# APPENDIX F.10

# PFP (CP-DD-5, CENTRAL PLATEAU)
# EVALUATION UNIT SUMMARY TEMPLATE

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# PART I. EXECUTIVE SUMMARY

## EU LOCATION

The Plutonium Finishing Plant (PFP) is located in the West portion of the 200 Area near the North End of the Hanford Site

## RELATED EUS

CP-LS-2

## PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES

The Plutonium Finishing Plant (PFP) became highly contaminated while recovering plutonium from scrap materials and producing plutonium metal and oxide powder and machined plutonium metal components for nuclear weapons for 40 years (1949 to 1989). When processing ended, approximately 20 tons of plutonium-bearing material remained and needed to be removed as transuranic or low-level waste. Stabilization and packaging of the material was completed in 2004. Bulk special nuclear material shipments to the Savannah River Site were completed in 2010.

Because the facilities within the PFP Complex supported the final production process associated with the manufacture of plutonium as part of the nation's defense program, radiological contamination is expected to be 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). 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).[1] There is also a potential for beryllium contamination in E4 ductwork, filter boxes, drain lines, and E3 and E4 filter rooms. PFP is categorized as a Hazard Category 2 nuclear facility. Buildings 234-5Z, 236-Z and 242-Z are facilities in which an accidental criticality is credible. Therefore, the facilities are classified as a Fissile Material Facility per HNF-7098, *Criticality Safety Program*.[2]

The 231-Z Isolation Building/Plutonium Metallurgy Facility, which is located about 600ft north of the Plutonium Finishing Plant (PFP) 234-5Z building and outside of the fence line, was constructed in 1944. It was originally designated the 231-Z Isolation Building, housing the final step of the plutonium extraction process that began at T Plant on the Hanford Site. Its original purpose was the purification and drying of the plutonium nitrate solution produced at the 224-T Bulk Reduction Building. It operated in this capacity from 1945 until 1957, when the function of the building shifted to plutonium metallurgy. Plutonium metallurgical research, fabrication development, and metallurgy work for weapons development was carried out until 1975. A major cleanout of gloveboxes and other plutonium-

[1] US Department of Energy, Richland Operations Office, *Action Memorandum for the Plutonium Finishing Plant Above-Grade Structures Non-Time Critical Removal Action*, DOE/RL-2005-13-Rev 0, May 2, 2005

[2] CH2MHill, Plutonium Finishing Plant Deactivation and Decommissioning Documented Safety Analysis, HNF-15500, Revision 13, March 22, 2016 (OUO Document).

contaminated equipment was undertaken in the period from 1978 to 1982. Small quantities of Pu-239 and Am-241 remain as holdup within the building and equipment, and it is categorized as a Hazard Category 3 nuclear facility.

This EU also contains nine waste sites consisting of French drains, cribs and trenches, and an underground storage tank (MUST). Quantities of Pu-239-240 are located in the 241-Z-361 settling tank for liquid waste from the 234-5Z, 242-Z and 236-Z buildings.

## BRIEF NARRATIVE DESCRIPTION

This Evaluation Unit consists of the Plutonium Finishing Plant (PFP), ancillary buildings, structures, and associated near-surface contaminated soils. From 1949 into early 1989 the PFP complex was used to process plutonium nitrate solution into hockey puck-sized plutonium metal "buttons" or oxide powder for shipment to the nation's weapons production facilities or for the fabrication of mixed-oxide reactor fuel. PFP also produced machined plutonium metal parts up until the late 1960's. The plutonium fabrication lines were previously removed in the 1975- 1976 timeframe.

In 1991, PFP's mission changed to stabilize and store reactive plutonium-bearing materials, complete terminal cleanout, and provide long-term vault storage. In 1996, DOE issued a formal shutdown order for the PFP.

Before the PFP facilities could be permanently decontaminated and demolished (ending the plutonium processing capability), the inventory of special nuclear material (SNM) at PFP needed to be converted to configurations suitable for shipment and/or storage. However, many of the defense nuclear material production lines at the Hanford Site had been shut down rapidly, leaving a sizeable inventory of chemically reactive plutonium-bearing material that could only be handled appropriately within the special glovebox confinement available at the dedicated plutonium facility within the PFP complex. These materials included nitric acid solutions, polycubes (plutonium imbedded in degrading plastic cubes), oxygen-reactive metal oxide with unknown moisture content, and residual material from the metal casting process.

The stabilization and packaging campaign was completed in February of 2004. The plutonium materials were packaged in compliant DOE-STD-3013-2004 ("3013") containers. Richland Operations received authorization in September 2007 to ship the loaded "3013" containers from PFP to the Savannah River Site for long-term storage and disposition. In addition to plutonium-bearing material packaged in "3013" containers, un-irradiated and slightly irradiated reactor fuel also was stored within the PFP Protected Area. Shipment offsite of all of the plutonium-bearing and special nuclear materials that had been stabilized, packaged, and stored at PFP to other DOE facilities was completed in December 2009.[3] The PFP Protected Area was shut down and was classified as a Property Protected Area. The 2736-Z Complex facilities that supported the stabilization and storage mission were deactivated and decommissioned, and all 2736-Z Complex above-ground structures were demolished in 2012.[4]

The PFP complex is in the process of being cleaned out and demolished to "slab-on-grade"[5] prior to transitioning the footprint to RL-0040 for surveillance and maintenance (S&M) and final waste site

[3] CH2MHill, Plutonium Finishing Plant Deactivation and Decommissioning Documented Safety Analysis, HNF-15500, Revision 13, March 22, 2016 (OUO Document).
[4] CH2MHill, *PFP Demolition Capital Asset Project Execution Plan*, DD-59139, Revision 0, August 18, 2015
[5] Slab-on-grade is defined in the Action Memorandum as "Each PFP above-grade structure would be demolished until only the slab and foundation remained. For structures with basements, tunnels, vaults, etc., the below-grade

remediation. Many of the initial large nuclear source term and material at risk reducing activities have been completed. The completed activities were associated with the prior plutonium vault storage of plutonium metal and oxides and other SNM, storing slightly irradiated and un-irradiated nuclear reactor fuels, the packaging and handling of plutonium bearing materials, and shipping the materials and fuels to other DOE-owned facilities. The remaining PFP D&D phases of the mission includes decontamination of equipment and facilities, removal of remaining process equipment, waste packaging, deactivation of facility systems, and demolition of the facilities, primarily centered on Buildings 234-5Z, 236-Z, 242-Z, and 291-Z, and their supporting structures.

The Removal Action Work Plan (DOE/RL-2011-03, Rev. 0) governing these activities was amended through TPA Change Notice TPA-CN-681 in November 2015 to include removal of the 236-Z and 242-Z slabs, along with the soil necessary to complete slab removal (approximately one meter below the slab), to reduce the overall radiological inventory of the PFP complex. However, this expansion of D4 work at the site is to be carried out as part of the S&M Phase, versus revising the current program of demolishing all of the buildings to slab on grade. The results of pre-slab removal characterization may indicate that the level of contamination in or below either slab would require controls more rigorous than the open-air demolition controls utilized for slab-on-grade demolition activities. In that event, DOE in consultation with the lead regulatory agency may choose to leave the slab(s) in place for future remediation. Following completion of slab removal, the excavations will be backfilled and activities would be conducted as needed to stabilize the surface in the PFP complex area to minimize contaminant migration in the environment until final disposition of the PFP complex area. This could include placement of a cover of compacted fill, gravel, asphalt or other appropriate material with sloping as needed to control run-on/run-off and erosion.[6]

This Evaluation Unit also includes the 231-Z Isolation Building/Plutonium Metallurgy Facility, which is located in the 200 West Area of the Hanford Site, about 600ft north of the Plutonium Finishing Plant (PFP) 234-5 building. The 231-Z building was constructed in 1944 and was originally designated the 231-Z Isolation Building, housing the final step of the plutonium extraction process that began at T Plant on the Hanford Site. Its original purpose was the purification and drying of the plutonium nitrate solution produced at the 224-T Bulk Reduction Building. It operated in this capacity from 1945 until 1957, when the function of the building shifted to plutonium metallurgy. Plutonium metallurgical research, fabrication development, and metallurgy work for weapons development was carried out until 1975. At that time weapons design work was phased out. During the years of 1978 to 1982, a cleanup effort of gloveboxes and equipment was undertaken. In 1982, a soils and sedimentation characterization laboratory was established in the building. Experiments in the characterization of contaminated crib soils were conducted during the 1980s. The 231-Z building is currently in a Surveillance and Maintenance (S&M) mode.

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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'." US Department of Energy, Richland Operations Office, *Removal Action Work Plan for the Deactivation, Decontamination, Decommissioning, and Demolition of the Plutonium Finishing Plant Complex*, DOE/RL-2011-03, Revision 1, March 2016

[6] *Removal Action Work Plan for the Deactivation, Decontamination, Decommissioning, and Demolition of the Plutonium Finishing Plant Complex*, DOE/RL-2011-03, Revision 1, US Department of Energy, Richland Operations Office, March 2016

## SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table F.10-1 provides a summary of nuclear and industrial safety related risks to humans and impacts to important physical Hanford site resources.

### Human Health

A Facility Worker is deemed to be an individual located anywhere within the physical boundaries of the PFP (CP-DD-5) facility area; a Co-located Person (CP) is an individual located 100 meters from the physical boundaries of thee; and the Public is an individual located at the closest point on the Hanford Site boundary not subject to DOE access control. The maximum calculated dose for the onsite public was evaluated at Highway 240 at a distance of 4.2 km (2.5 miles). The nearest site boundary is 12.5 km (7.4 mi) was used as the minimum distance to the MOI. The nuclear-related risks to humans are based on unmitigated (unprotected or controlled conditions) dose exposures expressed in a range of from *Not Discernible* (*ND*) to *High*. The estimated mitigated exposure, which takes engineered and administrative controls and protections into consideration, is shown in Table F.10-1 in parentheses.

### Groundwater and Columbia River

Direct impacts to groundwater resources and the Columbia River have been rated based on available information for the current status and estimates for future time periods. These impacts are also expressed in a range of from *Not Discernible* (*ND*) to *Very High*.

### Ecological Resources[7]

The risk ratings are based on the degree of physical disruption (and potential additional exposure to contaminants) in the current status and as a potential result of remediation options.

### Cultural Resources[7]

No risk ratings are provided for Cultural Resources. The Table identifies the three overlapping Cultural Resource landscapes that have been evaluated: Native American (approximately 10,000 years ago to the present); Pre-Hanford Era (1805 to 1943) and Manhattan/Cold War Era (1943 to 1990); and provides initial information on whether an impact (both direct and indirect) is KNOWN (presence of cultural resources established), UNKNOWN (uncertainty about presence of cultural resources), or NONE (no cultural resources present) based on written or oral documentation gathered on the entire EU and buffer area. Direct impacts include but are not limited to physical destruction (all or part) or alteration such as diminished integrity. Indirect impacts include but are not limited to the introduction of visual, atmospheric, or audible elements that diminish the cultural resource's significant historic features. Impacts to Cultural Resources as a result of proposed future cleanup activities will be evaluated in depth under Section 106 of the National Historic Preservation Act (16 USC 470, et. seq.) during the planning for remedial action.

[7] References throughout this Evaluation Unit Summary Template supporting analyses related to Ecological Resources and/or Cultural Resources may be found in Appendices J and K, respectively. Refer to the specific EU when searching for the reference.

**Table F.10-1. Risk Rating Summary (for Human Health, unmitigated nuclear safety basis indicated, mitigated basis indicated in parentheses (e.g., "Very High" (Low)).**

| Population or Resource | | Evaluation Time Period: Active Cleanup (to 2064) | |
|---|---|---|---|
| | | **Current Condition:** PFP and 231-Z | **From Cleanup Actions:** PFP Pre-Demolition & Demolition |
| **Human Health** | Facility Worker | ***PFP***: High (Low)<br>**231-Z:** Medium (Low) | ***Proposed PFP***: Med-High (Low)<br>***Proposed 231-Z:*** IS |
| | Co-located Person | ***PFP***: High (Low)<br>**231-Z**: Medium (Low) | ***Proposed PFP***: Med-High (Low)<br>***Proposed 231-Z:*** IS |
| | Public | ***PFP***: Low-Medium (ND)<br>**231-Z:** ND **(**ND) | ***Proposed PFP***: Low (ND)<br>***Proposed 231-Z:*** IS |
| **Environmental** | Groundwater (A&B) from vadose zone[a] | *High* – $CCl_4$<br>*ND* – Sr-90 and U(tot)[c]<br>*Low* – other PCs<br>**Overall**: *High* | *High* – $CCl_4$<br>*ND* – Sr-90 and U(tot)[c]<br>*Low* – other PCs<br>**Overall**: *High* |
| | Columbia River from vadose zone[a] | Benthic and Riparian: *ND*<br>Free-flowing: *ND*<br>**Overall**: *ND* | Benthic and Riparian: *ND*<br>Free-flowing: *ND*<br>**Overall**: *ND* |
| | Ecological Resources[b] | ND | ND to Low |
| **Social** | Cultural Resources[b] | **Native American**<br>Direct: Unknown<br>Indirect: Known<br>**Historic Pre-Hanford**<br>Direct: Unknown<br>Indirect: Known<br>**Manhattan/Cold War**<br>Direct: Known<br>Indirect: Known | **Native American**<br>Direct: Unknown<br>Indirect: Known<br>**Historic Pre-Hanford**<br>Direct: Unknown<br>Indirect: Known<br>**Manhattan/Cold War**<br>Direct: Known<br>Indirect: Known |

a. Threat to groundwater or Columbia River from Group A and B primary contaminants (PCs) (Table 6-1, CRESP 2015) remaining in vadose zone. Threats from plumes associated with the PFP EU are described in **Part V** with additional information provided in Appendix G.6 (CP-GW-2) for the 200-ZP Groundwater Interest Area (GWIA).

b. For both Ecological and Cultural Resources see Appendices J and K, respectively, for a complete description of Ecological Field Assessments and literature review for Cultural Resources. Ecological ratings are described in Table 4-11 of the Final Report.

c. These ratings are for PCs with reported inventories. (See **Parts V** and **VI** for details.) Treatment of $CCl_4$ entering the groundwater from PFP sites would be effective for groundwater contamination but would not impact the vadose zone threat or ratings. The Sr-90 and total uranium disposed of in PFP EU would each translate to a *Low* rating; furthermore, there is no current Sr-90 or total uranium plume in the 200-ZP GWIA linked to the PFP EU and it would likely require more than 150 years to reach groundwater in a sufficient amount to exceed the

drinking water standard over an appreciable area (**Part V**). The Sr-90 and total uranium rating after Active Cleanup period is *Low* to account for uncertainties.

## SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE HUMAN HEALTH

***Current- PFP Complex***

PFP is currently in the final stages and nearing completion of the Deactivation Phase of its authorized demolition to slab on grade D&D program. The Human Health Risks described below are summarized in an April 2015 *Control Decision Document for the Plutonium Finishing Plant Safety Basis* (HNF-58375, Revision 0), which is based on:

- HNF-15500, Revision 12, *Plutonium Finishing Plant Deactivation and Decommissioning Documented Safety Analysis*, (PFP DSA); and
- HNF-15502, Revision 12, *Plutonium Finishing Plant Deactivation and Decommission Technical Safety Requirements*, (PFP TSR)

Neither of these documents had been finalized and made available to this Risk Review Author at the time this analysis was prepared.

PFP Safety Basis revisions incorporated into this document were also based on the following:

- HNF-15501, Revision 1, *Plutonium Finishing Plant Deactivation & Decommissioning Preliminary Hazard Analysis and Addendums*, (PFP HA);
- CHPRC-00179, Revision 4, *Fire Hazards Analysis, Plutonium Finishing Plant Complex*, (PFP FHA); and
- Criticality Safety Evaluation Reports (PFP CSERs).

*Seismic event or Aircraft crash*: Design basis earthquake or aircraft crash assumed release of all MAR in the facilities. Facility Worker and Co-located person dose 890 rems and Public dose 7.3 rems.

*Unmitigated Risk*: Facility Worker – High; CP – High; Public – Medium

The major receptors at risk are the S&M facility worker and co-located person in close proximity to the facility. The event is NRH and the material at risk is all the MAR in the facilities. No safety-class or safety-significant SSCs and no technical safety requirements reduce potential consequences to these receptors were identified.

Defense in Depth mitigation measures include the Safety Management Programs.

*Mitigation Risk*: Facility Worker – Low; CP – Low; Public – ND

*234-5Z 1st Floor Fire Involving Contaminated Equipment*: Fire is initiated when combustible gloves and combustible window are ignited. A multiple glovebox fire is not expected because of distance between units. Facility Worker and Co-located person dose 710 rems and Public dose 5.9 rems.

