cost and schedule duration uncertainty revisions for high range. **Risks**: No risk additions or revisions for high range.
RL-0040	Nuclear Facility D&D–Remainder of Hanford	**Base Risk Model**: Existing PRA model developed by RL. **EU**: Cost and schedule duration uncertainty revisions for high range. **Risks**: No risk additions or revisions for high range.
RL-0041	Nuclear Facility D&D–River Corridor Closure Project	**Base Risk Model**: Existing PRA model developed by RL. **EU**: No revisions to cost and schedule duration uncertainty for high range. **Risks**: No risk additions or revisions for high range.
RL-0042	Nuclear Facility D&D–Fast Flux Test Facility Project	**Base Risk Model**: Existing PRA model developed by RL. **EU**: Cost and schedule duration uncertainty revisions for high range. **Risks**: No risk additions or revisions for high range.
RL-0100	Richland Community and Regulatory Support	**Base Risk Model**: CB-based risk model developed for high range. **EU**: Cost uncertainty developed for high range. **Risks**: No risk additions or revisions for high range.
RL-0201	Hanford Sitewide Services	**Base Risk Model**: CB-based risk model developed for high range. **EU**: Cost uncertainty developed for high range. **Risks**: One new event risk identified for high range.

Table D-1. Summary of Risk Analysis Methodologies for High Cost Ranges. (2 pages)

PBS	Title	Risk Analysis Methodology
RL-LTS	Long-Term Stewardship	**Base Risk Model**: CB-based risk model developed for high range. **EU**: Cost uncertainty developed for high range. **Risks**: No risk additions or revisions for high range.
ORP-0014	Radioactive Liquid Tank Waste Stabilization and Disposition	**Base Risk Model**: Existing CB-based risk model developed by ORP. **EU**: Cost uncertainty developed for high range. **Risks**: 21 of 65 existing risks were revised for high range. Four new discrete risks were added for high range.
ORP-0060	Major Construction – Waste Treatment Plant	**Base Risk Model**: CB-based risk model developed for high range. **EU**: Cost uncertainty developed for high range (separately from the CB-based risk model). **Risks**: Two new discrete risks were identified for high range.

CB = Oracle Crystal Ball software application.
D&D = decontamination and decommissioning.
EU = estimate uncertainty.
LTS = Long-Term Stewardship.
ORP = DOE, Office of River Protection.
PBS = project baseline summary.
PRA = Oracle Primavera Risk Analysis software application.
RL = DOE, Richland Operations Office.

RL-0013C. Solid Waste Stabilization and Disposition–200 Area

Risk Analysis Methodology

The existing Primavera Risk Analysis (PRA) model developed by RL served as the starting point for development of the high cost range for RL-0013C. An integrated cost and schedule risk analysis was performed using the resource-loaded RL-0013C schedule as the basis for the analysis. Each risk in the risk register was mapped to the appropriate affected activities in the schedule. Cost estimate and schedule duration uncertainty also were incorporated into the model and analyzed. The model was analyzed using PRA Version 8.7.

No new additional risks were identified to support development of the high cost range and no revisions to existing risks identified by RL were made. Estimating uncertainty for the high cost range was identified as follows: -15%/+50% applied to all waste stabilization and disposition work except for the following: project management (-10%/+15%); TRU retrieval and repackaging, Waste Receiving and Processing Facility, T-Plant, Central Waste Complex, and sludge disposition (-20%/+100%).

Key Risks

The following key risks have been identified for RL-0013C:

- Delays in receiving regulatory approvals (CH retrieval, alpha caisson retrieval and processing).
- Receipt of non-compliant waste from other projects.
- Spent fuel found in alpha caissons.

Monte Carlo Risk Analysis Results

The results of Monte Carlo risk analysis used to develop the high range for RL-0013C are summarized below in Table D-2.

Table D-2. RL-0013C Monte Carlo Analysis Results.

