DOE/RL-2004-05
Revision 1
Re-Issue

Engineering Evaluation/Cost Analysis for the Plutonium Finishing Plant Above-Grade Structures

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

United States Department of Energy
P.O. Box 550
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

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EXECUTIVE SUMMARY

This document presents the results of an engineering evaluation/cost analysis that evaluates options for the disposition of contaminated Plutonium Finishing Plant above-grade structures. This engineering evaluation/cost analysis is based on an existing U.S. Department of Energy and U.S. Environmental Protection Agency joint policy and was prepared in accordance with the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*. Furthermore this engineering evaluation/cost analysis is required under the *Hanford Federal Facility Agreement and Consent Order*, Interim Milestone M-83-22, "*Submit to Ecology an Engineering Evaluation/Cost Analysis(es) [EE/CA(s)] for approval and provide an Action Memorandum(a) as a primary document (s) for the decommissioning of the PFP Facility*."

The purpose of this engineering evaluation/cost analysis is to identify a recommended removal action from a viable set of alternatives. This non-time critical removal action is undertaken to mitigate threats to human health and the environment posed by the contaminated surfaces and hazardous substance inventory contained within the eventually degrading Plutonium Finishing Plant above-grade structures.

In general, the scope of this engineering evaluation/cost analysis includes Plutonium Finishing Plant structures that are accessible without excavation and includes the structures' associated basements, tunnels, and vaults. Each structure within the engineering evaluation/cost analysis scope is potentially contaminated. However if one of these structures is later determined to be noncontaminated, that structure may be excluded from this engineering evaluation/cost analysis' scope and be removed under existing U.S. Department of Energy authority prior to the *Comprehensive Environmental Response, Compensation, and Liability Act* response action. Also, if during deactivation activities there are other structures not currently identified in the scope of this engineering evaluation/cost analysis that are sufficiently similar to the structures addressed herein and are determined to be contaminated, this engineering evaluation/cost analysis may be used as a vehicle to clean up and remove those structures.

Any Plutonium Finishing Plant structures that are not contaminated are being removed under existing U.S. Department of Energy authority and do not require evaluation under this engineering evaluation/cost analysis.

Alternatives evaluated are:

- Alternative One: No Action
- Alternative Two: Surveillance and Maintenance
- Alternative Three: Deactivation/Stabilization
- Alternative Four: Slab-on-Grade
- Alternative Five: Entombment
- Alternative Six: Collapse and Cover.

Although Alternatives One, Two, Three, and Four apply a single removal activity for the Plutonium Finishing Plant above-grade structures, Alternatives Five and Six would require an approach that entombs, or collapses, select buildings while removing others. Table 4-1 identifies which alternatives were considered for each structure.

After summarizing site characteristics, providing building description, and establishing removal action objectives, these alternatives were evaluated in terms of effectiveness, implementability, and cost. The engineering evaluation/cost analysis contains a comparison of the relative performance of each alternative.

Based on the comparative analysis, the engineering evaluation/cost analysis recommends Alternative Four, Slab-on-Grade. Section 4.5 outlines the details of this alternative and Section 6.0 describes the basis for the recommendation.

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ACRONYMS

ACM	asbestos-containing material
AL	analytical laboratory
ARAR	applicable or relevant and appropriate requirement
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	Code of Federal Regulations
CCl_4	carbon tetrachloride
CWC	Central Waste Complex
DBBP	dibutylbutyl phosphate
D&D	decontamination and decommissioning
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy, Richland Operations Office
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	200 Areas Effluent Treatment Facility
$Fe(NO_3)_3$	ferric nitrate
HEPA	high-efficiency particulate air
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
HNO_3	nitric acid
LLBG	Low-Level Burial Grounds
LLW	low-level waste
LLMW	low-level mixed waste
$Mg(OH)_3$	magnesium hydroxide
MT	miscellaneous treatment
NaOH	sodium hydroxide
NDA	nondestructive assay
NEPA	*National Environmental Policy Act of 1969*
NPL	National Priorities List

ACRONYMS (cont)

PCB	polychlorinated biphenyls
PFP	Plutonium Finishing Plant
Policy	*Policy on Decommissioning Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*
PPE	personnel protective equipment
ppm	parts per million
PPSL	Plutonium Process Support Laboratory
PRF	Plutonium Recovery Facility
RCRA	*Resource Conservation and Recovery Act of 1976*
RCW	*Revised Code of Washington*
RECUPLEX	recovery of uranium and plutonium by extraction
RMA	remote mechanical "A"
RMC	remote mechanical "C"
ROD	Record of Decision
S&M	surveillance and maintenance
SHPO	State Historic Preservation Office
SNM	Special nuclear material
SWB	standard waste box
TBC	to-be-considered
TBD	to-be-determined
TBP	tributyl phosphate
TK	tank
TRU	transuranic
TRUM	transuranic mixed
TSCA	*Toxic Substances Control Act of 1976*
TSD	treatment, storage, and/or disposal
WAC	*Washington Administrative Code*
WIPP	Waste Isolation Pilot Plant
WRAP	Waste Receiving and Processing Facility

METRIC CONVERSION CHART

Into metric units / Out of metric units

If you know	Multiply by	To get	If you know	Multiply by	To get
Length			**Length**		
inches	25.40	millimeters	millimeters	0.03937	inches
inches	2.54	centimeters	centimeters	0.393701	inches
feet	0.3048	meters	meters	3.28084	feet
yards	0.9144	meters	meters	1.0936	yards
miles (statute)	1.60934	kilometers	kilometers	0.62137	miles (statute)
Area			**Area**		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.09290304	square meters	square meters	10.7639	square feet
square yards	0.8361274	square meters	square meters	1.19599	square yards
square miles	2.59	square kilometers	square kilometers	0.386102	square miles
acres	0.404687	hectares	hectares	2.47104	acres
Mass (weight)			**Mass (weight)**		
ounces (avoir)	28.34952	grams	grams	0.035274	ounces (avoir)
pounds	0.45359237	kilograms	kilograms	2.204623	pounds (avoir)
tons (short)	0.9071847	tons (metric)	tons (metric)	1.1023	tons (short)
Volume			**Volume**		
ounces (U.S., liquid)	29.57353	milliliters	milliliters	0.033814	ounces (U.S., liquid)
quarts (U.S., liquid)	0.9463529	liters	liters	1.0567	quarts (U.S., liquid)
gallons (U.S., liquid)	3.7854	liters	liters	0.26417	gallons (U.S., liquid)
cubic feet	0.02831685	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.7645549	cubic meters	cubic meters	1.308	cubic yards
Temperature			**Temperature**		
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit
Energy			**Energy**		
kilowatt hour	3,412	British thermal unit	British thermal unit	0.000293	kilowatt hour
kilowatt	0.94782	British thermal unit per second	British thermal unit per second	1.055	kilowatt
Force/Pressure			**Force/Pressure**		
pounds (force) per square inch	6.894757	kilopascals	kilopascals	0.14504	pounds per square inch

06/2001

Source: *Engineering Unit Conversions*, M. R. Lindeburg, PE., Third Ed., 1993, Professional Publications, Inc., Belmont, California.

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ENGINEERING EVALUATION/COST ANALYSIS FOR THE PLUTONIUM FINISHING PLANT ABOVE-GRADE STRUCTURES

1.0 INTRODUCTION

This document presents the results of an engineering evaluation/cost analysis (EE/CA) addressing the disposition of contaminated Plutonium Finishing Plant (PFP) Facility above-grade structures. The PFP above-grade structures consist of processing, support, and administrative buildings occupying approximately 23 hectares (58 acres). Past plutonium production operations resulted in potential contamination throughout the structures used for producing plutonium, which are addressed in this EE/CA. The U.S. Department of Energy (DOE) has identified no further use for the PFP Facility, making the structures candidates for decontamination and decommissioning (D&D).

1.1 REGULATORY REVIEW

Four areas of the Hanford Site, including the 200 Areas, were placed on the U.S. Environmental Protection Agency's (EPA) *Comprehensive Environmental Response, Compensation, and Liability* (CERCLA) *Act of 1980* National Priorities List (NPL) in November 1989.

PFP contains CERCLA hazardous substances, predominantly residual radionuclides and small quantities of residual hazardous chemicals. As there is no future use for the PFP Facility without ongoing maintenance, the integrity of the above-grade structures and internal systems will degrade, resulting in an increased potential for releases of these hazardous substances to the environment. The DOE, EPA, and the Washington State Department of Ecology (Ecology) have determined that a CERCLA non-time critical removal action is warranted to mitigate this threat.

The PFP Facility is located within the 200 Areas NPL. Cleanup of the NPL sites at the Hanford Site continues in accordance with the *Hanford Federal Facility Agreement and Consent Order* (HFFACO) (Ecology et al., 1994) and the National Contingency Plan regulations of Title 40, *Code of Federal Regulations* (CFR), Section 300. In addition to the NPL cleanup work, the DOE and the EPA have agreed on an approach for decommissioning surplus facilities consistent with the CERCLA requirements. The approach is documented in the "*Policy on Decommissioning Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)"* (hereinafter referred to as the Policy) issued jointly by DOE and EPA on May 22, 1995 (DOE and EPA, 1995). The Policy establishes that decommissioning activities will be conducted as non-time critical removal actions under CERCLA unless the circumstances at a facility make this inappropriate. The Policy encourages streamlined decision making, consistent with the DOE/EPA jointly issued *"Guidance on Accelerating CERCLA Environmental Restoration at Federal Facilities",* issued August 22, 1994 (DOE et al. 1994). Specifically, the Policy builds on the effort to "develop decisions that appropriately address the reduction of risk to human health and the environment as expeditiously as the law allows". The Policy is based on the provisions of Executive Order 12580, which delegates from the President to the U.S. Secretary of Energy certain CERCLA response authorities for facilities under DOE jurisdiction, custody, or control.

As required under the HFFACO, Ecology has been designated as the lead regulatory agency for this removal action under the HFFACO, Interim Milestone M-83-22, "*Submit to Ecology an Engineering Evaluation/Cost Analysis (es) [EE/CA(s)] for approval and provide an Action Memorandum(a) as a primary document(s) for the decommissioning of the PFP Facility.*" The lead regulatory agency is the regulatory agency assigned oversight responsibility with respect to the action being taken. After the public has commented on the alternatives presented in this EE/CA, public comments will be evaluated and a preferred alternative will be selected to disposition the PFP above-grade structures. This decision will be documented in an action memorandum.

Because of the potential threat to personnel associated with periodic inspection and maintenance activities during surveillance and maintenance (S&M), as well as the potential for a release through failure of a building envelope, the DOE has determined a non-time critical removal is appropriate to manage the risk associated with the PFP above-grade structures. This decision also is consistent with the requirements of HFFACO Interim Milestone M-83-22.

To ensure the project schedule meets the HFFACO milestone, some deactivation activities covered under this removal action are being performed under existing regulatory authority (i.e., categorical exclusions under the *National Environmental Policy Act* [NEPA] *of 1969*, environmental impact statements, environmental assessments, and supplemental analyses), before approval of CERCLA documentation.

In accordance with the *Secretarial Policy on the National Environmental Policy Act* (DOE 1994) and DOE Order 451.1B, NEPA values have been incorporate into this EE/CA to the extent practicable. The policy statement and DOE Order allow integration of the NEPA values into CERCLA documents, such as this EE/CA, rather than requiring separate documentation.

1.2 PURPOSE

The purpose of the EE/CA is to identify a recommended removal action from a viable set of alternatives. This EE/CA was prepared in accordance with CERCLA, 40 CFR 300.415, and the Policy.

1.3 SCOPE OF REMOVAL ACTION AND RELATIONSHIP TO FUTURE REMEDIAL ACTIONS

The scope of this PFP removal action is to mitigate the risks associated with the contaminated surfaces and hazardous substance inventory contained within the eventually degrading PFP structures identified in Table 1-1.

In this document, when discussing the activities that are to be performed, the terms "above-grade," below-grade" and "sub-grade" are used. The term "above-grade" in this document refers to items that are above or on the elevation of the surrounding ground (e.g., a building or concrete slab). Above-grade items are within the scope of this EE/CA. The term "below-grade" in this document means below the elevation of the surrounding ground but not completely covered by soil. For example, the basement of a building would be "below-grade." Below-grade rooms (basements, tunnels, vaults, etc.) of above-grade structures also are within the EE/CA scope. The term "sub-grade" in the context of this document is used when referring to an item that is completely covered by soil or other covering that is not readily removed (ex. a floor slab). For example, piping that is buried under a building is considered sub-grade. Unless specifically noted, sub-grade items are outside the scope of the EE/CA and therefore will remain after the removal/demolition of the items addressed by this EE/CA.

Potential contamination releases from sub-grade sources, such as buried structures, buried pipelines, soil, groundwater, or unplanned releases, while mitigated by this EE/CA to the extent practicable, will be the subject of future CERCLA response actions. Currently, there are no CERCLA cleanup criteria for sub-grade contamination established for waste sites in the 200 Areas. Cleanup levels will be identified in these future evaluations. These evaluations will be made in conjunction with the 200 Areas Operable

Unit remediation as described in the *200 Areas Remedial Investigation/Feasibility Study Implementation Plan - Environmental Restoration Program* (DOE/RL-98-28).

In addition to the removal action of this EE/CA, there are another three CERCLA removal actions being considered for the PFP Facility. Two structures within PFP, the 232-Z Facility and the 241-Z-361 Tank, are being evaluated under two separate CERCLA removal actions, *Engineering Evaluation/Cost Analysis for the Removal of the Contaminated Waste Recovery Process Facility, Building 232-Z* (DOE/RL-2003-29) and *Tank 241-Z-361 Engineering Evaluation/Cost Analysis* (DOE/RL-2003-52) respectively. Remediation of the sub-grade portions of PFP will be addressed in a subsequent non-time critical removal action. Along with the removal actions, waste sites associated with PFP operations, such as ponds, cribs, and trenches, identified in Operable Units 200-CW-5, 200-LW-2, 200-MW-1, 200-PW-1, and 200-PW-6, will be dispositioned when the remedial actions have been identified for these waste sites. Finally, two *Resource Conservation and Recovery Act* (RCRA) *of 1976* treatment, storage, and/or disposal (TSD) units, the 241-Z Treatment and Storage Tanks and the Plutonium Finishing Plant Treatment Unit, will be undergoing closure.

In general, the scope of the EE/CA includes PFP structures, items, components, etc. that are accessible without excavation. Some of these items (for example caissons and fire risers) may be deferred to follow on remedial activities.

Uncontaminated structures, which are being removed under existing DOE authority, do not require evaluation under this EE/CA and, therefore, are not included as part of the scope of this document. Each structure within the EE/CA's scope, such as those listed in Table 1-1, is potentially contaminated.

There are a large number of facilities on the Hanford Site. Many of the facilities are administrative and/or small in nature, with little or no contamination present within. Many facilities are associated with a larger facility and may be addressed as part of that larger facility. In such cases, facility complexes are typically identified as a single facility for the purpose of implementing the decommissioning process. This approach is consistent with the overall facility decommissioning plan for Hanford. For the PFP above-grade structures removal action, if a structure listed in Table 1-1 is later determined to be uncontaminated, that structure will be deleted from the ongoing scope of the removal action and be removed under existing DOE authority. Some slightly contaminated structures listed in Table 1-1 have been scheduled for demolition under existing DOE authority. These ongoing demolition activities of slightly contaminated structures are similar to those that will take place in support of this EE/CA's slab-on-grade alternative, entombment alternative, and collapse and cover alternative. If any of the listed alternatives is selected as the preferred removal action alternative, then the ongoing demolition activities will be incorporated as appropriate into the preferred alternative activities/disposal pathways (e.g., rubble from slightly contaminated demolished structures will be disposed of with other removal action rubble to an appropriate disposal site) and closed out as part of the removal action.

If other structures at PFP are identified during deactivation activities that are sufficiently similar to the structures addressed by this EE/CA (i.e., contaminated with hazardous substances that present a threat of release), this EE/CA will be modified to address dispositioning for those structures.

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Table 1-1. PFP Above-grade Structures in the EE/CA Scope.[1] (2 sheets)

Structure	Name/description	Comments
216-Z-9[2]	Crib and support structures: - 216-Z-9A, Contaminated Soil Removal Building - 216-Z-9B, Operator's Cubicle - 216-Z-9C, Mining Apparatus Enclosure	Crib activities include only addition of gravel or other fill material and/or soil stabilizers inside the crib and stabilizers or structural reinforcement outside the crib if required.
225-WC[2]	Wastewater Sampling Facility	Also known as the Instrumentation & Local Control Unit 55C-23.
234-5Z[3]	Plutonium Fabrication Facility	Includes the Plutonium Process Support Laboratory (PPSL), the hazardous waste storage area, the 267-Z Riser #9 Valve House, and basement tunnels.
234-5ZA	Change Room Addition	
236-Z[3]	Plutonium Reclamation Facility	
241-Z[3]	Tank Farm Waste Disposal Building	Also known as the Waste Storage and Treatment Facility. Includes above-grade enclosure, liquid waste storage and treatment tanks in below-grade concrete vaults, and 296-Z-3 stack.
241-ZA	Sample Building	
241-ZB	Sodium Hydroxide Tank	
241-ZG	Change Facility	
241-Z-RB	Retention Basin	Also known as the 207-Z building. Includes basins, valve room, and piping.
242-Z[3]	Waste Treatment Facility	
243-Z	Low-Level Waste Treatment Facility	Includes 296-Z-15 stack.
243-ZA	Low-Level Waste Storage Facility	Includes sump pit
243-ZB	Cooling Towers and Concrete Pad	
2503-Z	Electrical Switchyard	
252-Z-1	Electrical Substation	Electrical transformers and pad
270-Z	Operations and Support Facility	
2701-ZA	Central Alarm Station Facility	
2701-ZD	Badge house	
2702-Z	Microwave Tower and Communications Support Building	
2704-Z	Safeguards and Security Building	
2705-Z	Operations Control Facility	
2712-Z	Stack Monitoring Station	For 291-Z-001 stack.
2721-Z	Emergency Generator Building	Does not include below-grade fuel tank
2727-Z	Supply Storage Building	
2729-Z	Maintenance Storage Building	
2731-Z	Plutonium Drum Storage Building	
2731-ZA	Container Storage Building	Also known as the Clean Laundry Building
2734-ZA, -ZC, -ZK, and -ZL	Gas Bottle Storage	
2734-ZB, -ZD, -ZF, -ZG, and -ZH	Gas Bottle Storage	

Table 1-1. PFP Above-grade Structures in the EE/CA Scope.[1] (2 sheets)

Structure	Name/description	Comments
2734-ZJ	Liquid Nitrogen Storage and Supply	
2735-Z	Bulk Chemical Storage Tanks	
2736-Z[3]	Plutonium Storage Building	Includes 296-Z-6 stack.
2736-ZA[3]	Plutonium Storage Ventilation Structure	
2736-ZB[3]	Plutonium Storage Support Facility	Includes 296-Z-5 stack; 296-Z-7 stack.
2736-ZC	Cargo Restraint Transport Dock	
2736-ZD	Vault-EBR II Casks	
2902-Z	Elevated Water Storage Tower and Tank	Includes below-grade valve pit
2904-ZA[2]	Radiation and Flow Monitoring Station	
2904-ZB[2]	Monitoring Building	
291-Z[3]	Exhaust Air Filter Stack Building	Includes below-grade fan house, 252-Z-2 Electrical Substation, and sub-grade ductwork between 291-Z Building and 291-Z Stack.
291-Z-001[3]	Stack	Includes below-grade portion of the stack structure.
	PFP Complex Yards and Grounds[2]	Includes mobile offices buildings (e.g., MO-XXX), hazardous waste storage units and hazardous substance storage cabinets (e.g., HS-XX), interim storage vaults, and other miscellaneous items.