*Unmitigated Risk*: Facility Worker – High; CP – High; Public – Medium

Preventative Safety Significant Controls include Combustible Controls, Ignition Source Controls, Fire Sprinkler Systems and general Fire protection requirements. Defense in Depth mitigation measures include the Safety Management Programs, Confinement and Fire Sprinkler Flow Alarm.

*Mitigation Risk*: Facility Worker – Low; CP – Low; Public – ND

*Internal Equipment Explosion 242-Z*: The MAR for Building 242-Z is assumed to consist of 300 g of Am-241 and 1,000 g of the plutonium mixture with >10% Pu-240. The contribution to the radiological dose

consequences of the 300 g of Am-241 was equated to an inhalation dose equivalent plutonium mixture quantity. Therefore, the MAR for this event for Building 242-Z was assumed to be 5,000 g of the plutonium mixture. Facility Worker and Co-located person dose 300 rems and Public dose 2.4 rems.

*Unmitigated Risk*: Facility Worker – High; CP – High; Public – Medium

Preventative Safety Significant Controls include Combustible Controls, Flammable Gas Inventory and Chemical Management and Flammable Gas Venting Control. Defense in Depth mitigation measures include the Safety Management Programs and Confinement.

*Mitigation Risk*: Facility Worker – Low; CP – Low; Public – ND

*Internal Equipment Explosion 234-5Z*: For Buildings 234-5Z and 236-Z the quantities of chemicals are smaller. Bounding glovebox MAR was used, and the explosion does not breach outer surface of building. Facility Worker and Co-located person dose 240 rems and Public dose 2.0 rems.

*Unmitigated Risk*: Facility Worker – High; CP – High; Public – Medium

Preventative Safety Significant Controls include Combustible Controls, Flammable Gas Inventory and Chemical Management and Flammable Gas Venting Control. Defense in Depth mitigation measures include the Safety Management Programs and Confinement.

*Mitigation Risk*: Facility Worker – Low; CP – Low; Public – ND

*Drop of Equipment 234-5Z and 242-Z*: For the equipment drop occurring inside a confinement facility, a bounding case was considered whereby a glovebox in 242-Z contaminated with 5kg of plutonium holdup is dropped. Equipment is dropped and impacts the component below at a height of 3 m. Facility Worker and Co-located person dose 100 rems and Public dose 0.85 rems.

*Unmitigated Risk*: Facility Worker – High; CP – High; Public – Low

Preventative Safety Significant Controls include Hoisting and Rigging Controls. Defense in Depth mitigation measures include the Safety Management Programs and Confinement.

*Mitigation Risk*: Facility Worker – Low; CP – Low; Public – ND

*Additional Initiating Event Risks*: There are multiple other initiating events that could impact PFP and which would have High Unmitigated Risk (>25 rem dose) to the Facility Worker and Co-located Person and Low Risk (>0.1 rem dose) to Public. Many are related to fires and explosions such as: TRU Waste Staging Area Fire in 234-5Z, 236-Z, 242-Z; 234-5Z 1st Floor Fire Involving Contaminated Equipment; 242-Z Fire Involving Contaminated Equipment; 242-Z Facility Wide Fire; Internal Equipment Explosion - 236-Z; 234-5Z Duct Level or Second Floor Fire Involving Contaminated Equipment; Explosion in Facility Room or Containment Tent – 234-5Z, 242-Z; and TRU Waste Drum Explosion Inside Facility. Others include: Solid Spill from equipment removal - 234-5Z, 236-Z, 242-Z; Glovebox or Containment Loss of Confinement - 234-5Z, 236-Z, 242-Z; Wet Oxide Criticality 234-5Z, 236-Z, 242-Z; and Energetic Dispersal of Holdup Material – 234-5Z, 236-Z, 242-Z.

Preventative Safety Significant Controls include Material Management Program, Combustible Controls, Ignition Source Controls, General Fire Protection Requirements, Emergency Preparedness Program, Flammable Gas Inventory, and Chemical Management and Flammable Gas Venting Control, Nuclear Criticality Safety, Engineered Criticality Safety Features, and Criticality Detectors and Alarms. Defense in Depth mitigation measures include the Safety Management Programs, Confinement, Fire Sprinkler Systems, and Fire Sprinkler Flow Alarm.

***Current – 231-Z Building***

The 231-Z Isolation Building/Plutonium Metallurgy Facility is in a Surveillance and Maintenance (S&M) mode. No potential initiating event produced a human health risk to the facility Worker and Co-located person of High, and only one produced a Medium rating

*Maximum Possible Fire Scenario*: The scenario assumes that the current fire suppression systems fail upon demand and that the resulting fire burns with sufficient energy to result in a release of material to the environment. The event is a short duration event, so an acute ground release without plume meander is used to model the potential consequences. The assigned frequency category for this scenario is "anticipated". Facility Worker and Co-located person dose 17 rems and Public dose 0.016 rems.

*Unmitigated Risk*: Facility Worker – Medium; CP – Medium; Public – ND

Use of combustible controls and the operation of the suppression system as an industrial safety system will serve to reduce the potential for the fire scenario, as evaluated here.

*Mitigation Risk*: Facility Worker – Low; CP – Low; Public – ND

***Risks and Potential Impacts from Selected or Potential Cleanup Approaches – PFP Complex***

By the end of the Deactivation phase, much of the material at risk and transient combustibles will have been removed from the buildings. All equipment will have been removed from 242-Z. In the Pre-Demolition phase, activities generally include continued equipment, duct, and piping removal. Material at risk (MAR) levels during this phase will have been significantly reduced from those assumed in the Deactivation phase. Personnel will enter the building only to perform specific equipment removal and demolition preparation activities. However, until the pre-demolition phase is completed there is still some risk of fires, explosions and other initiating events that are estimated to result in High to Medium unmitigated human health risks. They include:

*234-5Z 1st Floor Fire Involving Contaminated Equipment*: During pre-demolition phase a fire could involve both gloveboxes and the MAR within these gloveboxes. The bounding equipment fire is a 17-foot diameter and could impact the holdup inventory of gloveboxes (400 g Pu or less) remaining at start of the Pre-Demo phase. Facility Worker and Co-located person dose 71 rems and Public dose 0.56 rems.

*Unmitigated Risk*: Facility Worker – High; CP – High; Public – Low

Preventative Safety Significant Controls include Combustible Controls and Ignition Source Controls. Defense in Depth mitigation measures include the Safety Management Programs, Confinement, Fire Sprinkler System, and Fire Sprinkler Flow Alarm.

*Mitigation Risk*: Facility Worker – Low; CP – Low; Public – ND

*Drop of equipment 234-5Z and 242-Z*: It was assumed that the gloveboxes or glovebox section remaining in the facility at the beginning of Pre-Demolition phase have been decontaminated to 400 g Pu or less. The equipment is dropped and impacts the component below at a height of 3 m. Facility Worker and Co-located person dose 30 rems and Public dose 0.24 rems.

*Unmitigated Risk*: Facility Worker – High; CP – High; Public – Low

Preventative Safety Significant Controls include Hoisting and Rigging Controls. Defense in Depth mitigation measures include the Safety Management Programs and Confinement.

*Mitigation Risk*: Facility Worker – Low; CP – Low; Public – ND

During final Demolition, the MAR levels will have been reduced even further and workers will not be inside the building. However, the demolition process will be performed in open air, and will destroy the confinement capabilities of the facilities and structures, resulting in increased risk of airborne releases of radioactive contamination as well as distribution of radioactive material in soils immediately surrounding the facilities and structures being demolished. Deactivation activities performed in the facilities will have removed equipment and materials containing residual radioactive material as necessary to ensure that airborne contamination generated during demolition will not exceed established control levels. Nevertheless, the deactivated facilities and structures will contain residual radioactive material on surfaces and in remaining piping, ductwork and other internal structures in quantities ranging from pCi/100 $cm^2$ to ηCi/100 $cm^2$ total alpha activity. In addition, equipment and materials that could not be readily deactivated prior to demolition may be left in place for disposal during the demolition process, and special demolition techniques will be used to remove these items in a manner which does not generate excessive airborne radioactive material. The demolition activities will create rubble and dust that will contain some quantity of radioactive material. To control the concentrations of airborne emissions during demolition, limits have been established to ensure that total alpha contamination remaining at the end of the deactivation phase on building surfaces are protective of human health and environment.[8]

*TRU Waste Drum Explosion Outdoors:* The generation and staging of TRU waste drums outside confinement will continue throughout the Demolition phase. A TRU waste drum explosion outside of confinement remains a possible event; however, the conditions and activities associated with the staging of TRU waste containers outside the facilities during Demolition phase are the same as those evaluated for Deactivation phase. Facility Worker and Co-located person dose 38 rems and Public dose 0.033 rems.

*Unmitigated Risk*: Facility Worker – High; CP – High; Public – ND

Preventative Safety Significant Controls include Material Management Controls, and additional Defense in Depth mitigation measures include the Safety Management and Emergency Preparedness Programs.

*Mitigation Risk*: Facility Worker – Low; CP – Low; Public – ND

*Seismic Event or Aircraft Crash*: Evaluation of these two events was not performed for the Pre-Demolition and Demolition phases. The risk will be continually decreasing due to Deactivation and Pre-Demolition phase activities, but it is difficult to predict a final facility- level inventory for Pre-Demolition and Demolition phase analyses. Since Natural Phenomenon risk is not controlled, the analyses for the Deactivation phase is presented as a bounding analysis for all phases.[9] Facility Worker and Co-located person dose 890 rems and Public dose 7.3 rems.

*Unmitigated Risk*: Facility Worker – Very High; CP – Very High; Public – Medium

The major receptors at risk are the S&M facility worker and co-located person in close proximity to the facility. The event is NRH and the material at risk is all the MAR in the facilities. No safety-class or safety-significant SSCs and no technical safety requirements reduce potential consequences to these receptors were identified.

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[8] CH2M Hill Plateau Remediation Company, *Data Quality Objectives for the Radiological Characterization of the Plutonium Finishing Plant,* CHPRC-02376, Revision 0, January 8, 2015.

[9] CH2MHill, Plutonium Finishing Plant Deactivation and Decommissioning Documented Safety Analysis, HNF-15500, Revision 13, March 22, 2016 (OUO Document).

Defense in Depth mitigation measures include the Safety Management Programs.

*Mitigation Risk*: Facility Worker – Low; CP – Low; Public – ND

***Risks and Potential Impacts from Selected or Potential Cleanup Approaches: 231-Z Building***

No information is available with regard to proposed cleanup strategies that may be used with the Isolation Building/Plutonium Metallurgy Facility.

## Groundwater, Vadose Zone, and Columbia River

***Current***

The CP-DD-5 EU sits just north of the boundary between the 200-UP and 200-ZP groundwater interest areas (GWIAs) (i.e., in the 200-ZP GWIA) that are described in the CP-GW-2 EU (Appendix D.6). The saturated zone beneath the vicinity of the CP-DD-5 (PFP) area has elevated levels of carbon tetrachloride ($CCl_4$) and nitrate based on 2014 groundwater results (http://phoenix.pnnl.gov/apps/gw/phoenix.html); sites within the CP-DD-5 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0). The current threats to groundwater and the Columbia River from contaminants already in the groundwater are evaluated as part of the CP-GW-2 EU (Appendix D.6). However, current threats to groundwater corresponding to only the CP-DD-5 EU contaminants *remaining* in the vadose zone (Table F.10-6) has an overall rating of *High* (based on carbon tetrachloride) as described in **Part V**. Contaminated groundwater is treated in the 200-ZP GWIA using the 200 West Pump and Treat (P&T) system[10] (DOE/RL-2016-09, Rev. 0). As indicated in **Part V**, no plumes have been linked to CP-DD-5 waste sites. Threats from contaminated groundwater in the area to contaminate additional groundwater or the Columbia River are evaluated as part of the CP-GW-2 EU (Appendix D.6).

For the 200-ZP GWIA (in 200 West), no plume currently emanating from the CP-DD-5 waste sites intersects the Columbia River at concentrations exceeding the corresponding water quality standard (WQS) as described in **Part V**. Thus current impacts to the Columbia River benthic and riparian ecology would be rated as *Not Discernible* (*ND*). Furthermore, the large dilution effect of the Columbia River on contamination from the seeps and groundwater upwellings also results in *ND* ratings. Thus the overall rating for the Columbia River during the Current period is *ND*.

***Risks and Potential Impacts from Selected or Potential Cleanup Approaches***

As described in **Part VI**, the remedial actions for the CP-DD-5 EU waste sites do not directly address the vadose zone legacy sites, including cribs, trench, and reverse well, and additional actions similar to those proposed for other contaminated vadose zone sites in the vicinity (e.g., as evaluated in the Focused Feasibility Study for the 200-UW-1 Operable Unit; DOE/RL-2003-23, Rev. 0) may be needed to return vadose zone concentrations to acceptable values. Because no final cleanup decisions have been made *for these legacy sites*, there is no way to definitively determine the risks and potential impacts to protected resources (groundwater and Columbia River). However, final cleanup decisions will be made to be protective of human health and the environment and thus some vadose contamination may be removed to satisfy remedial goals and a cover may be installed (at least in places) to limit infiltrating water that tends to be the primary motive force to mobilize contamination in the vadose zone. Thus even though there are risks to workers associated with the cleanup of the CP-DD-5 waste sites (described above and in **Part VI**), there is unlikely any discernible impact from likely cleanup actions on

[10] Soil vapor extraction was used between 1992 and 2012 to remove carbon tetrachloride vapors migrating through the vadose zone into 200-ZP groundwater (Section 12.10.2, DOE/RL-2016-09, Rev. 0).

groundwater or the Columbia River (and thus no changes were made to current ratings to account for uncertainties).

Contaminants from the CP-DD-5 EU waste sites are currently impacting the vadose zone and may threaten groundwater in the future; treatment using the treatment processes mentioned in the previous section is not predicted to decrease all concentrations to below thresholds before the Active Cleanup phase commences although there should be significant decreases in contaminant levels. Secondary sources in the vadose threaten to impact groundwater in the future, including the Active Cleanup period. The *High* rating associated with the CP-DD-5 EU waste sites (Table F.10-6) is associated with carbon tetrachloride ($CCl_4$) that could potentially impact the 200-ZP GWIA (Appendix G.6). As described in the TC&WM EIS and summarized in **Part V**, even though there appears to be insufficient impact to the overall rating from radioactive decay (since carbon tetrachloride is the risk driver) and recharge rate (due to large amounts of contaminants already in the groundwater), the treatment of the carbon tetrachloride (and other contaminants) in the 200-ZP GWIA (using the 200 West P&T system) would be effective for groundwater contamination but would not impact the threat or rating related to vadose zone contamination. There would not be a sufficient impact on peak concentrations in near-shore region of the Columbia River during or after cleanup to modify ratings (which are already *ND*). Thus the vadose zone ratings for current threats provided in Table F.10-6 would not be modified except for Sr-90 and total uranium (to address uncertainty) as described in **Part V**. The ratings for the remaining Group A and B primary contaminants (many of which are also being treated in the 200 West P&T Facility) remain unchanged (*Low*) as in Table F.10-6 to address uncertainties. The overall rating remains *High* after the Active Cleanup period.

## Ecological Resources

***Current***

This area is completely disturbed with buildings, parking areas, and cleared graveled areas. Migratory birds could nest on buildings. Work would be done when birds are not nesting, or other mitigation activities would be implemented.

***Risks and Potential Impacts from Selected or Potential Cleanup Approaches***

Removal of facility would include significant truck traffic/roadway disturbance to level 3 and above resources in buffer area (7%). Removal of facility will decrease potential nesting sites, roost sites, and raptor hunting perches. Also, remediation activities may disrupt possible occurrence of Piper's daisy recorded in current evaluations.

## Cultural Resources

***Current***

Area is heavily disturbed and the EU has not been inventoried for archaeological resources. Geomorphology indicates a moderate potential to contain intact archaeological resources on the surface and/or subsurface. Traditional cultural places are visible from EU. A National Register eligible historic/ethnohistoric trail/road is located within 500 meters of the EU.

National Register eligible Manhattan Project/Cold War Era buildings have been mitigated.

***Risks and Potential Impacts from Selected or Potential Cleanup Approaches***

Archaeological investigations and monitoring may need to occur prior to remediation. Based on geomorphological indicators, there is a moderate potential for intact archaeological resources.

Remediation disturbance may result in impacts to archaeological resources if they are present in the subsurface. Permanent indirect effects to viewshed are possible from demolition and remediation.

Manhattan Project/Cold War Era buildings will be demolished.

### Considerations for Timing of the Cleanup Actions

Because of the existence of a number of initiating events which might impact PFP and that represent Very High and High human health risks, the completion of it cleanup and demolition to slab on grade should be a high priority.

