APPENDIX F.9

REDOX (CP-DD-4, CENTRAL PLATEAU)
EVALUATION UNIT SUMMARY TEMPLATE

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PART I. EXECUTIVE SUMMARY

EU LOCATION

The Reduction-Oxidation (REDOX) Facility is located in the southwest portion of the 200 West Area of the Hanford Site. This EU includes the REDOX Canyon (S Plant), ancillary buildings, except 222-S laboratory, structures, and associated near-surface contaminated soils.

RELATED EUS

CP-LS-4

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES

The REDOX canyon, north sample gallery, and the exhaust system contain the significant inventories of the residual radiological contamination remaining after flushing, draining, and other inventory-reduction activities, as well as contamination in the sand filter. Together, the 202-S Canyon building and the 291-S exhaust system (exhaust tunnel, sand filter, and stack and condensate ancillary) are classified as a Hazard Category 2 facility based on the quantity, form, and location of the radioactive material.

The REDOX S&M Plan for the Canyon building and DSA for the REDOX Facility both contain statements concerning the accuracy of the available inventory information. "The list of hazardous materials remaining at REDOX is as complete as knowledge allows but the list was not developed at the time it was deactivated by personnel who worked at and deactivated the facility. The estimates are largely based on historical published data, the basis of which is unknown".[1] "In general, detailed radionuclide characterization data (i.e., form, quantity, and location) for the 202-S Canyon Building do not exist…. Because of this uncertainty, highly conservative assumptions are used when applying the limited inventory data. In any undertaking that involves intrusive activities into the REDOX Facility, caution must be exercised, recognizing that higher-than-predicted levels of contamination or materials may be encountered"[2] The estimated radiological inventories used in the DSA assume a total 1,980 Ci alpha and 17,840 Ci beta, with alpha activity assumed to be Pu-239 and beta activity to be Sr-90. These are lower than the inventories estimated for the B Plant, U Plant and PUREX facilities, all of which also had large amounts of Cs-137.

While deactivation activities removed the vast majority of hazardous chemicals, minor quantities of residual chemicals are expected to be found in the process vessels and piping located in the buildings throughout the facility. Deactivation procedures specified the use of nitric acid, permanganate, and oxalic acid that also are likely to be present in residual quantities. Asbestos-insulated steam lines run throughout the REDOX Facility. Asbestos also was used as a building material in the walls in the operating area of the 276-S Solvent Handling Building.[2]

This EU also includes five Unplanned Release-Surface/Near Surface Waste sites. Inventories are only available for one, UPR-200-W-61 which is ground contamination caused by a fire hose rupturing while

[1] US Department of Energy, *Surveillance and Maintenance Plan for the 202-S Reduction Oxidation (REDOX) Facility*, DOE/RL-98-19, Revision 3, Richland Office, January 10, 2008.
[2] CH2MHill Plateau Remediation Company, *Documented Safety Analysis for the Reduction-Oxidation Facility*, HNF-13830, Revision 4A, April 16, 2015.

flushing the H-10 to 241-SX transfer line. Back flow from the transfer line contaminated an outside ground area. The primary contaminants are Cs-137 (62.5Ci) and Sr-90 (2.06Ci). The area is not currently marked or posted.

BRIEF NARRATIVE DESCRIPTION

The REDOX Facility was the first large-scale, continuous-flow, solvent extraction process plant built in the United States for the recovery of plutonium from irradiated uranium fuel. Operations began in 1952 and continued until the facility was shut down in 1967. Deactivation started in 1967 and was completed in 1969 when it was transferred to Surveillance and Maintenance (S&M) status. It is classified as a Hazard Category 2 facility based on the quantity, form, and location of the radioactive material.

The facility consists of deactivated buildings and associated process equipment used for dissolution and separation of uranium, neptunium, and plutonium, as well as deactivated equipment used for waste concentration, waste neutralization, and solvent recovery. In addition to the main processing building (the 202-S Canyon Building), the REDOX Facility includes buildings formerly used for storing chemicals and materials, and support systems (e.g., ventilation).

In November 2016, DOE issued an Engineering Evaluation/Cost Analysis for the REDOX Complex (DOE/RL-2016-16, Rev 0) for public review and comment. The document proposes four non-time critical removal alternatives which are intended, with the exception of the No Action alternative, to offer a combination of actions to prevent or reduce the risk of release of hazardous substances including continued S&M, hazard abatement, demolition preparation, demolition, and grouting. Built in the 1950s and unoccupied since the mid-1960s, the REDOX buildings/structures in the scope of the EE/CA have severely degraded. Spread of contamination has been observed throughout the buildings and it is believed that it will intensify as the facilities continue to degrade. It is proposed that implementation of this removal action would commence in 2017, but would receive only partial funding over the 15-year period before a final ROD is expected to be issued.

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table F.9-1. 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 REDOX facility; a Co-located Person (CP) is an individual located 100 meters from the physical boundaries of the facility; 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 4.3 km (2.7 miles). The nearest site boundary is 12,580 m (7.8 mi) to the south and 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.9-1 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[3]

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[3]

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.

[3] 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.9-1. 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: Surveillance & Maintenance	**From Cleanup Actions[c]:** Interim D&D
Human Health	Facility Worker	***S&M***: Medium-High (Low)	Medium-High (Low)
	Co-located Person	***S&M***: Medium-High (Low)	Medium-High (Low)
	Public	***S&M***: ND	ND
Environmental	Groundwater (A&B) from vadose zone[a]	*ND* – Sr-90 and U(tot)[d], *Low* – Others with reported inventories **Overall**: *Low*	*ND* – Sr-90 and U(tot)[d], *Low* – Others with reported inventories **Overall**: *Low*
	Columbia River from vadose zone[a]	Benthic and Riparian: *ND* Free-flowing: *ND* **Overall**: *ND*	Benthic and Riparian: *ND* Free-flowing: *ND* **Overall**: *ND*
	Ecological Resources[b]	ND	ND to Low
Social	Cultural Resources[b]	**Native American** Direct: Unknown Indirect: Known **Historic Pre-Hanford** Direct: Unknown Indirect: Known **Manhattan/Cold War** Direct: Known Indirect: Known	**Native American** Direct: Unknown Indirect: Known **Historic Pre-Hanford** Direct: Unknown Indirect: Known **Manhattan/Cold War** Direct: Known Indirect: Known

a. Threat to groundwater or the Columbia River from Group A and B primary contaminants (PCs) (Table 6-1, CRESP 2015) remaining in the vadose zone.

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. The "Cleanup Actions" ratings below do not relate to or consider the proposed non-time critical removal action proposed in November 2016 (DOE/RL-2016-16, Rev 0). Determination of such risk ratings will be dependent on the Alternative chosen and development of a related Documented Safety Analysis.

d. There is no current Sr-90 or total uranium plume associated with the CP-DD-4 EU waste sites and thus current ratings are *ND*. The corresponding ratings after the Active Cleanup period are *Low* to account for uncertainties in the evaluation.

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

Current

The primary current activity at the site is Surveillance & Maintenance while it awaits final D&D.

Seismic Event: A seismic event is assumed resulting in the total failure of the 202-S Canyon Building structure with resulting ground level release of material. A previous structural study of the 202-S Canyon Building concluded that the building could withstand seismic events only up to a peak ground acceleration of 0.03 g versus more current 0.20 g required of Safety Class I facilities such as REDOX. The likely failure mode of the building would be a collapse of the roof into the canyon area. A structural analysis[4] determined that the blocks could withstand the impact of roof debris without failure. A subsequent analysis[5] showed that the cover blocks would withstand the impact of roof debris even under seismic loading conditions. In the most current DSA, total failure of the 202-S Canyon Building resulting from a seismic event is judged to have a frequency of unlikely. The vast majority of the source term is thought to be inside process equipment and piping located within the process cells. The estimated dose to the FW and CP is 108 rems and to the Public is 0.0943 rems.

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

The major receptor at risk is the facility worker in the canyon area. The event is NRH and the material at risk is limited to the residual materials; no safety-class or safety-significant SSCs and no technical safety requirements (TSRs) are identified. Applicable SMPs that provide worker safety for these types of actions include the work control process, hazardous material control program, and emergency preparedness program.

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

Product Receiver Cage Fire: The north sample gallery contains the original product loadout area that preceded the operations of the 233-S Plutonium Concentration Facility. The deactivated process equipment is located in the PR cage. A fire involving the combustible loading of the PR cage is postulated. The amount of contaminants that would be subject to release as a result of the postulated fire is limited to the surface contaminants present on the vessels, piping, and PMMA panels of the PR cage. The estimated dose to the FW and CP is 12.1 rems and to the Public is 0.0105 rems.

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

The major receptor at risk is the facility worker in the canyon area. The DSA concluded that no safety-class or safety-significant SSCs and no TSRs are required to prevent or mitigate the event. Applicable SMPs that provide worker safety for these types of actions include the fire protection program and work control program. The building structure does serve, to some extent, as a confinement barrier. As a result, the building structure is identified as defense in depth equipment ITS.

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

Canyon Load Drop: Routine S&M activities in the canyon exclude use of the canyon crane. However, during the facility's S&M history, the crane has been used to respond to upset conditions in the canyon cells. A heavy load such as cell cover blocks could be dropped accidentally over an open or partially opened cell (e.g., one or more cover blocks have been removed). The release is unmitigated by the

[4] Bechtel Hanford, *Load Drop Evaluation of 202-S Canyon Roof Structure,* 0200W-CA-0027, Rev. 0, January 30, 1997
[5] D&D ERC, 0200W-CA-C0033, *REDOX (202-S) Combined Seismic and Load Drop Effects on Cell Covers*

exhaust system and a ground-level release occurs. The estimated dose to the FW and CP is 19.6 rems and to the Public is 0.017 rems.

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

The major receptor at risk is the facility worker in the canyon area. The DSA concluded that no safety-class or safety-significant SSCs and no TSRs are required to prevent or mitigate the event. Applicable SMPs that provide worker safety for these types of actions include the work control program, hoisting and rigging requirements, the radiological protection program, and the maintenance program (including crane maintenance and general maintenance of SSCs). While no safety-class or safety-significant SSCs are required, passive confinement of the canyon structure is recognized as defense in depth equipment ITS.

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

Structural Degradation: The EE/CA document issued in November 2016 indicates that in addition to current radiological and chemical hazards, structural hazards exist due to the degradation in the structural integrity of the buildings and structures. Structural degradation could result in partial or total loss of radiological material, confinement, and/or worker injury. While the precise inventory of the contaminants and contaminant quantities remaining in the 202S Building and Ancillary Structures is not known, the documented amount of radiological contamination and ACM present in the deteriorating facilities indicates a sufficient threat of release to the environment. Contaminants could be released directly to the environment through a fire; breach in a utility pipe, containment wall, or roof; or building collapse as the buildings age and deteriorate. Contaminants could also be released to the environment indirectly through animal and human intrusions. No additional information is provided that would allow quantification of potential dose exposure from such events and thus determination of an appropriate risk rating to Facility Workers or Co-Located Persons.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

The several radiological event scenarios identified with current S&M activities at the REDOX site would still likely be present during the early D&D phases, but the most serious consequences would diminish as contaminated areas and equipment are removed and/or grouted in place.