[1] Includes below-grade rooms such as basements, tunnels, and vaults, etc.
[2] These items are located outside of the PFP Exclusion Area or, as in the case of the PFP Complex Yards and Grounds, *may* include some items outside of the PFP Exclusion Area.
[3] Major PFP structures: Those structures that were identified as having a source term and/or containing major processing equipment or one of the confinement systems.

2.0 SITE CHARACTERIZATION

This chapter summarizes the characteristics of the waste site as related to the removal action; including relevant background information about the PFP Facility, a description of the physical features of the waste site location, a description of each above-grade structure addressed by this EE/CA, and the hazardous substances and risks associated with those structures.

2.1 BACKGROUND AND SITE DESCRIPTION

The PFP Facility is located on the Hanford Site in the 200 West Area (Figures 2-1, and 2-2), approximately 51 kilometers (32 miles) northwest of Richland, Washington.

2.1.1 General Description

The PFP Facility was used to conduct plutonium processing, storage, and support operations for national defense, including the following:

- Special nuclear material handling and storage
- Plutonium recovery
- Plutonium conversion
- Laboratory support
- Waste handling
- Shutdown and operational facility surveillances.

As a result of plutonium processing activities, the PFP Facility contains an inventory of approximately 3,600 kilograms (7,900 pounds) of plutonium-bearing materials. For analysis in the environmental impact statement (EIS), *Final Environmental Impact Statement Plutonium Finishing Plant Stabilization* (DOE/EIS-0244-F), the plutonium-bearing materials were grouped into the following four inventory categories:

(1) Plutonium-bearing solutions
(2) Oxides, fluorides, and process residues
(3) Metals and alloys
(4) Polycubes and combustibles.

Further, the PFP EIS analyses considered an additional approximate 50 kilograms (110 pounds) of plutonium-bearing materials in systems (e.g., ventilation, process equipment, piping, walls, floors, etc.) that accumulated gradually over approximately 40 years of processing; the accumulated material is referred to as hold-up material.

For the purposes of the EE/CA, approximately 100 kilograms (220 pounds) of holdup material, in the form of pure/impure plutonium oxides and/or alloys, and sludges, are used as the basis for radiological dose consequences. The approximate 100 kilogram (220-pound) amount is comprised of a conservative nondestructive assay (NDA) inventory value [approximately 75 kilograms (165 pounds)] and a contingency [approximately 25 kilograms (55 pounds)]. Current conservative NDA values[1] for holdup material contained throughout the PFP Facility processing systems are estimated to be approximately 75 kilograms

[1] Conservative values are based on the total of the upper ranges of the NDA measurements taken.

(165 pounds)[2]. These approximate 75 kilograms (165 pounds) of plutonium include the approximate 50 kilograms (110 pounds) of the aforementioned hold-up material identified in the PFP EIS. Because of the inherent limitations of NDA analyses and potential locations within the PFP Facility that have not undergone NDA, an additional approximate 25 kilograms (55 pounds) also are included as contingency.

During the early 1990s, DOE authorized a number of equipment, instrumentation, and containment upgrades for the PFP Facility in preparation to stabilize the plutonium-bearing materials grouped into the four inventory categories. In the mid-1990s, several 'interim stabilization' measures were developed and completed, including thermal stabilization of some plutonium-bearing materials, removal of plutonium-contaminated equipment to reduce dose, and remediation of nearby soils, trenches, and sumps.

In October 1996, the DOE issued a shutdown order that stated the operation of the PFP Facility as a production processing plant was no longer required and directed the U.S. Department of Energy, Richland Operations Office (DOE-RL) to "initiate deactivation and the transition of the PFP in preparation for decommissioning" (Ahlgrimm 1996). In 1996, planning was initiated for integrating deactivation activities with the ongoing plutonium-bearing material stabilization activities to transition the PFP Facility to a low-risk/low-cost S&M condition. In 1997, the *PFP Deactivation Project Management Plan* (HNF-SD-CP-PMP-008) was issued. This document established a deactivation sequence for PFP and called for transitioning PFP processing facilities to a deactivated state with vault de-inventory to be completed by 2029 and demolition to be completed by 2038. Subsequent to issuance of this document, DOE-RL instructed PFP to find a more cost-effective plan that would support acceleration of the Hanford Site cleanup.

In November 1997, an alternate transition concept was presented to the Hanford Site Advisory Board. This alternative called for PFP to be deactivated, including vaults being de-inventoried, by 2014 and the process and vault facilities to be transitioned to a dismantled state by 2016. The dismantlement end point would be removal of above-grade structures to the first floor concrete slab (clean slab-on-grade). The remaining concrete slab and sub-grade structures, utilities, and systems would be transferred to the D&D S&M program pending final disposition. This concept has been incorporated as one of the alternatives in Chapter 4.0.

Current PFP Facility transition planning is provided in the *Integrated Project Management Plan for the Plutonium Finishing Plant Nuclear Material Stabilization Project* (HNF-3617). This integrated project management plan focuses on special nuclear material stabilization and packaging activities required in the Defense Nuclear Facilities Safety Board (DNFSB) 94-1/2000-1, *An Implementation Plan for Stabilization and Storage of Nuclear Material,* and initiation of more detailed deactivation planning for transition of the PFP Facility to a low-risk/low-cost S&M condition. Stabilization and packaging activities associated with DNFSB 94-1/2000-1 are scheduled to be completed by May 2004.

2.1.2 Site Access

Public access to the Hanford Site, including the 200 Areas, is controlled for the DOE at the Wye Barricade on Route 4 and the Yakima and Rattlesnake Barricades on State Highway 240. The Hanford Patrol, the Hanford Site security organization, is responsible for control at the barricades. An additional access point to the 200 East and 200 West Areas from Highway 240, with limited hours of operation, is located near the southeast corner of the 200 West Area. Highways 24, 240, and 243 pass through the Hanford Site, and are not DOE controlled under normal circumstances. Traffic on the Columbia River,

[2] NDA inventory estimates indicate that a best value of approximately 60 kilograms (132 pounds) of plutonium in hold-up material is located throughout the entire PFP Facility. The best value represents an average of a range of NDA measurements taken throughout the PFP Facility.

airspace over the Hanford Site, and access routes to areas used by non-DOE organizations (e.g., US Ecology; Energy Northwest Nuclear Power Plant) also are not subject to DOE controls under normal circumstances.

2.1.3 Flora and Fauna

Details regarding the Hanford Site can be found in the *Hanford Site 2001 Environmental Report* (PNNL-14295) and *Hanford Site National Environmental Policy Act (NEPA) Characterization* (PNNL-6415).

The PFP Facility is not located within a wetland or a floodplain. PFP is in an industrialized area with construction, processing, and decommissioning activities being conducted. The final end state of the PFP Facility, to be developed through the CERCLA process, will determine ultimate land use. Presently, the *Hanford Comprehensive Land-Use Plan Environmental Impact Statement Record of Decision* (64 FR 61615, November 12, 1999) states that the Central Plateau (i.e., the 200 Areas that include PFP) geographic area is designated Industrial-Exclusive.

What little plant community does exist primarily consists of semiarid species common to disturbed areas, such as cheatgrass, rabbitbrush, and other non-native plant species. Threatened and endangered plants and animals identified on the Hanford Site, as listed by the federal government (50 CFR 17) and Washington State (Washington National Heritage Program 2002), generally are not found in the vicinity of PFP, and are discussed in PNNL-6415. However, migratory birds (including the house finch, Say's phoebe, barn swallow, violet-green swallow, American robin, and western kingbird) and/or their nests (50 FR 13708) have been observed within the PFP area. No plants or animal species protected under the *Endangered Species Act of 1973*, candidates for such protection, or species listed by the Washington State government as threatened and endangered were observed in the vicinity of the PFP Facility. There are, however, two species of birds (Aleutian Canada goose and bald eagle) on the federal list of threatened and endangered species that have been observed on the Hanford Site. Additional details regarding the protection and enhancement of the bald eagle Hanford Site habitat are provided in the *Bald Eagle Site Management Plan for the Hanford Site, South-Central Washington* (DOE/RL-94-150).

2.1.4 Cultural Resources

General information regarding cultural resources on the Hanford Site can be found in PNNL-6415. A number of site-specific biological and cultural resource reviews for deactivating and dismantling the PFP Facility have been conducted. Findings and/or restrictions have been identified in these reviews and are summarized as follows.

Minor excavation activities (e.g., excavating to cap pipes at exterior building walls) would be limited to the immediate vicinity of previously disturbed areas. It is expected that deactivation activities would be consistent with the *Hanford Site Biological Resources Management Plan* (DOE/RL-96-32) and *Hanford Site Biological Resources Mitigation Strategy* (DOE/RL-96-88). An ecological resource review is conducted annually at the PFP Facility. As appropriate, certain restrictions might be applied as a result of these reviews. For example, during nesting periods (i.e., late April through late July), active nests for species protected under federal and state laws should not be moved/destroyed or the structure supporting the nest should not be deactivated/dismantled until the young have fledged (left the nest).

Eleven buildings (i.e., 232-Z, 234-5Z, 234-5ZA, 236-Z, 242-Z, 2701-ZA, 2704-Z, 2736-Z, 2736-ZA, 2736-ZB, and 291-Z) are eligible for listing in the National Register of Historic Places as contributing properties within the Manhattan Project and Cold War Era Historic District. Of these 11 buildings, four buildings (i.e., 234-5Z, 291-Z, 232-Z, and 2736-Z) have been recommended by DOE-RL for preservation for public education and interpretation through heritage tourism (DOE/RL-97-1047, *History of the Plutonium Production Facilities at the Hanford Site Historic District, 1943-1990*).

In addition, walkthroughs of PFP historic buildings have been conducted in accordance with the *Programmatic Agreement Among the U.S. Department of Energy, Richland Operations Office, the Advisory Council on Historic Preservation, and the Washington State Historic Preservation Office for the Maintenance, Deactivation, Alteration, and Demolition of the Built Environment on the Hanford Site, Washington* (DOE/RL-96-77) to assess contents and to locate any artifacts that might have interpretive or educational value as potential exhibits within local, state, or national museums. Artifacts within PFP have been identified and tagged.

Mitigation of the adverse effects on the physical structures within PFP resulting from deactivation has been accomplished through individual building documentations and a detailed discussion of the history and role of PFP as provided in Chapter 2.0 of DOE/RL-97-1047. Mitigation measures directed at public education, site interpretation, and artifact curation were presented in the *Mitigation Plan and Curation Plan for the Deactivation and Decommissioning of Historic Buildings at Plutonium Finishing Plant Complex (HCRC# 2002-200-021)* for this project (Hebdon 2002). The mitigation plan focused primarily on the four buildings recommended by DOE-RL to be preserved in-place for public education and interpretation through heritage tourism. The curation plan considered the disposition of artifacts tagged for interpretive purposes.

In January 2003, the State Historic Preservation Office (SHPO) provided final concurrence to DOE-RL (Griffith 2003) regarding the recommendations within the mitigation plan and curation plan. In summary, the SHPO agreed that because of public health and safety concerns posed by high radiological contamination levels, public access highly would be unlikely; therefore, deactivation activities could proceed. On September 29, 2003, further correspondence was received from the SHPO which allowed deactivation activities to extend approximately 1000 feet beyond the PFP fence line and included excavations to a depth of 20 feet (Whitlam 2003). In addition, DOE-RL is evaluating potential long-term curation facility(ies). PFP artifacts would be stored within the PFP Facility while deactivation activities are completed or suitable storage space is obtained, and until an interpretive center is established. PFP artifacts that are not contaminated will be retained; contaminated artifacts will be disposed after the objects thoroughly are documented[3].

2.2 FACILITY DESCRIPTION

This section describes the PFP Facility above-grade structures within the scope of this EE/CA and summarizes the processes that occurred at these locations. This section also identifies the types of waste that could be generated during the removal action and the quantities encountered should the structures be demolished to a 'slab-on-grade' condition as described in Chapter 4.0.

2.2.1 Building Descriptions

This section describes materials of construction, building floor plan, and function of each structure within the scope of this EE/CA. Building description information was primarily derived from the *History and Stabilization of the Plutonium Finishing Plant (PFP) Complex, Hanford Site* (HNF-EP-0924) and the *Plutonium Finishing Plant Final Safety Analysis Report* (HNF-SD-CP-SAR-021). To the extent

[3] A summation of the current PFP cultural and historic documentation is found in DOE/EA-1469, *Environment Assessment Deactivation of the Plutonium Finishing Plant, Hanford Site, Richland, Washington.*

practicable, building descriptions include the type and quantity of contaminated process equipment and major components of engineered systems that could be generated as demolition waste under this EE/CA.

2.2.1.1 216-Z-9 Crib and Support Structures Description

The 216-Z-9 Facility is located just southeast of the 234-5 Building outside of the double fences. This facility is comprised of the 216-Z-9 'crib' and three support structures (216-Z-9A, -9B, and -9C), which are installed, all or in part, on a concrete slab covering the crib. The structures are the 'contaminated-soil removal building', the 'operator’s cubicle', and the 'mining apparatus enclosure'.

The 216-Z-9 crib was built in 1954 as a 6.4 m (21-foot) deep underground soil disposal area with an enclosed 'cavern' (a wooden void space) at the head end. The crib walls are sloped toward the center of the floor. The crib floor is 9.1 m (30 feet) by 18.3 m (60 feet). The top of the crib at ground level was covered by a 23 cm (9-inch) thick concrete slab measuring 27.4 m (90 feet) by 36.6 m (120 feet), upon which sits facility structures. The 216-Z-9 crib is not a major process facility or support area of the PFP Facility and is the only waste site associated with this EE/CA. The crib operated from 1955 to 1962 serving the recovery of uranium and plutonium by solvent extraction (RECUPLEX) facility and receiving and disposing of streams of plutonium-bearing aqueous and liquid organic waste. A soil mining and leaching plan was developed in 1966 to remove the top layer of soil and leach out the plutonium. Cold test of mining equipment consisting of a clamshell assembly attached to a boom was conducted in 1972. Power was supplied by hydraulic cylinders. Equipment was mounted on 1.07 m (42-inch) risers placed across the face of the concrete cover slab. In 1973, a 10 percent cadmium nitrate solution was added to the soils as a poison before beginning mining. From 1976 to 1978, the trench floor was mined for plutonium using remotely operated equipment to reduce the risk of environmental contamination and the potential for criticality. Approximately, 58 kilograms (128 pounds) of plutonium were recovered.

The 'contaminated soil removal' building (216-Z-9A) was constructed in 1976 and is the largest 216-Z-9 facility structure. This building is located adjacent to and partially on the crib cover slab. The building, having an irregular footprint, is constructed of corrugated steel and is approximately 25.6 m (84 feet) long (east to west), 7.3 m (24 feet) wide (north to south), and approximately 3.7 m (12 feet) high corrugated steel. The building housed the glovebox that received excavated soil from crib mining operations via a conveyor and also contained support equipment for the glovebox and waste loadout. Equipment outside the glovebox has been removed except for supply cabinets and a portable air compressor and its captive air tank.

The 'operator cubicle' (216-Z-9B) was the control room to view and operate mining apparatus. This cubicle was constructed in 1976 and is located both above and below the crib concrete slab. The cubicle above-grade portion is a prefabricated steel shed that is approximately 2.4 m (8 feet) by 2.4 m (8 feet) and is 2.4 m (8 feet) high and was used as an entry for the below-grade control room area. The below-grade portion is of similar size and is constructed and located to allow operator viewing of below-grade mining activities.

The 'mining apparatus enclosure' (216-Z-9C), constructed in 1976, is located on the concrete slab covering the crib. The building is a prefabricated corrugated steel building that is approximately 3.7 m (12 feet) long by 3.0 m (10 feet) wide and 2.4 m (8 feet) high. This building was used as weather protection for the mobile clamshell assembly that 'mined' the crib via one of two openings in the crib cover.

2.2.1.2 225-WC Wastewater Sampling Facility Description

The 225-WC Building was constructed in 1995 and is located approximately 182.9 m (600 feet) southeast of 234-5Z outside the PFP fence line. The building is a corrugated steel structure that is approximately 5.5 m (18 feet) by 4 m (13 feet) and 2.9 m (9.5 feet) high placed on a concrete slab.

225-WC houses the sampling and monitoring equipment for the wastewater discharge to the Treated Effluent Disposal Facility.

2.2.1.3 234-5Z Plutonium Fabrication Facility Description

The building is approximately 54.9 m (180 feet) wide by 152 m (500 feet) long and extends from 2.9 m (9.5 feet) below-grade to 14.3 m (46.8) feet above-grade. Floor levels are designated as the basement, first floor, duct level, second floor, and roof level. The frame is of structural steel with an outer sheathing of aluminum panels over rock wool insulation and 16-gauge sheet steel. The basement is poured concrete. The first floor is a concrete slab. The duct level is sheet metal roof decking. The second floor is a concrete slab. The roof is insulated metal decking. Interior walls are reinforced concrete with metal studs, metal lath, and plaster. The reinforced concrete walls stop at the second floor. The vault and process area doors are constructed of steel. The building has two box-type reinforced concrete stairwells that extend to the roof.

The basement primarily consists of pipe tunnels containing drain piping to building sumps.

The first floor housed primary plutonium processing operations occurring in gloveboxes and/or hoods. The first floor also houses support areas such as instrument maintenance shops, building maintenance shops, locker rooms with change facilities and restrooms, and office spaces. The process operations included manual plutonium-bearing material stabilization and conversion initially in the 'rubber glove' line and later remote operations in Remote Mechanical "A" (RMA) ('oxide line') and Remote Mechanical "C" (RMC) line ('metal line') gloveboxes. By May 1976, some of the gloveboxes used for plutonium processing operations and most of the plutonium processing equipment were removed from the RMA and RMC lines and placed in 61 containers in retrievable transuranic **(**TRU) waste burial grounds in the 200 West Area. 234-5Z housed plutonium process improvement laboratory functions in the PPSL (Rooms 179B through 191 and Room 202), standards laboratory (Rooms 221C, 221D, and 221E), and PFP Analytical Laboratory (AL) (Rooms 131 through 157A). 234-5Z housed the RECUPLEX facility that used tributyl phosphate (TBP) diluted with carbon tetrachloride (CCl_4). In 1978, the Radioactive Acid Digestion Test Unit was emplaced in Rooms 235D and 235E and 196, and portions of Rooms 192, 197, and 235 to upgrade waste disposal practices where combustible material were shredded, fed into a digester where the material was mixed with nitric and sulfuric acids, residual solids were separated, the solution dried, and packaged for disposal. At this writing, primary plutonium process equipment remaining at 234-5Z that would require removal under this action includes approximately 84 gloveboxes and 59 hoods.

Building processes also included stabilization of non-organic plutonium-bearing solutions using the magnesium hydroxide [$Mg(OH)_3$] and oxalic precipitation process in the RMC line area; packaging of plutonium metals and oxides in the Bagless Transfer System glovebox; plutonium nitrate feed load-in/load-out; interim storage operations.

The duct level contains most of the service piping, ventilation ducts, and some filter boxes.

The second floor contains the lunchroom, a plastics shop, conference room, materials storage room, chemical feed preparation and aqueous makeup rooms, locker rooms with change facilities and restrooms, and office spaces. The second floor also contains exhaust-air ductwork including filter boxes, filter rooms, and the fan room. The fan room houses the ventilation supply fans, the steam inlet and distribution system, air dryers, the distilled water still, air chilling units, process vacuum pumps, and the vent and balance control room.

