APPENDIX G.5.7

PUREX CRIBS AND TRENCHES (INSIDE 200-EAST) (CP-LS-9, CENTRAL PLATEAU)

EVALUATION UNIT SUMMARY TEMPLATE

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TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

PART I. EXECUTIVE SUMMARY

EU LOCATION

Liquid waste sites on the east side of 200 East (associated with PUREX Operations and immediately surrounding the PUREX Facility).

RELATED EUS

CP-DD-1, CP-GW-1

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES

The waste sites comprising the CP-LS-9 EU include legacy waste sites (e.g., cribs, French drains, reverse wells, trenches, and unplanned releases (UPRs)) where liquid wastes was discharged and pipelines and associated equipment. The pipelines and associated equipment are treated in the Tank Waste and Farms EU (Appendix E.1 through Appendix E.11) (DOE/RL-2010-114, DRAFT A, p. A-7 – A-15). Of the remaining waste sites, inventory information is reported for selected legacy sites (i.e., 11 cribs, one trench, and one UPR) in the Soil Inventory Model, Rev. 1 (Corbin, et al. 2005), which is used as the basis for analysis.

The primary contaminants listed in the Soil Inventory Model (Corbin, et al. 2005) for the CP-LS-9 EU include:[1]

- *Radionuclides*: Am-241, Co-60, Cs-137/Ba-137m, Eu-154, tritium (H-3), I-129, Ni-63, Sr-90/Y-90, Tc-99, U-All isotopes, Pu-All isotopes
- *Chemicals*: Cr/Cr-VI, nitrate (NO_3), TBP, and U-Total

BRIEF NARRATIVE DESCRIPTION

The majority of the CP-LS-9 EU legacy waste sites with non-zero reported inventories (Table G.5.7-3 through Table G.5.7-5) are included in the 200-EA-1 Operable Unit (OU) and thus our focus here will be on that OU. The 200-EA-1 Operable Unit (OU) is part of the Hanford 200 Area Site, which is on the EPA National Priority List (NPL) (DOE/RL-2011-56, Rev. 1). The 200-EA-1 OU consists of waste sites in the 200 East Inner Area not already assigned to other OUs. The CP-LS-9 EU waste sites primarily consist of liquid waste disposal sites associated with PUREX Facility operations and a few other waste sites such as infrastructure buildings and pipelines and associated equipment. Liquid waste disposal sites include cribs, French drains, wells, trenches, and unplanned release sites. The primary radioactive contaminants include Am-241, Co-60, Cs-137, Eu-154, H-3, I-129, Ni-63, Sr-90, Tc-99, and isotopes of uranium and

[1] For radionuclides, those are listed if the total activity from the SIM, Rev. 1 exceeds 0.1 Ci or if they are listed in Table 6.1 (CRESP 2015a) and have a non-zero total activity. Unlike for the Interim Report (CRESP 2015b), the activities for all available uranium and plutonium were summed. For chemicals of potential concern, those are listed if the total mass from the SIM, Rev. 1 exceeds 1 kg or if they are listed in Table 6.1 (CRESP 2015a) and have a non-zero total mass. As indicated above, there were several WIDS codes that were included in the DataSheets for multiple EUs; those WIDS codes with non-zero inventory were included in only a single EU for evaluation purposes (and to not double count inventory).

plutonium. Primary chemical contaminants include Cr, NO_3, TBP, and uranium (total). All current land-use activities in the 200 West and 200 East Areas (where the CP-LS-9 is located) are *industrial* in nature (Hanford 200-Area ROD[2]). The following remedial actions alternatives will be considered:[3] i) No Action, ii) Maintain Existing Soil Cover, Institutional Controls (ICs), and Monitored Natural Attenuation (MNA), iii) Engineered Surface Barrier or Capping, iv) Removal, Treatment, and Disposal (RTD), and v) combinations of the options (DOE/RL-2004-66, Draft A; DOE/RL-2004-69, Draft A). The four (future) land-use scenarios listed in the Comprehensive Land Use Plan (CLUP) indicate that the 200 West and 200 East Areas are denoted *Industrial-Exclusive* (DOE/EIS-0222-F).