Base Cost	**$9.4B**	
Probability	**Base Cost w/Contingency ($B)**	**Total Contingency ($B)**
0%	$9.97	$0.57
10%	$11.68	$2.28
20%	$12.08	$2.68
30%	$12.38	$2.98
40%	$12.66	$3.26
50%	$12.93	$3.53
60%	$13.20	$3.80
70%	$13.50	$4.10
80%	**$13.85**	**$4.45**
90%	$14.38	$4.98
100%	$16.56	$7.16

RL-0020. Safeguards and Security

Risk Analysis Methodology

A cost risk analysis model based on the Oracle Crystal Ball (CB) software application was developed to quantify the high cost range for RL-0020. One discrete risk and cost estimate uncertainty were incorporated into the model and analyzed.

One new discrete risk event was identified to support development of the high cost range. Estimating uncertainty for the high cost range was identified as follows: -10%/+15% for all work.

Key Risks

The following key risk has been identified for RL-0020:

- Delay in the movement of fuel in multi-canister overpacks offsite. If there is a delay in the planned movement of spent nuclear fuel offsite using multi-canister overpacks, there will be additional security related costs incurred while the fuel remains on site.

Monte Carlo Risk Analysis Results

The results of Monte Carlo risk analysis used to develop the high range for RL-0020 are summarized below in Table D-3.

Table D-3. RL-0020 Monte Carlo Analysis Results.

Base Cost	**$10.1B**			
Probability	**Base Cost w/Contingency ($B)**	**Total Contingency ($B)**	**Cost Risk Impact ($B)**	**Estimate Uncertainty ($B)**
0%	$10.88	$0.73	$0.82	$(0.08)
10%	$11.06	$0.91	$0.92	$(0.01)
20%	$11.27	$1.12	$1.06	$0.06
30%	$11.43	$1.28	$1.17	$0.11
40%	$11.57	$1.42	$1.26	$0.15
50%	$11.70	$1.55	$1.36	$0.19
60%	$11.84	$1.69	$1.48	$0.21
70%	$11.98	$1.83	$1.60	$0.23
80%	**$12.16**	**$2.01**	**$1.75**	**$0.26**
90%	$12.39	$2.25	$1.95	$0.30
100%	$13.63	$3.48	$2.41	$1.07

RL-0030. Soil and Water Remediation–Groundwater/Vadose Zone

Risk Analysis Methodology

The existing PRA model developed by RL served as the starting point for development of the high cost range for RL-0030. An integrated cost and schedule risk analysis was performed using the resource-loaded RL-0030 schedule as the basis for the analysis. Each risk in the risk register was mapped to the appropriate affected activities in the schedule. Cost estimate and schedule duration uncertainty also were incorporated into the model and analyzed. The model was analyzed using PRA Version 8.7.

No new additional risks were identified to support development of the high cost range and no revisions to existing risks identified by RL were made. Estimating uncertainty for the high cost range was identified as follows: -15%/+50 applied to all remediation work except for integration and assessments, which was analyzed using -10%/+15%.

Key Risks

The following key risks have been identified for RL-0030:

- Pump and treat systems operate longer than planned.
- RI/FS not acceptable to regulators.
- RCRA/CERCLA issues delay ROD.
- Supplemental technology not ready in time.
- Sampling site not representative.
- Combined RFI/CMS/RI/FS with TSD closure information not accepted.
- Conceptual models invalidated.
- Pump and treat expansions required.
- Significant contamination is found.
- Nature and extent of contamination assumed is different than baseline.
- Groundwater contamination plume emerges.
- Documents review/approval delayed.
- Waste removal negotiations delay documents.

Monte Carlo Risk Analysis Results

The results of Monte Carlo risk analysis used to develop the high range for RL-0030 are summarized below in Table D-4.

Table D-4. RL-0030 Monte Carlo Analysis Results.