The roof level contains air supply ducts and exhaust outlets. The primary exhaust duct is the 1.4-m (54-inch) diameter supply to the 236-Z Building.

The 267-Z fire riser valve house is a sheet steel and structural steel structure located immediately north of, and attached to the northeast corner of the 234-5Z Building. It was not part of the original 234-5Z construction. The building houses the control valves for the 234-5Z fire water supply. It is 2.5 m (8 feet, 2 inches) long, 1.9 m (6 feet, 2 inches) wide, and 3.9 m (12 feet, 9 inches) high.

2.2.1.4 234-5ZA Change Room Addition Description

The 234-5ZA Building was built in 1993 and is located at the east end of the 234-5Z Building. The 234-5ZA is constructed of concrete block and is approximately 32 m (105 feet) long, 21.9 m (72 feet) wide and 4.6 m (15 feet) high. The building operated as a change room and control station and contained equipment for the accountability control station.

2.2.1.5 236-Z Plutonium Reclamation Facility Description

The 236-Z Plutonium Reclamation Facility (PRF) was constructed in 1963 and is located at the southeastern corner of the 234-5Z Building. The 236-Z is connected to 234-5Z by the 242-Z Building. The building is essentially a four-story structure, 24 m (79 feet) by 21.6 m (71 feet) by about 14.5 m (47.5 feet) high, surmounted at the southwest corner by a two-story penthouse, which is 6.9 m (22.5 feet) high. The exterior walls and floors are poured reinforced concrete and concrete block with the exception of the roof. The interior walls consist of plaster on metal lath, poured concrete, and concrete block. The roof is constructed of an open-web steel joist frame, a steel deck with rigid insulation that consists of light-weight concrete fill, and gravel-covered built-up roofing. The roof is tar and gravel over a concrete slab on a metal deck. A portion of the south wall is also the 30 cm (1-foot) thick wall of the process cell and includes an opening in the concrete block wall with large steel double doors. A high-efficiency particulate air (HEPA) filter is installed in the south door.

The PRF was built to replace the RECUPLEX facility and was completed in December of 1963, with hot feed operations beginning in the PRF on May 6, 1964. The 236-Z Building received process liquids from 234-5 Z as well as scrap from plutonium facilities in the DOE Complex. The PRF houses plutonium recovery process equipment that was used to convert various plutonium-bearing materials and aqueous feeds to a purified plutonium nitrate product suitable for conversion to plutonium metal or plutonium oxide. PRF processes included plutonium material and scrap stabilization [miscellaneous treatment (MT)] (hydrolysis, clarification, and calcinations); plutonium purification (feed preparation, solvent extraction, stripping, and organic cleanup); and concentration and clarification of the aqueous product and waste streams. The PRF incorporated a dedicated solvent extraction system capable of returning a plutonium nitrate product suitable for feed back into the RMA and RMC Lines. Except for residue stabilization/cleanout type operations, the PRF did not operate after 1989. The principal 236-Z internal feature is a single process equipment cell ('PRF canyon'). The cell is a three-story room in the center of the 236-Z Building that is 9.8 m (32 feet) wide by 15.8 m (52 feet) long by 7.9 m (26 feet) high and has 61 cm (2-foot) thick concrete walls (except on the south side, which is an exterior wall). The 236-Z housed the majority of the plutonium recovery process equipment that was used to convert various plutonium-bearing acid-digested ('scrap') materials and aqueous feeds to a purified plutonium nitrate product using continuous organic treatment and recycling using dibutyl phosphate and TBP-CCl_4 solvent extractants for return to the RMA and RMC lines. The equipment in the process cell includes many long, narrow, upright metal tanks or columns that vary in length from 76 cm (2.5 feet) to about 15.2 m (50 feet) and are 10.2 cm to 15.2 cm (4 inches to 6 inches) in diameter. Because of their height, the extraction column and stripping column extend into the column penthouse. At this writing, primary process equipment remaining at 236-Z that would require removal under this action includes approximately 16 gloveboxes, 81 process cell tanks, and 8 pieces of contaminated equipment.

An equipment transfer area is located against the large double door at the south end of the building consisting of a 10.7 m (35 feet) by 4 m (13 feet) airlock (Room 72) and two anterooms (Rooms 70 and 71).

The east side of the building was primarily the service side. The ground floor housed the maintenance shop areas. The second floor housed the maintenance glovebox and ventilation exhaust filter. The third floor housed building service equipment and electrical switch gear. The fourth floor housed the chemical preparation (Room 40), MT, operating control room, slag and crucible dissolver equipment, and a column room in which vertical sections of two liquid extraction columns penetrating the room from above and below are housed in a glovebox. The first through the fourth floors are serviced by a service elevator on the east side of the building.

2.2.1.6 241-Z Tank Farm Waste Disposal Building Description

The 241-Z Building, also known as the Waste Storage and Treatment Facility, is located approximately 101 m (330 feet) south of the 234-5Z Building. The 241-Z consists of a corrugated metal enclosure located above a below-grade concrete vault structure containing tanks (TK) D-4, D-5, D-6, D-7, and D-8. The vault structure was constructed as a portion of the PFP Facility between 1948 and 1951 and entered operations in 1949. The metal enclosure was built in 1979.

The 241-Z Building sits atop the concrete vault roof and is approximately 6 m (20 feet) wide, 28 m (92 feet) long, and has corrugated metal roof, exterior walls, and interior walls. The building is a weather cover for ventilation and electrical systems. The building houses a 680 kg (1,500-pound) capacity monorail crane, steam jet piping, chemical addition TK D-10 (out-of-service) and TK D-11, and instrument racks.

The below-grade vault structure is constructed of reinforced concrete, and the approximate dimensions are 6 m (20 feet) wide, 28 m (92 feet) long, and 7 m (22 feet) deep, with cell walls of the sumps being 30 cm (1-foot) thick. Each cell is 5.2 m (17 feet) wide, 5.2 m (17 feet) long, and 6.7 m (22 feet) deep. The vault roof (that also serves as the building floor) is at approximately grade level and consists of a poured 15 cm (6-inch) thick concrete slab with reinforced concrete cover blocks over each cell allowing access to the waste tanks. The vault structure consists of five separate cells each with its own sump and each containing a tank. There are approximately 25 drains from the multiple-branched pipe system that are routed to the pipe drain header to which the 241-Z Building transfer pipe is connected.

The 241-Z vault houses the RCRA permitted tank system for treatment and storage of PFP liquid mixed from plutonium processing operations in 234-5Z and 236-Z waste before transfer to the Double-Shell Tank System via Tank Farm 244-TX. TK D-4, D-5, D-7, and D-8 were part of the RCRA unit and were used to accumulate and treat the radioactive liquid waste generated in the PFP before transfer to the tank farms. Before plutonium stabilization processing ended in 2004, TK-D-8 received PFP aqueous waste from the PPSL, PFP AL, and periodic flushes from the vacuum seal water. Waste transferred to TK D-8 included filtrate solutions from plutonium solution treatment operations with the $Mg(OH)_3$ and oxalate precipitation process. TK D-4 and D-5 each have a capacity of 16,400 liters (4,332) gallons and D-7 and D-8 have a capacity of 17,900 liters (4,729 gallons). The stored waste was treated by the addition of chemicals, such as ferric nitrate [$Fe(NO_3)_3$] from TK D-11 and sodium hydroxide (NaOH) or potassium hydroxide before transfer to the 244-TX receiving facility as required to meet waste acceptance criteria. Sodium nitrite and $Fe(NO_3)_3$ were added to inhibit corrosion and stabilize the waste. TK D-6 is approximately the same size as TKs D-4 and D-5. It served the same function as the RCRA waste storage tanks but leaked and was removed from service before RCRA operations. Therefore, TK D-6 was not a portion of the RCRA unit. Soil contamination potentially exists under the TK D-6 vault cell. At this writing, the above mentioned tanks and any equipment (e.g., waste storage tank agitators, waste transfer pumps, sample pumps) not addressed or removed during RCRA closure activities will be addressed under this action.

The 296-Z-3 stack is on a concrete pad located just outside of the southwest corner of the building. The associated fans, filters, and controls are located in the 241-Z Building. The stack is 7.6 m (25 feet) high, 36 cm (14 inches) in diameter, and is constructed of stainless steel.

A list of tanks associated with the 241-Z Building is shown in Table 2-1.

2.2.1.7 241-ZA Sample Building Description

The 241-ZA Sample Building was constructed in 1972 and is located directly east of the 241-Z. The building is approximately 5.5 m (18 feet) long, 5 m (16.5 feet) wide, and 3.4 m (11 feet) high, and has corrugated metal roof and walls and a concrete floor.

The 241-ZA Building was used to collect and package samples taken from the 241-Z tanks and houses an annunciator panel, data chart recorder, and a sample processing glovebox (GB-2-241-ZA).

2.2.1.8 241-ZB Sodium Hydroxide Tank Description

The 241-ZB structure was constructed in 1972 and is located to the east of the 241-Z Building. The structure originally was built as a uranium load-out facility. Feed was from 236-Z via buried piping. The uranium nitrate line remains. This structure is a concrete pad that is approximately 6.1 m (20 feet) by 6.1 m (20 feet) and has a spill barrier. The pad houses the 15,400 liter (4,068-gallon) D-9 tank that contained NaOH used in buffering waste in the 241-Z below-grade tanks. There is steel grating above the tank. There are two sumps located within the spill barrier. One sump is located in a concrete pad adjacent to the D-9 Tank.

The 241-ZB (TK D-9) was added to the 241-Z Facility to collect PRF 'uranium containing' effluent after the PRF uranium partitioning process was added in the early 1970s. The intent was to return the collected liquid to the Uranium Trioxide Plant for conversion to oxide for recycle of the uranium. However, the partitioned uranium solution was found to be too high in plutonium concentration for the Uranium Trioxide Plant to accept the solution. The PRF-partitioned uranium solution was ultimately disposed to the Tank Farms. Subsequent to the PRF uranium partitioning process, TK D-9 was switched to NaOH storage for use in the 241-Z waste solution buffering process. The process line that connected the PRF and TK D-9 remains in place and is believed to be contaminated with uranium and plutonium.

2.2.1.9 241-ZG Change Facility Description

The 241-ZG Facility was built in 1981 and is located at the southeast corner of the 241-Z Building. The building is approximately 4.9 m (16 feet) long by 3.7 m (12 feet) wide and 3.4 m (11 feet) high. The exterior walls and roof are constructed of corrugated metal and the floor is concrete. Interior walls are gypsum board.

241-ZG houses the change room for personnel who are to enter the 241-Z Building and the 241-ZA Sampling Building.

2.2.1.10 241-Z-RB Retention Basin Description

The 241-Z-RB retention basin, also called the 207-Z Facility, was built in 1949 and is located to the east of the 241-Z Building. This structure is comprised of two side-by-side concrete waste water retention basins that are each approximately 12. 2 m (40 feet) long, 7.3 m (24 feet) wide, and 3.7 m (12 feet) deep.

The structure was used to hold liquid waste from the 241-Z complex. Liquid waste having low levels of radioactivity was discharged to the Z-19 trench or the U-10 pond, whereas waste with higher levels of radioactivity was discharged into the PFP crib system. The basins contain no major equipment. Covered valve pits exist at the west end of the basins that contain some small components. This basin has been isolated from PFP discharges.

2.2.1.11 242-Z Waste Treatment Facility Description

The 242-Z Building was constructed in 1963 and is connected to the southeast corner of the 234-5Z Building. The 242-Z also is connected to the 236-Z Building. The building is approximately 12.2 m (40 feet) wide, 7.9 m (26 feet) long, and 7.0 m (23 feet) high. The south wall of the 242-Z Building is of reinforced concrete. The remainder of the building has a structural steel frame covered with metal lath and plaster internally, and insulating material wall panels externally. The slightly peaked roof is constructed of metal decking, covered by insulation and built-up asphalt and gravel.

A corridor along the east side interconnects the 234-5Z, 242-Z, and 236-Z Buildings. An entrance enclosure existed along the west side that provided outside entry into both 242-Z and the 234-5Z Buildings has been sealed shut with welded steel plates. The south portion, approximately 12.2 m (40 feet) wide by 3 m (10 feet) long, is the tank room (tank cell) that extends the full inside building height and houses large, empty process vessels, cation and solvent exchange column, with pipe connecting to the process gloveboxes in the control room. The north portion, designated the control room, has a mezzanine over its west half for chemical addition tanks. The 242-Z Building shares its ventilation system with the main ventilation system in the 234-5Z Building.

The 242-Z Building was used to treat 234-5Z and PRF waste and extract americium from the liquid using special ion exchange resins. 242-Z originally provided chemical additions to 241-Z and the chemical addition lines remain. An americium recovery system was placed in a glovebox in 242-Z in 1964 and became operational in May of 1965. The system received acidic aqueous waste from the 242-Z solvent extraction column, neutralized the solution with NaOH, and co-extracted plutonium and americium-241 in an ion exchange system using 30 percent dibutylbutyl phosphate (DBBP) and 70 percent CCl_4. The solution was diluted with water, concentrated in a cation exchange americium concentration column, washed with ammonium nitrate, and loaded into product cans as americium nitrate. The process was made continuous in 1970 with addition of a second cation exchange column. In 1976, an accident caused high levels of contamination [plutonium, resin, and nitric acid (HNO_3)] to be deposited in the rooms of the process area, necessitating the isolation of the building, installation of a HEPA filter to the building exhaust system, and application of a strippable organic coating to contaminated surfaces.

2.2.1.12 243-Z Low-Level Waste Treatment Facility Description

The 243-Z Building, known as the Low-Level Waste Treatment Facility, was constructed in 1994 and is located east of the 291-Z Building. The building is approximately 21.3 m (70 feet) long, 10.7 m (35 feet) wide, and 4.6 m (15 feet) high and is constructed of corrugated steel and sits on a concrete slab.

This building consists of five rooms with a vestibule (Room 401) providing direct access to the change room (Room 402) and to the process area for waste water filtration (Room 405). The process area contains two media trains consisting of tanks, pumps, filters, and the associated piping and instrumentation necessary for operation and monitoring the equipment and incoming waste streams and treatment of the PFP effluents to remove low-level radioactive and chemical contamination before transfer to maintenance cover Z7. Room 403 is a drum washing room and Room 404 is a drum turning room.

Immediately to the north side of the building is the 296-Z-15 stack. The 296-Z-15 stack is 12.8 m (42 feet) high and 31 cm (12 inches) in diameter and is constructed of stainless steel.

2.2.1.13 243-ZA Low-Level Waste Storage Facility Description

The 243-ZA structure was constructed in 1994 and is located east of the 243-Z Building. The structure is a sump that is divided into an upper and lower sump. The lower sump is a concrete pit that is 5.2 m (17 feet) by 5.2 m (17 feet) and approximately 5.5 m (18 feet) deep. The upper sump is a tank basin at grade level that is surrounded by a 91 cm (3-foot) retaining wall.

The lower sump contains the 3,785 liter (1,000 gallon) influent sump tank and two 5-horsepower turbine pumps. The influent sump tank is 2.1 m (7 feet) tall with no overflow. The upper sump contains the 18,927 liter (5,000 gallon) influent surge tank that is 5.5 m (18 feet) tall with overflow.

2.2.1.14 243-ZB Cooling Towers and Concrete Pad Description

The 243-ZB was constructed in 1993 and is located north of 234-ZA. This structure is a concrete slab that is approximately 7.3 m (24 feet) by 4.6 m (15 feet).

The 243-ZB houses the closed-loop cooling water system and two fluid cooling units for 243-Z Building operations.

2.2.1.15 2503-Z Electrical Switchyard Description

The switchyard, located north of the 234-5Z Building is constructed of electric disconnect switches, electric cable, and insulators mounted on wooden poles. The entire unit is surrounded with a chain link fence approximately 2.4 m (8 feet) tall. The complete switch yard is approximately 12.2 m (40 feet) long, 6.1 m (20 feet) wide, and 7.6 m (25 feet) high. There are no interior or exterior walls.

2.2.1.16 252-Z-1 Electrical Substation Description

This substation abuts the north wall of the 234-5Z Building and contains electrical transformers mounted on concrete slabs. The substation does not contain walls or a roof.

2.2.1.17 270-Z Operations and Support Facility Description

The 270-Z is a single story office building of standard stick and mortar construction. The exterior walls are covered with stucco, while the interior walls are drywall and paint. The floor is concrete covered by carpeting and/or tile. The building is 47 m (154 feet) long, 26.2 m (86 feet) wide and 7 m (23 feet) high and is located north of the 234-5Z Building. The roof is comprised of steel decking covered by felt roofing, tar, and gravel (built up roof).

2.2.1.18 2701-ZA Central Alarm Station Facility Description

This building is constructed with concrete block on a concrete slab and is located in the northeast corner of PFP. It is approximately 15.2 m (49 feet, 10 inches) long, 12.2 m (40 feet) wide, and 4.1 m (13 feet, 4 inches) high. The interior walls are concrete block covered with painted gypsum board.

2.2.1.19 2701-ZD Badge House Description

The badge house is constructed of concrete block on a concrete slab, with a built up roof and is located in the northeast corner of PFP. The interior walls are either studs and drywall, or bullet proof steel and glass construction. The building is 31 m (51 feet, 4 inches) long, 14.2 m (46 feet, 8 inches) wide, and 5.5 m (18 feet) high.

2.2.1.20 2702-Z Microwave Tower and Communications Support Building Description

The 2702-Z Support Building is a 3.7m (12 feet) by 3.7 m (12 feet) pre-engineered, self-framed metal building with a standing-seam metal deck roof and is located interior to the PFP security fence. The microwave tower is constructed entirely of steel mounted on a concrete slab.

2.2.1.21 2704-Z Safeguards and Security Building Description

The 2704-Z Building was part of the original PFP construction. It is a wooden structure with transite shingles on both the roof and exterior walls and is located in the northeast corner of PFP. The interior walls are of painted lathe and plaster construction. The floors are wood covered with tile and/or carpeting. The building is 32.6 m (107 feet) long, 11.1 m (36 feet, 5 inches) wide, and 7m (23 feet) tall.

2.2.1.22 2705-Z Operations Control Facility Description

The Operations Control Facility provides the first screening of personnel entering the PFP complex. It also includes the personnel monitors for logging in/out PFP personnel for accountability purposes required during emergencies. The building is constructed of steel with interior walls constructed of drywall on steel studs and is located outside of the PFP security fence. The walls are painted, with the concrete floor covered with tile and carpeting. The building is 17.1 m (56 feet) long, 7.7 m (25 feet, 4 inches) wide, and 4.9 m (16 feet) high.

2.2.1.23 2712-Z Stack Monitoring Station Description

The 2712-Z Building was constructed in 1956 and is located on an elevated platform on the north side of the 291-Z-1 stack, approximately 15.2 m (50 feet) above-grade. The roof, sides, and door of the building are constructed of steel.

The building operated as a 291-Z-001 stack sampler and monitoring room and contains stack sampling and monitoring equipment. Prior to use at PFP, this structure was used in the 300 Area and contaminated with beta/gamma emitters.

2.2.1.24 2721-Z Emergency Generator Building Description

The 2721-Z Building was constructed in 1979 to house backup/emergency diesel electric generators. 2721-Z is located immediately southwest of the 234-5Z Building and approximately 7.9 m (26 feet) west of the 2736-ZB Building. 2721-Z is 14 m (46 feet) long by 5.8 m (19 feet) wide and is constructed of poured reinforced concrete walls and floor. The 2721-Z houses three diesel-driven generators used as backup power for the PFP facilities. A switchgear room is situated on the north end of the building.