The canyon area of the 202-S Canyon Building originally contained fuel processing areas. Today these areas contain deactivated equipment that was used for dissolution, separation, and decontamination of uranium and plutonium, as well as for waste concentration and neutralization, and solvent recovery. Inventories of hazardous substances, radiological material, and hazardous material were removed as part of the deactivation efforts. The remaining materials consist of residual contaminants that remain after flushing, draining, and other inventory-reduction activities, and contamination that remains in the exhaust system, primarily in the sand filter. The REDOX canyon, north sample gallery, and the exhaust system contain the significant inventories of the residual radiological contamination, but there is a very high degree of uncertainty as to form, quantity, and distribution. The current DSA[6] notes that in any undertaking that involves intrusive activities into the REDOX Facility (such as would be required in the initial D&D phases), caution must be exercised, recognizing that higher-than-predicted levels of contamination or materials may be encountered.

In November 2016, DOE issued an Engineering Evaluation/Cost Analysis for the REDOX Complex (DOE/RL-2016-16, Rev 0) for public review and comment. The document proposed four non-time critical

[6] CH2MHill Plateau Remediation Company, *Documented Safety Analysis for the Reduction-Oxidation Facility*, HNF-13830, Revision 4A, April 16, 2015.

removal alternatives which are intended, with the exception of the No Action alternative, to offer a combination of actions to prevent or reduce the risk of release of hazardous substances including continued S&M, hazard abatement, demolition preparation, demolition, and grouting. Built in the 1950s and unoccupied since the mid-1960s, the REDOX buildings/structures in the scope of the EE/CA have severely degraded. Spread of contamination has been observed throughout the buildings and it is believed that it will intensify as the facilities continue to degrade. The recommended removal action alternative would: conduct hazard abatement of the 202S Canyon; prepare the 202S Silo Service Area, 202S Annex, and 202S Canyon above grade areas for demolition; demolish the 276S Hexone Storage Tanks and the 293S Building; grout the 293S Building below grade areas; and demolish the 202S Annex. It is unclear at this time when these removal actions would be completed and what their impact on final remedial actions may be.

The D&D of the U Canyon is being used as a pilot for D&D of the other four canyons at the Hanford Site, and CHPRC has developed an extensive review of lessons learned that will benefit similar work that may be carried out at REDOX in the future. The selected remedial action for the U Plant calls for 1) consolidating and grouting equipment currently in the 221-U canyon into the process cells, 2) filling the process cell galleries, hot pipe trench, ventilation tunnel, drains and other voids below the operating deck and crane cabway deck levels with grout, 3) demolition of the canyon roof and walls to the approximate level of the canyon deck, and 4) burial of the remaining canyon structure beneath an engineered barrier. The cleanup remedy for U-Plant is to largely leave contamination in place and contain it in such a fashion that it presents no unacceptable risk to human health or the environment.[7]

The REDOX facility and U Plant are different with respect to their prior uses and levels of residual radiological contamination, the two U Plant DSAs (HNF-13829 Revisions 4 [OUO Doc] and 5) provide discussions of some of the accidents or events that could cause radiological exposure to workers and co-located persons during D4 of the REDOX canyon facilities. The primary risks were determined to be a seismic event and accidents involving size reduction and waste management types of activities that are required for the preparations for the canyon demolition, but which could cause a fire.

Groundwater, Vadose Zone, and Columbia River

Current

The CP-DD-4 (REDOX or S Plant) EU is located in the 200 West Area in the central part of the 200-UP groundwater interest area (GWIA). The 200-UP GWIA is described in the CP-GW-2 EU (Appendix D.6). The saturated zone beneath the CP-DD-4 area has elevated levels of total and hexavalent chromium, carbon tetrachloride (CCl_4), I-129, nitrate, Tc-99, and tritium (H-3) based on 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html); no CP-DD-4 waste sites are suspected of being able to contribute (even) 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 200-UP 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-4 EU contaminants *remaining* in the vadose zone (Table F.9-6) has an overall rating of *Low* (related to various primary contaminants) as described in **Part V**. In the 200 West Area, contaminated 200-UP groundwater is monitored and treated (DOE/RL-2016-09, Rev. 0). As indicated in **Part V**, no plumes have been linked to CP-DD-4 waste sites. Threats from

[7] CH2MHIll Plateau Remediation Company 2008, *Remedial Design/Remedial Action Work Plan for the 221-U Facility, DOE/RL-2006-21, Revision 0*, Prepared for the U.S. Department of Energy Assistant Secretary of Environmental Management U.S. Department of Energy, December 2008.

contaminated groundwater in the 200 West 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-UP GWIA, no plume from the CP-DD-4 EU currently 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**, remedial actions have not been selected for CP-DD-4 EU legacy wastes sites. Furthermore, contaminants from the CP-DD-4 EU waste sites are not suspected of currently impacting groundwater although they may be contaminating the vadose zone; treatment actions are currently being conducted for 200-UP groundwater using the WMA S-SX groundwater extraction system[8], the U Plant area P&T system (uranium plume), and the I-129 plume hydraulic control system. Secondary sources in the vadose may threaten to impact groundwater in the future, including the Active Cleanup period. The *Low* ratings (for all primary contaminants with reported inventories) for the CP-DD-4 EU waste sites (Table F.9-6) are associated with some mobile primary contaminants that may eventually impact groundwater in the 200 West Area (CP-GW-2, Appendix D.6).

As described in **Part V**, the groundwater transport analysis in the TC&WM EIS (Appendix O, DOE/EIS-0391 2012) for the CP-TF-2 (S-SX Tank and Waste Farms) EU, which is the considered representative of the REDOX (or S Plant) EU for the purpose of this evaluation, indicates there is an impact of emplacing the engineered surface barrier (and resulting reduction of infiltrating water) on the predicted peak groundwater concentrations at the S Barrier; however, the impact was not sufficient to drive all predicted concentrations below thresholds[9]. However, there are very small reported vadose zone inventories (i.e., from a single UPR) and thus any impacts predicted in the TC&WM EIS analysis are likely dominated by sources other than the REDOX EU. Furthermore, since ratings are already *Low*, these will not be modified to account for any uncertainties in the analysis.

There are only small very quantities of primary contaminants (Table F.9-3. through Table F.9-5.) associated with the one UPR that constitutes the reported CP-DD-4 vadose zone inventory. Furthermore, expected remedial options would tend to limit infiltrating water, which is the primary motive force to release and transport contaminants to groundwater. Surface barrier emplacement has not begun in the area, but there are active treatment processes ongoing in the 200-UP GWIA. The TC&WM EIS screening groundwater results for the area near the S Plant does indicate that Tc-99, I-129, and chromium (of the Group A and B primary contaminants) could be present at the S Barrier at predicted concentrations that would exceed thresholds; however, as noted above, the inventories for these constituent are insignificant relative to the other sources in the Central Plateau and thus current

[8] The WMA S-SX groundwater extraction system began operations in 2012 where extracted contaminated water is pumped to the 200 West P&T for treatment (Section 11.12.2, DOE/RL-2016-09, Rev. 0).

[9] 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 S Barrier is the closest to the S-SX Tank and Waste Farms EU and is considered representative of the subsurface near the REDXO (or S Plant) EU. Despite including sources other than those for the REDOX EU, the analysis in the TC&WM EIS was considered the most reasonable information to assess the impact of the engineered surface barrier emplacement.

and future plumes are not considered linked to CP-DD-4 sources (or at least any contribution from the CP-DD-4 sites would be subsumed in contributions from other EUs). It is also considered unlikely that these small inventories would lead plume areas to increase over time. Because current ratings are already *Low* for primary contaminants[10], these will not be changed based on radioactive decay or recharge impacts. 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 ratings for current threats provided in Table F.9-6 would not be modified (at the end of the Active Cleanup period). The overall rating thus remains *Low* (various contaminants) at the end of the Active Cleanup period and beyond.

Ecological Resources

Current

Currently, the area is all disturbed with buildings, and cleared areas. There could be migratory birds nesting on buildings. Work would be done when birds are not nesting, or other mitigation activities.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

No cleanup decisions have been made for deep vadose zone, and as a result, the potential effects of cleanup on ecological resources is uncertain for the active cleanup evaluation period. Cleanup decision for surface may change based on cleanup for deep vadose zone. Removal of facility would include significant truck traffic/roadway disturbance to level 3 and above resources in buffer area (2%). 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. Two archaeological isolates are located within 500 meters of the EU.

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

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Archaeological investigations and monitoring may need to occur prior to remediation. Although the area is heavily disturbed, 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.

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

[10] Because of the tendency for Sr-90 and uranium to sorb to Hanford sediments (and reinforced by predictions in the TC&WM EIS groundwater transport analysis (Appendix O, DOE/EIS-0391 2012), ratings for these constituents will be *ND* for the current period and *Low* afterwards to account for uncertainties in the evaluation.

Considerations for Timing of the Cleanup Actions

In November 2016, DOE issued an Engineering Evaluation/Cost Analysis for the REDOX Complex (EE/CA) (DOE/RL-2016-16, Rev 0) that proposed four non-time critical removal alternatives intended, with the exception of the No Action alternative, to offer a combination of actions to prevent or reduce the risk of release of hazardous substances including continued S&M, hazard abatement, demolition preparation, demolition, and grouting. Built in the 1950s and unoccupied since the mid-1960s, the REDOX buildings/structures in the scope of the EE/CA have severely degraded. The Canyon Deck has not been entered since 1997 and conditions on the deck are not known at this time. Based on current conditions in areas where surveillance inspections are performed, water accumulation, animal intrusion, structure deterioration, and contamination spread are expected. Substantial structural deterioration has been observed in the Silo. Significant water stains, dirt deposits, animal intrusion, and chemical stains are noted on all levels of the Silo. Deteriorated asbestos insulation has also been noted on most levels. The Plutonium Loadout Hood contains a large quantity of radiological inventory and surveillance reports indicate that radiological contamination has been spreading in every entry from 2012 to 2015. In 2012, the surveillance inspection of the west end of the North Sample Gallery was halted because water was observed running down the loadout hood, and the contamination level in the gallery exceeded radiological work permit (RWP) limits. Several rooms within the 202S Building are radiologically contaminated and need to be addressed before the occurrence of an unpredictable event that could be a threat to human health and the environment (HHE). The possibility for contamination migration is very likely and is aided by water intrusion. The 202S Building has been unoccupied for a much longer period of time than the other Canyon buildings; therefore, conditions are expected to be much worse.

The EE/CA document notes that the nearby 222S Laboratory operating baseline has been extended 30 to 40 more years to support operations of the Waste Treatment Plant. Due to the nearby location of 222S, full-scale demolition of the 202S Building may be delayed, and the S&M period may be extended. Risk mitigation activities (as recommended in this EE/CA) will need to be implemented to ensure that catastrophic failure of components (e.g., filters, roof, and stairwells) does not occur.

The date for completion of TPA Milestone M-085-90, “Submit Remedial Investigation/Feasibility Study Work Plan for 200-CR-1 to EPA,” is September 30, 2021 (Ecology et al., 1989a). Therefore, remedial actions are not expected to be implemented for a number of years thereafter. Without any near-term hazard mitigation actions, the structural deterioration and contamination spread could result in an unacceptable release to HHE. Although implementation of this proposed removal action would commence in 2017, it would receive only partial funding of its $180.7 million cost over the 15-year period before a final ROD is expected to be issued in 2032.[11] Thus, only a portion of the proposed removal action would be completed.