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table G.5.7-1 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 PUREX Cribs and Trenches inside 200 East Area (CP-LS-9); a Co-located Person (CP) is an individual located 100 meters from the physical boundaries of the PUREX Cribs and Trenches (inside 200-E) areas; and Public is an individual located at the closest point on the Hanford Site boundary not subject to DOE access control. 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 that takes engineered and administrative controls and protections into consideration, is shown 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

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.

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[2] http://www.epa.gov/region10/pdf/sites/hanford/200/hanford_200_rod.pdf

[3] The BC Cribs and Trenches area includes 28 waste disposal sites, including 26 cribs and trenches. A draft focused feasibility study (FFS) was developed for this area (DOE/RL-2004-66, DRAFT A). A similar study has not been prepared for the PUREX Cribs and Trenches (inside 200-E) waste sites although the 216-A-31 Crib was evaluated as part of the 200-PW-3 OU, which included an *In Situ* Vitrification option (DOE/RL-2009-117, Rev. 0). However, because the 216-A-31 waste site was not directly evaluated in the corresponding feasibility study (DOE/RL-2007-27, Rev. 0), this remedial alternative is not included here for CP-LS-9. Because of similarities in waste sites (primarily cribs and trenches) and location (200 East), the analysis provided in the BC Cribs and Trenches FFS will also be used here (and used instead of those provided in the Evaluation Unit Disposition Table (Appendix B)) because the hazards (associated with buried liquid waste legacy sites) are assumed similar enough for the rough order of magnitude analysis provided in this Review. Thus these alternatives (and the quantitative analysis provided in the BC Cribs and Trenches FFS) are used instead of those provided in the Evaluation Unit Disposition Table (Appendix B) for this EU. Note that the basic remedial component activities (No Action, capping, and RTD) are captured in both sets of remedial alternatives.

Cultural Resources

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.

Table G.5.7-1. 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: Monitoring and maintenance	Evaluation Time Period: Active Cleanup (to 2064) — From Cleanup Actions: Five alternatives considered
Human Health	Facility Worker	***Not Discernible (ND)-Low*** *(ND-Low)*	***Proposed Alternatives*: *ND-Low (No Action) to High (RTD)*** (*ND-Low to Low (RTD)*)
	Co-located Person	***ND-Low*** *(ND-Low)*	***Proposed Alternatives: ND-Low*** (*ND-Low*)
	Public	***ND*** (*ND*)	***Proposed Alternatives*: *ND*** (*ND*)
Environmental	Groundwater (A&B) from vadose zone[a]	*High* – I-129 & Sr-90 *Medium* – U(tot) *Low* – other A&B PCs **Overall**: *High*	*High* – I-129 & Sr-90[c] *Medium* – U(tot) *Low* – other A&B PCs **Overall**: *High*
	Columbia River from vadose zone[a]	Benthic and Riparian: *ND* (radionuclides) *ND* (chemicals) Free-flowing: *ND* (all) **Overall**: Not Discernible	Benthic and Riparian: *ND* (radionuclides) *ND* (chemicals)[d] Free-flowing: *ND* (all) **Overall**: Not Discernible
	Ecological Resources[b]	Low	Low to Medium
Social	Cultural Resources[b]	**Native American** Direct: Unknown Indirect: Known **Historic Pre-Hanford** Direct: Unknown Indirect: Known **Manhattan/Cold War** Direct: None Indirect: Known	**Native American** Direct: Unknown Indirect: Known **Historic Pre-Hanford** Direct: Unknown Indirect: Known **Manhattan/Cold War** Direct: None Indirect: Known

a. Threat to groundwater or the Columbia River from Group A and B primary contaminants (PCs) (Table 6-1, CRESP 2015a) remaining in the vadose zone. Threats from plumes associated with the PUREX Cribs and Trenches EU are described in Part V with additional information provided in Appendix G.5 (CP-GW-1) for the 200-BP Groundwater Interest Area (GWIA)

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

c. As described in **Part V**, the rating for Sr-90 is not changed during this period because the impact of radioactive decay on the large remaining vadose zone source is insufficient when accounting for uncertainty.

d. The TC&WM EIS (Appendix P) would suggest that hexavalent chromium would have *Medium* and *High* ratings for benthic and riparian zone impacts, respectively. However, current well data suggest that chromium is moving much more slowly than predicted resulting in *Not Discernible* ratings.