The saturated zone beneath the CP-DD-5 (PFP) area has elevated levels of carbon tetrachloride ($CCl_4$) and nitrate based on 2014 groundwater results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). Sites within the CP-DD-5 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0) and are likely currently contributing contamination to the vadose zone. Monitoring and treatment of groundwater is being conducted within the 200-ZP GWIA (via the 200 West Pump and Treat facility), which is described as part of the CP-GW-2 EU (Appendix D.6). Treatment efforts indicate a general downward trend in contaminant concentrations; however, some plume areas have increased (e.g., carbon tetrachloride, chromium, and TCE in 200-ZP) and concentrations continue to exceed cleanup levels. Thus additional cleanup actions or continuation of existing actions are likely warranted, including possible source retrieval or control for this EU.

There is potential for additional contaminant release and migration through the vadose that may eventually impact groundwater as cleanup activities are delayed. There is also potential risk from direct radiation to workers (and ecological receptors) from routine maintenance operations. However, there would be no *additional* risk to facility workers, co-located persons, or the public if cleanup is delayed

### Near-Term, Post-Cleanup Risks and Potential Impacts

When the PFP Complex D&D activities are completed, the above grade structures will have been removed leaving the structure slabs, below grade portions of the original structures, pipelines, tanks, and potentially contaminated soil in the areas below or around the original structures. The demolition of the PFP facilities to slab-on-grade is considered to be suitable for long term, low cost surveillance and maintenance pending final disposition.

**Groundwater:** During the Near-term, Post-Cleanup period (described in **Parts V** and **VI** and Table F.10-7), the ratings for the Group A and B primary contaminants are *High* (carbon tetrachloride) and *Low* (others) to address uncertainties.

**Columbia River:** As indicated in **Part V**, no radionuclides or chemicals from the 200 West Area (that includes the CP-DD-5 EU waste sites) are predicted to have concentrations exceeding screening values in this evaluation period. Thus the rating will not be modified and all ratings are *Not Discernible* (*ND*) as is the overall rating (Table F.10-7).

# PART II. ADMINISTRATIVE INFORMATION

## OU AND/OR TSDF DESIGNATION(S)

200-WA-1

### COMMON NAME(S) FOR EU

PFP, Plutonium Finishing Plant

### KEY WORDS

Plutonium, Hockey pucks, Buttons

### REGULATORY STATUS:

#### Regulatory basis

CERCLA, Non-time critical Action Memorandum (DOE/RL-2005-13)

#### Applicable regulatory documentation

DOE/RL-2011-59, Revision 0, *Surveillance and Maintenance Plan for the Plutonium Finishing Plant Complex,* June 2016

DOE/RL-2011-03, Revision 1, *Removal Action Work Plan for the Deactivation, Decontamination, Decommissioning, and Demolition of the Plutonium Finishing Plant Complex*, March 2016

#### Applicable Consent Decree or TPA milestones

TPA Milestone M-083-00A *PFP Facility Transition and Selected Disposition Activities* was amended May 18, 2016 to have a due date of September 30, 2017.[11]

### RISK REVIEW EVALUATION INFORMATION

#### Completed

August 19, 2016, updated February 20, 2017

#### Evaluated by

Henry Mayer, Amoret Bunn, Jennifer Salisbury and Kevin Brown

#### Ratings/Impacts Reviewed by

David Kosson and James Clarke

## PART III. SUMMARY DESCRIPTION

### CURRENT LAND USE

Industrial

### DESIGNATED FUTURE LAND USE

Pursuant to the 1999 Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS), the Central Plateau (200 Areas) geographic area is designated as Industrial-

[11] *Federal Facility Agreement and Consent Order Change Control Form, M-83-16-01*, May 18, 2016

Exclusive (an area suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, nonradioactive wastes, and related activities).

## PRIMARY EU SOURCE COMPONENTS

### Legacy Source Sites

The CP-DD-5 legacy waste sites with reported inventories consist of *liquid waste disposal* sites associated with PFP operations, including four cribs, one trench, one reverse well, and two unplanned releases (UPRs). The other sites with reported inventories, include buildings, and exhaust stack, and settling tank that are considered adequately isolated from the environment (and thus are not included in the vadose zone inventory).

### High-Level Waste Tanks and Ancillary Equipment

Not applicable

### Groundwater Plumes

The saturated zone beneath the CP-DD-5 (PFP) area has elevated levels of carbon tetrachloride ($CCl_4$) and nitrate based on 2014 groundwater results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). There are no CP-DD-5 sources linked to the groundwater plumes (DOE/RL-2016-09, Rev. 0). The 200 West Area plumes are described in detail in the CP-GW-2 EU (Appendix D.6). Waste sites within the CP-DD-5 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0) but have not been linked as sources for plumes in the 200 West area (DOE/RL-2016-09, Rev. 0). Monitoring and treatment of groundwater is being conducted within the 200-ZP GWIA (in the 200 West P&T facility), which are described as part of the CP-GW-2 EU (Appendix D.6).

### Operating Facilities

Not applicable

### D&D of Inactive Facilities

The Plutonium Finishing Plant (PFP) became highly contaminated while recovering plutonium from scrap materials and producing plutonium metal and oxide powder and machined plutonium metal components for nuclear weapons for 40 years (1949 to 1989). When processing ended, approximately 20 tons of plutonium-bearing material remained and needed to be removed as transuranic or low-level waste. Stabilization and packaging of the material was completed in 2004. Bulk special nuclear material shipments to the Savannah River Site were completed in 2010. PFP is categorized as a Hazard Category 2 nuclear facility.

Because the facilities within the PFP Complex supported the final production process associated with the manufacture of plutonium as part of the nation's defense program, radiological contamination is expected to be primarily plutonium and americium. There is also a potential for beryllium contamination in E4 ductwork, filter boxes, drain lines, and E3 and E4 filter rooms. PFP is categorized as a Hazard Category 2 nuclear facility.

The operational history of the complex indicates that former waste management practices, failures of equipment, accidents, and spills resulted in the release of radionuclides in the facilities and surrounding soils. Based on the potential threat posed to human health and the environment by the residual plutonium in the buildings and external piping, the DOE determined that it is appropriate to remove

facilities and structures to slab-on grade, and stabilize the sub-grade structures and sites within the complex.[12]

The 231-Z Isolation Building/Plutonium Metallurgy Facility, which is located about 600ft north of the Plutonium Finishing Plant (PFP) 234-5 building and outside of the fence line, was constructed in 1944. It was originally designated the 231-Z Isolation Building, housing the final step of the plutonium extraction process that began at T Plant on the Hanford Site. Its original purpose was the purification and drying of the plutonium nitrate solution produced at the 224-T Bulk Reduction Building. It operated in this capacity from 1945 until 1957, when the function of the building shifted to plutonium metallurgy. Plutonium metallurgical research, fabrication development, and metallurgy work for weapons development was carried out until 1975. A major cleanout of gloveboxes and other plutonium-contaminated equipment was undertaken in the period from 1978 to 1982. Small quantities of Pu-239 and Am-241 remain as holdup within the building and equipment, and it is categorized as a Hazard Category 3 nuclear facility.

This EU also contains ten waste sites consisting of French drains, cribs and trenches, and an underground storage tank (MUST). Quantities of Am-241 and Pu-239-240 are located in the 216-Z-3 Crib which received PFP and laboratory process liquid waste from 1952-1959 and the 241-Z-361 settling tank for liquid waste from the 234-5Z, 242-Z and 236-Z buildings.

## LOCATION AND LAYOUT MAPS

The Plutonium Finishing Plant Complex is located is located in the West portion of the 200 Area near the North End of the Hanford Site. The nearest point to PFP not subject to DOE access control is Washington State Highway 240, which is approximately 2.5 miles south of the facility. PFP is located outside of the probable maximum flood-affected zone of the Columbia River.

[12] CH2M Hill Plateau Remediation Company, *Data Quality Objectives for the Radiological Characterization of the Plutonium Finishing Plant,* CHPRC-02376, Revision 0, January 8, 2015.

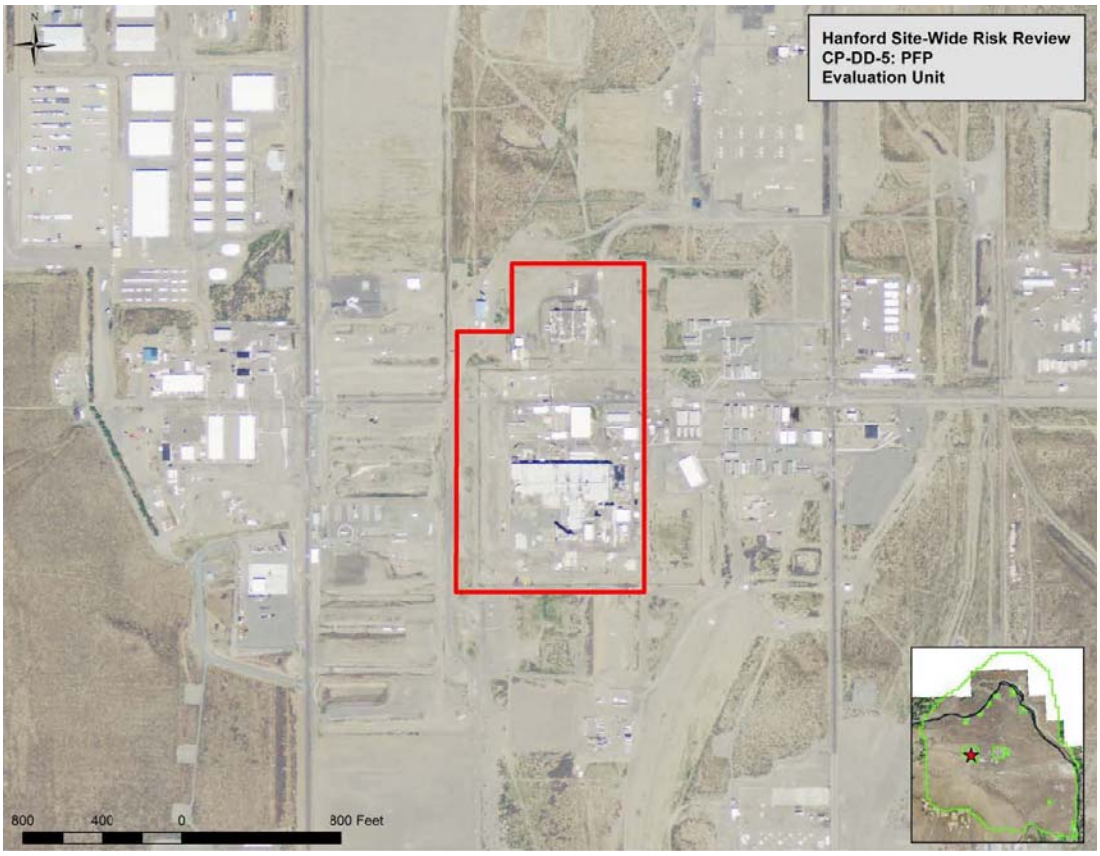


**Figure F.10-1. Plutonium Finishing Plant EU Location**

**Figure F.10-2. PFP Aerial Photo, December 2014**

# PART IV. UNIT DESCRIPTION AND HISTORY

## EU FORMER/CURRENT USE(S)

### LEGACY SOURCE SITES

The CP-DD-5 legacy waste sites with reported inventories consist of *liquid waste disposal* sites associated with PFP operations, including four cribs, one trench, one reverse well, and two unplanned releases (UPRs).

### GROUNDWATER PLUMES

The saturated zone beneath the CP-DD-5 area (PFP) has elevated levels of carbon tetrachloride ($CCl_4$) and nitrate based on 2014 groundwater results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). Plumes in the area are described as part of the 200-ZP GWIA described in CP-GW-2 EU (Appendix D.6). Sites within the CP-DD-5 EU, including 216-Z-5 Crib and 216-Z-10 Reverse Well are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0); however, CP-DD-5 waste sites have not been linked to Central Plateau plumes (DOE/RL-2016-09, Rev. 0). Monitoring and treatment of groundwater is being conducted within the 200-ZP GWIA (using the 200 West P&T facility).

## D&D OF INACTIVE FACILITIES

This Evaluation Unit consists of the Plutonium Finishing Plant (PFP), ancillary buildings, structures, and associated near-surface contaminated soils. From 1949 into early 1989 the PFP complex was used to process plutonium nitrate solution into hockey puck-sized plutonium metal "buttons" or oxide powder for shipment to the nation's weapons production facilities or for the fabrication of mixed-oxide reactor fuel. PFP also produced machined plutonium metal parts up until the late 1960's. The plutonium fabrication lines were previously removed in the 1975- 1976 timeframe.

In 1991, PFP's mission changed to stabilize and store reactive plutonium-bearing materials, complete terminal cleanout, and provide long-term vault storage. In 1996, DOE issued a formal shutdown order for the PFP.

Before the PFP facilities could be permanently decontaminated and demolished (ending the plutonium processing capability), the inventory of special nuclear material (SNM) at PFP needed to be converted to configurations suitable for shipment and/or storage. However, many of the defense nuclear material production lines at the Hanford Site had been shut down rapidly, leaving a sizeable inventory of chemically reactive plutonium-bearing material that could only be handled appropriately within the special glovebox confinement available at the dedicated plutonium facility within the PFP complex. These materials included nitric acid solutions, polycubes (plutonium imbedded in degrading plastic cubes), oxygen-reactive metal oxide with unknown moisture content, and residual material from the metal casting process.

The stabilization and packaging campaign was completed in February of 2004. The plutonium materials were packaged in compliant DOE-STD-3013-2004 ("3013") containers. Richland Operations received authorization in September 2007 to ship the loaded "3013" containers from PFP to the Savannah River Site for long-term storage and disposition. In addition to plutonium-bearing material packaged in "3013" containers, un-irradiated and slightly irradiated reactor fuel also was stored within the PFP Protected Area. Shipment offsite of all of the plutonium-bearing and special nuclear materials that had been stabilized, packaged, and stored at PFP to other DOE facilities was completed in 2010. The PFP Protected

Area was shut down and was classified as a Property Protected Area. The 2736-Z Complex facilities that supported the stabilization and storage mission were deactivated and decommissioned, and all 2736-Z Complex above-ground structures were demolished in 2012.

The PFP complex is in the process of being cleaned out and demolished to ”slab-on-grade” prior to transitioning the footprint to RL-0040 for surveillance and maintenance (S&M) and final waste site remediation. Many of the initial large nuclear source term and material at risk reducing activities have been completed. The completed activities were associated with the prior plutonium vault storage of plutonium metal and oxides and other SNM, storing slightly irradiated and un-irradiated nuclear reactor fuels, the packaging and handling of plutonium bearing materials, and shipping the materials and fuels to other DOE-owned facilities. The remaining PFP D&D phases of the mission includes decontamination of equipment and facilities, removal of remaining process equipment, waste packaging, deactivation of facility systems, and demolition of the facilities, primarily centered on Buildings 234-5Z, 236-Z, 242-Z, and 291-Z, and their supporting structures.

The Removal Action Work Plan (DOE/RL-2011-03, Rev. 0) governing these activities was amended through TPA Change Notice TPA-CN-681 in November 2015 to include removal of the 236-Z and 242-Z slabs, along with the soil necessary to complete slab removal (approximately one meter below the slab) to reduce the overall radiological inventory of the PFP complex. However, this expansion of D4 work at the site is to be carried out as part of the S&M Phase, versus revising the current program of demolishing all of the buildings to slab on grade. The results of pre-slab removal characterization may indicate that the level of contamination in or below either slab would require controls more rigorous than the open-air demolition controls utilized for slab-on-grade demolition activities. In that event, DOE in consultation with the lead regulatory agency may choose to leave the slab(s) in place for future remediation. Following completion of slab removal, the excavations will be backfilled and activities would be conducted as needed to stabilize the surface in the PFP complex area to minimize contaminant migration in the environment until final disposition of the PFP complex area. This could include placement of a cover of compacted fill, gravel, asphalt or other appropriate material with sloping as needed to control run-on/run-off and erosion

**234-5Z Plutonium Fabrication Facility (PFF):** Building 234-5Z is the principal structure of PFP and contained plutonium processing facilities and laboratories primarily to purify plutonium nitrate solutions, reduce the nitrate to plutonium metal, and fabricate plutonium metal parts. Building 234-5Z is approximately 180 ft wide by 500 ft long and extends from 9.5 ft below grade to 46.8 ft 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 sheet steel. The first and second floors are concrete slabs, while the duct level is constructed of sheet-metal roof decking. The roof is insulated metal decking. Interior walls are reinforced concrete, metal studs, metal lath, and plaster or drywall construction.

The 234-5Z Building first floor slab and the basement will remain onsite after completion of the current D4 program. The first floor slab and basement consist of poured concrete. The basement primarily consists of pipe tunnels containing drain piping. Pipe trenches beneath the main floor slab (Figure 3) connect to the pipe tunnels. Access to the below grade areas via stairwells will have been sealed, and all portions of the below grade area will be stabilized using fill or other means necessary to support the demolition activities and preclude future collapse.