Completing the initial phase of D4 to where the U Plant is today (consolidation of equipment from the canyon deck into process cells and the hot pipe trench, followed by filling the process cells, hot pipe trench, piping and electrical galleries, drain header, process sewer, and ventilation tunnel and ducts with grout) would remove the greatest potential radiological risks to humans and possibly permit a delay in final cleanup.

The saturated zone beneath the CP-DD-4 (S Plant) area has elevated levels of total and hexavalent chromium, carbon tetrachloride (CCl_4), I-129, nitrate, Tc-99, and tritium (H-3) based on 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). No waste sites within

[11] US Department of Energy, Richland Operations Office, *Engineering Evaluation/Cost Analysis for the REDOX Complex,* DOE/RL-2016-16, Revision 0, November 2016, p7-1.

the CP-DD-4 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0) but may be contributing contamination to the vadose zone (because these sites have not been linked to current plumes). Monitoring and treatment of groundwater is being conducted within the 200-UP GWIA (via the WMA S-SX groundwater extraction system with treatment in the 200 West Pump and Treat facility, the U Plant area P&T system for the uranium plume, and the I-129 plume hydraulic control system), 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., plumes except for nitrates and uranium in 200-UP) and concentrations continue to exceed cleanup levels. Thus additional cleanup actions are likely warranted for this EU.

There is potential for additional contaminant release and migration through the vadose that may eventually impact groundwater if 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 groundwater cleanup is delayed.

Near-Term, Post-Cleanup Risks and Potential Impacts

Human Health

There is Insufficient Information (IS) with regard to human health risks because the specific method of final cleanup for the REDOX complex has not been determined, and thus no Hazard Analysis or DSA describing near-term or post-cleanup risks have been prepared.

Groundwater: During the Near-term, Post-Cleanup period (described in **Parts V** and **VI** and Table F.9-7), the ratings for the Group A and B primary contaminants are *Low* to address uncertainties.

Columbia River: As indicated in **Part V**, no radionuclides or chemicals from the 200 West Area (that includes the CP-DD-4 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.9-7).

Cultural

Permanent indirect effects are possible if residual contamination remains after remediation. Manhattan Project/Cold War Era buildings will be demolished.

PART II. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S)

200-CR-1

COMMON NAME(S) FOR EU

Reduction-Oxidation Plant, REDOX, S Plant

KEY WORDS

Canyon, Plutonium Extraction, Uranium Processing

REGULATORY STATUS

Regulatory basis

The 1996 Agreement in Principle (DOE-RL1996) among the Tri-Parties of DOE, USEPA, and Washington State Department of Ecology established that the CERCLA Remedial Investigation/Feasibility Study process would be followed, on a case-by-case basis, to evaluate potential cleanup remedies and identify preferred alternatives for the final end state for the five major canyon buildings in the 200 Area of the Hanford Site.

Applicable regulatory documentation

Applicable Consent Decree or TPA milestones

Milestone M-085-01 originally required the U. S**.** Department of Energy, Richland Operations change Office (RL) to submit a package to establish a date for major milestone M-085-00 (completion of response actions for canyon facilities and Central Plateau Tier 2 Facilities) by September 30, 2012, but was later extended by 10 years to September 30, 2022 so that response actions for the canyons and associated waste sites can fully benefit from the lessons learned from the remediation of the U Plant Canyon, the first of the canyon facilities on the Central Plateau to be remediated. DOE is currently proposing to modify M-085-01 to read (underlined is new), "Submit a change package to establish a date for major milestone M-085-00 in accordance with schedules established in approved RD/RA work plans" and to extend the Due Date to June 30, 2026.

In addition, a new M-085 series Milestone has been proposed related to the REDOX facilities.

M-085-90: Submit Remedial Investigation/Feasibility Study Work Plan for 200-CR-1 (REDOX) to EPA. Due Date September 30, 2021

RISK REVIEW EVALUATION INFORMATION

Completed

August 5, 2016 and updated January 6, 2017

Evaluated by

Henry Mayer, Amoret Bunn and Jennifer Salisbury

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-

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

There are three sites with reported inventories (Table F.9-3. through Table F.9-5.); however, only the unplanned release site (UPR-200-W-61) represents vadose zone contamination. The other sites are considered isolated from the environment for the purpose of this evaluation.

High-Level Waste Tanks and Ancillary Equipment

Not applicable

Groundwater Plumes

The saturated zone beneath the CP-DD-4 (REDOX or S Plant) area has elevated levels of total and hexavalent chromium, carbon tetrachloride (CCl_4), I-129, nitrate, Tc-99, and tritium (H-3) based on 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). However, there are no CP-DD-4 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-4 EU are not suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0) and have not been linked as sources for current plumes in the 200 West area (DOE/RL-2016-09, Rev. 0). Monitoring and treatment of groundwater is being conducted within the 200-UP GWIA (using the WMA S-SX groundwater extraction system, the U Plant area P&T system, and the I-129 plume hydraulic control system), which are described as part of the CP-GW-2 EU (Appendix D.6).

Operating Facilities

Not applicable

D&D of Inactive Facilities

The REDOX facility consists of deactivated buildings and associated process equipment used for dissolution and separation of uranium, neptunium, and plutonium, as well as deactivated equipment used for waste concentration, waste neutralization, and solvent recovery. In addition to the main processing building (the 202-S Canyon Building), the REDOX Facility includes buildings formerly used for storing chemicals and materials, and support systems (e.g., ventilation).

The plant operated from 1952 until 1967. Deactivation started in 1967 and was completed in 1969, when the REDOX Facility was transferred to S&M. Inventories of hazardous substances, radiological material, and hazardous material were removed as part of the deactivation efforts. The remaining materials consist of residual contaminants in the 202-S Canyon Building that remain after flushing, draining, and other inventory-reduction activities, and contamination that remains in the 291-S exhaust system, primarily in the sand filter. No process material or chemical stocks remain. The list of hazardous materials remaining at REDOX is as complete as knowledge allows, but the list was not developed at the time it was deactivated by personnel who worked at and deactivated the facility. The estimates are largely based on historical published data, the basis of which is unknown.[12]

[12] US Department of Energy, *Surveillance and Maintenance Plan for the 202-S Reduction Oxidation (REDOX) Facility*, DOE/RL-98-19, Revision 3, Richland Office, January 10, 2008.

LOCATION AND LAYOUT MAPS

The REDOX Facility is located in the southwest portion of the 200 West Area of the Hanford Site.

Figure F.9-1. REDOX Plant Evaluation Unit Location.

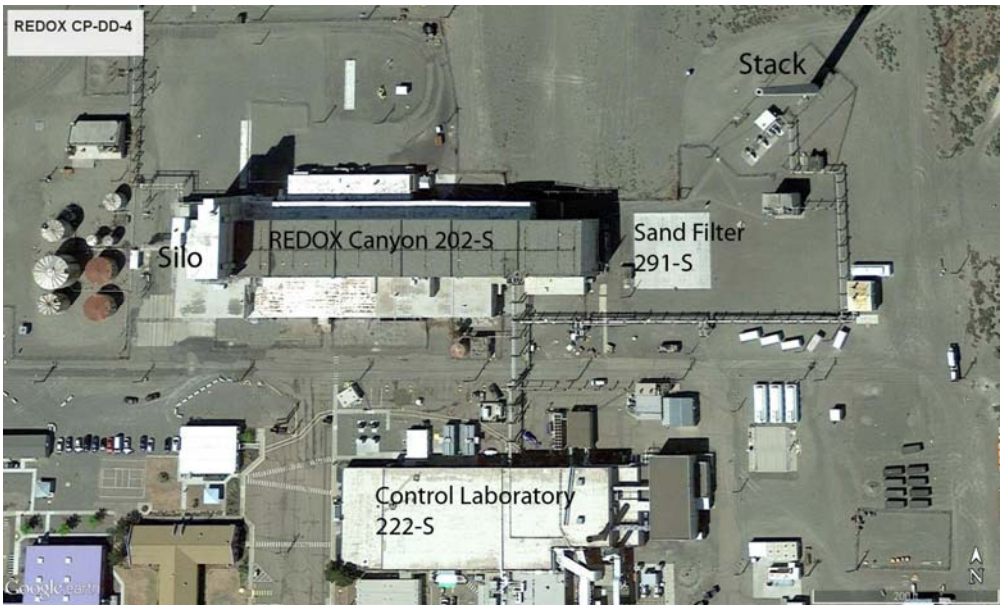

Figure F.9-2. REDOX Facility Aerial View.

PART IV. UNIT DESCRIPTION AND HISTORY

EU FORMER/CURRENT USE(S)

The REDOX plant, which was constructed between 1950 and 1952, was the fourth processing "canyon" constructed at Hanford and was the last one built in the 200-West Area. It looked different than earlier models, as it wasn't as long (470 feet) as its predecessors, but it was wider at 160 feet. In comparison to earlier processing canyons like T and B Plants, REDOX produced much less waste in its processing of irradiated fuel rods than earlier models. It was the first large-scale, continuous-flow, solvent-extraction process plant built in the United States for recovering plutonium from irradiated uranium fuel. The extraction process, which replaced the batch precipitation methods first used at the Hanford Site, was designed to separate uranium, plutonium, and neptunium as individual product streams from associated fission products in the irradiated fuel. REDOX was able to recover both the plutonium for weapons and the uranium from the fuel rods during processing where earlier models could not. The recycled uranium could be used again to make more fuel rods.

The liquid waste from the Reduction-Oxidation process contained many more chemicals than earlier waste types and it was significantly hotter when it went into the tank farms. Additionally, the process to extract plutonium from fuel rods at the REDOX Plant required a material called hexone to be used which is potentially explosive.[13]

The plant operated from 1952 until 1967 and processed approximately 24,000 tons of uranium fuel rods. The operations at REDOX consolidated plutonium processing programs into one building and process, which had previously required multiple facilities and processes. Deactivation started in 1967 and was completed in 1969, when the REDOX Facility was transferred to S&M. Deactivation included multiple flushes using water, diluted hot nitric acid, permanganate, and oxalic acid. The facility was flushed regularly with water for nearly a year after the initial cleaning.

LEGACY SOURCE SITES

The unplanned release site (UPR-200-W-61) is a powerhouse coal ramp washdown pit associated with the 284-W Powerhouse. The pit is partially filled in with tumbleweeds and surrounded with metal fence posts and a light chain wire. It is adjacent to a concrete pad, which is next to the railroad track and coal offloading chute.

GROUNDWATER PLUMES

The groundwater beneath the REDOX (S Plant) Area has elevated levels of total and hexavalent chromium, carbon tetrachloride (CCl_4), I-129, nitrate, Tc-99, and tritium (H-3) based on 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html) from the S Plant Area facilities and other 200 Area facilities. Current plumes are described as part of the 200-UP GWIA described in CP-GW-2 EU (Appendix D.6). No sites within the CP-DD-4 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0) and CP-DD-4 waste sites have not been linked to current plumes (DOE/RL-2016-09, Rev. 0). Monitoring and treatment of

[13] Hanford.gov, *About Us, Projects & Facilities, Reduction-Oxidation Plant (REDOX)* http://www.hanford.gov/page.cfm/REDOX

groundwater is being conducted within the 200-UP GWIA (using the WMA S-SX groundwater extraction system, U Plant area P&T system, and I-129 plume hydraulic control system).