2.2.1.25 2727-Z Supply Storage Building Description

The 2727-Z Building is a steel structure erected on a concrete slab located immediately east of the 236-Z Building. It is used for equipment and material storage for the PFP laboratory and operations personnel. It is 8.5m (28 feet) long, 4.9 m (16 feet) wide, and 4 m (13 feet) high.

2.2.1.26 2729-Z Maintenance Storage Building Description

The 2729-Z Building located southeast of the 236-Z Building, is a corrugated steel structure used for storage of maintenance materials and equipment. It is erected on a concrete slab. The building is 24.4 m (80 feet) long, 6.1 m (20 feet) wide and 4.1 m (13 feet, 4 inches) high.

2.2.1.27 2731-Z Plutonium Drum Storage Building Description

The plutonium drum storage building is located south of the 234-5Z Building and is a steel structure erected on a concrete slab. It is 14.6 m (48 feet) long, 4.9 m (16 feet) wide, and 3.3 m (10 feet, 8 inches) high.

2.2.1.28 2731-ZA Container Storage Building Description

The 2731-ZA Building, also known as the Clean Laundry Building, is a steel structure erected on a concrete slab and is located south of the 2736-ZB Building. It is 28.2 m (92 feet, 8 inches) long, 4.9 m (16 feet) wide, and 3.7 m (12 feet) high.

2.2.1.29 2734-ZA, -ZC, -ZK, and –ZL Gas Bottle Storage Description

These four facilities are/were used to store and "manifold" various gases for production and laboratory operations/support in the 234-5Z Building. Gas bottles may still be found in some of these structures, though some are out of service. They are constructed of concrete block or steel walls and roofing and steel supports. The structures vary in size but are approximately 3.7 m (12 feet) long, 3.7 m (12 feet) wide and 2.4 m (8 feet) high and are located adjacent to the 234-5Z Building.

2.2.1.30 2734-ZB, -ZD, -ZF, -ZG, and –ZH Gas Bottle Storage Description

These structures provide the same functions as those described above, but are constructed entirely of metal. They are very similar dimensionally to the concrete and steel structures described above and also are located adjacent to the 234-5Z Building.

2.2.1.31 2734-ZJ Liquid Nitrogen Storage and Supply Description

The 2734-ZJ Building is located to the west of the 234-5Z Building. The liquid nitrogen tank (vendor-owned) and nitrogen supply is comprised of a large liquid nitrogen tank (vertical orientation) mounted adjacent to an aluminum nitrogen gas generator. The gas generator transforms the liquid nitrogen to a gaseous state for use in the 234-5Z Building.

2.2.1.32 2735-Z Bulk Chemical Storage Tanks Description

The 2735-Z Building impoundment was built in 1954 and is located at the east end of the 234-5Z. The 2735-Z is a concrete pad 13.7 m (45 feet) by 9.8 m (32 feet) with a retaining wall that houses bulk chemical storage tanks.

Aluminum nitrate nonahydrate and HNO_3 were stored in separate 26,298 liter (7,000 gallon) bulk storage tanks. CCl_4 was stored in a 9,464 liter (2,500 gallon) tank. A chemical drain catch tank is approximately 1,325 liters (350 gallons) and is contaminated with plutonium.

2.2.1.33 2736-Z Plutonium Storage Building Description

The 2736-Z Building operated as the primary PFP plutonium storage building and is located on the south side of the 234-5Z Building. The 2736-Z also abuts the 2736-ZB Building. The 2736-Z was constructed in 1971 and is a one story building that is 19.8 m (65 feet) long by 17.1 m (56 feet) wide with reinforced concrete walls supported by cast-in-place concrete columns. The roof is a cast-in-place reinforced concrete slab.

The building consists of four vaults used for the storage of plutonium materials, divided by a corridor running the width of the building. The storage vaults held forms of plutonium product and scrap handled by PFP. This material included oxides; metal; sand, slag, and crucible ash; alloys; and other scrap forms. Each storage vault is approximately 8.5 m (28 feet) by 8.5 m (28 feet) in size. Vaults 1, 3, and 4 each contain concrete storage cubicles.

Vault 2 contains steel shelves and open storage space for plutonium material. Ventilation supply and exhaust ducts are mounted near the ceiling on the east and west walls respectively.

2.2.1.34 2736-ZA Plutonium Storage Ventilation Structure Description

The 2736-ZA Building, constructed in 1971, houses the ventilation equipment for the 2736-Z Building and is located approximately 1.5 m (5 feet) to the west of the 2736-Z Building. The 2736-ZA is a one story building approximately 12.2 m (40 feet) long by 6.7 m (22 feet) wide. The building floor, interior and exterior walls, and roof are constructed of poured reinforced concrete. The roof has a built-up tar and felt surface.

The 2736-ZA Building consists of two rooms. Room 649 is approximately 3.4 m (11 feet) by 3.4 m (11 feet) and formerly housed a diesel generator. Room 650 is approximately 7.9 m (26 feet) long by 6.7 m (22 feet) wide and houses the exhaust fans and HEPA filters, stack continuous air monitors and sampler, and equipment and instrumentation related to operation of the 2736-Z Building. The ventilation system exhausts through HEPA filters and exits the 296-Z-6 stack.

The 296-Z-6 stack is located in the northwest corner of the 2736-Z Building and is 4.3 m (14 feet, 8 inches) high in a 91 cm (36-inch) by 56 cm (22-inch) rectangular configuration. The stack is constructed of carbon steel and projects 76 cm (30 inches) above the roof.

2.2.1.35 2736-ZB Plutonium Storage Support Facility Description

The 2736-ZB Building was constructed in 1982 to support 2736-Z Building storage vault operations. The 2736-ZB Building is connected to the south side of the 2736-Z Building and is a one story building that is approximately 40.2 m (132 feet) by 27.4 m (90 feet) wide. The walls (except for administrative areas) and the roof are constructed of reinforced concrete.

2736-ZB activities included plutonium material shipping, receiving, sorting, and repackaging. The primary operational and support areas within the 2736-ZB Building were the stabilization and packaging equipment room (Room 642), outer can weld room (Room 641), interim storage room (Room 638), NDA laboratory (Room 637), control room (Room 642B), HEPA filter room (Room 641B), and decontamination room (Room 630). Other areas within the building include the International Atomic Energy Agency room (Room 639), and the mechanical room (Room 602) that houses the control unit, communication lines, air compressors, and heating, ventilation and air conditioning supply fans and pumps. Three container shipping and receiving/storage areas (Rooms 638, 641, and 642) physically are separated by walls. A storage area (Room 638A, also referred as the 638 'cage') has a steel security cage surrounding the metal storage shelves. Room 636 was used for plutonium material repackaging in the 2736-ZB repackaging glovebox that might be used during PFP deactivation for packaging residues in pipe overpack containers. A decontamination room (Room 630) is equipped with a shower and sink. Room 637 housed the NDA laboratory and computer equipment and offices.

The 2736-ZB Building contains a ventilation system that exhausts stabilization and packaging operations through the 296-Z-7 stack and the remainder of the building areas exhaust through the 296-Z-5 stack. The 296-Z-7 stack is located on a concrete pad just outside of the east wall of the building and is approximately 15.2 m (50 feet) tall, 41 cm (16 inches) in diameter, and is constructed of stainless steel. The 296-Z-5 stack is located on the northwest corner of the 2736-ZB Building and is 8.4 m (27 feet, 7 inches) high and 86 cm (34 inches) in diameter and constructed of stainless steel.

A liquid nitrogen system is located immediately west of the 2736-ZB and provides nitrogen gas to the 2736-ZB Building for cooling. In addition to the liquid nitrogen tank and aluminum gas generator, it includes a pad for the nitrogen cooling system. The complete assembly (tanks, gas generator, and cooling system) is approximately 7.6 m (25 feet) long, 4.6 m (15 feet) wide, and 2.4 m (8 feet) tall. The liquid nitrogen tank is vertically oriented and is roughly 4.6 m (15 feet) high and 15 cm (6 feet) in diameter.

2.2.1.36 2736-ZC Cargo Restraint Transport Dock Description

The 2736-ZC was constructed in the late 1970's and is an enclosed loading/unloading dock and corridor to shipping and receiving areas of the 2736-ZB Building. The loading dock is located outside the southeast corner of the 2736-ZB Building and is connected to rooms 643 and 644 of the 2736-ZB Building. The dock is a concrete pad enclosed in a metal building approximately 14.8 m (48 feet, 6 inches) long by 9.8 m (32 feet) wide and 4.9 m (16 feet) high with electric roll-up doors. 2736-ZC provides approximately 158 m^2 (1,700 ft^2) of enclosed storage for cargo-restraint transporters used for offsite receiving and shipping. The enclosure contains a jib crane, chain hoist, and drum handler. The dock primarily processed containers of waste but also processed containers of plutonium oxide powder, plutonium metal, and miscellaneous scrap materials from various onsite and offsite sources. Containers of plutonium material were not opened in 2736-ZC but were moved into 2736-ZB before being opened.

2.2.1.37 2736-ZD Vault – EBR II Casks Description

The 2736-ZD storage facility, located south of 2736-ZC, is a reinforced aboveground concrete cylindrical vault 2.4 m (8 feet) tall and 2.7 m (9 feet) in diameter, with a 30 cm (1 foot) thick interlocking cover and base plate. The vault wall is about 25 cm (10 inches) thick.. The cover and base are gasketed and bolted into place by stainless steel bolts. This facility is used for storage of experimental breeder reactor II (EBR-II) casks. This facility has no support equipment nor does it receive any Hanford Site utilities.

2.2.1.38 2902-Z Elevated Water Storage Tower and Tank Description

The 2902-Z water tower is located north of the 234-5Z Building. Construction for the 2902-Z water tower began in 1948. The 189,000 liter (50,000 gallon) elevated water tank (drained and currently out of service) formerly served as backup water supply to the PFP facilities. An associated below-grade valve pit has been disconnected.

2.2.1.39 2904-ZA Radiation and Flow Monitoring Station Description

The 2904-ZA monitoring station is a 3.7 m (12 feet) by 3.7 m (12 feet) pre-engineered, corrugated-metal building that housed the online alpha monitor as well as a composite sampler and a flow meter. A single riser penetrates an effluent line for purposes of sampling the stream. The building and its equipment was deactivated in February 1994 and is located outside of the PFP security fence.

2.2.1.40 2904-ZB Monitoring Building Description

The 2904-ZB monitoring building is located outside of the PFP security fence. This sheet metal building provided a sample point at the entrance to the 216-Z-20 crib (not in EE/CA scope) and was deactivated in May 1995.

2.2.1.41 291-Z Exhaust Air Filter Stack Building Description

The 291-Z Exhaust Air Stack Building is located approximately 16.2 m (53 feet) south of the central part of the 234-5Z Building. The 291-Z was constructed in 1949 as part of the PFP Facility and is a reinforced-concrete structure of irregular shape. The building is approximately 22.6 m (74 feet) wide by 43.6 m (143 feet) long with an overall height of approximately 7.0 m (23 feet) and is only 1.2 m (4 feet) above-grade.

This building houses the exhaust fans and plenums that provide ventilation exhaust for the 234-5Z, 242-Z, 236-Z, and 291-Z Buildings and formerly for the 232-Z Building (not in EE/CA scope). Although the ductwork from 232-Z Building remains physically connected to the 291-Z ventilation system, it was isolated from the 291-Z system in 1990 and replaced by a dedicated stack for the 232-Z Building solely. 291-Z also houses an electrical switchgear room called the 252-Z-2 Electrical Substation that is located on the east side of the 291-Z Building (Room 500) and is 10.7 m (35 feet) long and 5.5 m (18 feet) wide. South of the switchgear room is a mechanical room (Room 501) containing two 40 kg (90-pound) air compressors, and two 43 cm (17-inch) mercury air sample vacuum pumps. There is a plutonium-contaminated sump [1.2 m (4 feet) wide, 4.1 m (13 feet, 6 inches) long, and 2.2 m (7 feet, 2 inches) deep] located in the northeast corner of the mechanical equipment room that has three electrical pumps, and one backup steam jet that discharge to a header going to the 234-Z Building. The contamination in the sumps originates from the process vacuum pumps (previously removed). Contaminated process vacuum piping remains.

The ventilation fans and the inlet and exhaust plenums are the primary contents of the 291-Z Building. The building has two fan rooms (Rooms 502 and 504) that are each 42.7 m (140 feet) long, 3.96 m (13 feet) wide, and 4.1 m (13 feet, 6 inch) deep. The fan rooms contain seven electric motor-driven fans (three in Room 502 and four in Room 504). Each fan room contains one turbine driven fan. The building has an inlet plenum (Room 505) that is 41.5 m (136 feet) long, 4.6 m (15 feet) wide, and varies in depth but is about 6.1 m (20 feet) deep. The fan rooms are on each side of the inlet plenum and each fan room has a discharge plenum below. The two exhaust plenums (Rooms 503 and 510) discharge to a common discharge plenum to the 291-Z-001 stack (Room 508). The building also has a compressor and pumps room (Room 501), two cross passageways (Rooms 504 and 506), and an air supply room (Room 507).

Although sub-grade, the ductwork from the 291-Z Building to the 291-Z-001 Stack is within the scope of this EE/CA.

2.2.1.42 291-Z-001 Stack Description

The 291-Z-001 stack, also constructed in 1949, is adjacent to the 291-Z Building and provides the outlet for exhaust gases of the 234-5Z, 236-Z, 242-Z, and 291-Z Buildings. Until 1990, this stack also vented the exhaust from the 232-Z Building. This stack is 61 m (200 feet) tall and is constructed of reinforced concrete; its center is 19.2 m (63 feet) from the near end of 291-Z and 70.1 m (230 feet) from the south wall of the 234-5Z Building. The stack is separated structurally from the 291-Z Building by an expansion joint. The stack has an interior diameter varying from 4.1 m (13 feet, 6 inches) at the top to 5 m (16 feet, 6 inches) at the base. The thickness of its walls also varies, though not uniformly, from 15 cm (6 inches) at the top to 23 cm (9 inches) at the base. The stack foundation is a massive concrete footing block that is approximately octagonal in shape and has a dimension of 9.8 m (32 feet) across its flat sides. The foundation block is 8.3 m (27 feet, 2 inches) thick, and its top is about 1m (3 feet, 5 inches) above the finished grade. A 4.9 m (16-foot) diameter, 90° elbow opening in the footing connects the bottom of the stack to the 291-Z Building exhaust plenum.

2.2.1.43 PFP Complex Yards and Grounds Description

The following items are identified as "PFP Complex Yards and Grounds". The items identified are examples, but are not considered as inclusive of items that will be found and dispositioned from the PFP yards and grounds.

Mobile offices (MO-XXX) are trailer structures constructed of metal and wood framing. These structures vary in size from single-wide to multiple-wide. Mobile offices may contain office furniture, kitchen and bathroom facilities, and storage areas. Potential hazardous materials associated with mobile offices include lead-based paints, fluorescent light tubes, incandescent light bulbs, polychlorinated biphenyls (PCBs) containing light ballasts, asbestos insulation and mastic, mercury switches, emergency light batteries, oils from door actuators and electrical transformers, and radioactive sources in smoke detectors and exit signs. Mobile offices may be removed from PFP yards and grounds and reused.

Hazardous waste storage units and hazardous substance storage cabinets range from small fireproof cabinets to large multi compartment skids (HS-XX) that have historically been used for hazardous chemical storage and waste management. Larger units are equipped with automatic fire suppression and alarm signal capability. Potential hazardous materials associated with the cabinets are associated with the chemicals or waste stored/accumulated in them.

Interim storage vaults are aboveground, concrete and steel shielded, top-loading fuel storage vaults to be used to provide safe interim dry storage at PFP of Core Component Containers with Fast Flux Test Facility unirradiated fuel assemblies.

Other miscellaneous items could included telephone poles, power poles, lighting poles, steel barrier posts, fencing, razor wire, electrical transformers (both pole and pad mounted), conex boxes, and ground level cement/concrete structures.

2.2.2 Projected Type and Quantity of Waste Requiring Disposal

Table 2-2 lists radiological and chemical contaminants identified as having been used in PFP plutonium processes or otherwise found or used at PFP. These constituents have a potential to exist in removal action plutonium process system waste or structure demolition waste. Such substances, if found in sufficient quantity in removal action waste, would require the management of this waste to meet substantive requirements of applicable or relevant and appropriate requirements (ARARs) as identified in Chapter 5.0 for management of radioactive and/or hazardous waste.

Table 2-3 identifies quantities of waste, by waste type, that could be generated by demolition of structures within the scope of this EE/CA under a 'slab on grade' alternative as identified in Chapter 4.0 (i.e., concrete floors and foundations are left in place).

2.3 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

PFP primary plutonium processing building, 234-5Z, and ancillary processing and support buildings include 236-Z, 241-Z, 242-Z, 243-Z, 291-Z, 2736-Z, 2736-ZA, and 2736-ZB. The 234-5Z, 236-Z, 241-Z, 242-Z, and 243-Z Buildings contain plutonium chemical process equipment or process waste handling equipment. These process structures and equipment are contaminated with radiological and chemical substances used or generated during plutonium processing and process waste management operations. The 216-Z-9 crib (waste site) and associated Z-9 facilities (216-Z-9A, 216-Z-9B, and 216-Z-9C) are also contaminated. The 216-Z-9 crib was contaminated during disposal of RECUPLEX process liquid waste and associated Z-9 facilities were contaminated during 'mining' of the crib to remove plutonium-contaminated soil. Remaining buildings within the scope of this EE/CA are non-process support structures. Potential radiological and chemical substances in these buildings have been identified from characterization data, historical operating data, process knowledge, and knowledge of hazardous substances in construction materials (e.g., asbestos, PCBs).

The primary hazardous substances of concern are radioactive materials. Key radionuclide contaminants are transuranics including various plutonium isotopes (Pu-238 through Pu-240) and their decay products (americium-241, uranium isotopes U-234 through U-238, and neptunium-237) and lesser amounts of mixed fission products (cobalt-60, strontium-90, and cesium-137). The majority of contaminants are found in the form of adherent films and residues in deactivated process vessels, piping, equipment, and ventilation system ductwork. These contaminants also might exist because of releases throughout the decades of PFP operations that could have affected the immediate release area (e.g., spills of liquid or 'heavy' materials) or also could have affected a wider area and rooms or areas connected to the downstream ventilation system (e.g., releases of plutonium oxide or fluoride powders). Thus, mobile forms of plutonium could be found in any process area of the primary plutonium processing areas or the ventilation system for such areas. In most instances, the powders will be fixed (painted over) but loose powder contamination could exist in areas not generally accessed (e.g., panels, electric junction boxes, lighting fixtures, false ceilings, ventilation ductwork). For the purpose of this EE/CA, approximately 100 kilograms (220 pounds) of pure and/or impure plutonium powders, alloys, or sludges could exist within the contaminated buildings (Section 2.1.1).