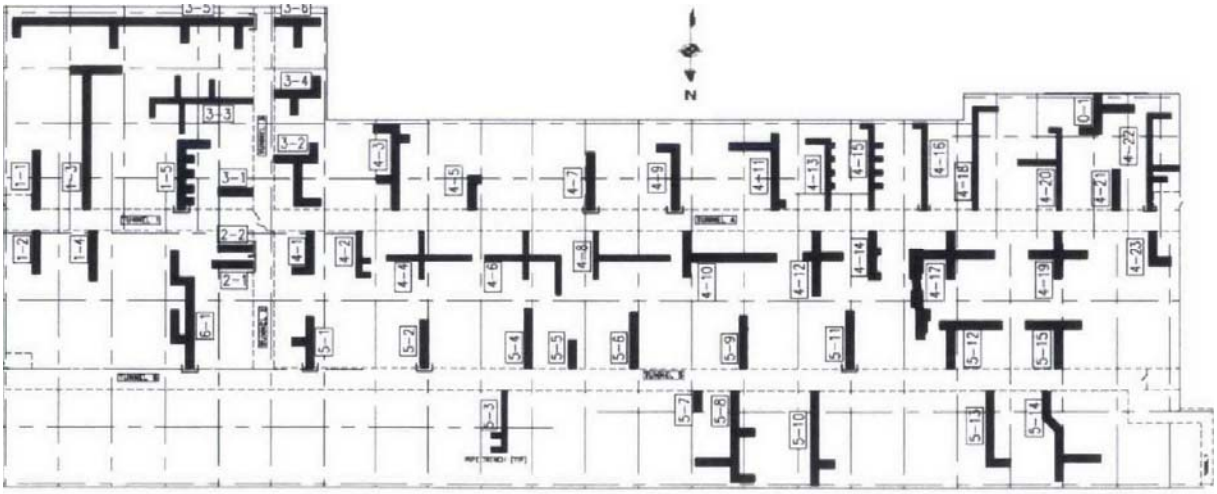

**Figure F.10-3. Building 234-5Z Below Grade Trenches[13]**

**236-Z Plutonium Reclamation Facility (PRF):** PRF was used to recover plutonium by material dissolution, purification, and stabilization processes. PRF houses the majority of the plutonium recovery process equipment used to convert various plutonium-bearing materials and aqueous feeds to a purified plutonium nitrate product suitable for conversion to plutonium oxide or metal. PRF is south of the southeastern corner of Building 234-5Z and is connected to it by the 242-Z Facility. The PRF is approximately 79 ft wide by 71 ft long. PRF has four stories plus a two-story column penthouse. The penthouse encloses the upper portion of the column glovebox. Except for the roof and the south end of the canyon, the building is constructed of reinforced concrete. The main roof is made of open-web steel-joist framing, steel decking, rigid insulation, and graveled built–up roofing. A portion of the south wall is also the 1-ft.-thick wall of the canyon and includes an opening in the reinforced concrete wall, filled by one set of large, steel double doors surrounded by a concrete block wall.

PRF's principal feature is a single process equipment cell (canyon) 10 meters wide by 16 meters long. The process cell contains a number of geometrically safe stainless steel 'pencil' vessels which were used to perform the main plutonium recovery processes. The process cell extends over the first, second and third floors of the facility and provisions are made for maintenance, reconfiguration and change-out of the process vessels by a remotely controlled in-cell 5 Ton crane. An airlock is provided at the south end of the cell for equipment introduction/removal. Disconnection of the vessels is made manually via flanged/screwed connections within four long glovebox suites located external to the process cell on the east and west walls on the first and second floors.

The fourth floor contains a chemical preparation room, miscellaneous treatment glovebox room, operations control room, slag and crucible dissolver loading glovebox room, and a room containing a glovebox housing the two 15 meter high pulse columns which extend vertically through the fourth floor roof into gloveboxes in the fifth and sixth floor penthouse building section.

The PRF ground level slab and below grade exhaust tunnel and pipe tunnel will remain on site. The facility was located near the southeastern comer of the 234-5Z Building and connected to it by the 242-Z

[13] US Department of Energy, Richland Operations Office, *Surveillance and Maintenance Plan for the Plutonium Finishing Plant Complex*, DOE/RL-2011-59, Draft B, November 2011.

Building. Below grade tunnels will be stabilized using fill or other means necessary to support the demolition activities and preclude future collapse. The highly contaminated PRF canyon floor will have been decontaminated and/or removed.

**242-Z Waste Treatment Facility:** Building 242-Z was built to extract americium and some of the plutonium from the waste stream that exited PRF (236-Z). This building is approximately 40 ft wide, 26 ft long, and 23 ft high. The building consists of two rooms and an airlock of shorter height at the west end. The building is located between the southeast corner of Building 234-5Z and the north wall of the PRF. A corridor runs along its eastern edge, connecting Buildings 234-5Z and 236-Z. The south wall of Building 242-Z (common with 236-Z) is constructed of reinforced concrete. The remainder of the building has a structural steel frame covered inside with metal lath and plaster, and outside with insulating-material wall panels. The slightly peaked roof is constructed of metal decking covered by insulation and built-up asphalt and gravel.

The building has not been used since an accident in 1976 that released contaminated material from a glovebox in the operations room. Subsequent to the accident, nonessential services were disconnected and contaminated surfaces were treated with a strippable coating. Entry to the building is non-routine and strictly controlled.

The 242-Z Building ground level slab and pipe tunnel will remain on site. The 242-Z Building connected the southeastern comer of the 234-5Z Building to the 236-Z Building. The below grade pipe tunnel will be stabilized using fill or other means necessary to support the demolition activities and preclude future collapse.

**291-Z Exhaust Stack:** Building 291-Z, also known as the exhaust fan and compressor house, is a reinforced-concrete structure approximately 53 ft south of the central part of Building 234-5Z. Of irregular shape, its approximate dimensions are 74 ft wide by 143 ft long. Its overall height is approximately 23 ft., with only 4 ft above grade. This building houses the exhaust fans, mechanical service equipment, and an electrical substation. Building 291-Z and its stack provide ventilation exhaust for Building 234-5Z, 242-Z, and 236-Z. The 200-ft high, reinforced concrete stack is attached to ventilation ducting coming from Building 291-Z. Its center is 63 ft from the near end of Building 291-Z and 230 ft from the south wall of Building 234-5Z. The stack's inside diameter is approximately 15 ft. The stack and Building 291-Z are separated by an expansion joint. The stack foundation is a massive concrete footing block that is approximately octagonal in shape and is 32 ft across its flat sides. The foundation block is approximately 27 ft thick and its top is about 3 ft above the finished grade. A 90° elbow opening in the footing connects the bottom of the stack to the main exhaust duct of Building 291-Z.

**241-Z Liquid Waste Treatment Facility**: The241 -Z Liquid Waste Treatment Facility started operations in 1949 to provide the PFP with the capability to treat, store, and dispose of radioactive mixed waste. This facility was permitted under RCRA and has been clean closed. The site is a buried, reinforced concrete structure with a sheet metal decking over the top. The buried structure consists of five separate cells, each containing a 4,300 gal tank (TK-D4, TK-D5, TK-D7, and TK-D8) which were cleaned and stabilized as part of the facility deactivation. The 241-Z Building is approximately 20 ft wide, 92 ft long, and 22 ft deep, and is located approximately 330 ft south of the 234-5Z Building. The upper portion of the structure has been removed and below grade space has been cleaned out and stabilized. The 241 -Z grade level slab, sheet metal decking, below grade cells and tanks will remain on site.

**Below Grade Structures**: Several below grade structures with large void spaces will remain after completion of demolition to slab on grade of the PFP facilities:

- 234-5Z Tunnels

- 241 -Z Vaults
- 291 -Z Exhaust Air Filter Stack Building (roof is considered at grade)

Provision for access to these facilities is not planned.

**231-Z Isolation Building/Plutonium Metallurgy Facility**: The 231-Z building was constructed in 1944 and was originally designated the 231-Z Isolation Building, housing the final step of the plutonium extraction process that began at T Plant on the Hanford Site. Its original purpose was the purification and drying of the plutonium nitrate solution produced at the 224-T Bulk Reduction Building. It operated in this capacity from 1945 unti11957, when the function of the building shifted to plutonium metallurgy. Plutonium metallurgical research, fabrication development, and metallurgy work for weapons development was carried out until 1975. At that time weapons design work was phased out. During the years of 1978 to 1982, a cleanup effo1t of gloveboxes and equipment was undertaken. In 1982, a soils and sedimentation characterization laboratory was established in the building. Experiments in the characterization of contaminated crib soils were conducted during the 1980s.

There are currently no operating processes at the 231-Z building. Active facility systems are limited to the fire suppression system and general utilities. During the current facility life cycle stage, planned facility activities will consist primarily of S&M and storage of incidental CP supplies and materials related to S&M activities, but will also include limited deactivation activities that are necessary to address identified corrective actions.

## ECOLOGICAL RESOURCES SETTING

### Landscape Evaluation and Resource Classification

Over 99% of the PFP EU is classified as level 0 habitat, with less than 1/10$^{th}$ acre each of level 1 and level 2 habitat where the EU boundary intersects adjacent vegetated areas (Appendix J).

The amount and proximity of biological resources surrounding the PFP EU were examined within the adjacent landscape buffer area, which extends 1904 ft (580 m) from the geometric center of the EU. Nearly 62% of the adjacent landscape buffer area is characterized as resource level 0 (Appendix J) and nearly 93% is level 2 or lower. To the north and south of the EU are isolated patches of levels 1, 2 and 3 resources that are not contiguous with areas outside the 200-West Area. Circular patches of level 3 resources are based on locations of state sensitive Piper's daisy (*Erigeron piperianus*) observed in previous years. None were noted during the May 2015 survey.

### Field Survey

On May 28, 2015, a visual survey was conducted of the PFP EU; observations were made from the perimeter of the fenced area. Demolition and clean-up activities prevented access to the area within the EU. Over 99% of the EU is bare ground; less than 1% of the EU contains Russian thistle (*Salsola tragus*) and/or cheatgrass (*Bromus tectorum*) on the north edge and a sliver of the level 2 habitat on the south edge (Appendix J). One bird was observed during the June survey (see the field data record for this EU in Appendix J).

## CULTURAL RESOURCES SETTING

The CP-DD-5, PFP EU has not been inventoried for archaeological resources, and it is unknown if an NHPA Section 106 review has been completed specifically for the remediation of the CP-DD-5, PFP EU, as one was not located for this area. The EU is located within the 200-West Area of the Hanford Site, an

area known to have low potential to contain Native American Precontact and Ethnographic archaeological resources and Pre-Hanford Early Settlers/Farming resources.

Cultural resource documented within the CP-DD-5, PFP EU include: Segments of the National Register-eligible Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required; ten National Register-eligible buildings that are contributing properties within the Manhattan Project and Cold War Era Historic District, with documentation required, and one National Register-eligible building that is a contributing property within the Manhattan Project and Cold War Era Historic District, with no documentation required. In accordance with the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56) (DOE-RL 1998), all documentation requirements have been completed for these properties.

# PART V. WASTE AND CONTAMINATION INVENTORY

## CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

### Legacy Source Sites

The CP-DD-5 legacy waste sites with reported inventories consist of *liquid waste disposal* sites associated with PFP operations, including four cribs, one trench, one reverse well, and two unplanned releases (UPRs).

### Vadose Zone Contamination

The CP-DD-5 EU waste sites include legacy sites (four cribs, one trench, one reverse well, and two UPRs) that represent soil and other vadose zone contamination where the reported inventory information is provided in Table F.10-3 through Table F.10-5 for all sites. Because the buildings, exhaust stack, and settling tank are considered sufficiently isolated from the vadose zone, these inventories are considered not part of the vadose zone inventory for the purpose of this Review.

The inventories provided in Table F.10-3 through Table F.10-5 (minus those for the buildings, exhaust stack, and settling tank) represent the reported contamination originally discharged (without decay correction[14]) to the vadose zone from the CP-DD-5 EU waste sites. These values are used to estimate the inventory remaining in the vadose zone using the process described in the Methodology Report (CRESP 2015) for the 2013 groundwater plume information as revised for the 2015 Groundwater Monitoring Data (DOE/RL-2016-09, Rev. 0) described in Appendix D.1. The focus in this section will be on the Group A and B contaminants (CRESP 2015) in the vadose zone due to their mobility and persistence and potential threats to groundwater (a protected resource). To summarize (DOE/RL-2016-09, Rev. 0)[15]:

[14] As described in the Methodology Report (CRESP 2015) values are typically not decay corrected because of the large uncertainties in many of the values used in the CRESP evaluations and the rough-order-of-magnitude evaluations presented in the Review. One exception, for example, is when evaluating long-term impacts to groundwater for Group A and B radionuclides (e.g., Sr-90) with half-lives that are relatively short relative to the evaluation period (CRESP 2015).

[15] The plume information is primarily taken from PHOENIX (http://phoenix.pnnl.gov/apps/gw/phoenix.html) that show the 2014 groundwater plumes. These plumes were assumed representative of 2015 groundwater plumes.

- *Chromium* – There are reported inventories for chromium in the CP-DD-5 waste sites (Table F.10-5) but no plumes in the vicinity and none have been associated with the CP-DD-5 waste sites. The reported inventory is dominated by the 216-Z-13, 216-Z-14, and 216-Z-15 Cribs.
- *Carbon tetrachloride ($CCl_4$)* – There are reported vadose zone inventories (Table F.10-5) and a large plume in the area that has not been linked to CP-DD-5 waste sites (where primary sources were discharges of liquid waste from the PFP plutonium separation processes to the 216-Z-1A, 216-Z-9, and 216-Z-18 Cribs and Trenches that are not part of CP-DD-5. The reported CP-DD-5 inventory is dominated by the 216-Z-13 and 216-Z-14 Cribs.
- *I-129* – There are no reported inventories (Table F.10-3).
- *Tc-99* – There are very small reported inventories (Table F.10-4) primarily distributed across the cribs.
- *Uranium* – There are very small reported vadose zone inventories (Table F.10-4 and Table F.10-5) distributed across the vadose zone sites (i.e., cribs, trench, and reverse well). The Sr-90 originally discharged into the sites other than the reverse well would have had to travel through much of the vadose zone to impact groundwater. (The 216-Z-10 Reverse well was operated in 1945 and the small amount discharged is considered dispersed through the saturated zone.) Using an analysis similar to that in Section 2.5 (Appendix E.2) for uranium in the T Tank and Waste Farms EU (200 West)[16], a uranium plume is not expected in the next 150 years due to retardation in the vadose zone. Thus total uranium is not considered significant threats to the Hanford groundwater during the first 150 years.
- *Sr-90 and other Group A&B Primary Contaminants (PCs)* – There are no current plumes for Sr-90 or other Group A&B PCs not mentioned above (i.e., C-14, Cl-36, or CN) in the vicinity of CP-DD-5; however, there are reported vadose zone inventories for Sr-90 (Table F.10-4) and but none for C-14 or Cl-36 (Table F.10-3) or CN or TCE (Table F.10-5). The reported Sr-90 vadose zone inventory is dominated by the 216-Z-5 Crib and 216-Z-10 Reverse well. The Sr-90 originally discharged into the sites other than the reverse well would have had to travel through much of the vadose zone to impact groundwater. (The 216-Z-10 Reverse well was operated in 1945 and thus the 4.8 Ci initially discharged would be less than 1 Ci in 2017 and considered dispersed through the saturated zone.) Using an analysis similar to that in Section 2.5 (Appendix E.2) for Sr-90 in the T Tank and Waste Farms EU (200 West)[16], a Sr-90 plume is not expected in the next 150 years due to retardation in the vadose zone or afterwards due to radioactive decay (+99.9% reduction in Sr-90 inventory). Thus Sr-90 (and the remaining Group A and B PCs for the reasons mentioned above) are not considered significant threats to the Hanford groundwater during the first 150 years.

Using the process outlined in Chapter 6 of the Methodology Report (CRESP 2015a) for the 2013 groundwater results as revised for the 2015 Groundwater Monitoring Data (DOE/RL-2016-09, Rev. 0) described in Appendix D.1, the remaining vadose zone inventories in Table F.10-6 are estimated by difference and used to calculate Groundwater Threat Metric (GTM) values for the Group A and B contaminants remaining in the vadose zone as illustrated in Table F.10-6. Note that the vadose zone (VZ) ratings are *High* for carbon tetrachloride ($CCl_4$) and *Low* for the other Group A and B PCs with reported

[16] The analysis in Section 2.5 of Appendix E.2 for the T Tank and Waste Farms EU is referenced instead of the more proximate TX-TY Tank Waste and Farms EU because the T Tank and Waste Farms analysis is more detailed and is essentially repeated for the TX-TY Sr-90 evaluation.

inventories with the exceptions of Sr-90 and total uranium. Because there is no current Sr-90 or total uranium plume nor one expected for the next 150 years as described above, the current rating for Sr-90 and total uranium is *Not Discernible* (*ND*). The overall current rating is defined as the highest over all the ratings and thus *High*.