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

There is no Documented Safety Analysis (DSA) or hazard analysis for the CP-LS-9 waste sites because these sites do not currently satisfy the requirements for performing these types of analyses. Thus evaluations of risk for this type of site (i.e., a legacy site) are often more qualitative in nature than those with a formal safety or hazard analysis.

Current

Facility workers are at risk when working near or within those areas with contaminated soil. Exposure to such contaminants is limited because contaminated soils and groundwater are located below grade. However, during certain characterization activities (e.g., drilling and sampling), there may be the potential for exposure to hazardous and radioactive contaminants; however, the potential exposure would be small and limited in duration. The workforce involved with characterization activities (which we will designate a Facility worker) would thus have an unmitigated *Not Discernible* (*ND*) to *Low* risk rating (as described below in **Part VI**). Risk to the Co-located Person (who is not in or near the contaminated soil) would also be rated *ND* to *Low.* The Public is rated as *ND* due to the remote distance to the site, depth from ground surface to soil contamination, and depth to groundwater contamination.

Unmitigated Consequences: Facility Worker – *ND* to *Low*, CP – *ND* to *Low*; Public – *ND*

Mitigation: The Department of Energy and contractor site-specific safety and health planning that includes work control, fire protection, training, occupational safety and industrial hygiene, emergency preparedness and response, and management and organization—which are fully integrated with nuclear safety and radiological protection—have proven effective in reducing industrial accidents at the Hanford Site to well below that in private industry. Further, the safety and health program must effectively ensure that ongoing task-specific hazard analyses are conducted so that the selection of appropriate PPE can be made and modified as conditions warrant. Task-specific hazard analyses must lead to the development of written work planning documents and standard operating procedures (SOPs) that specify the controls necessary to safely perform each task, to include continuous employee exposure monitoring. Finally, Institutional Controls (ICs) will be used to control access to residual contaminants in soil and groundwater as long as they exceed the cleanup levels (CULs). Thus resulting Facility worker risks remain rated as *ND* to *Low*; others also remain the same.

Mitigated Consequences: Facility Worker – *ND* to *Low*, CP – *ND* to *Low*; Public – *ND*

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Cleanup alternatives range from no action (monitoring and natural attenuation) to significant actions, including installation of an engineered barrier, and removal, treatment, and disposal (RTD) (DOE/RL-2004-66, Draft A; DOE/RL-2004-69, Draft A)[4]. Thus impacts to Facility workers (i.e., those performing the cleanup actions) from potential cleanup approaches would vary significantly. As described below

[4] Because no DSA, Hazards Analysis, or feasibility study has been prepared for the PUREX Cribs and Trenches (inside 200-E) area, the draft focused feasibility study (FFS), alternatives, and quantitative analysis developed for the BC Cribs and Trenches area (DOE/RL-2004-66, Draft A) and feasibility study for the 200-PW-1, 200-PW-3, and 200-PW-6 OUs are used to represent the risk and potential impacts associated with remedial options. Geographically, the BC Cribs and Trenches area is most proximate to the PUREX Cribs and Trenches (inside 200-E) area (for those such areas with focused feasibility studies) and the 216-A-31 Crib is part of the 200-PW-3 OU. The alternatives are very similar to those provided in the Evaluation Unit Disposition Table (Appendix B) for this EU.

(**Section VI**), the risk ratings for Facility workers range from *ND-Low* (No Action) to *High* (RTD) based on the action(s) that would be taken. Other ratings would not be impacted.

Unmitigated Risk: Facility Worker – *ND-Low* (No Action) to *High* (RTD); CP – ND-*Low*; Public – ND

Mitigation: See description in Section VI. Thus resulting Facility worker risks are rated as *Low* for active cleanup actions (RTD) and *ND-Low* for other actions; others remain the same.