Base Cost	**$7.9B**	
Probability	**Base Cost w/Contingency ($B)**	**Total Contingency ($B)**
0%	$8.50	$0.64
10%	$9.28	$1.41
20%	$9.43	$1.56
30%	$9.56	$1.70
40%	$9.66	$1.80
50%	$9.75	$1.89
60%	$9.86	$1.99
70%	$9.98	$2.11
80%	**$10.11**	**$2.25**
90%	$10.34	$2.47
100%	$11.20	$3.34

RL-0040. Nuclear Facility D&D–Remainder of Hanford

Risk Analysis Methodology

The existing PRA model developed by RL served as the starting point for development of the high cost range for RL-0040. An integrated cost and schedule risk analysis was performed using the resource-loaded RL-0040 schedule as the basis for the analysis. Each risk in the risk register was mapped to the appropriate affected activities in the schedule. Cost estimate and schedule duration uncertainty also were incorporated into the model and analyzed. The model was analyzed using PRA Version 8.7.

No new additional risks were identified to support development of the high cost range and no revisions to existing risks identified by RL were made. Estimating uncertainty for the high cost range was identified as follows: -30%/+50% was applied to all work.

Key Risks

The following key risks have been identified for RL-0040:

- Outer Area Implementation Area ROD for soil is not as assumed.
- Outer Area Implementation Area Remedy for underground piping not as planned.
- Borrow materials not available for 200 W Landfills Implementation Area.
- Balance of East Implementation Area ROD for soil is not as assumed.
- Borrow materials not available for ERDF Implementation Area.
- Radioactive material is considered to be contaminated waste that must be removed (rather than hold-up material).

Monte Carlo Risk Analysis Results

The results of Monte Carlo risk analysis used to develop the high range for RL-0040 are summarized below in Table D-5.

Table D-5. RL-0040 Monte Carlo Analysis Results.

Base Cost	**$13.7B**	
Probability	**Base Cost w/Contingency ($B)**	**Total Contingency ($B)**
0%	$16.95	$3.21
10%	$18.56	$4.83
20%	$18.94	$5.20
30%	$19.22	$5.48
40%	$19.48	$5.74
50%	$19.74	$6.01
60%	$20.03	$6.29
70%	$20.33	$6.60
80%	**$20.68**	**$6.95**
90%	$21.21	$7.47
100%	$23.47	$9.74

RL-0041. Nuclear Facility D&D–River Corridor Closure Project

Risk Analysis Methodology

The existing PRA model developed by RL served as the starting point for development of the high cost range for RL-0041. An integrated cost and schedule risk analysis was performed using the resource-loaded RL-0041 schedule as the basis for the analysis. Each risk in the risk register was mapped to the appropriate affected activities in the schedule. Cost estimate and schedule duration uncertainty also were incorporated into the model and analyzed. The model was analyzed using PRA Version 8.7.

No new additional risks were identified to support development of the high cost range and no revisions to existing risks identified by RL were made. Estimating uncertainty for the high cost range was identified as follows: -30%/+50% was applied to all work.

Key Risks

The following key risks have been identified for RL-0041:

- Additional remediation may be required for other 100 Area segments.
- Total volume of high-dose 300-296 waste site material exceeds available hot cell space.
- Building/system degradation and failures during S&M mode.
- Delayed ENW license amendment approval for 618-11 burial ground remediation.
- 618-11 VPU/Caissons – negatively impact ENW.
- DOE and SHPO MOA process takes longer than planned (waste site 618-11).
- K-West Basin residual TRU waste discovered that must be remote handled.

Monte Carlo Risk Analysis Results

The results of Monte Carlo risk analysis used to develop the high range for RL-0041 are summarized below in Table D-6.

Table D-6. RL-0041 Monte Carlo Analysis Results.

Base Cost	**$1.4B**	
Probability	**Base Cost w/Contingency ($B)**	**Total Contingency ($B)**
0%	$1.52	$0.10
10%	$1.64	$0.21
20%	$1.67	$0.25
30%	$1.70	$0.28
40%	$1.72	$0.30
50%	$1.74	$0.32
60%	$1.76	$0.34
70%	$1.79	$0.36
80%	**$1.81**	**$0.39**
90%	$1.84	$0.42
100%	$2.02	$0.60

RL-0042. Nuclear Facility D&D–Fast Flux Test Facility Project

Risk Analysis Methodology

The existing PRA model developed by RL served as the starting point for development of the high cost range for RL-0042. An integrated cost and schedule risk analysis was performed using the resource-loaded RL-0042 schedule as the basis for the analysis. Each risk in the risk register was mapped to the appropriate affected activities in the schedule. Cost estimate and schedule duration uncertainty also were incorporated into the model and analyzed. The model was analyzed using PRA Version 8.7.