## Groundwater Plumes

Sites within the CP-DD-5 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0); however, no CP-DD-5 waste sites have been linked to current plumes (DOE/RL-2016-09, Rev. 0). Monitoring and treatment of groundwater is being conducted within the 200-ZP GWIA using the 200 West P&T facility; these actions are described as part of the CP-GW-2 EU (Appendix D.6). As shown in Table F.10-6, no saturated zone inventories have been related to the CP-DD-5 EU; the process for deriving these inventories is described in CRESP Methodology Report (CRESP 2015a) originally for the 2013 groundwater plume information as revised for the 2015 Groundwater Monitoring Data (DOE/RL-2016-09, Rev. 0) described in Appendix D.1.

In general the 2015 groundwater plumes are evaluated in separate EUs (see Appendix D.1 through Appendix D.6); furthermore, as described in previous sections, no portions of the 200-ZP GWIA plumes are associated with the CP-DD-5 EU waste sites (DOE/RL-2016-09, Rev. 0). Note that carbon tetrachloride is the primary risk driver (*High* rating) for the 200-ZP GWIA; however, there are no PFP EU sources associated with these plumes, and the remaining vadose zone sources from other EUs would drive future risks to groundwater.

***Impact of Recharge Rate and Radioactive Decay on Groundwater Ratings***

As described in Appendix E.2 for the CP-TF-1 (T Tank and Waste Farms) EU, the TC&WM EIS screening groundwater transport analysis indicates that there is little impact of emplacing an engineered surface barrier (and resulting reduction of infiltrating water) on the predicted peak groundwater concentrations (relative to thresholds) at the T Barrier[17]. This result is likely due to the significant amounts of contaminants already in the groundwater and not due to an ineffective surface barrier. To summarize, the screening groundwater results at the T Barrier (Appendix O, DOE/EIS-0391 2012) include:

- Tc-99 peak concentration is 6,480 pCi/L (CY 2050) for the No Action Alternative versus 6,600 pCi/L (CY 2051) for Landfill Closure where the threshold value is 900 pCi/L.
- I-129 peak concentration is 26.1 pCi/L (CY 4560) for the No Action Alternative versus 12.6 pCi/L (CY 2050) for Landfill Closure where the threshold value of 1 pCi/L.
- Chromium peak concentration is 336 µg/L (CY 2036) for the No Action Alternative versus 353 µg/L (CY 2045) for Landfill Closure where the threshold value is 100 µg/L (total) or 48 µg/L (hexavalent).
- Uranium peak concentration is 9 µg/L (CY 11,840) for the No Action Alternative versus 1 µg/L (CY 11,843) for Landfill Closure where the threshold value is 30 µg/L (total uranium).

[17] The barrier represents the edge of the infiltration barrier to be constructed over disposal areas that are within 100 meters [110 yards] of facility fence lines (DOE/EIS-0391 2012). The T Barrier is the closest to the T Tank and Waste Farms EU and is considered reasonably representative of conditions near the PFP EU. Despite including sources other than those for the PFP EU, the analysis in the TC&WM EIS was considered a reasonable source of information to assess the potential impact of the engineered surface barrier emplacement.

- No values are reported at the T Barrier for Sr-90 for either scenario, which indicates that predicted peak fluxes that were less than $1\times10^{-8}$ Ci/yr (Appendix O, DOE/EIS-0391 2012, p. O-2).

Since the peak concentrations are predicted to remain above thresholds for Tc-99, I-129, and chromium even after surface barrier emplacement, it is decided to not alter the PFP EU ratings related to groundwater based on different recharge rate scenarios. This effect is likely not due to an ineffective surface barrier but instead the amount of these contaminants already in the groundwater and possible contributions of sources outside the PFP EU (used in the TC&WM EIS analysis[18]).

## Columbia River

Threats to the Columbia River similar to those presented by the PFP EU were evaluated in Section 2.5 of Appendix E.2 for CP-TF-1 (T Single-shell Tank and Waste Farm in 200 West) where all risks and potential impacts were rated *Not Discernible* (*ND*).

## Facilities for D&D

The Plutonium Finishing Plant (PFP) became highly contaminated while recovering plutonium from scrap materials and producing plutonium metal and oxide powder and machined plutonium metal components for nuclear weapons for 40 years (1949 to 1989). When processing ended, approximately 20 tons of plutonium-bearing material remained and needed to be removed as transuranic or low-level waste. Stabilization and packaging of the material was completed in 2004. Bulk special nuclear material shipments to the Savannah River Site were completed in 2010. PFP is categorized as a Hazard Category 2 nuclear facility. Buildings 234-5Z, 236-Z and 242-Z are facilities in which an accidental criticality is credible. Therefore, the facilities are classified as a Fissile Material Facility per HNF-7098, *Criticality Safety Program*.[19]

The primary hazardous substances of concern 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). 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). There is also a potential for beryllium contamination in E4 ductwork, filter boxes, drain lines, and E3 and E4 filter rooms. The radioactive contamination of concern for the PFP building demolition is located on surfaces, under paint and tiles, within ducts, and in other inaccessible places.

The 231-Z Isolation Building/Plutonium Metallurgy Facility, which is located about 600ft north of the Plutonium Finishing Plant (PFP) 234-5 building and outside of the fence line, was constructed in 1944. It was originally designated the 231-Z Isolation Building, housing the final step of the plutonium extraction process that began at T Plant on the Hanford Site. Its original purpose was the purification and drying of the plutonium nitrate solution produced at the 224-T Bulk Reduction Building. It operated in this capacity from 1945 until 1957, when the function of the building shifted to plutonium metallurgy. Plutonium metallurgical research, fabrication development, and metallurgy work for weapons

[18] Analyses specific to each Tank Farm or Central Plateau EU are not available; thus the aggregate screening analysis provided in the TC&WM EIS was used as an indication.

[19] CH2MHill, Plutonium Finishing Plant Deactivation and Decommissioning Documented Safety Analysis, HNF-15500, Revision 13, March 22, 2016 (OUO Document).

development was carried out until 1975. A major cleanout of gloveboxes and other plutonium-contaminated equipment was undertaken in the period from 1978 to 1982. Small quantities of Pu-239 and Am-241 remain as holdup within the building and equipment, and it is categorized as a Hazard Category 3 nuclear facility.

The 241-Z-361 Settling Tank is located south of the 236-Z building and served as a settling tank for liquid waste from 234-5Z, 242-Z and 236-Z buildings. The unit is an underground reinforced concrete structure with a 3/8 inch steel liner. The tank has inside dimensions of 26 by 13 feet with 1 foot thick walls. The bottom slopes, resulting in an internal height variation between 17 and 18 feet. The top is 2 feet below grade. The tank is estimated to contain a residual 30 to 75 kilograms plutonium in the sludge.

Two authoritative sources, the 2012 *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (TC & WM EIS)* (DOE/EIS-0391) and the 2016 *Removal Action Work Plan for the Deactivation, Decontamination, Decommissioning, and Demolition of the Plutonium Finishing Plant Complex*, DOE/RL-2011-03, Revision 1 (*D4RA*), differ in the amount of Pu 238-242 and Am-2411 located in the principle U Plant structures, and thus the potential risk to human health as the buildings are being demolished and in the rubble that will be created and shipped to ERDF. These estimates are shown in Table F.10-2 below. The large differences between Pu 238-241 and Am 241 may be related to decay (or not) of Pu-241 to Am-241. Because Am-241 is the daughter product of radioactive decay of Pu-241 and has a much longer half-life than Pu-241 (433 yrs versus 14.3 yrs), it is a continuing source of Am-241. Neither source indicates the decay date on which these estimates have been computed. However, Pu-239 is a long-lived (24.1 years) isotope of an element of great human health and environmental concern, and the total Pu reported in the EIS for the 234-5Z & 291-Z and 236Z facilities is much lower than that of the D4RA analysis.

The authors have used the more current site specific and conservative estimates for total Pu and Am-241 from the 2016 Removal Action Work Plan analysis for 234-5Z, 291-Z, 236-Z and 242-Z in Tables F.10-3 and 4 below.

**Table F.10-2. Inventories in Principle Structures (amounts in Ci)**

| | **234-5Z & 291-Z** | | **236-Z** | | **242-Z** | |
|---|---|---|---|---|---|---|
| **Isotopes** | *D4RA* | *EIS* | *D4RA* | *EIS* | *D4RA* | *EIS* |
| Pu-238 | 350 | | 340 | | 21 | |
| Pu-239 | 2,000 | | 1,900 | | 30 | |
| Pu-240 | 710 | | 690 | | 22 | |
| Pu-241 | 12,000 | | 12,000 | | 830 | |
| Pu-242 | 0.29 | | 0.28 | | 0.02 | |
| Total Pu | 15,060 | 10.7 | 14,930 | 4,700 | 903 | 86 |
| Am-241 | 1,100 | 10.3 | 1,100 | 4,600 | 49 | 3,500 |

**Table F.10-3. Inventory of Primary Contaminants [a].**

| WIDS | Description | Decay Date | Ref[b,c,d] | Am-241 (Ci) | C-14 (Ci) | Cl-36 (Ci) | Co-60 (Ci) | Cs-137 (Ci) | Eu-152 (Ci) | Eu-154 (Ci) | H-3 (Ci) | I-129 (Ci) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All | Sum[e] | | | 3,650 | NR | NR | 0.00069 | 8.9 | 2.70E-06 | 0.0003 | NR | NR |
| 231-Z | Isolation Building | 2003 | EIS-S | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| 232-Z | Process Building | 2002 | EIS-S | 3.5 | NR | NR | NR | NR | NR | NR | NR | NR |
| 236-Z | PRF | | D4RA | 1,100 | NR | NR | NR | NR | NR | NR | NR | NR |
| 242-Z | Waste Treatment | | D4RA | 49 | NR | NR | NR | NR | NR | NR | NR | NR |
| 234-5Z & 291-Z | PFF & Exhaust Stack | | D4RA | 1,100 | NR | NR | NR | NR | NR | NR | NR | NR |
| 241-Z-361 | Settling Tank | | EIS-S | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| 216-Z-5 | Cribs | 2001 | SIM | 1,200 | NR | NR | 0.00029 | 3.8 | 1.10E-06 | 0.00013 | NR | NR |
| 216-Z-13 | Cribs | 2001 | SIM | 5.80E-08 | NR | NR | NR | 3.50E-08 | NR | NR | NR | NR |
| 216-Z-14 | Cribs | 2001 | SIM | 6.00E-08 | NR | NR | NR | 3.60E-08 | NR | NR | NR | NR |
| 216-Z-15 | Cribs | 2001 | SIM | 6.30E-08 | NR | NR | NR | 3.80E-08 | NR | NR | NR | NR |
| 216-Z-10 | Other | 2001 | SIM | 190 | NR | NR | 0.00038 | 4.9 | 1.50E-06 | 0.00016 | NR | NR |
| 216-Z-4 | Trenches | 2001 | SIM | 7.6 | NR | NR | 1.80E-05 | 0.23 | 7.10E-08 | 7.80E-06 | NR | NR |
| UPR-200-W-103 | UPR | 2001 | SIM | 0.24 | NR | NR | NR | NR | NR | NR | NR | NR |
| UPR-200-W-130 | UPR | 2001 | SIM | 9.10E-06 | NR | NR | NR | 1.60E-10 | 3.40E-13 | 3.50E-11 | NR | NR |

a. NR = Not recorded

b. EIS-S = DOE/EIS-0391 2012

c. SIM = RPP-26744, Rev. 0

d. D4RA= *Removal Action Work Plan for the Deactivation, Decontamination, Decommissioning, and Demolition of the Plutonium Finishing Plant Complex*, DOE/RL-2011-03, Revision 1

e. Radionuclides are summed without decay correction since the uncertainties in inventories are large.

**Table F.10-4. Inventory of Primary Contaminants (cont)(a).**

| WIDS | Description | Decay Date | Ref[b,c,d] | Ni-59 (Ci) | Ni-63 (Ci) | Pu (total) (Ci) | Sr-90 (Ci) | Tc-99 (Ci) | U (total) (Ci) |
|---|---|---|---|---|---|---|---|---|---|
| All | Sum[e] | | | NR | NR | 35,704 | 8.7 | 0.00017 | 4.10E-04 |
| 231-Z | Isolation Building | 2003 | EIS-S | NR | NR | 6.8 | NR | NR | NR |
| 232-Z | Process Building | 2002 | EIS-S | NR | NR | 48 | NR | NR | NR |
| 236-Z | PRF | | D4RA | NR | NR | 14,930 | NR | NR | NR |
| 242-Z | Waste Treatment | | D4RA | NR | NR | 903 | NR | NR | NR |
| 234-5Z & 291-Z | PFF & Exhaust Stack | | EIS-S | NR | NR | 15,060 | NR | NR | NR |
| 241-Z-361 | Settling Tank | | EIS-S | NR | NR | 4,700 | NR | NR | NR |
| 216-Z-5 | Cribs | 2001 | SIM | NR | NR | 34 | 3.7 | 7.20E-05 | 1.50E-04 |
| 216-Z-13 | Cribs | 2001 | SIM | NR | NR | 1.70E-06 | 1.50E-08 | NR | 1.40E-05 |
| 216-Z-14 | Cribs | 2001 | SIM | NR | NR | 1.80E-06 | 1.60E-08 | NR | 1.50E-05 |
| 216-Z-15 | Cribs | 2001 | SIM | NR | NR | 1.80E-06 | 1.60E-08 | NR | 1.60E-05 |
| 216-Z-10 | Other | 2001 | SIM | NR | NR | 16 | 4.8 | 9.30E-05 | 0.0002 |
| 216-Z-4 | Trenches | 2001 | SIM | NR | NR | 0.75 | 0.23 | 4.50E-06 | 9.60E-06 |
| UPR-200-W-103 | UPR | 2001 | SIM | NR | NR | 5.9 | NR | NR | 2.50E-10 |
| UPR-200-W-130 | UPR | 2001 | SIM | NR | NR | 5.20E-05 | 1.40E-10 | 1.80E-11 | 1.00E-09 |

a. NR = Not recorded

b. EIS-S = DOE/EIS-0391 2012

c. SIM = RPP-26744, Rev. 0

d. D4RA= *Removal Action Work Plan for the Deactivation, Decontamination, Decommissioning, and Demolition of the Plutonium Finishing Plant Complex*, DOE/RL-2011-03, Revision 1.

e. Radionuclides are summed without decay correction since the uncertainties in inventories are large.