D&D OF INACTIVE FACILITIES[14]

The deactivated REDOX Facility contains buildings and process equipment formerly used for dissolution and separation of uranium, neptunium, and plutonium, as well as deactivated equipment formerly used for waste concentration, waste neutralization, and solvent recovery. In addition to the main process areas, the REDOX Facility includes buildings that were formerly used to store chemicals and materials and support systems (e.g., ventilation, exhaust stacks, and environmental monitoring systems). The REDOX Facility will remain unoccupied for the duration of S&M activities.

The 202-S Canyon Building is a large multi-story, reinforced-concrete structure housing nine process cells and deactivated support operating, piping, sample galleries, and a tower process area referred to as the silo. The process cells (e.g., dissolver cell A, south extraction cell F) contain deactivated processing equipment. The silo contains deactivated solvent-extraction columns. The202-S Canyon Building is serviced by the 291-S exhaust ventilation system. Exhaust air passes through a sand filter before being discharged to the environment. The building is 468 ft long and 161 ft wide. The canyon area is 83 ft high, with 60 ft above grade. The silo area is 132 ft high, with 117 ft above grade (see Figure 3 for Canyon Cell Floor Level Plan View and Figure 4 for Longitudinal Section).

The canyon area operated at high levels of radioactivity and was separated from the canyon service areas by massive concrete shielding. It is arranged in two parallel rows of process cells that run east and west separated by 2 ft thick concrete walls for shielding. The canyon fuel processing areas contain deactivated equipment that was used for dissolution, separation, and decontamination of uranium and plutonium, as well as for waste concentration and neutralization, and solvent recovery. Removable 4 ft thick concrete process cell cover blocks from the canyon deck above the cells. The cell cover blocks are stepped and tapered to eliminate a path for direct radiation streaming and skyshine.

Piping, operating, and sample galleries are located on the north and south sides of the canyon. A storage gallery is located under the south sample gallery. The product receiver (PR) cage, which served as the plutonium loadout hood, is located in the north sample gallery. The PR cage (also known as the “Pu loadout hood” and the “plutonium loadout hood”) and selected areas of the north sample gallery were stabilized with actions initiated in 1999. These stabilization activities eliminated known and suspected sources of radiological contamination.

The 202-S silo area, located at the west end of the canyon, houses deactivated solvent-extraction columns and aqueous makeup vessels. The shaft, or tower process area, was designed specifically to house long extraction columns so that column solutions cascaded from one column to the next. The silo is 132 ft high, 84 ft long and 41 ft wide, and consists of former process and operating areas. The fuel processing side of the silo area was operated and maintained remotely and is separated from silo service areas by concrete shielding. Solvent-extraction columns were removed from and brought into the facility through the column removal tunnel, located on the north side of the silo near the column or tower shaft’s floor.

[14] CH2MHill Plateau Remediation Company, *Documented Safety Analysis for the Reduction-Oxidation Facility*, HNF-13830, Revision 4A, April 16, 2015.

The column laydown trench is located outside the 202-S Canyon Building and is connected to the silo via an underground tunnel. The trench is covered by diamond-plate steel and has a six layer asphalt pad beside it. The trench also has a weather cover. The columns were removed from the silo shaft, placed in caissons, and loaded onto a transportation cart. The columns were then rolled to the other side of the tunnel. As a result of caisson and column removal activities, the laydown trench is highly contaminated. The number of remaining columns in the silo shaft is uncertain. Current inventory assumptions bound the inventory.

Active confinement in the 202-S Canyon Building is provided by controlled airflow from areas of no or lesser contamination to areas of greater contamination. The motive force of the airflow is provided by the 291-S exhaust system. The 291-S sand filter removes radioactive particles from exhaust air before the air is discharged to the atmosphere. The sand filter is a below-grade structure, approximately 85 ft by 85 ft by 20 ft, consisting of approximately 12 ft of sand and 8 ft of air space in a concrete shell. The filter medium decreases in particle size from coarse gravel at the bottom to 30-mesh sand at the top. The roof over the sand filter was repaired and is in good condition.

The REDOX Facility has no wet or dry pipe sprinkler systems. Because the facility is not normally occupied, the 202-S Canyon Building contains no portable fire extinguishers. Five hydrants are supplied by the sanitary water system near the REDOX Facility and are located within 300 ft of the building. The fire hydrants are located south and northwest of the building and provided adequate coverage. The water supplies from these hydrants are adequate for manual fire-fighting efforts. Fire department operational access to the facility is adequate.

Inventories of hazardous substances, radiological material, and hazardous material were removed as part of the deactivation efforts. The remaining materials consist of residual contaminants that remain after flushing, draining, and other inventory-reduction activities, and contamination that remains in the exhaust system, primarily in the sand filter. No process material or chemical stocks remain. The majority of the radiological inventory remaining at the REDOX Facility is located in the 202-S Canyon Building and 291-S exhaust system sand filter. Relatively minor quantities are located in other buildings, typically as residues or surface contamination (see Table 2 for more detail on above grade structures).

In November 2016 DOE issued an EE/CA for the REDOX Complex (DOE/RL-2016-16, Rev 0) that proposed four non-time critical removal alternatives which are intended, with the exception of the No Action alternative, to offer a combination of actions to prevent or reduce the risk of release of hazardous substances including continued S&M, hazard abatement, demolition preparation, demolition, and grouting. Built in the 1950s and unoccupied since the mid-1960s, the REDOX buildings/structures in the scope of the EE/CA have severely degraded. Spread of contamination has been observed throughout the buildings and it is believed that it will intensify as the facilities continue to degrade. The recommended removal action alternative would: conduct hazard abatement of the 202S Canyon; prepare the 202S Silo Service Area, 202S Annex, and 202S Canyon above grade areas for demolition; demolish the 276S Hexone Storage Tanks and the 293S Building; grout the 293S Building below grade areas; and demolish the 202S Annex. It is unclear at this time when each of these removal actions would be completed and what their impact on final remedial actions might be.

The D&D of the U Canyon is being used as a pilot for D&D of the other four canyons at the Hanford Site, and CHPRC has developed an extensive review of lessons learned that will benefit similar work that may be carried out at REDOX in the future. The selected remedial action for the U Plant calls for 1) consolidating and grouting equipment currently in the 221-U canyon into the process cells, 2) filling the process cell galleries, hot pipe trench, ventilation tunnel, drains and other voids below the operating deck and crane cabway deck levels with grout, 3) demolition of the canyon roof and walls to the

approximate level of the canyon deck, and 4) burial of the remaining canyon structure beneath an engineered barrier. The cleanup remedy for U-Plant is to largely leave contamination in place and contain it in such a fashion that it presents no unacceptable risk to human health or the environment.[15]

The REDOX facility and U Plant are different with respect to their prior uses and levels of residual radiological contamination, the two U Plant DSAs (HNF-13829 Revisions 4 [OUO Doc] and 5) provide discussions of some of the accidents or events that could cause radiological exposure to workers and co-located persons during D4 of the REDOX canyon facilities. The primary risks were determined to be a seismic event and accidents involving size reduction and waste management types of activities that are required for the preparations for the canyon demolition, but which could cause a fire. It is unclear whether the proposed non-time critical removal actions proposed in November 2016 would alter this remedial action plan.

[15] CH2MHIll Plateau Remediation Company 2008, *Remedial Design/Remedial Action Work Plan for the 221-U Facility, DOE/RL-2006-21, Revision 0*, Prepared for the U.S. Department of Energy Assistant Secretary of Environmental Management U.S. Department of Energy, December 2008.

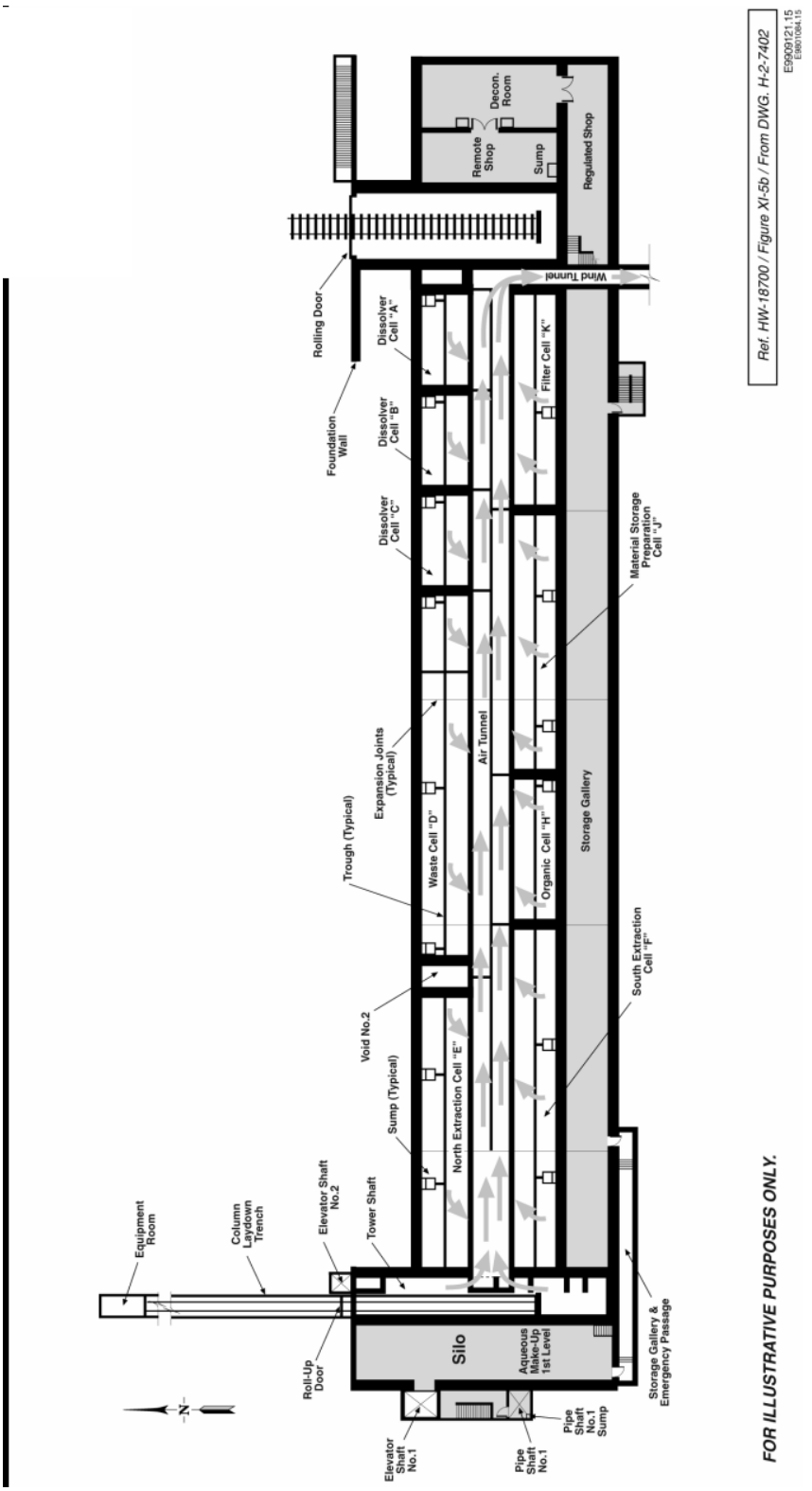

Figure F.9-3. 202-S Canyon Cell Floor Level Plan View.