No new additional risks were identified to support development of the high cost range and no revisions to existing risks identified by RL were made. Estimating uncertainty for the high cost range was identified as follows: -30%/+50% was applied to all work.

Key Risks

The following key risks have been identified for RL-0042:

- FFTF D&D and WTP operations not aligned - continued bulk sodium storage at FFTF required.
- No path to disposition highly radioactive components.
- System piping requires modification to treat residual sodium.
- WTP will not use FFTF bulk sodium.
- Building/system degradation and failures during S&M mode.
- Technical validation for entombment/residual sodium not defined.
- ETF may not be available to disposition liquid waste.
- ERDF not available for demolition waste.

Monte Carlo Risk Analysis Results

The results of Monte Carlo risk analysis used to develop the high range for RL-0042 are summarized below in Table D-7.

Table D-7. RL-0042 Monte Carlo Analysis Results.

Base Cost	**$0.7B**	
Probability	**Base Cost w/Contingency ($B)**	**Total Contingency ($B)**
0%	$0.78	$0.03
10%	$0.87	$0.12
20%	$0.90	$0.15
30%	$0.93	$0.18
40%	$0.95	$0.20
50%	$0.97	$0.22
60%	$0.99	$0.24
70%	$1.02	$0.27
80%	$1.05	$0.30
90%	$1.10	$0.35
100%	$1.28	$0.53

RL-0100. Richland Community and Regulatory Support

Risk Analysis Methodology

A cost risk analysis model based on the CB software application was developed to quantify the high cost range for RL-0100. Cost estimate uncertainty was incorporated into the model and analyzed. Estimating uncertainty for the high cost range was identified as follows: -10%/+15% for all work.

Key Risks

No discrete event risks have been identified for RL-0100.

Monte Carlo Risk Analysis Results

The results of Monte Carlo risk analysis used to develop the high range for RL-0100 are summarized below in Table D-8.

Table D-8. RL-0100 Monte Carlo Analysis Results.

Base Cost	**$1.07B**			
Probability	**Base Cost w/Contingency ($B)**	**Total Contingency ($B)**	**Cost Risk Impact ($B)**	**Estimate Uncertainty ($B)**
0%	$0.97	$(0.09)	$0.00	$(0.09)
10%	$1.04	$(0.03)	$0.00	$(0.03)
20%	$1.05	$(0.01)	$0.00	$(0.01)
30%	$1.06	$(0.00)	$0.00	$(0.00)
40%	$1.07	$0.01	$0.00	$0.01
50%	$1.08	$0.02	$0.00	$0.02
60%	$1.09	$0.03	$0.00	$0.03
70%	$1.10	$0.04	$0.00	$0.04
80%	**$1.11**	**$0.05**	**$0.00**	**$0.05**
90%	$1.13	$0.07	$0.00	$0.07
100%	$1.21	$0.14	$0.00	$0.14

RL-0201. Hanford Sitewide Services

Risk Analysis Methodology

A cost risk analysis model based on the CB software application was developed to quantify the high cost range for RL-0201. One discrete risk and cost estimate uncertainty were incorporated into the model and analyzed.

One new discrete risk event was identified to support development of the high cost range. Estimating uncertainty for the high cost range was identified as follows: -10%/+15% included based on level of effort activities; -10%/+50% included for reliability projects (infrastructure upgrades).

Key Risks

The following key risk has been identified for RL-0201:

- Availability of Hanford Site infrastructure, utilities and services "outside the fence" of tank farm infrastructure is less than adequate. If the infrastructure and services are not available or sufficient to support the RPP mission such as SST retrievals, waste feed delivery, treatment, and immobilization, then mission schedule durations and costs will increase.

Monte Carlo Risk Analysis Results

The results of Monte Carlo risk analysis used to develop the high range for RL-0201 are summarized below in Table D-9.

Table D-9. RL-0201 Monte Carlo Analysis Results.