Mitigated Risk: Facility Worker – *ND-Low* to *Low* (RTD); CP – *ND-Low*; Public – *ND*

Groundwater, Vadose Zone, and Columbia River

Current

The CP-LS-9 EU is in the 200-PO groundwater interest area (GWIA) that is described in the CP-GW-1 EU (Appendix D.5). The saturated zone beneath the vicinity of the CP-LS-9 (PUREX Cribs and Trenches (inside 200-E)) area has elevated levels of I-129, nitrate, Sr-90, tritium (H-3), and uranium (total) based on the 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html); sites within the CP-LS-9 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0). Current threats to groundwater and the Columbia River from contaminants already in the groundwater are evaluated as part of the CP-GW-1 EU (Appendix D.5). However, current threats to groundwater corresponding to only the CP-LS-9 EU contaminants *remaining* in the vadose zone (Table G.5.7-6) has an overall rating of *High* (based on Sr-90 and I-129) as described in **Part V**. Contaminated groundwater is being monitored bur not treated in the 200-PO GWIA (DOE/RL-2016-09, Rev. 0). As indicated in **Part V**, 200-PO plumes for I-129 (also part of 200-BP GWIA), Sr-90, and total uranium (of the Group A and B primary contaminants) have been linked to CP-LS-9 waste sites. Threats from contaminated groundwater in the area to contaminate additional groundwater or the Columbia River are evaluated as part of the CP-GW-1 EU (Appendix D.5).

For the 200-PO GWIA, no plume currently emanating from the CP-LS-9 waste sites intersects the Columbia River at concentrations exceeding the corresponding water quality standard (WQS) as described in **Part V**. Thus current impacts to the Columbia River benthic and riparian ecology would be rated as *Not Discernible* (*ND*). Furthermore, the large dilution effect of the Columbia River on contamination from the seeps and groundwater upwellings also results in *ND* ratings. Thus the overall rating for the Columbia River during the Current period is *ND.*

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

As described in **Part VI**, the remedial actions being considered for the CP-LS-3 EU waste sites include i) No Action, ii) Maintain Existing Soil Cover, Institutional Controls (ICs), and Monitored Natural Attenuation (MNA), iii) Engineered Surface Barrier or Capping, iv) Removal, Treatment, and Disposal (RTD), and v) combinations of these options; however, no final cleanup decisions have been made. Because no final cleanup decisions have been made, there is no way to definitively determine the risks and potential impacts to protected resources (groundwater and Columbia River). However, final cleanup decisions will be made to be protective of human health and the environment and thus it is likely that at least some vadose contamination will be removed to satisfy remedial goals and a cover will be installed (at least in places) to limit infiltrating water that tends to be the primary motive force to mobilize contamination in the vadose zone. Thus even though there are risks to workers associated with the cleanup of the CP-LS-9 waste sites (described above and in **Part VI**), there is unlikely any discernible impact from likely cleanup actions on groundwater or the Columbia River (and thus no changes were made to the current ratings to account for uncertainties).

Contaminants from the CP-LS-9 EU waste sites are currently impacting the vadose zone and groundwater. Without treatment concentrations are unlikely to fall below thresholds before the Active Cleanup phase commences. Secondary sources in the vadose also threaten to continue to impact groundwater in the future, including during the Active Cleanup period. The *High* rating associated with the CP-LS-9 EU waste sites (Table G.5.7-6) is associated with Sr-90 and I-129 remaining in the vadose zone that potentially could continue to impact 200-PO GWIA (which is part of CP-GW-1, Appendix G.5); these contaminants already have 200-PO plumes that have been linked to CP-LS-9 sources (where the I-129 plumes crosses into the 200-BP GWIA). As described in the TC&WM EIS and summarized in **Part V**, radioactive decay would support that the rating would be maintained (at *High*) for Sr-90 during the Active Cleanup period and changed to *Medium* for the Near-term, Post Cleanup period; no other ratings would be impacted (either from decay or transport considerations). 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 G.5.7-6 would only be modified for Sr-90 as described in **Part V**. The ratings for the remaining Group A and B primary contaminants remain unchanged as in Table G.5.7-6 to account for undetermined treatment and to address uncertainties. Thus the overall rating remains *High* for all periods considered.