**Table F.10-5. Inventory of Primary Contaminants (cont)(a).**

| WIDS | Description | Ref[b,c] | CCl4 (kg) | CN (kg) | Cr (kg) | Cr-VI (kg) | Hg (kg) | NO3 (kg) | Pb (kg) | TBP (kg) | TCE (kg) | U (total) (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All | Sum | | 590 | NR | 50 | NR | 8.4 | 40,000 | 25 | 61 | NR | 0.59 |
| 231-Z | Isolation Building | EIS-S | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| 232-Z | Process Building | EIS-S | NR | NR | NR | NR | NR | 130 | NR | NR | NR | NR |
| 236-Z | PRF | EIS-S | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| 242-Z | Waste Treatment | EIS-S | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| 234-5Z & 291-Z | PFF & Exhaust Stack | EIS-S | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| 241-Z-361 | MUST | EIS-S | NR | NR | NR | NR | 6.9 | NR | NR | NR | NR | NR |
| 216-Z-5 | Cribs | SIM | 8.6 | NR | 0.32 | NR | NR | 39,000 | NR | 20 | NR | 0.23 |
| 216-Z-13 | Cribs | SIM | 220 | NR | 13 | NR | 0.71 | NR | 0.5 | NR | NR | 0.02 |
| 216-Z-14 | Cribs | SIM | 220 | NR | 13 | NR | 0.74 | NR | 0.52 | NR | NR | 0.02 |
| 216-Z-15 | Cribs | SIM | NR | NR | 24 | NR | 0.013 | NR | 24 | NR | NR | 0.021 |
| 216-Z-10 | Other | SIM | 11 | NR | 0.01 | NR | NR | 1600 | NR | 26 | NR | 0.29 |
| 216-Z-4 | Trenches | SIM | 0.54 | NR | 0.00011 | NR | NR | 30 | NR | 1.3 | NR | 0.014 |
| UPR-200-W-103 | UPR | SIM | 130 | NR | NR | NR | NR | NR | NR | 14 | NR | 3.30E-07 |
| UPR-200-W-130 | UPR | SIM | NR | NR | 4.10E-05 | NR | NR | NR | NR | NR | NR | 1.30E-06 |

a. NR = Not recorded

b. EIS-S = DOE/EIS-0391 2012

c. SIM = RPP-26744, Rev. 0

**Table F.10-6. Summary of the Evaluation of Threats to Groundwater as a Protected Resource from Saturated Zone (SZ) and Remaining Vadose Zone (VZ) Contamination associated with the Evaluation Unit.**

| PC | Group | WQS | Porosity[a] | $K_d$ (mL/g)[a] | ρ (kg/L)[a] | VZ Source $M^{Source}$ | SZ Total $M^{SZ}$ | Treated[c] $M^{Treat}$ | VZ Remaining $M^{Tot}$ | VZ GTM ($Mm^3$) | VZ Rating[d] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C-14 | A | 2000 pCi/L | 0.23 | 0 | 1.84 | --- | --- | --- | --- | --- | *ND* |
| I-129 | A | 1 pCi/L | 0.23 | 0.2 | 1.84 | --- | --- | --- | --- | --- | *ND* |
| Sr-90 | B | 8 pCi/L | 0.23 | 22 | 1.84 | 8.69E+00 Ci | --- | --- | 8.69E+00 Ci | 6.14E+00 | *ND*[(e)] |
| Tc-99 | A | 900 pCi/L | 0.23 | 0 | 1.84 | 1.70E-04 Ci | --- | --- | 1.70E-04 Ci | 1.89E-04 | *Low* |
| CCl4 | A | 5 µg/L | 0.23 | 0 | 1.84 | 5.86E+02 kg | --- | --- | 5.86E+02 kg | 1.17E+02 | *High* |
| Cr | B | 100 µg/L | 0.23 | 0 | 1.84 | 5.02E+01 kg | --- | --- | 5.02E+01 kg | 5.02E-01 | *Low* |
| Cr-VI | A | 10 µg/L[b] | 0.23 | 0 | 1.84 | 5.02E+01 kg | --- | --- | 5.02E+01 kg | 1.05E+00 | *Low* |
| TCE | B | 5 µg/L | 0.23 | 2 | 1.84 | --- | --- | --- | --- | --- | *ND* |
| U(tot) | B | 30 µg/L | 0.23 | 0.8 | 1.84 | 5.95E-01 kg | --- | --- | 5.95E-01 kg | 2.68E-03 | *ND*[(e)] |

a. Parameters obtained from the analysis provided in Attachment 6-1 to Methodology Report (CRESP 2015).

b. "Model Toxics Control Act—Cleanup" (WAC 173‑340) Method B groundwater cleanup level for hexavalent chromium.

c. Treatment amounts from the 2015 Hanford Annual Groundwater Report (DOE/RL-2016-09, Rev. 0).

d. Groundwater Threat Metric rating based on Table 6-3, Methodology Report (CRESP 2015).

e. As discussed in **Part V**, no appreciable total uranium or Sr-90 plume would be expected in the TC&WM EIS evaluation period due to transport considerations. Thus the *Low* rating would apply after the Active Cleanup period to account for uncertainties.

# PART VI. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

## CURRENT CONCEPTUAL MODEL

### Pathways and Barriers

Briefly describe the current institutional, engineered and natural barriers that prevent release or dispersion of contamination, risk to human health and impacts to resources:

1. What nuclear and non-nuclear safety accident scenarios dominate risk at the facility? What are the response times associated with each postulated scenario?

There are a number of nuclear related safety accident scenarios that have the potential for causing Very High and High radioactive exposure to the Facility Worker and Co-located Person. They are: Seismic event or aircraft crash, 234-5Z 1st Floor Fire Involving Contaminated Equipment, Internal Equipment Explosion in 242-Z, Internal Equipment Explosion in 234-5Z, and Drop of Equipment in 234-5Z and 242-Z.

2. What are the active safety class and safety significant systems and controls?

No safety-class or safety-significant SSCs and no technical safety requirements reduce potential consequences to the target receptors in the seismic and aircraft events. For the others, Preventative Safety Significant Controls include Combustible Controls, Ignition Source Controls, Fire Sprinkler Systems and general Fire protection requirements, Flammable Gas Inventory, Chemical Management and Flammable Gas Venting Controls, and Hoisting and Rigging Controls.

The remaining hazards at the end of the Deactivation phase are planned such that accident analysis for the Pre-Demolition phase supports a control set no longer reliant on Safety Significant equipment except for the Criticality Detectors and Alarms. Accident analysis for the Demolition phase supports a control set with no safety equipment at all.[20]

3. What are the passive safety class and safety significant systems and controls?

Defense in Depth mitigation measures include the Safety Management Programs, Confinement and the Fire Sprinkler Flow Alarm.

4. What are the current barriers to release or dispersion of contamination from the primary facility? What is the integrity of each of these barriers? Are there completed pathways to receptors or are such pathways likely to be completed during the evaluation period?

The primary barrier to release or dispersion of contaminants from each building during the deactivation and pre-demolition phases is the confinement provided by the building.

The demolition phase will be performed in open air, and will destroy the confinement capabilities of the facilities and structures, resulting in increased risk of airborne releases of radioactive contamination as well as distribution of radioactive material in soils immediately surrounding the facilities and structures being demolished.

5. What forms of initiating events may lead to degradation or failure of each of the barriers?

[20] CH2M Hill Plateau Remediation Company, *Control Decision Document for the Plutonium Finishing Plant Safety Basis*, HNF-58375, Revision 0, May 2015.

Prior to demolition, a seismic or plane crash event is the only identified scenario that could damage the building sufficiently to release the contaminants.

6. What are the primary pathways and populations or resources at risk from this source?

An air release to the Facility Worker, Co-located person and Public are all potentially at risk.

7. What is the time frame from each of the initiating events to human exposure or impacts to resources?

Seconds or minutes in terms of exposure to humans and the environment

8. Are there current on-going releases to the environment or receptors?

No known on-going releases to humans outside the building envelope.

## POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

### Facility Worker

The operational history of the complex indicates that former waste management practices, failures of equipment, accidents, and spills resulted in the release of radionuclides in the facilities and surrounding soils. Because the facilities within the PFP Complex supported the final production process associated with the manufacture of plutonium as part of the nation's defense program, radiological contamination is expected to be primarily plutonium and americium. There is also a potential for beryllium contamination in E4 ductwork, filter boxes, drain lines, and E3 and E4 filter rooms. PFP is categorized as a Hazard Category 2 nuclear facility.

### Co-Located Person

See Facility Worker

### Public

The Public has a Low to Medium potential risk from several nuclear related accident scenarios.

### Groundwater

Table F.10-6 represents current risks and associated ratings for the saturated zone (groundwater) from remaining vadose zone contamination associated with the CP-DD-5 vadose zone sites. Sites within the CP-DD-5 EU may have contaminated the vadose zone and are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0). The current risk and potential impact ratings for the CP-DD-5 EU are *High* (carbon tetrachloride), *ND* (Sr-90 and total uranium), and *Low* (other Group A and B PCs) (Table F.10-6). Monitoring and treatment of groundwater is being conducted within the 200-ZP GWIA (using the 200 West P&T facility), which is described as part of the CP-GW-2 EU (Appendix D.6). No plumes within the Central Plateau have been linked to CP-DD-5 EU waste sites.

### Columbia River

As described in Appendix D.6 (CP-GW-2 EU) and **Part V**, no plumes from the 200 West Area (that includes the CP-DD-5 waste sites) currently intersect the Columbia River, thus current ratings for all contaminants for the benthic, riparian, and free-flowing ecology are *ND*.

### Ecological Resources

Summary of Ecological Review:

- The PFP building complex is already undergoing demolition and the disturbance associated with ongoing construction/demolition activities appear to limit wildlife use of the area. Previous surveys observed nesting birds on various man-made structures within the EU; however, many of these structures have been removed. There is essentially no vegetation in the EU, and therefore virtually no change in resource levels within the EU as cleanup activities continue.
- Level 3 resources within the adjacent landscape buffer area are either isolated or represent previous locations of Piper's daisy, a state sensitive species. Loss of individual Piper's daisies is not expected to affect population viability. Loss of the other patches of level 3 is also not expected to impact connectivity with habitats outside the 200-West Area.

## Cultural Resources

The CP-DD-5, PFP EU is located within the 200-West Area of the Hanford Site, an area known to have low potential to contain Native American Precontact and Ethnographic archaeological resources and Pre-Hanford Early Settlers/Farming resources. Much of the 200 Areas were addressed in a cultural resources report entitled *Archaeological Survey of the 200 East and 200 West Areas, Hanford Site* (Chatters and Cadoret 1990). The focus of this archaeological survey was on inventorying all undisturbed portions of the 200-East and 200-West Areas. This report concluded that much of the 200-East and 200-West Areas can be considered areas of low archaeological potential with the exception of intact portions of an historic/ethnohistoric trail/road corridor which runs through the 200-West Area.

The CP-DD-5 PFP EU has not been inventoried for archaeological resources, and it is unknown if an NHPA Section 106 review has been completed specifically for remediation of CP-DD-5, PFP EU. It is unlikely that intact previously undocumented archaeological material is present in the EU, both on the surface and in subsurface areas, because the soils in the CP-DD-5 PFP EU appear to have been heavily disturbed by Hanford Site activities.

**Archaeological sites, buildings and Traditional Cultural Properties (TCPs) located within the EU[21]**

- Segments of the National Register-eligible Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required, are located within the CP-DD-5 PFP EU. In accordance with the 1998 *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56), all documentation requirements have been completed for this property.
- There are 11 National Register-eligible buildings that are contributing properties within the Manhattan Project and Cold War Era Historic District located within CP-DD-5 PFP EU (all 11 are contributing within the Manhattan Project and Cold War Era Historic District, 10 recommended for individual documentation and 1 with no additional documentation required). Mitigation for contributing buildings/structures has been completed in accordance with the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56) (DOE-RL 1998).

See Appendix K, Table 47, for more information about the 11 buildings that are National Register-eligible Manhattan Project and Cold War Era buildings located within CP-DD-5 PFP EU.

[21] Traditional cultural property has been defined by the National Park Service as "a property, a place, that is eligible for inclusion on the National Register of Historic Places because of its association with cultural practices and beliefs that are (1) rooted in the history of a community, and (2) are important to maintaining the continuity of that community's traditional beliefs and practices" (Parker & King 1998).

**Archaeological sites, buildings, and TCPs located within 500 meters of the EU**

- One archaeological site associated with the Pre-Hanford Early Settlers/Farming Landscape has been recorded within 500 meters of the EU. This archaeological site has not been formally evaluated for listing in the National Register of Historic Places.
- Noncontributing segments of a National Register eligible historic/ethnohistoric trail/road are located within 500 meters of the EU.
- There are 7 National Register-eligible buildings that are contributing properties within the Manhattan Project and Cold War Era Historic District located within 500 meters of the CP-DD-5 PFP EU (all 7 are contributing within the Manhattan Project and Cold War Era Historic District, 6 with individual documentation required, and 1 with no additional documentation required). Mitigation for contributing buildings/structures has been completed in accordance with the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56) (DOE-RL 1998).

See Appendix K, Table 48, for more information about the seven buildings that are National Register-eligible Manhattan Project and Cold War Era buildings located within 500 meters of the CP-DD-5 PFP EU

- The 232-Z, Waste Incinerator Facility is located within 500 meters of the CP-DD-5, PFP EU. This facility was selected as part of the Federal/Public working group meetings (held between 1997 and 1998) for preservation and heritage tourism. The 232-Z building was selected (along with several other facilities) as one of those necessary to tell the story of plutonium finishing (HCRP 2003) and its role within the process for producing plutonium at the Hanford Site. As such, the building was selected for preservation in place, and HAER level documentation was completed for this facility.

**Closest Recorded TCP**

There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from the CP-DD-5, PFP EU.

## CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

### Selected or Potential Cleanup Approaches

The major cleanup phases include:[22,23]

***Deactivation (TSR Step-Out Preparation Phase):*** This phase encompasses activities for glovebox/equipment decontamination, disassembly, and waste removal. These activities represent the effort to remove the majority of the remaining radiological material-at-risk (MAR) from the gloveboxes/equipment to the extent necessary to allow loading of waste items into waste containers. Decontamination efforts will be performed as necessary and, in most cases, fixatives applied to gloveboxes and equipment. A limit of 100 rem total effective dose (TEDE) to the collocated worker is used to determine if safety significant SSCs are necessary to prevent or mitigate the hazards associated with planned activities in the facilities. After sufficient material-at-risk is removed from the facility such

[22] CH2MHill Plateau Remediation Company , *PFP Demolition Capital Asset Project Execution Plan*, DD-59139, Revision 0, August 18, 2015

[23] CH2M Hill Plateau Remediation Company, *Criteria Document for the Plutonium Finishing Plant Safety basis (DSA12/TSR12)*, HNF-57150, Revision 0, December 9, 2014.

that the unmitigated doses for evaluation basis accidents are below 100 rems the Deactivation Phase will be considered complete.

***Pre-Demolition:*** This phase of activities involves the removal of gloveboxes and other TRU waste items remaining in the facilities after the Deactivation Phase has been completed. Staging of gloveboxes and filter boxes will include interior cleanout, application of fixative, and installation of scaffolding and lifting slings, as required. The general practice will be to attempt to decontaminate equipment to less than TRU levels such that they can be disposed of as LLW, thus minimizing the need to size reduce and ship the TRU waste to the Waste Isolation Pilot Plant.[24] A protective structure fabricated from scaffolding materials will be installed to ensure that gloveboxes and filter boxes are protected from falling debris as the excavator progresses toward the location of the glovebox or filter box. The excavator operator will move large segments away from the staged glovebox or filter box, which minimizes the risk of penetrating the surface of the glovebox or filter box.[25] Other Pre-Demolition phase activities may include grouting TRU piping in the 234-5Z tunnels, grouting the 236-Z canyon floor, removal of hazardous waste, and removal of all energy sources so that the facilities may be declared Cold and Dark; however, these activities may be also be performed during the Deactivation phase. In this phase, portions of the fire protection and ventilation system will be deactivated and removed.

***Demolition:*** At the start of the demolition phase, some gloveboxes, filter boxes, piping, ducting, and tanks will remain within interior rooms and will require demolition of interior walls or partitions for access and removal. These items are either integral to construction of the facility (e.g., HA-46), require partial facility demolition to access (e.g., tunnel drain lines, Miscellaneous Treatment (MT) gloveboxes), or are designated as LLW (e.g., radioactive acid digestion test unit (RADTU) gloveboxes) and will be removed during the demolition phase. These items will require demolition of exterior walls, interior walls or partitions, or floors for access. Gloveboxes, filter boxes, piping, and tanks that have been staged for extraction during demolition will be removed from the facility using a crane and/or an excavator with a grapple attachment.[11]

Each PFP above-grade structure will be demolished to within 6 inches of the slab and foundation, with the exception of the four-foot high walls and roof of Building 291-Z, PFP Exhaust Fan and Compressor House. Structures with below-grade areas, such as basements, tunnels, and vaults, will be left in place, as well as the below-grade slab and foundation. Equipment, piping, and ducting remaining in accessible below-grade areas will be such that the remaining material may be dispositioned as low-level waste (LLW) with the building rubble during the final remediation of the PFP zone, which is the selected alternative in DOE/RL-2004-05, *Engineering Evaluation/Cost Analysis for the Plutonium Finishing Plant Above-Grade Structures*. Below-grade voids left by this work will be backfilled as needed, after any required sampling or surveys, with clean fill or gravel.

In general, the facilities will be demolished using standard demolition techniques (e.g., excavator with a hoe-ram, a hydraulic shear with steel shear jaws, concrete pulverizer jaws or breaker jaws). Other industry standard practices for demolition may also be used (e.g., mechanical saws, cutting torches, and controlled explosives). For the most part, open-air demolition will be used and conformance with emissions controls will be monitored throughout the process. Controls such as fogs and sprays,

[24] CH2MHill, Plutonium Finishing Plant Deactivation and Decommissioning Documented Safety Analysis, HNF-15500, Revision 13, March 22, 2016 (OUO Document).
[25] CH2M Hill Plateau Remediation Company, *Plutonium Finishing Plant Demolition Plan*, CHPRC-02582, Revision 0, July 2015.

encapsulation, and tenting will be used as needed to control the release of any contaminants within acceptable limits and maintain ALARA exposures and radiological releases.

For structures with basements, tunnels, vaults, etc., the below-grade walls would be left standing as well as the below-grade slab and foundation. Exposed areas such as the 234-SZ tunnels or 241-Z vaults that exist below-grade would be filled and covered with a suitable material to grade level to prevent water accumulation but not preclude any future remedial activity. 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 (of compacted fill, gravel, asphalt or other appropriate material with an engineered slope), if needed, to the slab to prevent run-on/run-off.[26]

The major contractor milestones and activities as of July 2015 were:

- Complete PFP facilities decommissioning to demolition ready – April 2016
- Complete PFP facilities D&D to slab-on-grade – September 2016

Post-demolition work will include post-demolition surveys, sealing of below-grade accesses, removal of deferred items, application of contamination fixatives, PFP cap installation (if required), final cleanup, final surveys, and posting and access control measures.