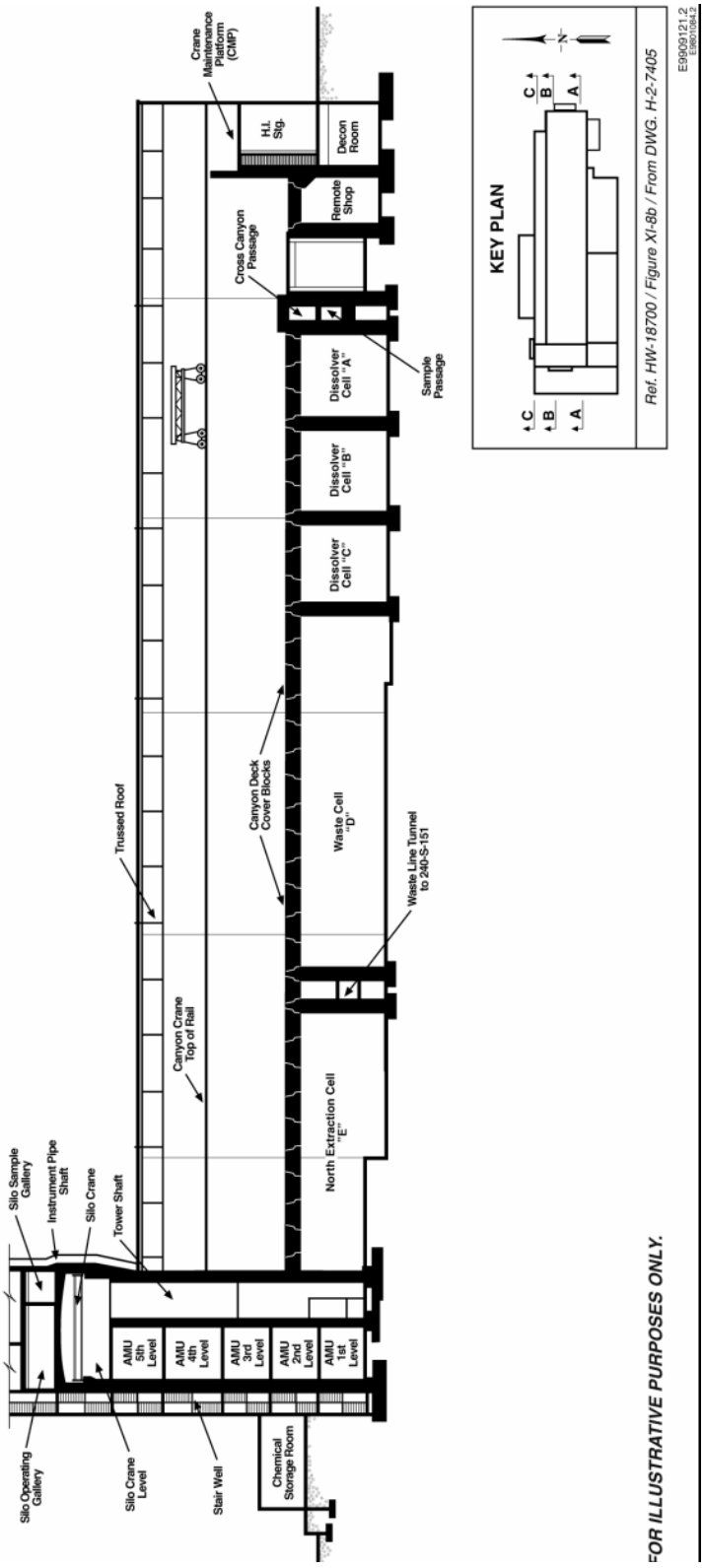

Figure F.9-4. 202-S Canyon Longitudinal Section.

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification

Within the EU boundary 100% of the area is classified as level 0 (Appendix J, Table J.76, and Table J.77). The amount and proximity of biological resources surrounding the REDOX EU were examined within the adjacent landscape buffer area, which extends 1099 ft (335 m) from the geometric center of the EU. Approximately 98% of the buffer area is classified as level 2 or lower (Appendix J, Table J.77). The remainder of the buffer area is classified as level 3 resources that occur along the southern edge of the buffer area where it extends into the higher level resources south of the 200-West Area fence.

All of the 222-S Laboratory EU is encompassed within the buffer area, as are parts of the REDOX Cribs and Trenches EU. Additional details on the resources within those EUs are available in those sections of this report.

Field Survey

On May 27, 2015 a pedestrian survey was performed in the REDOX EU, a complex of buildings surrounded by bare graveled surfaces kept free of vegetation through regular use of herbicides. No vegetation occurs within the 6 acre EU (Appendix J, Table J.77, and Figure J.90). Two species of birds were observed within the EU and are listed in the field data records for this EU in Appendix J.

CULTURAL RESOURCES SETTING

Currently, no portion of the CP-DD-4, REDOX EU has been inventoried for archaeological resources, however, the 200-East and 200-West Areas are generally considered to be areas of low archaeological potential. Three National Register-eligible Manhattan Project and Cold War Era buildings located within the EU (all 3 are contributing within the Manhattan Project and Cold War Era Historic District, 1 recommended for individual documentation and 2 with no additional documentation required). Mitigation for contributing buildings/structures has been completed as per the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56) (DOE-RL 1998). National Register-eligible Manhattan Project and Cold War Era buildings located within the CP-DD-4 REDOX EU include: 202-S, REDOX Canyon Building; 292-S, Stack Monitoring Building/Jet Pile; and 293-S, Acid Recovery & Gas Treatment Building.

No additional archaeological sites and/or TCPs are known to be located within the boundary of the EU. Most of the land within the EU is extensively disturbed by associated 200 West Area operations. There is a low potential for intact archaeological resources to be present within these disturbed areas.

There are 2 archaeological isolates located within 500 meters of the EU. One of these is associated with the Native American Precontact and Ethnographic Landscape and the other is associated with the Pre-Hanford Early Settlers/Farming Landscape. Neither of these recorded resources has been evaluated for listing in the National Register of Historic Places, however, it should be noted that isolates are typically assumed not eligible.

A segment 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, is located within 500 meters of the CP-DD-4, REDOX EU. In addition, there are 4 National Register-eligible Manhattan Project and Cold War Era buildings located within 500 meters of the EU (all 4 are contributing within the Manhattan Project and Cold War Era Historic District with no additional documentation required). Mitigation for contributing properties has been completed as per the *Hanford*

Site Manhattan Project and Cold War Era Historic District Treatment Plan (DOE/RL-97-56) (DOE-RL 1998).

Historic Maps and aerial imagery indicate that the area was relatively undeveloped aside from one historic trail/road in the general vicinity of the EU. This suggests a low potential for archaeological resources associated with the Pre-Hanford Early Settlers/Farming Landscape era to be present. Geomorphology indicates a moderate potential for cultural resources associated with the Native American Precontact and Ethnographic landscape to be present within the EU boundary. These resources, if present, would likely be limited to areas of intact, undisturbed Holocene dune sand deposits. Extensive ground disturbance across large portions of the EU, however, may negate this moderate potential.

Because the EU has not been inventoried for cultural resources and because of the potential for buried archaeological deposits within the CP-DD-4, REDOX EU, it may be appropriate to conduct surface and subsurface archaeological investigations in these areas prior to initiating any remediation activities. Indirect effects are always possible when TCPs are known to be located in the general vicinity. Consultation with Hanford Tribes (Confederated Bands of the Yakama Nation, Wanapum, Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce) and other groups who may have an interest in the areas (e.g. East Benton Historical Society, Prosser Cemetery Association, Franklin County Historical Society, the Reach, and the B-Reactor Museum Association) may need to occur. Consultation with Hanford Tribes may also be necessary to provide input on indirect effects to both recorded and potential unrecorded TCPs in the area and other cultural resource issues of concern.

PART V. WASTE AND CONTAMINATION INVENTORY

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The unplanned release site (UPR-200-W-61) is a powerhouse coal ramp wash-down pit associated with the 284-W Powerhouse. The pit is partially filled in with tumbleweeds and surrounded with metal fence posts and a light chain wire. It is adjacent to a concrete pad, which is next to the railroad track and coal offloading chute.

Vadose Zone Contamination

The CP-DD-4 sites with reported inventories (Table F.9-3. through Table F.9-5.) consist of a building, an exhaust system, and an unplanned release (UPR), where only the UPR is assumed to represent soil and other vadose zone contamination. The building and exhaust system are assumed adequately isolated from the environment for the purpose of this evaluation. The inventories provided for the UPR represent the reported contamination originally discharged (without decay correction[16]) to the vadose zone from the CP-DD-4 waste sites. These values are used to estimate the inventory remaining in the

[16] 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).

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); however, no plumes have been associated with CP-DD-4 waste sites. To summarize[17]:

- *Chromium* – There is a small reported inventory for chromium (Table F.9-5.) in UPR-200-W-61.
- *Carbon tetrachloride (CCl_4), cyanide* (*CN*), and *trichloroethene (TCE)* – There are no reported vadose zone inventories for these contaminants (Table F.9-5.).
- *I-129* – There is a very small reported inventory (Table F.9-3.) in UPR-200-W-61.
- *Tc-99* – There is a small reported vadose zone inventory (Table F.9-3.) in UPR-200-W-61.
- *Uranium* – There is a small reported vadose zone inventory (Table F.9-3. and Table F.9-5.) in UPR-200-W-61.
- *Sr-90 and other Group A&B Primary Contaminants (PCs)* – There are small reported vadose zone inventories for Sr-90 (Table F.9-3.) and C-14 (Table F.9-3.) in UPR-200-W-61 but none for Cl-36 (Table F.9-3.).

No CP-DD-4 waste sites have been linked to existing plumes in the Hanford Central Plateau (DOE-RL/2016-09, Rev. 0). Because of the tendency of uranium and Sr-90 to sorb to Hanford vadose zone media and that the TC&WM EIS groundwater transport analysis at the S Barrier[18] (see Section 5.5 in Appendix E.5) indicates that neither Sr-90 or uranium are expected to migrate appreciably in the area (Appendix O, DOE/EIS-0391 2012), these primary contaminants (both with reported inventories) are given *Not Discernible* (*ND*) current ratings and *Low* ratings afterwards[19] to address uncertainties in the evaluation. For the other Group A and B constituents, the TC&WM EIS groundwater transport analysis indicates that predicted peak concentrations at the U Barrier for Tc-99, I-129, and chromium (for Group A and B primary contaminants) could exceed thresholds during the evaluation period; however, sources for the plumes for these contaminants are not part of CP-DD-4 and thus any contributions from CP-DD-4 in the future would be considered subsumed in plumes for other EUs. The ratings for these are thus not changed based on this analysis.

Using the process outlined in Chapter 6 of the Methodology Report (CRESP 2015) 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 for CP-DD-4 in Table F.9-6 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. The vadose zone (VZ) ratings are *Not Discernible* (*ND*) for Sr-90 and total uranium (as described above) and *Low* for the other Group A and B primary

[17] 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.
[18] 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 S Barrier is the closest to CP-DD-4. Despite including sources other than those for CP-DD-4, the analysis in the TC&WM EIS was considered a reasonable source of information to assess the potential transport in the Hanford subsurface.
[19] The current ratings for Sr-90 and total uranium would be *Low* if these constituents were considered mobile in the Hanford subsurface.

contaminants with reported inventories. The overall current rating is defined as the highest over all the ratings and thus *Low*.