To the extent practicable, known quantities of containerized hazardous chemicals will have been removed from EE/CA structures in preparation for this removal action. Nonradiological substances identified in Table 2-2 as having a potential to be present in removal action waste originate from construction materials, plutonium product chemical impurities, process chemicals, Hanford and Rocky Flats ash processed at PFP, and decontamination solutions. Nonradiological constituents generally considered to provide the most significant personnel health risks through ingestion, contact, and/or inhalation are PCBs, asbestos, beryllium, heavy metals, acids/caustics, and hazardous process chemicals (e.g., carbon tetrachloride, TBP, DBBP). Residual quantities of hazardous chemicals could remain as hold up or heels in process piping, tanks, and vessels, or as residue on contaminated process equipment or structures. Although most tanks and vessels have been drained, there is little documentation indicating that many have been flushed and therefore residues are anticipated to exist. Because PFP processes were radioactive, chemical contamination likely will exist only in the presence of radionuclides.

2.4 RISK EVALUATION AND SITE CONDITIONS THAT JUSTIFY A REMOVAL ACTION

The primary risk associated with the PFP above-grade structures in the current configuration is due to the radiological inventory. Radionuclides are known carcinogens. Existing safety analyses performed for these structures, while not prepared specifically to support a risk analysis, provide an overview of the potential dose to site personnel and the public from a possible release. Scenarios from the most recent safety analysis were used to provide a qualitative analysis of the risk from the structures.

Studies indicate that there is a potential for a release to the environment due to structural failure brought on by earthquake, wind, storms, etc., as well as ongoing exposure to site personnel. The safety analysis for these structures documents various accident scenarios. The safety analysis did not evaluate potential ecological receptors in the vicinity of the PFP above-grade structures. However, any inventory released from a seismic event would contaminate surrounding soils. Although the ecological studies indicate there are no receptors in the immediate vicinity of the structures, a collapse could result in aerial dispersion of radionuclides reaching receptors beyond the PFP fence line. In addition, although a remote possibility, a release to soils potentially could provide a pathway for migration to groundwater. Any release to soils would require remediation to prevent future environmental exposure.

A potential for a release of hazardous substances resulting in an increase of radiation, inhalation, and ingestion risks associated with the structures contamination justify a CERCLA non-time-critical removal action.

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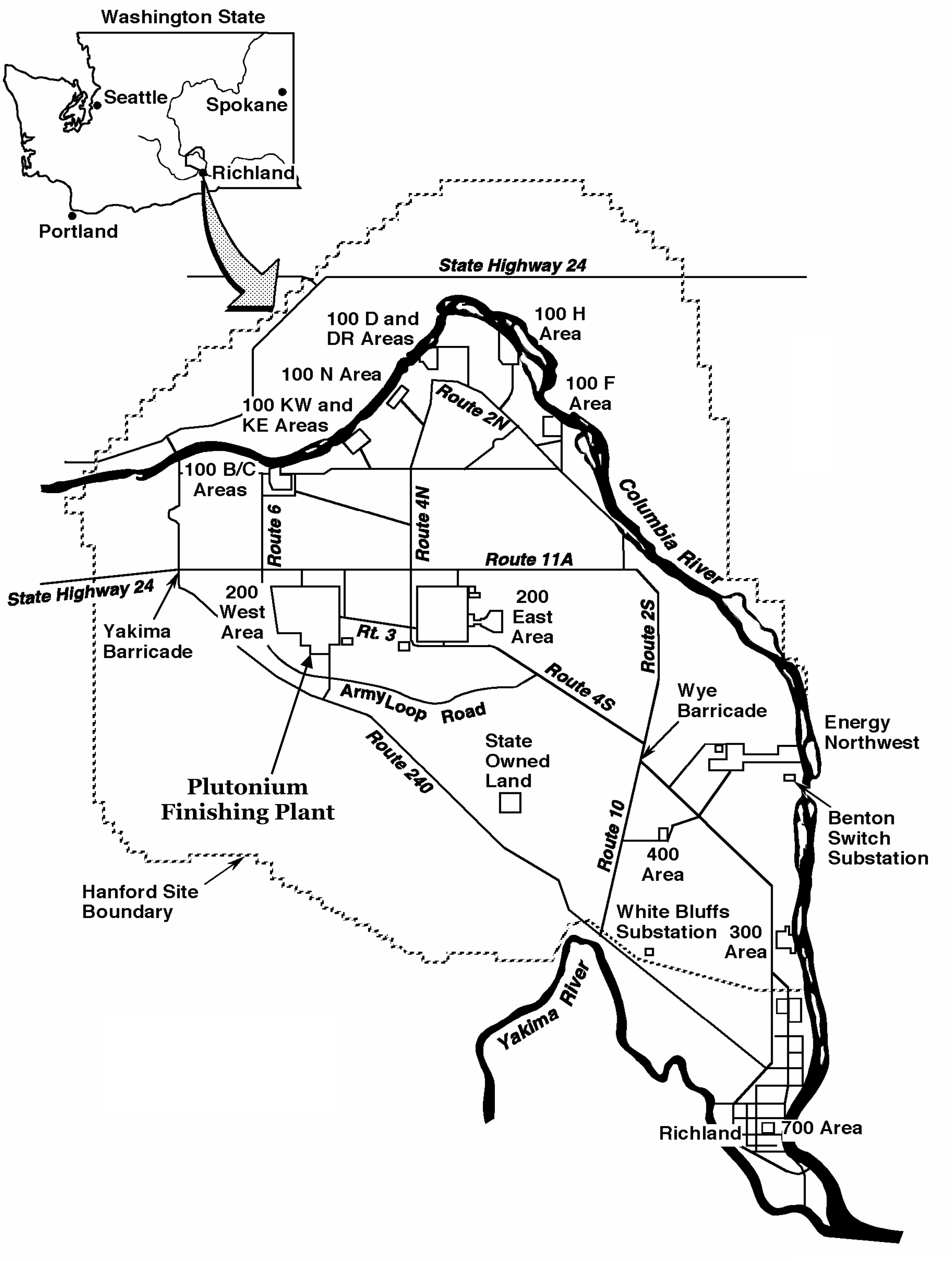

Figure 2-1. Hanford Site and Washington State.

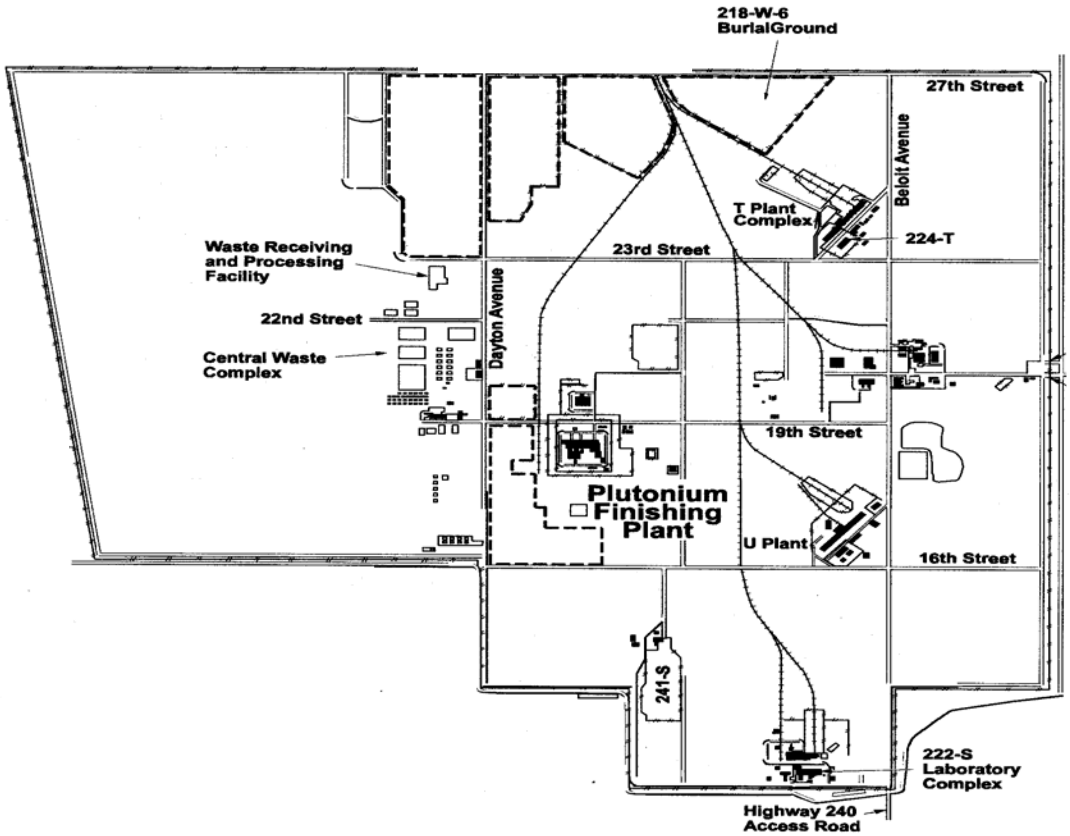

Figure 2-2. 200 West Area.

Table 2-1. 241-Z Tank System.

Component[1]	**Function**	**Size**	**Comments**
TK D-4	Lag storage tank	16,400 L	347 stainless steel, 3 m wide x 2.4 m high
TK D-5	Waste treatment and shipping tank	16,400 L	347 stainless steel, 3 m wide x 2.4 m high
TK D-6	Storage tank - out of service	N/A	347 stainless steel, 3 m wide x 2.4 m high
Overflow Tank (located in D-6 vault)	Overflow receiver tank – out of service	~1,500 L	Irregular shaped concrete tank in corner of D-6 Cell. Approx. 2.4 m high and 1.2 m wide on two sides and 60 cm wide on other two sides
TK D-7	Lag storage tank	17,900 L	347 stainless steel, 3 m wide x 2.4 m high
Overflow Tank (located in D-7 vault)	Overflow receiver tank	700 L	304L Stainless Steel, 0.8 m wide x 1.8 m high
TK D-8	Waste receiver tank	17,900 L	347 stainless steel, 3 m wide x 2.4 m high
TK D-9 (234-ZB)	Sodium hydroxide supply tank – out of service	15,400 L	Previously used for uranium nitrate loadout.
TK D-10	Sodium nitrite makeup tank – out of service	190 L	304 stainless steel
TK D-11	Ferric nitrate makeup tank	190 L	304 stainless steel

[1] Some of the components may be removed or cleaned prior to removal action.

Table 2-2. Potential Radiological and Hazardous Substances in Removal Action Waste[1] (2 sheets)

1-Naphthyamine sulfuric acid
1-naphtylamine-7 sulfamic acid
Aluminum nitrate nona-hydrate [2](ANN)
Aluminum (oxide)
Americium (nitrate, fluoride)
Argon
Asbestos [3][piping and duct insulation, floor/ceiling tiles, transite wallboard, cove mastic, door actuators, electrical wiring, gaskets)
Barium (oxide)
Benzene
Beryllium (oxide)
Boron (oxide)
Bromobenzene
Butanol
Cadmium [batteries, paint]
Calcium (metal, fluoride, iodide, nitrate, oxide)
Carbon (activated bone char)
Carbon tetrachloride
Cerium (nitrate, oxide)
Chlorine
Chromium (oxide)
Citric acid
Cobalt
Copper (metal, oxide)
Dibutyl phosphate (DBP)
Dibutyl butyl phosphonate (DBBP)
Dysprosium
Ethanol
Ethylene glycol
Europium
Ferrous ammonium sulfate
Fluorine
Freon
Gadolinium
Gallium (oxide)
Hydrazine
Hydrochloric acid
Hydrofluoric acid
Hydrogen fluoride
Hydrogen fluoride gas
Hydrogen peroxide
Hydroxylamine nitrate
Hydroxylamine sulfate
Iodine (crystals)
Iron (oxide, nitrate)
Isopropanol
Lanthanum nitrate
Lead [paint, batteries, floor drains, shielding bricks, sprinkler heads/fusible links]

Table 2-2. Potential Radiological and Hazardous Substances in Removal Action Waste[1] (2 sheets)

Lithium (oxide)
Magnesium (hydroxide, oxide)
Manganese (oxide)
Mercury [thermometers, instruments, switches, paint]
Methyl Isobutyl ketone [paint]
Molybdenum (oxide)
Monobromobenzene
Monobutyl Phosphate
Neodymium (nitrate, oxide)
Neptunium
Nickel [batteries] (carbonyl, oxide)
Nitric acid
Nitrogen
Oxalic acid
Polychlorinated Biphenyls (PCBs) [paint, capacitors, electrical wiring, fluorescent light ballasts, hydraulic fluids transformers]
Perchloroethylene
Phosphoric acid
Phosphoric (oxide)
Potassium (hydroxide, oxide, permanganate, sulfate)
Propane
Propylene glycol
Plutonium (metal, dioxide, fluoride, nitrate, oxalate, oxide, silicate)
Samarium
Silicon (oxide)
Silver (persulfate)
Sodium (bicarbonate, carbonate, hydroxide, nitrate, nitrite, sulfate)
Sulfamic acid
Sulfur
Sulfuric acid
Tantalum (oxide)
Thorium (oxide)
Tin (monoxide)
Titanium (oxide)
Toluene [from paint]
Tributyl phosphate (TBP)
Triethylalamine
Tritium
Tungsten (oxide)
Uranyl nitrate
Uranium (oxide)
Vanadium
Xylene (from paint)
Zinc (oxide)
Zirconium (oxide)

[1] List derived from *Review of Constituents That May Impact Air Permitting During Legacy Holdup Removal and Facility Cleanout of the Plutonium Finishing Plant* (Hoyt and Teal, 2003) and *The Plutonium Finishing Plant Residual Chemical Hazards Assessment Data* (HNF-13940).
[2] ( ) = Known chemical formulation(s), or, acronym
[3] [ ] = Potential constituent source.

Table 2-3. Projected Quantity of Waste from Structure Demolition[1,2]

Building number	Low-level waste[3] (LLW)	Low-level mixed waste[4](LLMW)	TRU waste[5]	Transuranic mixed (TRUM) waste[6]	Demolition waste[7]
216-Z-9 [13]	0	0	6	>1	149
225-WC[14]	To Be Determined (TBD)	0	0	0	118
234-5Z[8]	2,540	42	1,674	167	35,162
236-Z	471	10	1,352	135	4,465
241-Z[9]	227	2	81	8	74
242-Z	612	12	85	9	464
243-Z[10]	84	0	0	0	0
2503-Z	0	2,700	0	0	0
252-Z-1	TBD	0	0	0	6
270-Z	TBD	0	0	0	788
2701-ZA[16]	TBD	0	0	0	473
2702-Z	TBD	0	0	0	89
2704-Z	TBD	0	0	0	24
2705-Z	TBD	0	0	0	89
2721-Z	TBD	0	0	0	16
2727-Z	TBD	0	0	0	89
2729-Z	TBD	0	0	0	106
2731-Z[17]	345	0	0	0	0
2734-ZA[18]	TBD	0	0	0	63
2734-ZB[19]	TBD	0	0	0	99
2734-ZJ	TBD	0	0	0	3
2735-Z[14]	15	93	0	0	0
2736-Z[11]	0	0	53	5	1,769
2902-Z	42	4	0	0	0
2904-ZA[20]	TBD	0	0	0	173
291-Z[12]	12	0	23	2	432
PFP Yards & Grounds	TBD	0	0	0	3172

[1] Waste volumes derived from *Waste Volume Estimates to Support Preparation of the PFP Above-Grade Engineering Evaluation/Cost Analysis (EE/CA)* (Killoy 2004a).
[2] Volumes are in cubic meters.
[3] LLW volume includes LLW drums and LLW Boxes.
[4] LLMW includes LLMW drums only.
[5] TRU waste includes TRU drums and TRU standard waste boxes (SWBs).
[6] TRUM waste volume includes TRUM waste drums and TRUM waste SWBs.
[7] Demolition debris transported to the Environmental Restoration Disposal Facility (ERDF) in rolloff boxes [15 cubic meters (20 cubic yards) each].
[8] 234-5Z also includes 234-5ZA.
[9] 241-Z also includes 241-ZA, 241-ZB, 241-ZG and 241-Z-RB.
[10] 243-Z also includes 243-ZA and 243-ZB.
[11] 2736-Z also includes 2736-ZA, 2736-ZB, 2736-ZC, and 2736-ZD.
[12] 291-Z also includes 291-Z-001 stack and 2712-Z.
[13] 216-Z-9 also includes 216-Z-9A, 216-Z-9B, 216-Z-9C.
[14] These structures are potentially contaminated. Contamination and potential quantity of non-demolition waste is currently unknown.
[15] 234-ZB also includes 234-ZC.
[16] 2701-ZA also includes 2701-ZD.
[17] 2731-Z also includes 2731-ZA.
[18] 2734-ZA also includes 2734-ZC, -2734-ZK, and 2734- ZL.
[19] 2734-ZB also includes 2734-ZD, 2734-ZF, 2734-ZG, and 2734-ZH.
[20] 2904-ZA also includes 2904-ZB.

3.0 REMOVAL ACTION OBJECTIVES

The primary purpose of this EE/CA is to analyze the removal action alternatives to address the risks within the PFP Facility and to determine the most appropriate removal alternative(s). Removal actions will be performed in a manner protective of human health and the environment. The principal threats to be addressed are the residual radioactive hazardous substances and hazardous chemicals associated with PFP.

Based on the potential hazards identified in Chapter 2.0, Sections 2.3 and 2.4, the specific removal action objectives are as follows:

- Objective Number One - Reduce the inventory of hazardous substances contained within the PFP Facility
- Objective Number Two - Reduce or eliminate the potential for exposure to hazardous substances above levels that are a danger to personnel, public, and/or environment
- Objective Number Three - Reduce or eliminate the potential for a release of hazardous substances
- Objective Number Four - Safely manage (treat and/or dispose) waste streams generated by the removal action
- Objective Number Five - Reduce or eliminate the need for future S&M activities
- Objective Number Six - Facilitate and not preclude future remediation at the PFP Facility, including remediation of sub-grade portions of the PFP Facility and sub-grade waste sites.

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4.0 DISCUSSION OF ALTERNATIVES

The removal action alternative for the PFP above-grade structures must be protective of human health and the environment. The following six removal action alternatives were identified for consideration:

- Alternative One: No Action
- Alternative Two: Surveillance and Maintenance
- Alternative Three: Deactivation/Stabilization
- Alternative Four: Slab-on-Grade
- Alternative Five: Entombment
- Alternative Six: Collapse and Cover.

Table 4-1 identifies alternatives considered for each of the PFP above-grade structures within the scope of this EE/CA.

4.1 POSSIBLE DISPOSAL PATHS FOR THE ALTERNATIVES

With the exception of the No Action alternative, each of the alternatives would result in generation of waste. The majority of the contaminated debris likely would be designated as LLW; however, quantities of mixed waste, dangerous waste, and/or TRU waste could be generated. Waste management ARARs are discussed in Chapter 5.0, Section 5.1.2.

Waste generation by removal activities for Alternatives Two through Six would require disposal at an appropriate disposal facility. Waste management would be a common element among these alternatives.

Most of the contaminated waste generated during implementation of these alternatives could be disposed at either ERDF or the Low-Level Waste Burial Grounds (LLBG), both are located in the 200 Areas. ERDF is an engineered facility that provides a high degree of protection to human health and the environment. The ERDF and the LLBG disposal options technically are similar in that these both involve land disposal of waste. However, because ERDF is an engineered land disposal facility, ERDF will be chosen whenever a waste stream could go to either LLBG or ERDF.