The PFP complex is currently in the process of being cleaned out and demolished to ”slab-on-grade” prior to transitioning the footprint to RL-0040 for surveillance and maintenance (S&M) and final waste site remediation. Many of the initial large nuclear source term and material at risk reducing activities have been completed. The remaining PFP D&D phases of the mission includes decontamination of equipment and facilities, removal of remaining process equipment, waste packaging, deactivation of facility systems, and demolition of the facilities, primarily centered on Buildings 234-5Z, 236-Z, 242-Z, and 291-Z, and their supporting structures.

The Removal Action Work Plan (DOE/RL-2011-03, Rev. 0) governing these activities was amended through TPA Change Notice TPA-CN-681 in November 2015 to include removal of the 236-Z and 242-Z slabs, along with the soil necessary to complete slab removal (approximately one meter below the slab), during the S&M Phase to reduce the overall radiological inventory of the PFP complex. The results of pre-slab removal characterization may indicate that the level of contamination in or below either slab would require controls more rigorous than the open-air demolition controls utilized for slab-on-grade demolition activities. In that event, DOE in consultation with the lead regulatory agency may choose to leave the slab(s) in place for future remediation. Following completion of slab removal, the excavations will be backfilled and activities would be conducted as needed to stabilize the surface in the PFP complex area to minimize contaminant migration in the environment until final disposition of the PFP complex area.

## Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

Significantly less than 1 kg of residual contamination is expected to 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). 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.[11]

[26] US Department of Energy, Richland Operations Office, *Action Memorandum for the Plutonium Finishing Plant Above-Grade Structures Non-Time Critical Removal Action*, DOE/RL-2005-13-Rev 0, May 2, 2005

The remedial actions that have either been identified or additional actions needed to address vadose zone contamination would leave existing contaminants in CP-DD-5 waste sites as well as that contamination that has been released from CP-DD-5 waste sites into the vadose zone. Waste sites within the CP-DD-5 EU may threaten groundwater in the 200-ZP GWIA, which is being treated using the 200-West Pump and Treat Facility (DOE/RL-2016-09, Rev. 0). However, remedial actions will be taken until resulting residual contamination levels satisfy remedial objectives and monitoring of both vadose and saturated zone contamination will continue to assess remedial action performance. Residual concentrations cannot be determined at this time.

## Risks and Potential Impacts Associated with Cleanup

The Deactivation phase represents the current stage of the facility where the MAR is at its greatest. Decontamination activities, equipment removals, and size reduction activities are ongoing. The MAR is potentially in a releasable form (e.g., oxide powder), and accident consequences are highest. The Pre-Demolition phase represents a configuration were MAR has been fixed, sequestered, or reduced.[27]

During final Demolition, the MAR levels will have been reduced even further and workers will not be inside the building. However, the demolition process will be performed in open air, and will destroy the confinement capabilities of the facilities and structures, resulting in increased risk of airborne releases of radioactive contamination as well as distribution of radioactive material in soils immediately surrounding the facilities and structures being demolished. Deactivation activities performed in the facilities will have removed equipment and materials containing residual radioactive material as necessary to ensure that airborne contamination generated during demolition will not exceed established control levels. Nevertheless, the deactivated facilities and structures will contain residual radioactive material on surfaces and in remaining piping, ductwork and other internal structures in quantities ranging from pCi/100 $cm^2$ to ηCi/100 $cm^2$ total alpha activity. In addition, equipment and materials that could not be readily deactivated prior to demolition may be left in place for disposal during the demolition process, and special demolition techniques will be used to remove these items in a manner which does not generate excessive airborne radioactive material. The demolition activities will create rubble and dust that will contain some quantity of radioactive material. To control the concentrations of airborne emissions during demolition, limits have been established to ensure that total alpha contamination remaining at the end of the deactivation phase on building surfaces are protective of human health and environment.[28]

PNNL's modeling results of air releases during the proposed demolition indicate that for the bulk of the PFP facilities, including the PFP stack, the radiological exposures from the planned demolition efforts will be below the designated limits for air and soil exposures. However, the demolition of the 236-Z main process cell has the potential for releases of alpha-emitting radionuclides in excess of Hanford administrative limits beyond the current fence line of the PFP area. The PNNL analysis assumed remaining contamination levels in the 236-Z cell are at an average of 50 nCi/gram, but noted that it is possible that different methods and/or extensive decontamination could reduce the contamination levels, and thus reduce the levels of potential exposures.[29]

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[27] CH2MHill, Plutonium Finishing Plant Deactivation and Decommissioning Documented Safety Analysis, HNF-15500, Revision 13, March 22, 2016 (OUO Document).
[28] CH2M Hill Plateau Remediation Company, *Data Quality Objectives for the Radiological Characterization of the Plutonium Finishing Plant,* CHPRC-02376, Revision 0, January 8, 2015.
[29] Pacific Northwest National Laboratory*, Air Dispersion Modeling of radioactive Releases During Proposed PFP Complex Demolition Activities*, PNNL-20173, January 2011

Other risks are largely industrial in nature and similar to those at other demolition sites. The facilities will be demolished using standard demolition techniques (e.g., excavator with a hoe-ram, a hydraulic shear with steel shear jaws, concrete pulverizer jaws or breaker jaws). Other industry standard practices for demolition may also be used (e.g., mechanical saws, cutting torches, and controlled explosives).

## POPULATIONS AND RESOURCES AT RISK OR POTENTIALLY IMPACTED DURING OR AS A CONSEQUENCE OF CLEANUP ACTIONS

### Facility Worker

The demolition process will be performed in open air, and will destroy the confinement capabilities of the facilities and structures, resulting in increased risk of airborne releases of radioactive contamination as well as distribution of radioactive material in soils immediately surrounding the facilities and structures being demolished.

### Co-located Person

See Facility Worker above

### Public

See facility Worker above.

### Groundwater

As described in **Part V**, there will be a continuing threat during this period to groundwater (as a protected resource) from mobile primary contaminants in PFP vadose zone sites. Impacts from current plumes that are not linked to PFP sites are described in Appendix G.6 for the CP-GW-2 EU.

There are contaminant sources (legacy source sites) in the vadose zone that pose continuing risk to groundwater (via the vadose zone). The vadose zone (VZ) GTM values for the Group A and B primary contaminants for the PFP EU translate to ratings of up to *High* for carbon tetrachloride. As indicated in **Part V**, Sr-90 and total uranium are unlikely to impact the groundwater in sufficient quantities to exceed the drinking water standard and thus are not considered significant future threats. These ratings correspond to an overall rating of *High* for both the Active and Near-term, Post-Cleanup periods.

The 200 West Area P&T system in the 200-ZP GWIA is assumed to be operational during this evaluation period, which will be treating groundwater contamination in the 200 West area.

It is considered unlikely that additional groundwater resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

### Columbia River

As described in **Part V**, impacts to the Columbia River benthic, riparian, and free-flowing ecology for the Active Cleanup and Near-term, Post Cleanup periods are rated as *Not Discernible* (*ND*). Additional information on groundwater plumes and potential threats associated with sources including those from the PFP waste sites are described in Appendix G.6 for the CP-GW-2 EU (200-ZP GWIA).

It is considered unlikely that additional benthic or riparian resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

## Ecological Resources

Remove, Treat and Dispose of waste involves personnel through the target (remediation) area, car and pickup truck traffic through the non-target and target (remediation) area, truck, heavy equipment (including drill rigs) traffic on roads through the non-target and target area, caps (and other containment), soil removal and contamination in the soil, vegetation control, and irrigation (for revegetation) will cause the following disturbance from remediation activities: Carry seeds or propagules (pieces of vegetation or other biological parts that can grow and/or reproduce) on tires of vehicles or blowing from heavy equipment; injure or kill vegetation or small invertebrates or small animals; vehicle traffic can make paths, compact soil, scare or displace animals, can impact animal behavior or reproductive success; affect animal dispersion and habitat use (e.g., some birds avoid nesting near roads because of song masking); displacement of animals from near roads due to increased noise or other disturbances; and heavy equipment may permanently destroy areas of the site with intense activity. Soil removal can cause more severe effects because of blowing soil (and seeds). During remediation, radionuclides or other contaminants could be released or spilled on the surface, and depending upon the type and quantity, could have adverse effects on the plants and animals on-site. Use of non-specific herbicides for vegetation control results in some mortality of native vegetation (especially native forbes), and allows exotic species to move in; it may change species composition of native communities, but it also could make it easier for native species to move in; improved methods could yield positive results. Irrigation requires a system of pumps and water, resulting in physical disturbance; repeated irrigation from the same locations could result in some soil compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area.

Alternatively, barriers could be the remediation option and involves personnel car and pickup truck traffic through the non-target and target (remediation) area, truck and heavy equipment traffic on roads through the non-target and target area, dust suppression, and irrigation (for revegetation) will cause the following disturbance from remediation activities: Carry seeds or propagules (pieces of vegetation or other biological parts that can grow and/or reproduce) on person (boots, clothes, equipment) or tires of vehicles or blowing from heavy equipment; injure vegetation or small invertebrates or small animals (e.g., insects, snakes); make paths or compact soil; scare or displace animals. Caps and other containment can cause compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Destruction of soil invertebrates at depths of pits. Potential bringing up of dormant seeds from soil layers; disruption of ground-living small mammals and hibernation sites of snakes and other animals on-site of containment; often disrupts local aquatic environment and drainage; often non-native plants used on caps (which can become exotic/alien adjacent to the containment site). Additional water from dust suppression could lead to more diverse and abundant vegetation in areas that receive water, which could encourage invasion of exotic species; the latter could displace native plant communities; excessive dust suppression activities could lead to compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Irrigation requires a system of pumps and water, resulting in physical disturbance; repeated irrigation from the same locations could result in some soil compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. These effects will be higher in the EU itself.

## Cultural Resources

Potential direct effects are possible from personnel, car, pick-up, truck and heavy equipment traffic/use through both target (remediation) and non-target areas during active cleanup. These activities may

inadvertently expose resources close to the surface. Additionally, traffic through these areas may lead to the introduction of invasive species and/or a decrease in the presence of native plants used for medicinal or tribal religious purposes. Heavy equipment use for remedial activities (such as RTD of contaminated soils, structures, etc.) may lead to an alteration of the landscape, and the act of soil removal may destroy resources; if resources are not destroyed, then, soil removal may disturb or adversely affect resources. Lastly, during remediation, radionuclides or other contamination released or spilled on the surface could have long-term effects if the contamination remains and resources become contaminated and/or plants having cultural importance to Tribes do no recolonize or thrive.

Potential indirect effects are possible from personnel traffic through target (remediation) areas as well as car, pick-up, truck and heavy equipment traffic/use through both target (remediation) and non-target areas. It is possible that these activities may decrease viewshed values and/or impact viewshed through the introduction of increased dust, the creation of trails, etc. Heavy equipment use for remedial actions could potentially cause alterations to the landscape and impacts to viewsheds. Lastly, during remediation, radionuclides or other contamination released or spilled on the surface could have long-term effects if the contamination remains and resources become contaminated and/or plants having cultural importance to Tribes do no recolonize or thrive.

## ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

The operational history of the complex indicates that former waste management practices, failures of equipment, accidents, and spills resulted in the release of radionuclides in the facilities and surrounding soils. Any inventory released to the environment due to structural failure brought on by earthquake, wind, storms, age, etc. could result in a potential dose to site personnel and the public (via aerial dispersion of radionuclides that reaches receptors beyond the PFP fence line), and although a remote possibility, a release to soils potentially could provide a pathway for migration to groundwater.

Sites within the CP-DD-5 EU have likely contaminated the vadose zone and are suspected of being able to eventually contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0). Despite on-going treatment (200 West P&T), vadose zone contamination may continue (depending on the control of infiltrating water to the waste sites) and some contaminant plumes in the 200 West area may continue to increase in size and impact additional groundwater. Additional remedial actions may be required in the future to address vadose zone contamination not addressed in the PFP actions.

## NEAR-TERM, POST-CLEANUP STATUS, RISKS AND POTENTIAL IMPACTS

Significantly less than 1 kg of residual contamination is expected to 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).

## POPULATIONS AND RESOURCES AT RISK OR POTENTIALLY IMPACTED AFTER CLEANUP ACTIONS (FROM RESIDUAL CONTAMINANT INVENTORY OR LONG-TERM ACTIVITIES)

**Table F.10-7. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup.**

| Population or Resource | | Risk/Impact Rating | Comments |
|---|---|---|---|
| **Human** | Facility Worker | ND to Low | Slab on-grade cleanup is believed to protective of human health. |
| | Co-located Person | ND to Low | |
| | Public | ND | |
| **Environmental** | Groundwater (A&B) from vadose zone[(a)] | *High* – $CCl_4$<br>*Low* – other PCs<br>**Overall**: *High* | *Current* GTM values for Group A&B primary contaminants (Table F.10-7): *High* ($CCl_4$), *ND* (Sr-90 and U(tot)), and *Low* (other PCs with reported inventories). Sr-90 and U(tot) not likely to impact groundwater (**Part V**) and given Low ratings here to address uncertainties. Treatment in 200-ZP assumed effective for groundwater but would not change vadose zone ratings. Predicted impact from changes in recharge rates not taken into account to address uncertainties. |
| | Columbia River from vadose zone[(a)] | Benthic:<br>*ND*<br>Riparian:<br>*ND*<br>Free-flowing:<br>*ND*<br>**Overall**: *ND* | TC&WM EIS screening results indicate that exposure to radioactive and chemical contaminants from peak groundwater discharge below benchmarks for both benthic and riparian receptors (**Part V**). Dilution factor of greater than 100 million between Columbia River and upwellings. |
| | Ecological Resources[(b)] | ND to Low | Post-cleanup monitoring might pose a risk to level 3 and above resources in the buffer area. Possible disruption of migratory birds and Piper's daisy. |
| **Social** | Cultural Resources[(b)] | **Native American**<br>Direct: Unknown<br>Indirect: Known<br>**Historic Pre-Hanford**<br>Direct: Unknown<br>Indirect: Known<br>**Manhattan/Cold War**<br>Direct: None | Potential direct effects are possible (and potentially permanent) if contamination remains and/or resources are contaminated. Resources may be destroyed and/or have to be removed. Plants having cultural importance to Tribes may not recolonize or thrive. Potential indirect |

| Population or Resource | | Risk/Impact Rating | Comments |
|---|---|---|---|
| | | Indirect: None | effects are possible (and potentially permanent) if contamination remains and/or resources are contaminated. If contamination remains, access to and/or use of resources may be prohibited. |

a. Threat to groundwater or Columbia River for Group A and B contaminants remaining in the vadose zone. Threats from existing plumes are described in more detail in Appendix G.6 (CP-GW-2).

b. For both Ecological and Cultural Resources see Appendices J and K, respectively, for a complete description of Ecological Field Assessments and literature review for Cultural Resources. Ecological ratings are described in Table 4-11 of the Final Report.