Groundwater Plumes

No vadose zone sites within the CP-DD-4 EU with reported inventories are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0). Monitoring and treatment of groundwater is being conducted within the 200-UP GWIA (using the WMA S-SX groundwater extraction system, U Plant area P&T system, and I-129 plume hydraulic control system); these actions are described as part of the CP-GW-2 EU (Appendix D.6). As shown in Table F.9-6, no saturated zone inventories have been associated with CP-DD-4; the process for deriving these inventories is described in CRESP Methodology Report (CRESP 2015) 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 the previous sections, no portions of the groundwater plumes are associated with CP-DD-4 (DOE/RL-2016-09, Rev. 0). Note that nitrate, hexavalent chromium, tritium (H-3), and I-129 are risk drivers (*Medium*) for the 200-UP GWIA; however, there are no CP-DD-4 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 Section 3.5 of Appendix E.3 for the S-SX Tank and Waste Farms EU (CP-TF-2), the TC&WM EIS screening groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates there is an impact of emplacing the engineered surface barrier (and resulting reduction of infiltrating water) on the predicted peak groundwater concentrations at the S Barrier; however, the impact does not result in peak concentrations below thresholds[20]. This result is likely due to the significant amounts of contaminants already in the groundwater (from sources other than CP-DD-4) and not due to an ineffective surface barrier. To summarize, the results for Central Plateau sources including those in addition to the S Plant EU (Appendix O, DOE/EIS-0391 2012) include:

- Tc-99 peak concentration is 22,800 pCi/L (CY 3072) for the No Action Alternative versus 1,510 pCi/L (CY 2051) for the Landfill Scenarios where the threshold value is 900 pCi/L.
- I-129 peak concentration is 29.1 pCi/L (CY 3136) for the No Action Alternative versus 2.8 pCi/L (CY 2050) for the Landfill Scenarios versus a threshold value of 1 pCi/L.
- Chromium peak concentration is 541 µg/L (CY 3242) for the No Action Alternative versus 156 µg/L (CY 2050) for the Landfill Scenarios versus a threshold value of 100 µg/L (total) or 48 µg/L (hexavalent).

[20] 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 S Barrier is the closest to the S-SX Tank and Waste Farms EU. Despite including sources other than those for the S-SX Tank and Waste Farms 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.

- Uranium peak concentration is 41 µg/L (CY 11,778) for the No Action Alternative versus 0 µg/L (CY 11,850) for the Landfill Scenarios versus a threshold value of 100 µg/L (total) or 48 µg/L (hexavalent).
- No values are reported at the S Barrier for Sr-90, or carbon tetrachloride for either scenario, which indicates that the appropriate sources were not considered in the analysis (e.g., for carbon tetrachloride), or peak fluxes that were less than 1×10^{-8} Ci/yr for radionuclides or 1×10^{-8} g/yr for chemical contaminants (Appendix O, DOE/EIS-0391 2012, p. O-2).

Despite the large impacts on the predicted peak concentrations, these peak values at the S Barrier still exceed threshold values within 50 years and thus the saturated and vadose ratings will not be altered even though predicted impacts due to barrier emplacement may be large[21]. Thus the saturated zone ratings for the Active and Near-term Post-Cleanup periods would be rated as *Low* for this period (where the *Low* rating was maintained to account for uncertainty). Furthermore, groundwater is being treated in the area; these potential impacts are described below.

Columbia River

Threats to the Columbia River similar to those presented by the CP-DD-2 EU were evaluated in Section 5.5 of Appendix E.5 for CP-TF-4 (U 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 deactivated REDOX Facility contains buildings and process equipment formerly used for dissolution and separation of uranium, neptunium, and plutonium, as well as deactivated equipment formerly used for waste concentration, waste neutralization, and solvent recovery. In addition to the main process areas, the REDOX Facility includes buildings that were formerly used to store chemicals and materials and support systems (e.g., ventilation, exhaust stacks, and environmental monitoring systems).

Inventories of hazardous substances, radiological material, and hazardous material were removed as part of the deactivation efforts. No process material or chemical stocks remain. The majority of the radiological inventory remaining is located in the 202-S Canyon Building and 291-S exhaust system sand filter. Relatively minor quantities are located in other buildings, typically as residues or surface contamination. The November 2016 EE/CA indicates that the primary radionuclide contaminants include, but are not limited to, uranium-234, uranium-235, uranium-238, plutonium-239/240, americium-241, and mixed fission products such as strontium-90, cesium-137, cobalt-60, europium-152, and europium-155. The majority of contaminants are found in the form of adherent films and residues within the structures.

"In general, detailed radionuclide characterization data (i.e., form, quantity, and location) for the 202-S Canyon Building do not exist…. Because of this uncertainty, highly conservative assumptions are used when applying the limited inventory data. In any undertaking that involves intrusive activities into the REDOX Facility, caution must be exercised, recognizing that higher-than-predicted levels of contamination or materials may be encountered"[22] The estimated radiological inventories used in the DSA assume a total 1,980 Ci alpha and 17,840 Ci beta, with alpha activity assumed to be Pu-239 and

[21] 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.
[22] CH2MHill Plateau Remediation Company, *Documented Safety Analysis for the Reduction-Oxidation Facility*, HNF-13830, Revision 4A, April 16, 2015.

beta activity to be Sr-90. These are lower than the inventories estimated for the B Plant, U Plant and PUREX facilities, all of which also had large amounts of Cs-137.

Table F.9-2. REDOX Above Grade Structures with Hazard Classification[23]

Building Number	Building Name	Inventory and Segmentation Summary	Facility Hazard Classification
202-S	Canyon and Service Building	Contains significant residual inventory or contamination remaining from deactivation.	HC 2
211-S	Liquid Chemical Storage Tank Farm	Former chemical storage tanks emptied and deactivated. No significant inventory remains.	< HC 3
233-S	Plutonium Concentratio n Facility	Demolished	< HC 3
276-S	Solvent Handling Facility	Former chemical storage and recycle, which is inactive and isolated.	< HC 3
291-S	Canyon Exhaust System	Provides active exhaust of former canyon process areas. The 291-S sand filter provides filtrations and retains significant inventory. Also includes wind tunnel, EF-1 and EF-2 fans, and the 291-S-1 stack.	HC 2 (common with 202-S Canyon Building)
292-S	Control and Jet Pit House	Facility is inactive except for condensate capacities for the 291-S exhaust system. Minor inventories reside, but the condensate capacity is required for exhaust operations.	HC 2 (common with 291-S exhaust)
293-S	Nitric Acid Recovery and Iodine Backup	Facility is deactivated and minor amounts of radiological contamination remain.	HC 3 *
2706-S	Storage Building	Demolished (contaminated slab w/overburden)	< HC 3
2708-S	Lagger Storage Building	Used for miscellaneous storage. Negligible contamination remains.	< HC 3
2710-S	Nitrogen Storage Building	Deactivated and isolated facility with negligible amounts of contamination suspected.	< HC 3
2711-S	Stack Gas Monitoring Building	Deactivated with minor amount of contamination assumed to remain.	HC 3 *
2715-S	Storage Building	Building may be used to store packaged waste to support REDOX activities.	HC 2 (common with 202-S Canyon Building)
2718-S	Sand Filter Sample Building	Deactivated and isolated from the plant. Minor amounts of contamination are assumed to remain.	HC 3 *
2904-SA	Cooling Water Sampling Building	Deactivated and isolated facility with negligible to minor amounts of contamination assumed to remain.	< HC 3

[23] CH2MHill Plateau Remediation Company, *Documented Safety Analysis for the Reduction-Oxidation Facility*, HNF-13830, Revision 4A, April 16, 2015.

Table F.9-3. Inventory of Primary Contaminants [a]

WIDS	Description	Decay Date	Ref[b, c]	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[d]			0.0056	0.0013	NR	0.0017	63	0.00025	0.017	0.023	3.50E-05
202-S	Canyon Building		DSA	NR	NR	NR	NR	NR	NR	NR	NR	NR
291-S	Exhaust System		DSA	NR	NR	NR	NR	NR	NR	NR	NR	NR
UPR-200-W-61	UPR	2001	SIM	0.0056	0.0013	NR	0.0017	63	0.00025	0.017	0.023	3.50E-05

a. NR = Not reported
b. DSA = HNF-13830, Rev. 4. Table 3.1
c. SIM = RPP-26744, Rev. 0
d. Radionuclides are summed without decay correction since the uncertainties in inventories are large.

Table F.9-4. Inventory of Primary Contaminants (cont)[a]

WIDS	Description	Decay Date	Ref[b, c]	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)
All	Sum[d]			0.00015	0.013	2,000	17,800	0.022	1.80E-05
202-S	Canyon Building		DSA	NR	NR	1,600	9,800	NR	NR
291-S	Exhaust System		DSA	NR	NR	340	8,000	NR	NR
UPR-200-W-61	UPR	2001	SIM	0.00015	0.013	0.008	2.1	0.022	1.80E-05

a. NR = Not reported
b. DSA = HNF-13830, Rev. 4. Table 3.1
c. SIM = RPP-26744, Rev. 0
d. Radionuclides are summed without decay correction since the uncertainties in inventories are large.

Table F.9-5. 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		NR	NR	2.4	NR	0.00027	120	2.60E-11	NR	NR	0.026
202-S	Canyon Building	DSA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
291-S	Exhaust System	DSA	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
UPR-200-W-61	UPR	SIM	NR	NR	2.4	NR	0.00027	120	2.60E-11	NR	NR	0.026

a. NR = Not reported
b. DSA = HNF-13830, Rev. 4. Table 3.1
c. SIM = RPP-26744, Rev. 0

Table F.9-6. Summary of the Evaluation of Current 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	1.25E-03 Ci	---	---	1.25E-03 Ci	6.27E-04	*Low*
I-129	A	1 pCi/L	0.23	0.2	1.84	3.53E-05 Ci	---	---	3.53E-05 Ci	1.36E-02	*Low*
Sr-90	B	8 pCi/L	0.23	22	1.84	2.06E+00 Ci	---	---	2.06E+00 Ci	1.46E+00	*ND*[(e)]
Tc-99	A	900 pCi/L	0.23	0	1.84	2.20E-02 Ci	---	---	2.20E-02 Ci	2.45E-02	*Low*
CCl4	A	5 µg/L	0.23	0	1.84	---	---	---	---	---	*ND*
Cr	B	100 µg/L	0.23	0	1.84	2.39E+00 kg	---	---	2.39E+00 kg	2.39E-02	*Low*
Cr-VI	A	48 µg/L[b]	0.23	0	1.84	2.39E+00 kg	---	---	2.39E+00 kg	4.99E-02	*Low*
TCE	B	5 µg/L	0.23	2	1.84	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.23	0.8	1.84	2.58E-02 kg	---	---	2.58E-02 kg	1.16E-04	*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?

The primary safety accident scenarios that create the greatest radiological risk to the Facility Worker and Co-located Person are a seismic event causing a total failure of the canyon building structure, a heavy load drop inside the canyon onto one or more open or partially open cells, and a fire in the Product Receiver Cage. An airborne release would be immediate.