Base Cost	**$20.4B**			
Probability	**Base Cost w/Contingency ($B)**	**Total Contingency ($B)**	**Cost Risk Impact ($B)**	**Estimate Uncertainty ($B)**
0%	$19.09	$(1.28)	$0.00	$(1.28)
10%	$20.66	$0.29	$0.40	$(0.11)
20%	$20.94	$0.56	$0.48	$0.08
30%	$21.15	$0.78	$0.55	$0.23
40%	$21.33	$0.96	$0.60	$0.36
50%	$21.51	$1.13	$0.65	$0.49
60%	$21.68	$1.31	$0.69	$0.61
70%	$21.87	$1.50	$0.74	$0.75
80%	**$22.10**	**$1.72**	**$0.81**	**$0.92**
90%	$22.41	$2.04	$0.89	$1.15
100%	$24.13	$3.76	$1.08	$2.68

RL-LTS. Long-Term Stewardship

Risk Analysis Methodology

A cost risk analysis model based on the CB software application was developed to quantify the high cost range for RL-LTS. Cost estimate uncertainty was incorporated into the model and analyzed. Estimating uncertainty for the high cost range was identified as follows: -10%/+15% for all work.

Key Risks

No discrete risks have been identified for RL-LTS.

Monte Carlo Risk Analysis Results

The results of Monte Carlo risk analysis used to develop the high range for RL-LTS are summarized below in Table D-10.

Table D-10. RL-LTS Monte Carlo Analysis Results.

Base Cost	**$12.22B**			
Probability	**Base Cost w/Contingency ($B)**	**Total Contingency ($B)**	**Cost Risk Impact ($B)**	**Estimate Uncertainty ($B)**
0%	$11.22	$(1.00)	$0.00	$(1.00)
10%	$11.97	$(0.25)	$0.00	$(0.25)
20%	$12.11	$(0.11)	$0.00	$(0.11)
30%	$12.23	$0.01	$0.00	$0.01
40%	$12.32	$0.10	$0.00	$0.10
50%	$12.42	$0.20	$0.00	$0.20
60%	$12.51	$0.29	$0.00	$0.29
70%	$12.61	$0.39	$0.00	$0.39
80%	**$12.73**	**$0.51**	**$0.00**	**$0.51**
90%	$12.90	$0.67	$0.00	$0.67
100%	$13.73	$1.51	$0.00	$1.51

ORP-0014. Radioactive Liquid Tank Waste Stabilization and Disposition

Risk Analysis Methodology

The existing CB-based model developed by ORP served as the starting point for development of the high cost range for ORP-0014. An integrated cost and schedule risk analysis was performed using a summary level schedule as the basis for the analysis. Each risk in the risk register was mapped to the appropriate affected activities in the summary schedule. Cost estimate uncertainty was analyzed as a separate Monte Carlo analysis and then combined with risk analysis results.

Four new additional risks were identified to support development of the high cost range and revisions were made to 21 existing risks identified by ORP. Estimating uncertainty for the high cost range was identified for specific WBS cost elements; in aggregate, an overall estimate uncertainty range of -25%/+56% was identified.

Key Risks

The following key risks have been identified for ORP-0014:

- Mission extension results in need for facility replacements and major upgrades (*new risk identified for high cost range).*
- Waste incidental to reprocessing (WIR) determinations are required for newly-generated waste forms (*new risk identified for high cost range*).
- Spent ion exchange media from TSCR and optimized LAWPS do not have a disposition path (*new risk identified for high cost range*).
- WTP PT becomes nonfunctional due to major black cell system failures (*new risk identified for high cost range*).
- 242-A Evaporator availability is less than adequate.
- SST retrieval systems performance does not meet requirements due to unexpected conditions.
- Inability to maintain adequate DST space.
- DST availability to perform mission functions is less than adequate.
- Waste feed delivery (WFD) is not available at the demand rate.
- WFD does not meet the WTP PT waste acceptance criteria (WAC).
- Cross-site transfer system startup is delayed.
- CH-TRU waste treatment startup is delayed.
- Waste receiver facilities are not available when needed.
- LAWPS hot commissioning is delayed.
- WTP PT hot commissioning is delayed.
- WTP PT throughput rate does not meet plan.
- WTP PT radioactive secondary solid waste not able to be treated or disposed as planned.
- WTP LAW throughput rate does not meet plan.
- WTP ILAW glass mass quantity differs from plan.
- WTP LAW radioactive solid secondary waste not able to be treated or disposed as planned.
- WTP HLW hot commissioning is delayed.
- WTP HLW throughput rate does not meet plan.
- Supplemental ILAW glass mass and/or quality differs from plan.
- Availability of Hanford Site infrastructure, utilities and services less than adequate.
- Facilities and equipment become obsolete.