Construction and operation of ERDF was authorized using a CERCLA record of decision (ROD), *Environmental Restoration Disposal Facility Record of Decision* (EPA et al, as amended), and explanation of significant differences (ESD), *U.S. Department of Energy Hanford Environmental Restoration Disposal Facility, Hanford Site, Benton County, Washington, Explanation of Significant Differences(ESD)* (EPA et al. 1996). ERDF is an engineered structure designed to meet RCRA minimum technological requirements for landfills, including standards for a double liner, a leachate collection system, leak detection, and final cover. The ESD (EPA et al. 1996) modified the ERDF ROD (EPA et al., as amended) to clarify the eligibility of waste generated during cleanup on the Hanford Site. Per the ESD, ERDF is eligible for disposal of any LLW, mixed waste, and hazardous/dangerous waste generated as a result of CERCLA or RCRA cleanup actions (e.g., D&D waste, RCRA past-practice waste, and investigation-derived waste), provided that the waste meets ERDF waste acceptance criteria and that appropriate CERCLA decision documents are in place.

The waste generated during the selected CERCLA removal action for the PFP aboveground structures would fall within the definition of waste eligible for disposal at ERDF as established in the ERDF ROD and subsequent ESD and ROD amendments. Waste might require treatment to meet ERDF waste acceptance criteria. The type of treatment and the location of treatment would be determined on a case-by-case basis. Solidification, encapsulation, neutralization, and size reduction/compaction might be employed to treat various waste types. For waste requiring treatment, the techniques would be documented in a waste treatment plan for ERDF.

Several mixed waste streams already have been reviewed and approved for treatment and disposal at ERDF. These mixed waste streams are as follows.

- Radioactively contaminated elemental mercury could be amalgamated.
- Radioactively contaminated elemental lead could be macroencapsulated at ERDF.
- Aqueous solutions could be treated (solidified) in accordance with the approved waste treatment plan.

While most waste generated during the removal action likely would meet ERDF waste acceptance criteria, some waste might not meet or might not be able to be treated to meet ERDF acceptance criteria. Specifically, this would include low-level radioactive and nonradioactive liquid waste and TRU waste that might be encountered or generated during the removal action. Liquid waste containing levels of radioactive and/or nonradioactive hazardous substances meeting the 200 Areas Effluent Treatment Facility (ETF) waste acceptance criteria would be sent to the ETF and treated to meet ETF waste discharge standards. Liquids that do not meet ETF waste acceptance criteria would be either sent to another permitted TSD unit that accepts liquid waste or solidified and either disposed at ERDF (if ERDF waste acceptance criteria are met) or stored at the Central Waste Complex (CWC).

TRU waste would be placed in interim storage at CWC waiting shipment to the Waste Isolation Pilot Plant (WIPP), using the Waste Receiving and Processing Facility (WRAP) if necessary, in accordance with the schedule established for completing remedial actions on the Hanford Site.

These specific waste management facilities, ETF, CWC, WRAP, LLBG, or ERDF are considered to be onsite for the purposes of CERCLA for management and/or disposal of waste from removal actions proposed in this document[4]. There is no requirement to obtain a permit to manage or dispose of CERCLA waste at these facilities. However, ETF, CWC, LLBG, and WRAP already have been permitted for management of non-CERCLA waste, and any CERCLA waste handled at these facilities must be managed in accordance with the substantive requirements of the existing permits. It is expected that the great majority of the waste generated during the removal action proposed in this document can be disposed on the removal action work site.

For waste that must be sent offsite, such as TRU waste, EPA would make a determination in accordance with 40 CFR 300.440 as to the acceptability of the proposed disposal site for receiving this CERCLA removal action waste if necessary.

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[4] CERCLA Section 104(d)(4) states that, where two or more noncontiguous facilities are reasonably related on the basis of geography, or on the basis of the threat or potential threat to the public health or welfare or the environment, the President may, at his discretion, treat these facilities as one for the purpose of this section. The preamble to the "National Oil and Hazardous Substances Pollution Contingency Plan" (40 CFR 300) clarifies the stated EPA interpretation that when noncontiguous facilities are reasonably close to one another, and wastes at these sites are compatible for a selected treatment or disposal approach, CERCLA Section 104(d)(4) allows the lead agency to treat these related facilities as one site for response purposes and, therefore, allows the lead agency to manage waste transferred between such noncontiguous facilities without having to obtain a permit. Therefore, ERDF, LLBG, ETF, WRAP, and CWC are considered to be onsite for the purposes of CERCLA under this removal action. It should be noted that the scope of work covered in this removal action is for those above-grade structures and waste contaminated with hazardous substances. Materials encountered during implementation of the selected removal action that are not contaminated with hazardous substances will be dispositioned by DOE.

4.2 ALTERNATIVE ONE: NO ACTION

Under the No Action alternative, access to PFP above-grade structures would not be restricted. Plutonium holdup disposition activities will be completed[5] prior to this removal action with approximately 20 to 50 kg of residual contamination remaining. No additional facility stabilization would be performed. The No Action alternative would not address the hazards posed by the above-grade structures. The structures would continue to deteriorate. Initial risks of the No Action alternative would be minimal to the environment. Barring an unusual event, contaminants are assumed to remain confined within the structures. Industrial and radiological hazards would exist under a No Action alternative assumption because controls to prevent access would not be maintained. Risks over time can be expected to increase as deterioration of the structures progresses and the structural integrity of the above-grade structures and their systems are compromised. Eventually, the PFP above-grade structures decay would be expected to result in radiological releases to the environment and potential exposure to personnel and the public. Physical hazards associated with partial structural collapse also would be anticipated.

4.2.1 Cost Estimates for Alternative One: No Action

The near-term costs for implementing this alternative would be negligible.

4.3 ALTERNATIVE TWO: SURVEILLANCE AND MAINTENANCE

Alternative Two would ensure that PFP above-grade structures are maintained in a safe condition until final disposition. Approximately 20 to 50 kg of residual contamination will remain after completion of plutonium holdup disposition activities prior to the removal action. For this alternative, the S&M of each above-grade structure is estimated to continue until 2030. This date was chosen to assume a basis for determining long-term S&M for the purpose of evaluating Alternatives Two and Three for this EE/CA. Current PFP decommissioning dates are much earlier. Under this alternative, the structures would remain in the S&M program until final PFP Facility decommissioning occurs. These S&M measures would include periodic radiological and industrial hazard monitoring (both inside and outside of a structure), cold weather protection, preventive maintenance, annual roof inspections, identification and minor repair of friable asbestos, and general visual inspections. Critical safety, fire prevention, and environmental systems would remain operating. Major maintenance operations, such as roof maintenance, would be performed to ensure the maintenance of safe conditions and the control of the ongoing deterioration process. Additionally, limited decontamination and fixative application would occur to control the spread of radiological contamination.

The prime goal of this alternative is to prevent radiological environmental releases and to avoid industrial accidents. Adoption of Alternative Two extends the life obligation of the PFP above-grade structures for approximately the next 30 years, during which time deterioration progresses and unusual events might occur. Severe weather conditions could create structure conditions amenable to radiological releases, and

[5] Plutonium holdup disposition is considered complete when "All material has been removed, treated (if required), characterized, and packaged to meet Hanford Site Solid Waste Acceptance Criteria [which incorporates the WIPP Waste Acceptance Criteria (WAC) requirements] or packaged to DOE-STD-3013 Standard requirements and stored in the vaults, or removed from the PFP protected area, or removed from the Material Control Accountability (MC&A) records. Any 3013 containers generated need to be removed from the protected area" by transferring to Savannah River or another DOE-approved interim storage facility. (Quoted text is taken from the *Project Hanford Management Contract, Number DE-AC06-96RL13200, Modification M166, Attachment 1, DOE-RL Performance Completion Criteria/Evaluation Document, Performance Objective 2c.*)

long-term aging of confinement structures could lead to eventual failure. These conditions, accompanied by minimum surveillance efforts, could result in an unplanned radiological release.

Because minimal surveillance readily would not detect structure decay (e.g., system corrosion or structural breakdown), preventive maintenance might not occur in time, and response actions could be required. This approach could result in the spread of contamination. An ongoing S&M program would have to become increasingly more labor intensive and expensive requiring periodic characterization efforts to counter these conditions. Such conditions ultimately would lead to increased personnel exposure to radioactive material and contamination. While the magnitude of an ongoing S&M program should be controlled to conserve funding and be responsive only to safety issues, the program financial growth should be planned to account for progressive structure deterioration. Data evaluation, inspection/observations, and future structure plans should be factored into the S&M planning and implementation.

4.3.1 Cost Estimates for Alternative Two: Surveillance and Maintenance

The Alternative Two cost estimates were prepared by in-house project managers and are shown in Table 4-2. Total nondiscounted costs or constant dollars are used for evaluation of alternatives in this EE/CA. Since funding will not be set aside initially, no present-worth analysis is warranted. These estimates include a projection of costs over the S&M period for roof replacement and maintenance. Waste generation under this alternative would occur, but is considered to be minimal on an annual basis. However, these costs are much greater in comparison to the other alternatives because the extended duration of generating routine waste (27 years vs. the 4-5 years in the other alternatives) more than offsets the costs generated by decommissioning activities.

The identified costs do not account for increased efforts required if the PFP above-grade structures deterioration is accelerated or if an unusual deleterious event occurred that required emergency response and cleanup. These costs also do not include structure disposition. S&M cleanup actions often incur costs at different times. For example, construction costs (e.g., roof replacement) could be followed by periodic costs in subsequent years or decades to maintain the effectiveness of the remedy.

The costs for S&M are less than Alternative Three, Deactivation/Stabilization, but greater than the costs for other alternatives.

4.4 ALTERNATIVE THREE: DEACTIVATION/STABILIZATION

Alternative Three would ensure that PFP above-grade structures are maintained in a safe condition until final disposition. Approximately 5 to 30 kg of residual contamination will remain after completion of plutonium holdup disposition activities. Plutonium holdup disposition activities would be completed prior to the removal action. For this alternative, the PFP above-grade structures would be deactivated, consisting of residual waste material removal including tank flushing, and the process equipment and other items stabilized. The structures would be transition to long-term S&M as describe in Section 8.0 of the HFFACO Action Plan (Ecology et al. 1994). Like Alternative Two, this long-term S&M is expected to continue until 2030. As in Alternative Two, S&M measures would include minimal long-term radiological and industrial hazard monitoring (both inside and outside of a structure), cold weather protection, preventive maintenance, annual roof inspections, identification and minor repair of friable asbestos, and general visual inspections. Major maintenance operations, such as roof maintenance, would be performed to ensure the maintenance of safe conditions and the control of the ongoing deterioration process. Additionally, limited decontamination and fixative application would occur to control the spread of radiological contamination.

The primary elements of Alternative Three are as follows:

- Remove the substantial nonradiological and radiological hazardous substances from within the above-grade structures including associated below-grade basements, tunnels, vaults, etc.
- Decontaminate, fix contamination, and isolate systems as needed
- Leave structures in place with critical safety and environmental systems operating
- Dispose of the various waste forms generated in these operations
- Conduct periodic S&M.

Substantial nonradiological hazardous substances would be removed, which would include asbestos-containing material (ACM), equipment oils, mercury, and potentially materials/liquids in the floor drains.

During removal of nonradiological and radiological substances, equipment and structures would be decontaminated according to standard Hanford Site work practices. Any radiological contamination that could not be removed would be fixed in place using standard practices. Tank and piping systems would be isolated from each other and from access to the environment. Piping and drains entering or exiting the structures would be isolated at the boundary of the structure.

The PFP above-grade structures (including associated below-grade basements, tunnels, vaults, etc.) would be left in place. Even though the majority of the structures inventory would be removed, inaccessible inventory still would be present, including contaminated portions of the structures themselves. After the stabilization activity occurs, the structures would be maintained by S&M. The yearly cost of S&M, however, would be reduced significantly from that in Alternative Two.

The major risk associated with this alternative is the safety of personnel involved in both the radiological aspects of the hazardous substance removal and decontamination and the industrial aspects of a structure's D&D. These risks are related to the potential release of contamination, and the hazards associated with deactivation/stabilization activities.

4.4.1 Cost Estimates for Alternative Three: Deactivation/Stabilization

The Alternative Three cost estimates were prepared by in-house project managers and are shown in Table 4-2. Costs are presented in terms of total nondiscounted costs or constant dollars. Since funding will not be set aside initially, no present-worth analysis is warranted.

The costs for Alternative Three are greater than other alternatives.

4.5 ALTERNATIVE FOUR: SLAB-TO-GRADE

Alternative Four would ensure that PFP above-grade structures are dispositioned in a safe condition. This alternative would consist of the following primary elements:

- Remove the nonradiological and radiological hazardous substances from within the above-grade structures including associated below-grade basements, tunnels, vaults, etc.

- Decontaminate, fix contamination, and isolate systems as needed
- Remove above-grade and, as needed, basement, tunnel, vault, etc., equipment
- Demolish above-grade structures to grade
- Cut off equipment penetrating the structures slab, as needed, and seal penetrations to prevent intrusion or leakage
- Dispose of the various waste forms generated during these operations
- Stabilize the area
- Install a cover as needed
- Conduct periodic S&M.

Plutonium holdup disposition activities would be completed. Significantly less than 1 kg of residual contamination would remain after completion of the slab-on-grade activities. The remaining residual contamination would be trapped in the building foundation slabs and sub-grade structures (including buried piping and ductwork).

Nonradiological hazardous substances would be removed. These would include ACM, chemical feed tanks and piping, equipment oils, mercury, control panels, and potentially materials/liquids in the floor drains. Radiological hazardous substances removal would include removal of process hoods and piping. Equipment, vessels, and piping systems might need to be isolated and severed to facilitate removal and/or disposal. Remote handling equipment might be used to facilitate removal of equipment and piping. While concerns for operational methods and technology used would be encountered and resolved during removal actions, no major issues exist that might compromise this alternative. No sub-grade (e.g., buried structures, buried pipelines, soil, groundwater, or unplanned releases) source terms would be removed or treated.

In general, piping and vessels would be removed from a structure, either before or as part of that structure demolition. Piping entering or exiting a structure below-grade would be plugged or grouted to prevent potential pathways to the environment.

Demolition would use heavy equipment (e.g., excavator with various attachments) to demolish the structures. Other industry standard practices for demolition also could be used (e.g., mechanical saws, cutting torches). Each PFP above-grade structure would be demolished until only the slab and foundation remained. In addition, miscellaneous debris in the surrounding area, like fencing, telephone poles, etc., will be removed and disposed of during demolition. For structures with basements, tunnels, vaults, etc., the below-grade walls would be left standing as well as the below-grade slab and foundation. These remaining surface portions of a structure are referred to in this document collectively as the structure's 'slab'.

Exposed areas such as the 234-5Z tunnels or 241-Z vaults that exist below-grade would be filled and covered with grout, gravel, or other suitable material to grade level to prevent water accumulation. Each PFP above-grade structure footprint would be stabilized to prevent migration of any residual contamination to the environment if needed. This migration prevention could include adding a cover to the slab to prevent run-on/run-off.

Over time contaminants could still pose a risk through a potential groundwater transport exposure pathway. Further soil or waste site remediation would be conducted in coordination with future remedial actions as described in Section 1.3.

The major risk associated with this alternative is personnel safety during the hazardous substance removal and decontamination and the industrial aspects of a structures D&D. These risks are related to the potential release of contamination, and the hazards associated with the demolition activities.

4.5.1 Cost Estimates for Alternative Four: Slab-on-Grade

The cost estimates for Alternative Four were prepared by in-house project managers and are shown in Table 4-2. Costs are presented in terms of total nondiscounted costs or constant dollars. Since funding will not be set aside initially, no present-worth analysis is warranted.

The costs for Alternative Four are greater than the costs for Alternatives Five and Alternative Six, but less than the costs for Alternatives Two and Alternative Three, S&M and Deactivation/Stabilization respectively.

4.6 ALTERNATIVE FIVE: ENTOMBMENT

Alternative Five would allow for applicable PFP above-grade structures (for structures identified for this alternative, see Table 4-1) to be cleaned out sufficiently for individual structures to be designated as LLW units. The structures would be entombed in concrete or other appropriate material. Partial entombment would result in filling select above-grade structures and removing others. Total entombment would fill and encase applicable above-grade structures. In each instance, applicable basement, tunnel, vault, etc., structures would be filled. Applicable buried radioactive pipes and ducts would be plugged or grouted to prevent potential pathways to the environment.

Alternative Five would consist of the following primary elements:

- Remove the substantial nonradiological and radiological hazardous substances from within the above-grade structures including associated below-grade basements, tunnels, vaults, etc.
- Decontaminate, fix contamination, and isolate systems as needed
- Remove selected gloveboxes and equipment as needed
- Dispose of the various waste forms generated during operations
- Fill applicable basement, tunnel, vaults, etc. portions of the structures with concrete or other appropriate material
- Fill and encase applicable above-grade structures or fill select above-grade structures and remove remaining applicable above-grade structures that are not entombed
- Install a cover if needed
- Conduct periodic S&M.

Plutonium holdup disposition activities would be completed before entombment activities are initiated and would leave approximately 4 kg of residual contamination in each building with an estimated total of approximately 6 kg of holdup remaining in the entire PFP Complex.

Disposition would be via entombment in concrete or other appropriate material. In general, this would involve pouring a concrete retaining wall around a structure. This wall would act as the concrete form. Concrete would be pumped into and around the structure. Before starting the pouring of concrete into the structure, gloveboxes, ducts, and voids would be filled with lightweight concrete or an equivalent. For areas of known or suspected sub-grade soil contamination, the top of the entombment could be sloped to direct run off away from contaminated areas. No sub-grade (e.g., buried structures, buried pipelines, soil, groundwater, or unplanned releases) source terms would be removed or treated.

The end product would be a tall block of concrete, up to 70 feet in some cases, entombing a structure. A sealant would be applied to the concrete. Miscellaneous debris in the surrounding area, like fencing, telephone poles, fire risers, etc., will be removed and disposed of during entombment. The top would be sloped to promote run-off. An additional cover could be added to increase the integrity of the concrete surface from weathering. Partial entombment also could result in some applicable above-grade structures being removed. For the above-grade structures that are not being entombed, the removal action for this alternative will be 'slab-on-grade' (as described for Alternative Four).

4.6.1 Cost Estimate for Alternative Five: Entombment

The cost estimates for Alternative Five were prepared by in-house project managers and are shown in Table 4-2. Costs are presented in terms of total nondiscounted costs or constant dollars. Since funding will not be set aside initially, no present-worth analysis is warranted.

The costs for Alternative Five are less than other alternatives. However, costs for this alternative exclude any associated waste disposal costs should future disposition of the entombed structures occur.

4.7 ALTERNATIVE SIX: COLLAPSE AND COVER

The goal of this alternative is to minimize the quantity of waste and construction debris that would be removed from the PFP Facility. This alternative would result in the applicable PFP above-grade (for structures identified for this alternative, see Table 4-1) structures having been cleaned up to meet LLW standards, and structurally collapsed in-place to reduce the height of the final skyline. Parts of the structures and debris that meet LLW or free-release standards would remain within the engineered cover that would be built over each collapsed structure. A void fill would be introduced to prevent subsidence, but necessarily would not be relied on as a fixative to hold residual contamination in place. The engineered covers would be designed to prevent water infiltration and dispersion of surface contamination by wind. No sub-grade source terms would be removed or treated. Again, miscellaneous debris in the surrounding area, like fencing, telephone poles, fire risers, etc., will be removed and disposed of during cover placement. Applicable buried radioactive pipes and ducts would be plugged or grouted to prevent potential pathways to the environment.

Alternative Six consists of the following primary elements:

- Remove the substantial nonradiological and radiological hazardous substances from within the above-grade structures including associated below-grade basements, tunnels, vaults, etc.