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 (TSRs) were identified as preventing or mitigating these events. Applicable SMPs that provide worker safety for these types of actions include the work control process, fire protection, hazardous material control, and emergency preparedness programs.

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

The passive confinement features of the building and canyon structures were recognized as defense in depth equipment important to safety (ITS).

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 remaining radiological materials consist of residual contaminants in the 202-S Canyon Building that remain after flushing, draining, and other inventory-reduction activities, and contamination that remains in the 291-S exhaust system, primarily in the sand filter. As such, they are located below ground level and contained within rigid closed structures.

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

A seismic event or heavy load drop on an open cell could lead to a failure or degradation of the canyon building barrier. In general, the risk of structure failure due to facility degradation would increase over time, and the risk of an accidental release would also increase the longer the structures await the eventual remedial action for the OU.[24]

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

[24] US Department of Energy, Richland Operations Office, *Engineering Evaluation/Cost Analysis for the REDOX Complex,* DOE/RL-2016-16, Revision 0, November 2016.

No populations or resources are at risk unless one of the above mentioned initiating events causes an airborne release, and then only the S&M worker or a co-located person located within a 100 yd. perimeter.

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

Immediate (within seconds) through a ground level or airborne release

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

None

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker

Only those involved in quarterly S&M activities.

Co-Located Person (CP)

No one should be within the fenced in REDOX facility other than S&M workers

Public

The nearest site boundary is at Highway 240 at a distance of 4.3 km (2.7 miles) and the postulated accident scenarios would not present any risk to the Public.

Groundwater

Table F.9-6 represents the current risks and associated ratings for the saturated zone (groundwater) from remaining vadose zone contamination associated with the CP-DD-4 waste sites. Sites within the CP-DD-4 EU may have contaminated the vadose zone but are not suspected of being able to contribute contaminants to the saturated zone (DOE/RL-92-16, Rev. 0). The current risk and potential impact ratings for the CP-DD-4 EU are *ND* (Sr-90 and total uranium) and *Low* (other Group A and B PCs) (Table F.9-6). Monitoring and treatment of groundwater is being conducted within the 200-UP GWIA (using the WMA S-SX groundwater extraction system, the U Plant area P&T system, and the I-129 plume hydraulic control system), which is described as part of the CP-GW-2 EU (Appendix D.6). No plumes within the 200-UP GWIA have been linked to CP-DD-4 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-4 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: 100% of the EU is classified as a level 0 resource.
- Resources in the adjacent landscape buffer area on the south side of the 200-West fence are contiguous with an extensive area of higher level biological resources and Washington State element occurrences. These resources are not expected to be impacted by cleanup activities at REDOX.

Cultural Resources

Summary:

- There are 3 National Register-eligible Manhattan Project and Cold War Era buildings located within the EU (all 3 are contributing within the Manhattan Project and Cold War Era Historic District, 1 recommended for individual documentation and 2 with no additional documentation required). Mitigation for contributing buildings/structures has been completed as per the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56) (DOE-RL 1998) and building demolition is ongoing.
- No additional archaeological sites and/or TCPs are known to be located within the EU.
- There are 2 archaeological isolates located within 500 meters of the EU. One of these is associated with the Native American Precontact and Ethnographic Landscape and the other is associated with the Pre-Hanford Early Settlers/Farming Landscape. Neither of these recorded resources has been evaluated for listing in the National Register of Historic Places, however, it should be noted that isolates are typically assumed not eligible.
- A segment 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, is located within 500 meters of the REDOX EU. In accordance with the 1998 *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56) (Department of Energy 1998), all documentation requirements have been completed for this property.
- There are 4 National Register-eligible Manhattan Project and Cold War Era buildings located within 500 meters of the EU (all 4 are contributing within the Manhattan Project and Cold War Era Historic District with no additional documentation required). Mitigation for contributing buildings/structures has been completed as per the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56) (DOE-RL 1998) and building demolition is ongoing.
- There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from the REDOX EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

The 1996 Agreement in Principle (DOE-RL1996) among the Tri-Parties of DOE, USEPA, and Washington State Department of Ecology (Ecology) established that the CERCLA Remedial Investigation/Feasibility Study process would be followed, on a case-by-case basis, to evaluate potential cleanup remedies and identify preferred alternatives for the final end state for the five major canyon buildings in the 200 Area of the Hanford Site. The 221-U Facility was selected as a pilot project for this effort. Its final RI/FS evaluated five remedial action alternatives, one of which was “Full Removal and Disposal”. In this alternative, the 221-U Facility structure and contents would be removed and demolished, including the foundation below existing grade level. Structural material, facility contents, and associated soil above risk-based standards would be disposed at the ERDF. The selected remedy was “Close in Place-Partially Demolish Structure”, under which equipment on the canyon deck will be consolidated into the process cells and hot pipe trench; equipment, process cells, and other open areas will be filled with grout, the structure will be partially demolished, and the remaining structure will be buried under an engineered barrier. This alternative was determined to be more protective of remedial action workers and provide somewhat greater long-term effectiveness and permanence when compared to full removal and disposal of the facilities. It was also determined to provide somewhat greater long-term effectiveness

and permanence at a lower cost than the two Entombment alternatives considered. [25] The REDOX plant and U Plant are very different with respect to their prior uses and levels of residual radiological contamination, but their canyon structures and the primary location of radiological contaminants are similar.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

Assuming that the U Plant D&D concept is used, the contaminant inventory within the demolished and buried REDOX structures will likely be the same as their starting points. However, risk to human health, ecological receptors, or natural resources will be minimized by containment and institutional controls to eliminate potential pathways of exposure to the contaminants. This would be accomplished through waste encapsulation in grout, use of the substantial concrete canyon structure for entombment of waste, and the construction of an engineered barrier over the remaining grouted structure.

The remedial actions that are being evaluated would leave existing vadose zone contamination in the CP-DD-4 vadose zone site as well as any contamination that has been released from CP-DD-4 waste sites into the vadose zone. The UPR within the CP-DD-4 EU may have contributed mobile contaminants to the vadose zone and may eventually threaten groundwater, which is being treated in 200-UP using the WMA S-SX groundwater extraction system, the U Plant area P&T system, and I-129 plume hydraulic control system (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

Inventories of hazardous substances, radiological material, and hazardous material were removed as part of the REDOX facility deactivation efforts. The remaining materials consist of residual contaminants that remain after flushing, draining, and other inventory-reduction activities, and contamination that remains in the exhaust system, primarily in the sand filter. No process material or chemical stocks remain. The majority of the radiological inventory remaining at the REDOX Facility is located in the 202-S Canyon Building and 291-S exhaust system sand filter. Relatively minor quantities are located in other buildings, typically as residues or surface contamination

There does not appear to be any reason workers would need to enter the 202-S Canyon process cells. Following the U Plant protocol, a fixative would be applied to all equipment located on the deck before being moved into the cells and all workers would wear protective gear. Such workers will be required to have extensive training on hazardous waste and radiologic safety, and will wear proper protective suits and respirators, radiation monitoring badges, and will undergo regular biomonitoring.

Movement of equipment on the deck and into the cells may require size reduction and will require lifting and movement with overhead or portable cranes. Although experienced skill craft workers will be responsible for these operations and special precautions will be taken, there is always the potential for an industrial type accident or injury within these confined spaces. It should be noted that there were no accidents or injuries during the U Canyon D&D work.

[25] CH2MHIll Plateau Remediation Company 2008, *Remedial Design/Remedial Action Work Plan for the 221-U Facility, DOE/RL-2006-21, Revision 0*, Prepared for the U.S. Department of Energy Assistant Secretary of Environmental Management U.S. Department of Energy, December 2008.

Methods under consideration at the U Plant for final demolition of the canyon structure include controlled blasting and manual methods including cutting, wrecking balls and jack hammers which will introduce worker risks similar to D&D building demolitions carried out on other buildings at Hanford. No DSA or other risk analysis of these last phases of D&D has been developed to determine major risks and potential impacts, and thus how applicable they will be to the final D&D of the REDOX canyon building.

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

Facility Worker

Protection of workers from physical, chemical, and radiological hazards would be achieved by mitigating hazards, extensive planning, use of mock ups, and worker training and protection (see attached *Hanford Site Hazards Guide* and CH2MHill Safety Reference Documents at http://chprc.hanford.gov/page.cfm/CHPRCSafetyReferenceDocuments).

Co-located Person

Protection of workers and other individuals located 100 meters from the REDOX facility boundary from physical, chemical, and radiological hazards would be achieved by mitigating hazards, extensive planning, use of mock ups, and worker training. Also see references in Worker section above.

Public

Surveillance and maintenance activities will continue throughout the D&D process to monitor radiological conditions, check safety related items, provide for facility-security controls and ensure there is no public access to the REDOX site by unauthorized personnel or the public.

Groundwater

As described in **Part V**, there is likely to be very little discernible impact to groundwater during this period from primary contaminants from the REDOX (S Plant) EU. These impacts are described in more detail in Appendix G.6 for the CP-GW-2 EU.

Furthermore, there is a contaminant source with a reported inventory in the vadose zone that may pose a very small continuing risk to groundwater (via the vadose zone). The vadose zone (VZ) GTM values for the Group A and B primary contaminants for the REDOX EU translate to ratings of *Low* (to represent uncertainty). As indicated in **Part V**, Sr-90 or uranium are unlikely to impact the groundwater in sufficient quantities to exceed the drinking water standard and thus are not considered a significant future threat. These ratings correspond to an overall rating of *Low* for both the Active and Near-term, Post-Cleanup periods to account for uncertainties.

The WMA S-SX groundwater extraction system, the U Plant area P&T system, and the I-129 plume hydraulic control system in the 200-UP GWIA are 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 REDOX (S Plant) waste sites are described in Appendix G.6 for the CP-GW-2 EU (200-UP 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

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, soil removal and contamination in the soil, dust suppression, 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 person (boots, clothes, equipment), from 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 causes complete destruction of existing ecosystem, but these effects are potentially more severe because of blowing soil (and seeds); and potential for exposure of dormant seeds. In the revegetation stage, there is the potential for invasion of exotic species, changing the species diversity of native communities.

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 onsite. 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. Use of nonspecific 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. 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 soil removal, remediation of contaminated soils, 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. Utilization of caps, barriers and/or other containments may destroy resources located close to the surface. If resources are not destroyed, containments 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, 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 soil removal, remediation of contaminated soils, 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. Utilization of caps, barriers and/or other containments may destroy resources located close to the surface. If resources are not destroyed, containments 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.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

In November 2016, DOE issued an Engineering Evaluation/Cost Analysis for the REDOX Complex (EE/CA)(DOE/RL-2016-16, Rev 0) that proposed four non-time critical removal alternatives intended, with the exception of the No Action alternative, to offer a combination of actions to prevent or reduce the risk of release of hazardous substances including continued S&M, hazard abatement, demolition preparation, demolition, and grouting. Built in the 1950s and unoccupied since the mid-1960s, the REDOX buildings/structures in the scope of the EE/CA have severely degraded. The Canyon Deck has not been entered since 1997 and conditions on the deck are not known at this time. Based on current conditions in areas where surveillance inspections are performed, water accumulation, animal intrusion, structure deterioration, and contamination spread are expected. Substantial structural deterioration has been observed in the Silo. Significant water stains, dirt deposits, animal intrusion, and chemical stains are noted on all levels of the Silo. Deteriorated asbestos insulation has also been noted on most levels. The Plutonium Loadout Hood contains a large quantity of radiological inventory and surveillance reports indicate that radiological contamination has been spreading in every entry from 2012 to 2015. In 2012, the surveillance inspection of the west end of the North Sample Gallery was halted because water was observed running down the loadout hood, and the contamination level in the gallery exceeded radiological work permit (RWP) limits. Several rooms within the 202S Building are radiologically contaminated and need to be addressed before the occurrence of an unpredictable event that could be a threat to human health and the environment (HHE). The possibility for contamination migration is very likely and is aided by water intrusion. The 202S Building has been unoccupied for a much longer period of time than the other Canyon buildings; therefore, conditions are expected to be much worse.