Monte Carlo Risk Analysis Results

The results of Monte Carlo risk analysis used to develop the high range for ORP-0014 are summarized below in Table D-11.

Table D-11. ORP-0014 Monte Carlo Analysis Results.

Base Cost	**$213.9B**			
Probability	**Base Cost w/Contingency ($B)**	**Total Contingency ($B)**	**Cost Risk Impact ($B)**	**Estimate Uncertainty ($B)**
0%	$236.7	$22.8	$95.5	-$72.7
10%	$340.1	$126.2	$167.3	-$41.1
20%	$367.7	$153.8	$179.4	-$25.6
30%	$390.7	$176.8	$189.0	-$12.1
40%	$412.8	$198.9	$198.3	$0.7
50%	$435.1	$221.2	$207.6	$13.6
60%	$458.9	$245.0	$217.7	$27.3
70%	$485.8	$271.9	$229.4	$42.5
80%	**$518.1**	**$304.2**	**$243.5**	**$60.7**
90%	$563.4	$349.5	$264.0	$85.5
100%	$812.4	$598.5	$404.3	$194.1

ORP-0060. Major Construction – Waste Treatment Plant

Risk Analysis Methodology

An incremental cost and schedule risk analysis model based on the CB software application was developed to quantify the high cost range for ORP-0060. The model is incremental because the results serve as an addition to the existing risk analysis rather than a replacement. Two new discrete risks were incorporated into the model and analyzed.

Estimate uncertainty for the high range was calculated separately from the Monte Carlo risk model for ORP-0060. Estimate uncertainty for LBL/DFLAW is based on BCP-02; and for PT and HLW is based on USACE Parametric Estimate. For the purposes of the high cost range, estimate uncertainty results were escalated at a 4% annual rate.

Key Risks

The following key risks have been identified for ORP-0060:

- Technical uncertainty and challenges for HLW and PT completion (*new risk identified for high cost range*).
- Implementation schedule uncertainty for HLW and PT (*new risk identified for high cost range*).
- Equipment performance issues during factory acceptance testing.
- Project execution below performance baseline; systemic failure.
- Technical challenges and uncertainties.
- Aging and obsolescence of existing work.
- Additional rework issues discovered during restart of construction.
- Delays in completing ORP operational readiness review.
- Complex features that fail to be operationally ready.
- Major equipment failures.
- Transition impacts from construction to startup.
- Construction quality deficiencies.

Monte Carlo Risk Analysis Results

The results of Monte Carlo risk analysis used to develop the high range for ORP-0060 are summarized below in Table D-12. The Total Risk Impact values shown in the table include the impact of the two new discrete risks identified as well as the impacts of existing risks.

Table D-12. ORP-0060 Monte Carlo Analysis Results.

Base Cost	**$15.5B**	
Probability	**Base Cost w/Risk Impacts ($B)**	**Total Risk Impacts[a] ($B)**
0%	$19.38	$3.88
10%	$20.87	$5.37
20%	$21.50	$6.00
30%	$22.00	$6.50
40%	$22.49	$6.99
50%	$23.02	$7.52
60%	$23.60	$8.10
70%	$24.27	$8.77
80%	$25.05	$9.55
90%	**$26.07**	**$10.57**
100%	$28.53	$13.03

a. Estimate uncertainty for the high range was calculated separately from the Monte Carlo risk model for ORP-0060. Values shown include discrete event risk only. Additional estimate uncertainty of about $4.2B is included in the high range value of about $30.3B.