- Decontaminate, fix contamination, and isolate systems as needed
- Remove gloveboxes and equipment as needed
- Dispose of waste generated during these operations
- Fill basement, tunnel, vaults, etc. portions of the structures with concrete or other appropriate material
- Collapse structures in place to rubble
- Fill void with concrete or other appropriate material
- Install a cover
- Conduct periodic S&M.

The cover could include one of the following types to provide protection due to the potential migration of contamination:

- Asphalt cover
- Contamination control cover (i.e., a highly weather resistant contamination barrier ensuring confinement of residual contamination and serving as an interim protective measure; not intended for final site closure nor to meet requirements of a RCRA cap)
- RCRA-equivalent cover.

Plutonium holdup disposition activities would be completed. After deactivation is complete and before collapse and cover activities are initiated, approximately 3 kg of residual contamination could remain in each building with an estimated total of approximately 4 kg of residual contamination in the entire PFP Complex. For the above-grade structures that are not undergoing collapse and cover, the removal action for this alternative will be 'slab-on-grade' (as described for Alternative Four).

4.7.1 Cost Estimate for Alternative Six: Collapse and Cover

The Alternative Six cost estimates were prepared by in-house project managers and are shown in Table 4-2. Costs are presented in terms of total nondiscounted costs or constant dollars. Since funding will not be set aside initially, no present-worth analysis is warranted.

The costs for Alternative Six are greater than Alternative Five, Entombment, but less than other alternatives. However, costs for this alternative exclude any associated waste disposal costs should future disposition of the collapsed structures occur.

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Table 4-1. Removal Action Alternatives Considered For Each PFP Above-Grade Structure (2 sheets).

Building/Structure	#1. No Action	#2. Cont'd Surveillance & Maintenance	#3. Deactivation/ Stabilization	#4. Slab-0n-Grade	#5. Entombment[5]	#6. Collapse & Cover[5]
216-Z-9 Crib and support structures[1]	X	X	X	X	X	
225-WC	X	X	X	X		X
234-ZB	X	X	X	X		
234-ZC	X	X	X	X		
234-5Z	X	X	X	X	X	X
234-5ZA	X	X	X	X		X
236-Z	X	X	X	X	X	X
241-Z	X	X	X	X	X[2]	
241-ZA	X	X	X	X		
241-ZB	X	X	X	X	X	
241-ZG	X	X	X	X		
241-Z-RB	X	X	X	X	X	
242-Z	X	X	X	X	X	X
243-Z	X	X	X	X		X
243-ZA	X	X	X	X	X[3]	X
243-ZB	X	X	X	X		
2503-Z	X	X	X	X		
252-Z-1	X	X	X	X		
270-Z	X	X	X	X		
2701-ZA	X	X	X	X		
2701-ZD	X	X	X	X		
2702-Z	X	X	X	X		
2704-Z	X	X	X	X		
2705-Z	X	X	X	X		
2712 –Z	X	X	X	X		X
2721-Z	X	X	X	X		
2727-Z	X	X	X	X		
2729-Z	X	X	X	X		
2731-Z	X	X	X	X		
2731-ZA	X	X	X	X		

Table 4-1. Removal Action Alternatives Considered For Each PFP Above-Grade Structure (2 sheets).

Building/Structure	#1. No Action	#2. Cont'd Surveillance & Maintenance	#3. Deactivation/ Stabilization	#4. Slab-0n-Grade	#5. Entombment[5]	#6. Collapse & Cover[5]
2734-ZA, -ZC, -ZK, and –ZL	X	X	X	X		
2734-ZB, -ZD, -ZF, -ZG, and -ZH	X	X	X	X		
2734-ZJ	X	X	X	X		
2735-Z	X	X	X	X		X
2736-Z	X	X	X	X	X	X
2736-ZA	X	X	X	X	X	X
2736-ZB	X	X	X	X	X	X
2736-ZC	X	X	X	X		
2736-ZD	X	X	X	X		
2902-Z	X	X	X	X		
2904-ZA	X	X	X	X		
2904-ZB	X	X	X	X		
291-Z	X	X	X	X	X[4]	X
291-Z-001 stack	X	X	X	X		X
PFP Complex Yards and Grounds	X	X	X	X		

[1] The only activity associated with this removal action for 216- Z-9 crib would be to stabilize the surface area of the crib (such as adding a layer of pea gravel) and/or to install a cover. Under this removal action, no sub-grade activities would be conducted for 216-Z-9. Remediation of 216-Z-9 would be evaluated in follow-on CERCLA documentation (prepared for Central Plateau Remediation).

[2] 241-Z entombment alternative includes metal enclosure removal.

[3] The 243-ZA building can be entombed with the above-grade tank removed.

[4] 291-Z entombment alternative includes stack removal

[5] For the above-grade structures that are not undergoing entombment or collapse and cover, the removal action will be 'slab-on-grade'.

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Table 4-2. Cost Estimates for Alternatives ($1000)[1].

Element	Alternative One No Action	Alternative Two Surveillance and Maintenance	Alternative Three Deactivation/ Stabilization	Alternative Four Slab-on-Grade	Alternative Five Entombment	Alternative Six Collapse and Cover
Removal Activity[2]	$0	$919,184	$75,953	$141,857	$113,842	$130,020
Lab Support for Transition[3]	$0	$17,727	$35,132	$65,617	$52,658	$60,141
Maintain Transition Program[4]	$0	$8,586	$17,017	$31,782	$25,505	$29,130
Transition Operations Support[5]	$0	$26,831	$53,177	$99,319	$76,229	$91,031
Project Management[6]	$0	$353,819	$432,404	$76,229	$76,229	$76,229
Maintain Special Nuclear Material (SNM)[7]	$0	$58,409	$58,409	$7,537	$7,537	$7,537
Surveillance & Maintenance[8]	$0	NA	$880,860	$111,761	$111,761	$114,178
Waste Disposal Costs[9]	$0	$214,576	$214,576	$71,601	$54,840	$67,525
Total	$0	$1,599,132	$1,767,528	$605,702	$518,601	$575,790

[1] Cost estimate information provided in *Cost Estimate to Support Preparation of the Plutonium Finishing Plant Above-Grade Engineering Evaluation/Cost Analysis (EE/CA)* (Killoy 2004b).
[2] NTC removal activities for structures as identified on Table 4-1.
[3] Includes support for stabilization of plutonium material, legacy holdup removal, decommissioning, deactivation & cleanout of lab hoods/gloveboxes.
[4] Includes Decommissioning project oversight; communications, safety, and technology interface support; environmental & regulatory support, records management and quality assurance.
[5] Includes fabrication support services, vent & balance support, Decommissioning training, radiological control support, policy/procedure development support, health & safety support, and procurement of consumable materials.
[6] Includes PFP project management support to ensure compliance, milestone/performance initiative monitoring & control, work breakdown structure development/control, baseline estimating/planning/scheduling. In addition, this element includes dosimetry, medical, telephones/Hanford Local Area Network costs, along with hookup, maintenance, and troubleshooting support.
[7] Includes SNM accountability, management, oversight, administrative and compliance support; internal audits, inventories, surveillances, maintenance of equipment & safeguards/security systems, training, and housekeeping.
[8] Includes facility predictive and corrective maintenance activities, facility-related modifications, engineering support, utilities and janitorial services. S&M cost for Alternative Two are included in the Removal Activity costs.
[9] Includes waste characterization, package, storage, and shipment; waste container procurement; spill response & mitigation; and chemical management. This element also includes sample analysis & repacking of WIPP samples and preparation & delivery of a WIPP sample report.

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5.0 ANALYSIS OF ALTERNATIVES

CERCLA requires that non-time-critical removal action alternatives be evaluated against three criteria: effectiveness, implementability, and cost. To provide a more comprehensive evaluation, the criterion of effectiveness is divided into subcriteria that are consistent with the requirements for CERCLA actions. The removal action alternatives are evaluated against the following subcriteria:

- Effectiveness
  - Overall protection of human health and the environment
  - Compliance with ARARs
  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility, or volume through treatment
  - Short-term effectiveness.
- Implementability
- Cost.

State and public acceptance would be evaluated after Ecology and the public have had an opportunity to review and comment on this EE/CA. Each criterion is explained briefly in the following sections; a detailed analysis of each alternative relative to each criterion follows. Finally, the alternatives are compared against one another relative to each criterion.

The alternatives for the PFP above-grade structures removal action are reiterated below:

- Alternative One: No Action
- Alternative Two: Surveillance and Maintenance
- Alternative Three: Deactivation/Stabilization
- Alternative Four: Slab-on-Grade
- Alternative Five: Entombment
- Alternative Six: Collapse and Cover.

5.1 EFFECTIVENESS

The effectiveness criterion refers to the ability to meet the removal objectives (as outlined in Section 3.0) within the scope of the removal action and in terms of overall protection of public health and the environment.

5.1.1 Overall Protection of Human Health and the Environment

This criterion evaluates whether the alternative achieves adequate overall elimination, reduction, or control of risks to human health and the environment posed by the likely exposure pathways. This criterion draws on the assessment of the other evaluation criteria identified previously. Reducing the potential threat to acceptable levels is a CERCLA threshold requirement and is the primary objective of the removal action. The evaluation of this criterion was based on qualitative analysis and assumptions regarding the radionuclides inventory as show in Section 2.2

Alternative One does not provide overall protection to human health and the environment. As the structures deteriorate over time with no ongoing maintenance, contamination could be released to the environment. The radioactive inventory, including alpha-emitting radionuclides, would expose Hanford Site personnel, and potentially the public to an unacceptable radiation dose. This alternative does not meet any of the six removal action objectives outlined in Chapter 3.0. Because this alternative does not meet the threshold requirement of meeting overall protection of human health and the environment, especially in the long term, this alternative is not analyzed further. For the remainder of this EE/CA, when 'all' the alternatives are mentioned, 'all' represents Alternatives Two through Six.

Alternatives Two through Six would meet the overall protection criterion. Alternatives Two and Three provide adequate overall protection of human health and the environment, although the maintenance effort and funding required to maintain this protection would increase over time. The roof of each structure, and the structures themselves, would require modification, repair, and replacement to maintain contamination and radioactive inventory confinement within the structures during the period of S&M. As such, Alternative Two and Three do not fully satisfy Removal Action Objective Number Five. Additionally, Alternatives Two and Three would not remove as much of the radioactive inventory within the structures as Alternatives Four, Five, and Six. Therefore Alternatives Two and Three do not fully satisfy Removal Action Objective Numbers One, Two, and Three with respect to the overall protection criterion. Relative to the other alternatives, Alternatives Two and Three do not perform as well under this criterion.

Alternatives Four through Six either would remove, or fix in-place, existing loose contamination and the majority of the radioactive inventory present for these structures. This would reduce or eliminate release pathways to the environment and meet the removal action objectives. The risk associated with residual sub-grade contamination that might be present would be minimized through interim surface stabilization. Alternative Four would remove more inventory than Alternatives Five and Six because Alternative Four removes the contaminated debris while Alternatives Five and Six leave the remaining contamination in place. Furthermore, the concrete slab of Alternative Four, the sloped entombment of Alternative Five, and the cover of Alternative Six effectively isolates any sub-grade contamination.

5.1.2 Compliance with Applicable or Relevant and Appropriate Requirements and Other Standards

This criterion addresses whether a removal action will, to the extent practicable, meet ARARs. In accordance with 40 CFR 300.415(d), removal actions shall, to the extent practicable, contribute to the efficient performance of any anticipated long-term remedial action with respect to the release concerned. ARARs are defined to mean only substantive requirements. ARARs do not include administrative requirements. Furthermore, onsite actions are exempt from obtaining federal, state, and local permits [40 CFR 300.400(e)]. The ARARs criterion must be met for a removal action to be eligible for consideration. To-be-considered (TBC) information is nonpromulgated advisories or guidance issued by federal or state governments that legally are not binding and do not have the status of potential ARARs. In certain situations, TBC information should be referenced with ARARs in determining the removal action necessary for protection of human health and the environment.

Because the activities primarily would result in waste generation and potential for air emissions, the key ARARs proposed for the alternatives being considered include waste management standards and standards controlling emissions to the environment. Final ARARs, which must be complied with during implementation of the selected removal action, will be documented in the CERCLA AM. The proposed ARARs are discussed generally in the following sections and are documented in detail in Table 5-1.

5.1.2.1 Waste Management Standards

A variety of waste streams would be generated under the proposed removal action alternatives. It is anticipated that most of the waste would be designated as LLW. Small quantities of TRU waste, dangerous or mixed waste, PCB-contaminated waste, and asbestos and ACM also might be generated. The great majority of the waste would be in a solid form. However, some aqueous solutions might be generated.

The identification, storage, treatment, and disposal of hazardous waste and the hazardous component of mixed waste are governed by RCRA. Authority to implement most of the RCRA was delegated to the State of Washington, which implements RCRA requirements under *Washington Administrative Code* (WAC) 173-303. The dangerous waste standards for generation and storage would apply to the management of any dangerous or mixed waste generated at PFP above-grade structures. Treatment standards for dangerous or mixed waste subject to RCRA land disposal restrictions are specified in WAC 173-303-140, which incorporates 40 CFR 268 by reference.

The management and disposal of PCB waste are governed by the *Toxic Substances Control Act* (TSCA) *of 1976*, which is implemented by 40 CFR 761. The TSCA regulations contain specific provisions for PCB waste, including PCB waste that contains a radioactive component. PCBs also are considered underlying hazardous constituents under RCRA and thus might be subject to WAC 173-303-140 and 40 CFR 268 requirements.

Removal and disposal of asbestos and ACM are regulated under the *Clean Air Act* (40 CFR 61, Subpart M). These regulations provide for special precautions to prevent environmental release or exposure to personnel of airborne emissions of asbestos fibers during removal actions. 40 CFR 61.150 identifies packaging requirements.

It is anticipated that alternatives would be performed in compliance with all waste management ARARs. All waste streams would be evaluated, designated, and managed in compliance with the appropriate requirements. Before disposal, waste would be managed in a protective manner to prevent release to the environment or unnecessary exposure to personnel. Waste that is designated as LLW would be disposed at ERDF, which is engineered to meet relevant and appropriate performance standards under 10 CFR 61.

Waste that is designated as either contact-handled or remote-handled TRU waste or TRUM waste would be stored at CWC until packaged and certified at the WRAP Facility for eventual disposal at WIPP.

Waste designated as dangerous or mixed waste would be treated as appropriate to meet land disposal restrictions, and disposed at ERDF. ERDF is engineered to meet landfill design standards under WAC 173-303-665. All applicable packaging and pre-transportation requirements for dangerous or mixed waste generated at PFP above-grade structures would be identified and implemented prior to movement of any waste. Some of the aqueous waste designated as LLW, dangerous, or mixed waste would be transported to ETF for disposal. ETF is authorized to treat aqueous waste streams generated on the Hanford Site and dispose of these streams at a designated state approved land disposal facility.

Waste designated as PCB remediation waste likely would be disposed at ERDF or WIPP, depending on whether the waste is a LLW or a TRU waste respectively. ERDF is authorized to accept solid PCB waste containing PCB concentration up to 500 parts per million (ppm) for disposal. All TRU waste suspected to contain PCBs would be evaluated to determine whether the waste meets ERDF or WIPP waste acceptance criteria. Any PCB waste that does not meet ERDF or WIPP waste acceptance criteria would be retained at an onsite PCB storage area meeting the substantive requirements for TSCA storage. The waste would be transported to an appropriate disposal facility for future disposal.

Asbestos and ACM would be removed, packaged as appropriate, and disposed of at ERDF.

Alternatives Two through Six meet the proposed waste management ARARs and therefore meet Removal Action Objective Number Four.

5.1.2.2 Standards Controlling Releases to the Environment

The proposed removal action has the potential to generate airborne emissions of both radioactive and nonradioactive emissions.

The federal *Clean Air Act* and the "Washington Clean Air Act" [*Revised Code of Washington* (RCW) Chapter 70.94] regulate airborne emissions. Table 5-1 provides detailed discussion of the potential ARARs under these regulations.

WAC 173-400 and 173-460 establish requirements for emissions of criteria/toxic air pollutants. The primary source of emissions would be particulate matter and/or other toxic constituents. Particulate emissions would be controlled through standard industrial practices (i.e., best available control technology) including, but not limited to, application of water spray, fixatives and/or temporary confinement enclosures/glovebag containments. Alternatives Two through Six would be expected to comply with these standards and thereby satisfy Removal Action Objective Number Three with respect to controlling airborne releases.

5.1.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence criterion addresses whether the alternative leaves an unacceptable risk after the removal action is completed. This criterion also refers to the ability of the removal action to maintain long-term reliable protection of human health and the environment after remedial action objectives have been met.

In Alternatives Two and Three, S&M would be carried out until the eventual D&D of the PFP Facility. Therefore, these alternatives would be effective at protecting human health during this time frame, although the efforts to maintain that level of protection necessarily would become increasingly aggressive as the above-grade structures age. Because contamination would be left in place with these alternatives, environment release risk would remain. With time, the effectiveness of these alternatives would diminish. These alternatives would not provide a permanent solution with respect to the PFP above-grade structures, because final D&D or inventory removal would need to occur at some future time. These two alternatives do not fully meet Removal Action Objective Number Five.

Alternatives Four, Five, and Six would provide greater protection of human health and the environment compared to Alternatives Two or Three. These alternatives would provide a long-term remedy for the purposes of meeting the removal action objectives. Alternative Four would remove the majority of contaminated inventory associated with each structure while Alternatives Five and Six isolate the contaminated inventory from the environment. Further remedial actions potentially would be required for sub-grade and surrounding contamination, which is considered a small quantity compared to the inventory within the building itself. For Alternative Four, above-grade contamination and structures would be removed and disposed, thereby creating an effective and long-term remedy. This would allow improved access to contamination surrounding the above-grade structures for future remedial action. There would be no unacceptable risk attributable to the slab and sub-surface areas of any of the structures remaining after completion of the removal action under Alternative Four.

Alternatives Four, Five, and Six are judged to be comparable in terms of long-term protectiveness because each of these alternatives would leave either a barrier or a slab in place, thereby isolating any potential sub-grade contamination. However, by placing the waste in ERDF, LLBG, or an offsite TSD facility as in Alternative Four, access to sub-surface areas should future remedial actions be required readily would be more available and Removal Action Objective Number Six would be better satisfied compared to Alternatives Five and Six.

5.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

This criterion refers to an evaluation of the anticipated performance of the treatment technologies that might be employed in a removal action. This criterion assesses whether the alternative permanently and significantly reduces the hazard posed through application of a treatment technology. This could be accomplished by destroying the contaminants, reducing the quantity of contaminants, or irreversibly reducing the mobility of contaminants. Reduction of toxicity, mobility, and/or volume contributes toward overall protectiveness. It is anticipated that a maximum of 10% of the waste generated under Alternatives Two through Six would require treatment to meet ERDF, WIPP, or offsite TSD facility waste acceptance criteria. Treatment would not be a significant component of the removal action. However, because Alternative Four would generate substantially more waste than Alternatives Two, Three, Five, or Six, these alternatives might be considered more effective at meeting this criterion. Most of the treatment methods anticipated (e.g., macroencapsulation) would act to reduce the mobility of contaminants. Some treatment methods (e.g., elementary neutralization) would reduce the toxicity of contaminants. Each alternative would evaluate recycling to reduce the volume of material disposed.

5.1.5 Short-Term Effectiveness

The short-term effectiveness criterion refers to any potential adverse effects on human health (e.g., personnel or surrounding public) and the environment during the removal action implementation phases. The criterion also refers to an evaluation of the speed with which the remedy achieves protection.