Sites within the CP-DD-4 EU may have contaminated the vadose zone and may eventually impact groundwater (DOE/RL-92-16, Rev. 0); however, reported vadose inventories are very low and unlikely to significantly increase plume areas. Furthermore, there are on-going treatment actions (WMA S-SX groundwater extraction system, U Plant area P&T system, and I-129 plume hydraulic control system) that will also limit any additional impact to groundwater. Additional remedial actions may be required in the future if conditions change dramatically.

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

Assuming that the U Plant D&D concept is used at REDOX facility, the risk to human health, ecological receptors, or natural resources will be minimized by containment and institutional controls to eliminate potential pathways of exposure to the contaminants. This would be accomplished through waste encapsulation in grout, use of the substantial concrete canyon structure for entombment of waste, and the construction of an engineered barrier over the remaining grouted structure. The only humans that would be at potential risk would be those conducting and annual or five-year inspection of the barrier.

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

Table F.9-7. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup.

Population or Resource		Risk/Impact Rating	Comments
Human	Facility Worker	Low	Only during annual and five-year inspections
	Co-located Person	ND	
	Public	ND	
Environmental	Groundwater (A&B) from vadose zone[(a)]	*Low* (Group A&B PCs) **Overall**: *Low*	*Current* GTM values for Group A and B primary contaminants (Table F.9-6): *ND* (U(tot) and Sr-90) and *Low* (other PCs with reported inventories). Sr-90 and U(tot) not likely to impact groundwater (**Part V**) and are assigned Low ratings here to address uncertainties. Treatment in 200-UP assumed effective for groundwater but would not impact vadose zone ratings.
	Columbia River from vadose zone[(a)]	Benthic: *ND* Riparian: *ND* Free-flowing: *ND* **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[(a)]	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[(a)]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown Indirect: Known **Manhattan/Cold War:** Direct: None Indirect: None	Permanent indirect effects are possible if residual contamination remains after remediation. Manhattan Project/Cold War Era buildings will be demolished.

a. Threat to groundwater or Columbia River for Group A and B contaminants remaining in the vadose zone. Threats from existing plumes associated with the REDOX (S Plant) EU are described in **Part V** with more detailed evaluation 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

As noted above, assuming that the U Plant D&D concept is used at the REDOX facility, the long-term risk to human health, ecological receptors, or natural resources after cleanup will be minimized by containment and institutional controls to eliminate potential pathways of exposure to the contaminants. This would be accomplished through waste encapsulation in grout, use of the substantial concrete canyon structure for entombment of waste, and the construction of an engineered barrier over the remaining grouted structure. The only humans that would be at potential risk would be those conducting and annual or five-year inspection of the barrier.

PART VII. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

Hanford Site-Wide Risk Review
CP-DD-4 (REDOX)

Table F.9-8. Waste Site and Facility List

Site Code	Name, Aliases, Description	Feature Type	Site Status	ERS Classificat	ERS Reclassifica	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation	Comments
2904-S-170	2904-S-170; 2904-S-170 Control Structure; 2904-S-170 Weir Box	Waste Site	Inactive	Accepted	None	Control Structure	Pipeline and associated valves, etc.	200-CR-1		
200-W-189-PL	200-W-189-PL; Lines SNL-5350 and SNL-5351; Transfer Lines from 219-S to 241-SY Tank Farm	Waste Site	Active	Accepted	None	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	Not Applicable		
200-W-75	200-W-75; Radiological Logging System (RLS) Calibration Silos	Waste Site	Inactive	Accepted	None	Experiment/Test Site	Field Test Site	200-WA-1		
200-W-157-PL	200-W-157-PL; Pipeline from 202-S to 200-W-152-PL and 216-S-10 Ditch; Pipeline from 205-S to REDOX Chemical Sewer; REDOX Chemical Sewer	Waste Site	Inactive	Accepted	None	Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-158-PL	200-W-158-PL; Pipeline from 293-S to 200-W-152-PL	Waste Site	Inactive	Accepted	None	Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
600-291-PL	600-291-PL; LERF Line; TEDF Line; 200 Area Treated Effluent Disposal Facility Pipeline	Waste Site	Active	Accepted	None	Process Sewer	Pipeline and associated valves, etc.	Not Applicable		
202-S	202-S; 202-S REDOX; S Plant	Waste Site	Inactive	Accepted	None	Process Unit/Plant	Process Building	200-CR-1		
200-W-146-PL	200-W-146-PL; Pipeline from 293-S to 216-S-22 Crib	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-150-PL	200-W-150-PL; Pipelines Associated with 216-S-13 Crib	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-152-PL	200-W-152-PL; Pipeline from 202-S to 2904-S-170 Control Structure and 216-S-17 Pond; REDOX Process Sewer	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-43	200-W-43; 291-S Stack Sand Filter	Waste Site	Active	Accepted	None	Sand Filter	Crib - Subsurface Liquid Disposal Site	Not Applicable		
296-S-1	296-S-1; 296-S-1 Stack	Waste Site	Inactive	Accepted	Consolidated	Stack	Process Building	Not Applicable		
296-S-12	296-S-12; 296-S-12 Stacks	Waste Site	Inactive	Accepted	Consolidated	Stack	Process Building	Not Applicable		

296-S-4	296-S-4; Low-Level Decontamination Sink and Special Work Permit Lobby Vent; REDOX Decontamination Room; Regulated Shop; Regulated Tool Room	Waste Site	Inactive	Accepted	Consolidated	Stack	Process Building	Not Applicable		
296-S-2	296-S-2; 296-S-2 Stack; Hoods Ventilation and PR Cage; REDOX North Sample Gallery	Waste Site	Inactive	Accepted	Consolidated	Stack	Process Building	Not Applicable		
296-S-6	296-S-6; 296-S-6 Stack; REDOX Silo Ventilation	Waste Site	Inactive	Accepted	Consolidated	Stack	Process Building	Not Applicable		
200-W-15	200-W-15; S Plant Project W-087 Hexone Discovery	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	TBD		
UPR-200-W-41	UPR-200-W-41; Railroad Contamination; REDOX Railroad Cut Contamination; UN-200-W-41	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-WA-1		
UPR-200-W-43	UPR-200-W-43; Contaminated Blacktop East of 233-S; UN-200-W-43	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-CR-1		
UPR-200-W-56	UPR-200-W-56; Contamination at the REDOX Column Carrier Trench; UN-200-W-56	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-CR-1		
UPR-200-W-61	UPR-200-W-61; REDOX Ground Contamination; UN-200-W-61	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-CR-1		
UPR-200-W-57	UPR-200-W-57; 233-S Fire; UN-200-W-57; UPR-200-E-120 (error in area number assignment)	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-CR-1		
233-S	233-S; 233-S Plutonium Concentration Facility	Waste Site	Inactive	Accepted	Rejected	Process Unit/Plant	Process Building	Not Applicable	X	Rejected
2718-S	2718-S; 2718-S Filter Monitoring Building; 2718-S Sand Filter Monitor; 2718-S Sand Filter Sampler	Waste Site	Active	Accepted	Rejected	Process Unit/Plant	Process Building	Not Applicable	X	Rejected
276-S	276-S; 276-S Solvent Facility; 276-S Solvent Handling Facility	Waste Site	Inactive	Accepted	Rejected	Process Unit/Plant	Process Building	Not Applicable	X	Rejected
2904-SA	2904-SA; 2904-SA Cooling Water Sampler Building; 2904-SA Sample Building	Waste Site	Inactive	Accepted	Rejected	Process Unit/Plant	Process Building	Not Applicable	X	Rejected
291-S	291-S; 291-S Fan and Filter Building; 291-S Fan Control Building; 291-S Fan House	Waste Site	Active	Not Accepted	None	Process Unit/Plant	Process Building	Not Applicable	X	Not Accepted
292-S	292-S; 292-S Jet Pit House Building	Waste Site	Inactive	Accepted	Rejected	Process Unit/Plant	Process Building	Not Applicable	X	Rejected
293-S	293-S; 293-S Off Gas Treatment; 293-S Off-Gas Treatment and Recovery; 293-S Offgas Treatment Facility	Waste Site	Inactive	Accepted	Rejected	Process Unit/Plant	Process Building	Not Applicable	X	Rejected
233-SA	233-SA; 233-SA Exhaust Filter Building	Waste Site	Inactive	Not Accepted	None	Process Unit/Plant	Process Building	Not Applicable	X	Not Accepted

200-W-211-PL	200-W-211-PL; 207-SL Retention Basin Sewer Pipelines; Pipelines from Boiler Annex and Pump Lift Station to 207-SL Basin; Retention Waste Sewer from 219-S and 222-S to 207-SL Basin	Waste Site	Active	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	Not Applicable	X	Included in 222-S Eval.
296-S-7	296-S-7; 296-S-7 East and West Stacks; 296-S-7E; 296-S-7W; Dual Stacks; REDOX Product Building (233-S) Ventilation	Waste Site	Inactive	Not Accepted	None	Stack	Process Building	Not Applicable	X	Not Accepted
200-W-253	200-W-253; 233-S and 233-SA Contaminated Soil Footprint	Waste Site	Inactive	Discovery	None	Unplanned Release	Unplanned Release - Surface/Near Surface	TBD	X	Discovery
222S-BA	222S BOILER ANNEX	Facility	ACTIVE			BUILDING	Infrastructure Building			
2710S	INERT GAS GENERATOR BUILDING	Facility	INACTIVE			BUILDING	Process Building			
2715S	OIL STORAGE BUILDING	Facility	INACTIVE			BUILDING	Infrastructure Building			
2708S	STORAGE BUILDING NORTH SIDE OF 202S	Facility	INACTIVE			BUILDING	Infrastructure Building			
202S	REDOX CANYON AND SERVICE FACILITY	Facility	INACTIVE			BUILDING	Process Building		X	Duplicative
293S	ACID RECOVERY AND GAS TREATMENT BUILDING	Facility	INACTIVE			BUILDING	Process Building		X	Duplicative
276S	COLD SOLVENT STORAGE AND MAKEUP BUILDING	Facility	INACTIVE			BUILDING	Process Building		X	Duplicative
2904SA	COOLING WATER SAMPLER BUILDING	Facility	INACTIVE			BUILDING	Process Building		X	Duplicative
292S	JET PIT HOUSE	Facility	INACTIVE			BUILDING	Infrastructure Building		X	Duplicative
2718S	EQUIPMENT LEAD SHIELDING STORAGE SHED	Facility	INACTIVE			BUILDING	Process Building		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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