### LONG-TERM, POST-CLEANUP STATUS – INVENTORIES AND RISKS AND POTENTIAL IMPACT PATHWAYS

Significantly less than I kg of residual contamination is expected to 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). 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.[1]

## PART VII. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

**Table F.10-8. Hanford Site-Wide Risk Review CP-DD-5 (PFP) Waste Site and Facility List**

| Site Code | Name, Aliases, Description | Feature Type | Site Status | ERS Classification | ERS Reclassification | Site Type | Site Type Category | Operable Unit | Exclude from Evaluation | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 216-Z-16 | 216-Z-16; 216-Z-16 Crib | Waste Site | Inactive | Accepted | None | Crib | Crib - Subsurface Liquid Disposal Site | 200-WA-1 | | |
| 216-Z-3 | 216-Z-3; 216-Z-3 Culvert; 216-Z-8; 234-5 No. 3 & 4 Cribs | Waste Site | Inactive | Accepted | None | Crib | Crib - Subsurface Liquid Disposal Site | 200-PW-1 | | |
| 216-Z-5 | 216-Z-5; 231-W Sumps; 231-W-1 & 2 Cribs | Waste Site | Inactive | Accepted | None | Crib | Crib - Subsurface Liquid Disposal Site | 200-PW-6 | | |
| 216-Z-6 | 216-Z-6; 216-Z-6 & 6A Crib; 231-W Crib; 231-W-4 Crib; 231-Z-6; 216-W-4; 216-Z-4 | Waste Site | Inactive | Accepted | None | Crib | Crib - Subsurface Liquid Disposal Site | 200-WA-1 | | |
| 200-W-178-PL | 200-W-178-PL; Lines HSW-202 and HSW-203; Pipeline from 241-Z to 244-TX DCRT | Waste Site | Inactive | Accepted | None | Direct Buried Tank Farm Pipeline | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |
| 216-Z-1D | 216-Z-1D; Drainage Ditch to U Swamp; Z Plant Ditch; 216-Z-1 | Waste Site | Inactive | Accepted | None | Ditch | Pond/Ditch – Surface Liquid Disposal Site | 200-CW-5 | | |
| 200-W-249 | 200-W-249; 2736-ZB and 2736-ZC Concrete Slabs | Waste Site | Inactive | Accepted | None | Foundation | Storage Pad | TBD | | |
| 216-Z-13 | 216-Z-13; 216-Z-13 A and B; 216-Z-13 Dry Well; 234-5 Dry Well #1; Miscellaneous Stream #261 | Waste Site | Active | Accepted | None | French Drain | Crib - Subsurface Liquid Disposal Site | 200-WA-1 | | |
| 216-Z-14 | 216-Z-14; 216-Z-14 A and B; 216-Z-14 Dry Well; 234-5 Dry Well #2; Miscellaneous Stream #262 | Waste Site | Active | Accepted | None | French Drain | Crib - Subsurface Liquid Disposal Site | 200-WA-1 | | |
| 216-Z-15 | 216-Z-15; 216-Z-15 Dry Well; 234-5 Dry Well #3; Miscellaneous Stream #263 | Waste Site | Inactive | Accepted | None | French Drain | Crib - Subsurface Liquid Disposal Site | 200-WA-1 | | |
| 216-Z-10 | 216-Z-10; 216-Z-2; 231-W Reverse Well; 231-W-150; 231-W-151 Dry Well or Reverse Well; 231-Z Well; 299-W15-51 | Waste Site | Inactive | Accepted | None | Injection/Reverse Well | Crib - Subsurface Liquid Disposal Site | 200-PW-6 | | |

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| 241-Z | 241-Z; 241-Z Sump; 241-Z Tank Farm; 241-Z Tank Pit; 241-Z Treatment and Storage System; 241-Z Treatment and Storage Tanks; 241-Z-D-4; 241-Z-D-5; 241- Z-D-7; 241-Z-D-8 | Waste Site | Inactive | Accepted | None | Neutralization Tank | Underground Storage Tank | 200-IS-1 | | |
| 232-Z | 232-Z; 232-Z Building Foundation; 232-Z Incineration Facility; 232-Z Incinerator; 232-Z Waste Incineration Facility | Waste Site | Inactive | Accepted | None | Process Unit/Plant | Process Building | TBD | | |
| 200-W-125-PL | 200-W-125-PL; 216-Z-1 Ditch Replacement Pipeline | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |
| 200-W-174-PL | 200-W-174-PL; 216-Z-1A Modified Pipeline; Lines 1035 and 1036; Pipelines from 234-5Z to 216-Z-1A and 216-Z-18 Crib | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD | | |
| 200-W-199-PL | 200-W-199-PL; Pipelines from Building 231-Z to 231-W-151 Vault | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |
| 200-W-200-PL | 200-W-200-PL; Pipeline from 231-Z to 216-Z-16 Crib | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |
| 200-W-201-PL | 200-W-201-PL; Pipeline from 231-Z to 216-Z-17 Crib | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |
| 200-W-202-PL | 200-W-202-PL; Pipeline from 231-W-151 to 216-Z-5 Crib | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |
| 200-W-203-PL | 200-W-203-PL; Pipeline from 231-W-151 Vault to 216-Z-7 Crib | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |
| 200-W-204-PL | 200-W-204-PL; Pipeline from 231-W-151 Vault to 216-Z-10 Reverse Well | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |
| 200-W-205-PL | 200-W-205-PL; Pipelines from 235-5Z to 241-Z-8 Silica Storage Tank and 216-Z- 8 French Drain | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD | | |
| 200-W-206-PL | 200-W-206-PL; Pipelines from 234-5Z to 216-Z-9 Crib | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| 200-W-207-PL-B | 200-W-207-PL-B; PFP Process Sewer Segments Connecting to TEDF System | Waste Site | Active | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | Not Applicable | | |
| 200-W-208-PL | 200-W-208-PL; Pipeline from Diversion Boxes 200-W-58 and 200-W-59 to 216-Z- 12 Crib | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD | | |
| 200-W-209-PL | 200-W-209-PL; 207-Z Pipelines | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |
| 200-W-210-PL | 200-W-210-PL; Pipeline from 241-Z-361 Settling Tank to 216-Z-1, 216-Z-2 and 216-Z-3 Cribs and 216-Z-1A Tile Field | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD | | |
| 200-W-214-PL | 200-W-214-PL; Pipeline from 291-Z to 216-Z-13 French Drain | Waste Site | Active | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD | | |
| 200-W-215-PL | 200-W-215-PL; Pipeline from 291-Z to 216-Z-14 French Drain | Waste Site | Active | Accepted (Proposed) | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD | | |
| 200-W-216-PL | 200-W-216-PL; Pipelines from 291-Z to 216-Z-15 French Drain | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |
| 200-W-219-PL | 200-W-219-PL; 241-Z Primary Pipe Trench; Pipe Tunnel 3; Pipelines from 235-Z to the North Side of 241-Z | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |
| 200-W-220-PL | 200-W-220-PL; Pipeline from 241-Z to 241-Z-361 Settling Tank | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD | | |
| 200-W-224-PL | 200-W-224-PL; Pipeline from 234-5Z and 236-Z to West Side of 241-Z | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |
| 200-W-225-PL | 200-W-225-PL; PFP Six Inch Condensate Line Connecting to Process Sewer | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |
| 200-W-228-PL | 200-W-228-PL; 3-Inch Contaminated Waste Line; Pipeline from 232-Z to 241-Z | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |

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| 200-W-229-PL | 200-W-229-PL; Pipeline from 2736-ZB to 241-Z | Waste Site | Inactive | Accepted | None | Radioactive Process Sewer | Pipeline and associated valves, etc. | TBD_200-IS-1 | | |
| 231-W-151 | 231-W-151; 231-W-151 Sump; 231-W-151 Vault; 231-W-151-001 (Tank); 231-W-151-002 (Tank); 231-Z-151 Sump; | Waste Site | Inactive | Accepted | None | Receiving Vault | Underground Storage Tank | 200-WA-1 | | |
| 207-Z | 207-Z; 207-Z Retention Basin; 241-Z Retention Basin; 241-ZRB; 241-Z-RB | Waste Site | Inactive | Accepted | None | Retention Basin | Crib - Subsurface Liquid Disposal Site | 200-WA-1 | | |
| 241-Z-361 | 241-Z-361; 241-Z-361 Settling Tank; IMUST; Inactive Miscellaneous Underground Storage Tank | Waste Site | Inactive | Accepted | None | Settling Tank | Underground Storage Tank | 200-PW-1 | | |
| 216-Z-17 | 216-Z-17; 216-Z-17 Ditch | Waste Site | Inactive | Accepted | None | Trench | Crib - Subsurface Liquid Disposal Site | 200-WA-1 | | |
| 216-Z-4 | 216-Z-4; 216-Z-4 Crib; 231-W-3 Crib; 231-W-3 Pit; 231-W-3 Sump; 216-Z-3 | Waste Site | Inactive | Accepted | None | Trench | Crib - Subsurface Liquid Disposal Site | 200-WA-1 | | |
| 200-W-171 | 200-W-171; 200-W-219-PL Line Leak; Leak from 234-5Z Pipe Trench to 241-Z Tank D-6 | Waste Site | Inactive | Accepted | None | Unplanned Release | Unplanned Release - Subsurface | TBD_200-IS-1 | | |
| UPR-200-W-103 | UPR-200-W-103; 216-Z-18 Line Break; Pipe Line Leak; UN-200-W-103; UN-216-W-13 | Waste Site | Inactive | Accepted | None | Unplanned Release | Unplanned Release - Subsurface | 200-WA-1 | | |
| UPR-200-W-130 | UPR-200-W-130; Line Leak at 231-W-151 Sump; UN-200-W-130 | Waste Site | Inactive | Accepted | None | Unplanned Release | Unplanned Release - Subsurface | 200-IS-1 | | |
| UPR-200-W-23 | UPR-200-W-23; Waste Box Fire at 234-5Z; UN-200-W-23 | Waste Site | Inactive | Accepted | None | Unplanned Release | Unplanned Release - Surface/Near Surface | 200-WA-1 | | |
| UPR-200-W-79 | UPR-200-W-79; Contamination Spread at 241-Z; UN-200-W-79 | Waste Site | Inactive | Accepted | Consolidated | Unplanned Release | Unplanned Release - Surface/Near Surface | Not Applicable | | |
| 200-W-58 | 200-W-58; Z-Plant Diversion Box #1 | Waste Site | Inactive | Accepted | None | Valve Pit | Pipeline and associated valves, etc. | 200-IS-1 | | |
| 200-W-59 | 200-W-59; Z-Plant Diversion Box #2 | Waste Site | Inactive | Accepted | None | Valve Pit | Pipeline and associated valves, etc. | 200-IS-1 | | |
| 2607-Z | 2607-Z | Waste Site | Inactive | Accepted | None | Septic Tank | Septic System | 200-WA-1 | X | Septic System |
| 2607-Z1 | 2607-Z1; Septic Tank and Drainfield | Waste Site | Inactive | Accepted | None | Septic Tank | Septic System | 200-WA-1 | X | Septic System |
| 234-5Z HWSA | 234-5Z HWSA; 234-5Z Hazardous Waste Storage Area | Waste Site | Active | Accepted | Rejected | Storage Pad (<90 day) | Storage Pad | Not Applicable | X | Rejected |

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| UPR-200-W-159 | UPR-200-W-159; Caustic Spill at Plutonium Finishing Plant; UN-200-W-159 | Waste Site | Inactive | Accepted | Rejected | Unplanned Release | Unplanned Release - Surface/Near Surface | Not Applicable | X | Rejected |
| UPR-200-W-74 | UPR-200-W-74; Overground Line Leak at 241-Z; UN-200-W-74 | Waste Site | Inactive | Accepted | Rejected | Unplanned Release | Unplanned Release - Surface/Near Surface | Not Applicable | X | Rejected |
| UPR-200-W-75 | UPR-200-W-75; Contamination Spread at 241-Z; UN-200-W-75 | Waste Site | Inactive | Accepted | Rejected | Unplanned Release | Unplanned Release - Surface/Near Surface | Not Applicable | X | Rejected |
| UPR-200-W-89 | UPR-200-W-89; Radioactive Contamination Southwest of 236-Z Building; UN-200-W-89; UN-216-W | Waste Site | Inactive | Not Accepted | None | Unplanned Release | Unplanned Release - Surface/Near Surface | Not Applicable | X | Not Accepted |
| UPR-200-W-90 | UPR-200-W-90; Radioactive Contamination South of 236-Z Building; UN-200-W-90; UN-216-N | Waste Site | Inactive | Accepted | Rejected | Unplanned Release | Unplanned Release - Surface/Near Surface | Not Applicable | X | Rejected |
| UPR-200-W-91 | UPR-200-W-91; Radioactive Contamination Near 234-5Z Building; UN-200-W-91; UN-216-W-91 | Waste Site | Inactive | Accepted | Rejected | Unplanned Release | Unplanned Release - Surface/Near Surface | Not Applicable | X | Rejected |
| 231Z | MATERIALS ENGINEERING LABORATORY | Facility | INACTIVE | | | BUILDING | Process Building | | | |
| 234-5Z | PLUTONIUM FABRICATION FACILITY | Facility | ACTIVE | | | BUILDING | Process Building | | | |
| 234-5ZA | PFP MICON, ACES, AND MASK FIT | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | | |
| 234-5Z-BA | 234-5Z BOILER ANNEX | Facility | ACTIVE | | | BUILDING | Process Building | | | |
| 236Z | PLUTONIUM RECLAMATION FACILITY | Facility | INACTIVE | | | BUILDING | Process Building | | | |
| 242Z | WASTE TREATMENT FACILITY | Facility | INACTIVE | | | BUILDING | Process Building | | | |
| 242ZA | 242ZA ANNEX ENTRANCE | Facility | INACTIVE | | | BUILDING | Infrastructure Building | | | |
| 243Z | LOW LEVEL WASTE TREATMENT | Facility | ACTIVE | | | BUILDING | Process Building | | | |
| 267Z | RISER #9 VALVE HOUSE | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | | |
| 2704Z | OFFICE ADMINISTRATION BUILDING | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | | |
| 270Z | PFP SUPPORT FACILITY // INSIDE THE | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | | |
| 2727Z | SUPPLY STORAGE BUILDING | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | | |
| 2729Z | STORAGE BUILDING | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | | |
| 2734ZL | HYDROGEN FLUORIDE FACILITY | Facility | INACTIVE | | | BUILDING | Process Building | | | |
| 291Z | EXHAUST AIR FILTER STACK BUILDING | Facility | ACTIVE | | | BUILDING | Process Building | | | |
| HO6406376 | CHANGE TRAILER SOUTHWEST OF | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | | |
| 243ZA | LOW LEVEL WASTE STORAGE | Facility | ACTIVE | | | STRUCTURE | Storage Pad | | | |

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| 243ZB | COOLING TOWERS AND CONCRETE | Facility | ACTIVE | | | STRUCTURE | Process Building | | | |
| 2503Z | 13.8KV SWITCH YARD NORTH OF 234- | Facility | ACTIVE | | | STRUCTURE | Infrastructure Building | | | |
| 2712Z | STACK MONITORING STATION | Facility | ACTIVE | | | STRUCTURE | Infrastructure Building | | | |
| 2734ZA | GAS BOTTLE STORAGE | Facility | ACTIVE | | | STRUCTURE | Infrastructure Building | | | |
| 2734ZB | GAS STORAGE | Facility | ACTIVE | | | STRUCTURE | Infrastructure Building | | | |

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| 2734ZC | GAS STORAGE | Facility | ACTIVE | | | STRUCTURE | Infrastructure Building | | | |
| 2734ZD | PROCESS GAS STORAGE | Facility | ACTIVE | | | STRUCTURE | Infrastructure Building | | | |
| 2734ZK | GAS STORAGE | Facility | ACTIVE | | | STRUCTURE | Infrastructure Building | | | |
| 2735Z | CHEMICAL STORAGE | Facility | INACTIVE | | | STRUCTURE | Infrastructure Building | | | |
| 2736ZA | PLUTONIUM STORAGE VENTILATION STRUCTURE | Facility | INACTIVE | | | STRUCTURE | Process Building | | | |
| 291Z001 | STACK, 234-5Z, 236Z, AND 242Z MAIN | Facility | ACTIVE | | | STRUCTURE | Process Building | | | |
| 2721Z | DEMO'D -- EMERGENCY GENERATOR BUILDING | Facility | DEMO""D | | | BUILDING | Infrastructure Building | | X | Demoed |
| 2731ZA | DEMO'D -- STORAGE BUILDING | Facility | DEMO""D | | | BUILDING | Infrastructure Building | | X | Demoed |
| 2736ZB | DEMO'D --PLUTONIUM STORAGE SUPPORT FACILITY | Facility | DEMO""D | | | BUILDING | Process Building | | X | Demoed |
| MO014 | INSIDE FENCE AT PFP BY 2704Z | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | X | Mobile Office |
| MO2308 | RESTROOM TRL AT NE CORNER OF 234-5Z | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | X | Mobile Office |
| MO2311 | RESTROOM TRL WEST OF 270Z | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | X | Mobile Office |
| MO2501 | SHOWER TRAILER NE OF 234-5 | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | X | Mobile Office |
| MO2502 | SHOWER TRAILER WEST OF 270Z | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | X | Mobile Office |
| MO428 | MO INSIDE FENCE AT PFP | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | X | Mobile Office |

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| MO429 | MO INSIDE FENCE AT PFP | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | X | Mobile Office |
| MO432 | MOBILE OFFICE AT 270Z | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | X | Mobile Office |
| MO671 | MOBILE OFFICE SE OF 234-5ZA | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | X | Mobile Office |
| MO970 | MOBILE OFFICE SOUTH OF 2704Z | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | X | Mobile Office |
| MO971 | MOBILE OFFICE EAST OF 236Z | Facility | ACTIVE | | | BUILDING | Infrastructure Building | | X | Mobile Office |
| 231W151 | SUMP TANK AND WELL | Facility | INACTIVE | | | STRUCTURE | Underground Storage Tank | | X | Duplicative |
| 2736ZC | DEMO'D -- CARGO RESTRAINT TRANSPORT DOCK | Facility | DEMO""D | | | STRUCTURE | Infrastructure Building | | X | Demoed |
| 241Z361 | WASTE SETTLING TANK - UNDERGROUND | Facility | INACTIVE | | | TANK | Underground Storage Tank | | X | Duplicative |

Note that only those waste sites with a WIDS (Waste Information Data System) Classification of "Accepted" are included in the evaluation, along with non-duplicate facilities, identified via the Hanford Geographic Information System (HGIS).

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