Under Alternatives Two and Three, there would be a potential for exposure to personnel during the S&M period because personnel would be required to enter the contaminated above-grade structures to perform periodic surveillances and any maintenance work required. This potential for exposure would become greater over-time as each structure deteriorates. Limiting personnel time in contaminated areas and providing the necessary PPE appropriate to the tasks would mitigate this risk. The speed, with which full protection is achieved, however, would be lengthy since the final removal of contaminant inventory would not be planned to occur until D&D of the PFP Facility.

With regard to short-term risks to personnel during implementation, Alternatives Four, Five, and Six would increase potential exposure for personnel in relation to Alternatives Two and Three because personnel would be entering the contaminated structures for a concentrated time and would be handling more contaminated materials. Again, limiting personnel time in contaminated areas and providing the necessary PPE appropriate to the tasks would mitigate this risk. Also, the handling of contaminated materials would increase the potential for a release to the environment, especially to the air, in the near term. Strict adherence to appropriate environmental regulations would help ensure that the potential for releases would be minimized. Alternatives Two and Three present a lesser hazard in the short-term than do Alternatives Four, Five, and Six. However, Alternatives Two and Three do not achieve the same level of protection in the timeframe provided by Alternatives Four, Five, and Six. For this reason, none of the alternatives fully satisfy this criterion.

5.2 IMPLEMENTABILITY

Implementability refers to the technical and administrative feasibility of a removal action, including the availability of materials and services needed to implement the selected solution. From a technical standpoint, Alternatives Two and Three easily could be implemented, as demonstrated by success of the deactivation and S&M programs currently ongoing on the Hanford Site. S&M techniques widely are used throughout the Hanford Site, and no specialized materials or services would be required except when major repairs would be needed on a contaminated PFP above-grade structure. As time goes by, the primary implementation deterrent would be subjecting S&M personnel to increasing potential contamination exposure as structure deterioration increases. However, normal precautions for dealing with contamination would be applied.

Alternative Four also could be implemented with relative ease. The specialized skills that would be required to work in a highly alpha radiation contaminated structure are available within the existing workforce on the Hanford Site. ERDF already is authorized via a ROD (EPA et al. 1995) to receive CERCLA waste meeting the acceptance criteria generated on the Hanford Site. WIPP currently is operational, and TRU waste can be stored at CWC until the WIPP schedule can accommodate Hanford-generated waste.

Implementation of Alternatives Five and Six also can be accomplished on the Hanford Site. However, more planning to deal with the uncertainties of implementing large-scale building entombment or collapse and the new procedures for such work on the Hanford Site would be needed as compared with Alternative Four.

Although any of the alternatives would be implementable, Alternatives Two and Three might be easier to implement in the near term because these alternatives would not require the engineering, planning, and demolition activities necessary to implement Alternatives Four, Five, and Six. However, in the long term, implementation of Alternatives Two and Three might become less feasible, because S&M activities would become more costly, aggressive, and frequent.

Alternative Four would perform substantially better than Alternatives Two, Three, Five, and Six with respect to meeting the removal action objective of facilitation and consistency with future remedial actions (i.e., Removal Action Objective Number Six) at or near the PFP Facility. If a surface barrier is selected as part of a future remedy for this waste site, demolition of nearby surface structures would be required, and this would best occur under Alternative Four. Alternative Four also would perform better than Alternatives Two, Three, Five, and Six at facilitating the evaluation and remediation of any potential sub-grade contamination. In Alternatives Two, Three, Five, and Six, the continued presence of the above-grade structures or the results of the removal actions (entombment or collapse and cover) would limit access to sub-grade contamination. Alternative Four would perform best for facilitating and achieving consistency with future sub-grade remedial actions. None of the alternatives discussed in this document would be expected to interfere with other nearby facility operations.

5.3 COST

This criterion considers the relative cost of the alternatives, to the extent that the costs can be quantified. The No Action Alternative (Alternative One) has no costs associated with it, but has been eliminated as an option as this alternative does not provide overall protection to human health and the environment.

Anticipated costs for Alternative Two, S&M, are $1.6 billion. This is the anticipated ongoing cost for S&M activities alone and does not include the potential costs for any future upgrades to the building to ensure structural integrity (other than roof replacement) and to minimize releases to the environment. Costs for Alternative Three are approximately $1.8 billion for deactivation and stabilization of the PFP above-grade structures. Alternative Four costs are approximately $606 million to remove structures to a slab-on-grade condition. Alternative Five costs are approximately $519 million to entomb select structures and to remove to a slab-on-grade condition other above-grade structures (such as 225-WC, 234-ZB, 234-ZC and others) as identified in Table 4-1. Alternative Six costs are approximately $576 million to collapse and cover select structures and to remove to a slab-on-grade condition other above-grade structures as identified in Table 4-1.

Cost estimates for each alternative are provided in Table 4-2.

5.4 OTHER CONSIDERATIONS

In accordance with DOE NEPA policy, DOE CERCLA documents are required to incorporate NEPA values (e.g., analysis of cumulative, offsite, ecological, and socioeconomic impacts) to the extent practicable.

Cumulative impacts could occur in both the short term and long term because of the interrelationships between the removal action at the PFP above-grade structures and other 200 Area activities, such as waste sites and groundwater remediation, deactivation and D&D of surrounding facilities, and operation of waste treatment facilities. Short-term cumulative impacts were considered in terms of both air quality and resource allocation. With appropriate work controls, airborne releases from any removal action would be expected to be minor. The contribution to cumulative impacts on local and regional air quality would be minimal. With respect to resource allocation, Alternatives Two through Six as well as other PFP Facility activities would require resources in terms of budget, materials, and disposal space. The contribution to short-term cumulative impacts would be less for Alternatives Two and Three and greater for Alternatives Four, Five, and Six, which would require substantially greater budget resources (in the short-term).

In the long term, the overall cumulative effect of a removal action at the PFP above-grade structures and other activities in the 200 Areas would be to enhance the protection of personnel, the public, and the environment. This is consistent with the values expressed by the regulators, stakeholders, affected tribes, and the public. Alternatives Two through Six would contribute to this enhanced protection. Alternatives Four through Six create the greatest and most long-term positive effect.

None of the alternatives would be expected to adversely affect existing ecological or cultural resources, or to have any socioeconomic impacts, including disproportionately high and adverse impacts to minority or low-income populations. Alternatives Two through Six would require an irreversible and irretrievable commitment of resources in the form of land area at ERDF for waste disposal. The total quantity of waste generated and the associated land area required would be relatively small compared to the 200 Areas response activities. Alternatives Five and Six also would require a commitment of resources in the form of concrete and cover material respectively.

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Table 5-1. Identification of Potential Applicable or Relevant and Appropriate Requirements and To Be Considered for the PFP Above-Grade Structures (4 sheets).

Potential ARAR Citation	Potential ARAR or TBC	Requirement	Rationale for Use
WASTE MANAGEMENT STANDARDS			
Regulations pursuant to the *Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq. – Implemented through the *Hazardous Waste Management Act*, RCW 70.105			
Dangerous Waste Regulations, (WAC 173-303):			
Solid Waste Identification Specific subsections: WAC 173-303-016 WAC 173-303-017	ARAR	These regulations define how to identify when materials are and are not solid waste.	Substantive requirements of these regulations are potentially applicable because these define how to determine which materials are subject to the designation regulations. Specifically, materials that are generated for removal from the CERCLA site during the removal action would be subject to the procedures for identification of solid waste to ensure proper management.
Dangerous/Mixed Waste Designation WAC 173-303-070(3)	ARAR	This regulation establishes the procedures to be used to determine if solid waste requires management as dangerous waste. These procedures are used to identify which waste codes are appropriate for application to the waste.	Substantive requirements of these regulations are potentially applicable to materials encountered during the removal action. Specifically, solid waste that is generated for removal from the CERCLA site during this removal action would be subject to the dangerous waste designation procedures to ensure proper management.
Dangerous/Mixed Waste Management Specific subsections: WAC 173-303-073 WAC 173-303-077 WAC 173-303-170(3)	ARAR	These regulations establish the management standards for solid waste designated as dangerous or mixed waste. Special waste is addressed in WAC 173-303-073. Universal waste is addressed in WAC 173-303-077. Generator standards are identified through WAC 173-303-170(3).	Substantive requirements of these regulations are potentially applicable to materials encountered during the removal action. Specifically, the substantive standards for management of special waste and universal waste and the substantive standards for management of dangerous/mixed waste are applicable to the interim management of certain waste that will be generated during the removal action. For purposes of this removal action, WAC 173-303-170(3) includes the substantive provisions of WAC 173-303-200 by reference. WAC 173-303-200 further includes certain substantive standards from WAC 173-303-630 and -640 by reference.
Dangerous/Mixed Waste Disposal Specific subsection: WAC 173-303-140(4)	ARAR	This regulation establishes state standards for land disposal of dangerous waste and incorporates by reference, federal land disposal restrictions of 40 CFR 268, that are applicable to solid waste that designates as dangerous or mixed waste in accordance with WAC 173-303-070(3).	The substantive requirements of this regulation are potentially applicable to materials encountered during the removal action. Specifically, dangerous/mixed waste that is generated and removed from the CERCLA site during the removal action for offsite (as defined by CERCLA) land disposal would be subject to the identification of applicable land disposal restrictions at the point of generation of the waste. The actual offsite treatment of such waste would not be ARAR to this removal action, but would instead be subject to all applicable laws and regulations.

Table 5-1. Identification of Potential Applicable or Relevant and Appropriate Requirements and To Be Considered for the PFP Above-Grade Structures (4 sheets).

Potential ARAR Citation	Potential ARAR or TBC	Requirement	Rationale for Use
Recycling Requirements Specific subsections: WAC 173-303-120(3) WAC 173-303-120(5)	ARAR	These regulations define the requirements for the recycling of materials that are solid and dangerous waste. Specifically, WAC 173-303-120(3) provides for management of certain recyclable materials, including spent refrigerants, antifreeze, and lead-acid batteries. WAC 173-303-120(5) provides for the recycling of used oil.	Substantive requirements of these regulations are potentially applicable to certain materials that might be encountered during the removal action. Recyclable materials that are exempt from regulation as dangerous waste and that are not otherwise subject to CERCLA as hazardous substances can be recycled and/or conditionally excluded from certain dangerous waste requirements.
Final TSD Unit Requirements Specific subsection: WAC 173-303-610(2)	ARAR	This regulation establishes requirements applicable to final status TSD units undergoing closure.	Substantive requirements of this regulation would be potentially applicable to any RCRA final status TSD unit within the CERCLA site and undergoing closure activities in conjunction with the removal action. Substantive requirements of this regulation would be relevant and appropriate to any interim status TSD unit undergoing closure in conjunction with the removal action.
Regulations pursuant to the *Toxic Substances Control Act (TSCA)*, 15 USC 2601 et seq.			
Polychlorinated Biphenyls Manufacturing, Processing, Distribution in Commerce, and Use Provisions (40 CFR 761)			
PCB Waste Management and Disposal Specific subsections: 40 CFR 761.50(b)(1) 40 CFR 761.50(b)(2) 40 CFR 761.50(b)(3) 40 CFR 761.50(b)(4) 40 CFR 761.50(b)(7) 40 CFR 761.50(c)	ARAR	These regulations establish standards for storage and disposal of PCB wastes.	Substantive requirements of these regulations are potentially applicable to the storage and disposal of PCB liquids, items, remediation waste, and bulk product waste at ≥50 ppm. The specific identified subsections from 40 CFR 761.50(b) reference the specific sections for management of each PCB waste type. Radioactive PCB waste can be disposed in accordance with 40 CFR 761.50(b)(7).
Regulations pursuant to the *Solid Waste Management, Recovery and Recycling Act*, RCW 70.95			
"Minimum Functional Standards for Solid Waste Handling," (WAC 173-304)			
Nondangerous, Nonradioactive Solid Waste Management Specific subsection: WAC 173-304-200(2)	ARAR	This regulation establishes requirements for the on-site storage of solid waste that is not dangerous or radioactive waste.	Substantive requirements of these regulations are potentially applicable to materials encountered during the removal action. Specifically, nondangerous, nonradioactive solid wastes (i.e., hazardous substances that are only regulated as solid waste) that will be containerized for removal from the CERCLA site would be managed onsite according to the substantive requirements of this standard.
To-Be-Considered pursuant to relevant facility acceptance criteria			

Table 5-1. Identification of Potential Applicable or Relevant and Appropriate Requirements and To Be Considered for the PFP Above-Grade Structures (4 sheets).

Potential ARAR Citation	Potential ARAR or TBC	Requirement	Rationale for Use
Environmental Restoration Disposal Facility Waste Acceptance Criteria (BHI-00139)	TBC	This document establishes waste acceptance criteria for the Environmental Restoration Disposal Facility.	Waste destined for management at ERDF must meet acceptance criteria to ensure proper disposal.
The Hanford Site Solid Waste Acceptance Criteria (HNF-EP-0063)	TBC	This document establishes waste acceptance criteria for the Central Waste Complex.	Waste destined for management at CWC must meet acceptance criteria to ensure proper disposal.
The Hanford Site Solid Waste Acceptance Criteria (HNF-EP-0063)	TBC	This document establishes waste acceptance criteria for the Waste Receiving and Processing Facility.	Waste destined for management at WRAP must meet acceptance criteria to ensure proper disposal.
Liquid Waste Processing Facilities Waste Acceptance Criteria (HNF-3172)	TBC	This document establishes waste acceptance criteria for the 200 Area Effluent Treatment Facility.	Waste destined for management at ETF must meet acceptance criteria to ensure proper disposal.
STANDARDS CONTROLLING RELEASES TO THE ENVIRONMENT			
Regulations pursuant to the *Clean Air Act of 1977*, 42 USC 7401, et seq.			
"National Emission Standards for Hazardous Air Pollutants (NESHAP)," (40 CFR 61)			
40 CFR 61.92	ARAR	Emissions of radionuclides to the ambient air shall not exceed amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr.	Substantive requirements of this standard are potentially applicable because this removal action may include activities such as open-air demolition of contaminated structures, excavation of contaminated soils, and operation of exhausters and vacuums, each of which may provide airborne emissions of radioactive particulates to unrestricted areas. As a result, requirements limiting emissions potentially apply. This is a risk-based standard for the purposes of protecting human health and the environment.
40 CFR 61.93	ARAR	Emissions from point sources of airborne radioactive material shall be measured. Measurement techniques may include, but are not limited to, sampling, calculation, smears, or other reasonable methods for identifying emissions as determined by the lead agency.	Substantive requirements of this standard are potentially applicable because point source emissions of radionuclides to the ambient air may result from activities performed during the removal action such as open-air demolition of contaminated structures, excavation of contaminated soils, and operation of exhauster and vacuums. This standard exists to assure compliance with emission standards.
40 CFR 61.145(a) 40 CFR 61.145(c) 40 CFR 61.150	ARAR	Regulated asbestos-containing materials shall be removed in accordance with specific handling, packaging, and disposal requirements where the potential to emit asbestos exists.	Substantive requirements of this standard are potentially applicable because this removal action includes abatement of asbestos and asbestos-containing materials in the form of pipe and tank insulation, transite siding, and ductwork. As a result, there is potential to emit asbestos to unrestricted areas and the requirements for the removal, handling, and packaging of asbestos potentially apply.
Regulations pursuant to the *Washington Clean Air Act*, RCW 70.94 / *Department of Ecology*, RCW 43.21A			

Table 5-1. Identification of Potential Applicable or Relevant and Appropriate Requirements and To Be Considered for the PFP Above-Grade Structures (4 sheets).

Potential ARAR Citation	Potential ARAR or TBC	Requirement	Rationale for Use
"Radiation Protection - Air Emissions," (WAC 246-247)			
WAC 246-247-040(3) WAC 246-247-040(4)	ARAR	Emissions shall be controlled to assure emission standards are not exceeded.	Substantive requirements of this standard are potentially applicable because fugitive, diffuse, and point source emissions of radionuclides to the ambient air may result from activities performed during the removal action, such as open-air demolition of contaminated structures, excavation of contaminated soils, and operation of exhauster and vacuums. This standard exists to assure compliance with emission standards.
WAC 246-247-075		Emissions from non-point and fugitive sources of airborne radioactive material shall be measured. Measurement techniques may include, but are not limited to sampling, calculation, smears, or other reasonable method for identifying emissions as determined by the lead agency.	Substantive requirements of this standard are potentially applicable because fugitive and non-point source emissions of radionuclides to the ambient air may result from activities performed during the removal action such as open-air demolition of contaminated structures and excavation of contaminated soils. This standard exists to assure compliance with emission standards.
"General Regulations for Air Pollution," (WAC 173-400)			
Air Contaminant Emission Standards Specific subsections: WAC 173-400-040 WAC 173-400--113	ARAR	Methods of control shall be employed to minimize the release of air contaminants associated with fugitive emissions resulting from materials handling, construction, demolition, or other operations. Emissions are to be minimized through application of best available control technology.	Substantive requirements of these standards are potentially relevant and appropriate to this removal action because there may be visible, particulate, fugitive, and hazardous air emissions and odors resulting from decontamination, demolition, and excavation activities. As a result, standards established for the control and prevention of air pollution may be relevant and appropriate.
"Controls for New Sources of Air Pollution," (WAC 173-460)			
WAC 173-460-030 WAC 173-460-060 WAC 173-460-070	ARAR	Emissions of toxic air contaminants shall be quantified and ambient impacts evaluated. Best available control technology for toxics shall be used as determined by the lead agency to protect human health and the environment.	Substantive requirements of these standards are potentially relevant and appropriate to this removal action because there is the potential for toxic air pollutants to become airborne as a result of decontamination, demolition, and excavation activities. As a result, standards established for the control of toxic air contaminants may be relevant and appropriate.

6.0 RECOMMENDED ALTERNATIVE

The recommended removal action alternative for the PFP above-grade structures is Alternative Four, Slab-on-Grade. This alternative would provide the best balance of protecting human health and the environment associated with the hazardous substance inventory within the structures, meeting the removal action objectives, and providing a cost-effective option. Alternative Four has significantly smaller quantities of material remaining, i.e., the slab, as a result of the end state of this removal action compared with Alternatives One, Two, Three, Five, and Six.

Alternative One does not provide overall protection to human health and the environment. Alternatives Two and Three provides adequate overall protection of human health and the environment, but at an increasing cost over time. Additionally, Alternative Two would not remove the radioactive inventory within the above-grade structures while Alternative Three does not remove the entire radioactive inventory within the above-grade structures. Therefore, none of these alternatives were selected.

Alternatives Five and Six are judged to be comparable in terms of long-term protectiveness with Alternative Four. Alternatives Five and Six potentially could provide additional long-term protection relative to Alternative Four, if significant radiological inventory actually is located in the structure's foundation. Alternative Four is comparable to Alternatives Five and Six because a stabilized structure foundation is left in place, thereby isolating any potential sub-grade contamination remaining after removal of the above-grade structures. Alternative Four is consistent with current removal actions being applied at the Hanford Site while Alternatives Five and Six are unproven methods at the Hanford Site. Both Alternatives Five and Six would provide an end-state that does not preclude future actions beneath the above-grade structures (e.g., Operable Units 200-CW-5, 200-LW-2, 200-MW-1, 200-PW-1, and 200-PW-6); however, costs would be increased if any remedial actions are required.

The cost for Alternative Four is somewhat higher than the costs for Alternatives Five and Six, but these estimated amounts are close enough to be considered similar as CERCLA removal actions allow an estimation tolerance of +50/-30% of the estimate for the actual removal action cost.

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7.0 REFERENCES

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