Ecological Resources

Current

29% of EU and 33% of the buffer is level 3 (there is no level 4 and above resources). There are small, isolated patches of level 3 resources. Piper's daisy and sagebrush are found in the EU. Low impact rating is based on minimal activity and regular application of herbicides.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Multiple remediation actions will be used to address the diversity of waste sites. Remediation has the high potential to impact the resources (population of State sensitive species, including Piper's daisy) within the EU and adjacent buffer. Protection of sensitive species needs to be considered during remediation activities; revegetation with sensitive species is very difficult. Exotic species introduction can preclude the survival of existing native populations. Construction activity and noise can disrupt sensitive wildlife. Revegetation of area after remediation needs to consider the potential for competition with other level 3 resources.

Cultural Resources

Current

Area is highly disturbed and small portions of the EU have been inventoried for archaeological resources. Geomorphology indicates a low potential to contain intact archaeological resources on the surface and/or subsurface. There are no known recorded archaeological resources within the EU. Two isolated finds associated with the Historic Pre-Hanford landscape are located within 500 meters of the EU. Two TCPs are visible from the EU.

There are no Manhattan Project/Cold War Era buildings located within the EU. The Manhattan Project/Cold War Era buildings located within 500 meters of the EU have been mitigated.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Archaeological investigations and monitoring may need to occur prior to remediation. The geomorphology indicates a low 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 capping, installation of surface barriers and from residual contamination that may remain. Temporary indirect effects to viewshed are possible during remediation.

National Register eligible Manhattan Project/Cold War Era buildings located within 500 meters of the EU will be demolished, but they have already been mitigated.

Considerations for Timing of the Cleanup Actions

The saturated zone beneath the CP-LS-9 (PUREX Cribs and Trenches (inside 200-E)) area currently has elevated levels of I-129, nitrate, Sr-90, tritium (H-3), and uranium (total) based on 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). Sites within the CP-LS-9 EU (e.g., 216-A-4, 216-A-5, 216-A-10, 216-A-21, 216-A-27, 216-A-36A/B, and 216-A-45) are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0). Groundwater monitoring is being conducted within the 200-PO GWIA, which is described as part of the CP-GW-1 EU (Appendix D.5). In general, large-scale treatment efforts directed at groundwater have not been started in 200 East[5] and some plume areas (e.g., CN, Cr, Sr-90, and Tc-99) are increasing. Thus cleanup actions are warranted for this EU (200 East).

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

Near-Term, Post-Cleanup Risks and Potential Impacts

Groundwater: During the Near-term, Post-Cleanup period (described in Table G.5.7-7), the ratings for Group A and B primary contaminants are unchanged from the current ratings in Table G.5.7-6 because treatment options have not been defined. The exception is Sr-90, which is rated *Medium* during the during the Near-term, Post Cleanup period due to radioactive decay (**Part V**); the current rating of *High* for Sr-90 is not changed for the Active Cleanup period because of the large remaining inventory source.

Columbia River: As indicated in **Part V**, no radionuclides or chemicals from the 200-PO GWIA are currently predicted to have concentrations exceeding screening values in this evaluation period[6]. Thus the rating will not be modified and all ratings are *Not Discernible* (*ND*) as is the overall rating (Table G.5.7-7).

[5] A treatability study to remove uranium from the perched water zone beneath the B Complex is ongoing (DOE/RL-2016-09, Rev. 0); however, this study is unrelated to CP-LS-9 EU waste sites and plumes.

[6] Using the predictions from the TC&WM EIS (Appendix P) would lead to *Medium* (benthic zone) and *High* (riparian zone) ratings for the Active Cleanup and Near-term, Post-Cleanup periods (Section 6.5 in Appendix E.6). However, well data suggest that chromium is not moving toward the Columbia River at the predicted rate; thus a rating of *Not Discernible* (*ND*) was ascribed for these zones

PART II. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S)

CP-LS-9 EU. The *Operable Unit Cross-Walk* in Attachment 1 indicates 200-EA-1 and 200-PW-3. The other Operable Unit mentioned in Attachment 1 (for WIDS codes included in the evaluation) is 200-IS-1.

COMMON NAME(S) FOR EU

PUREX Cribs and Trenches (inside 200-E)

KEY WORDS

PUREX Cribs and Trenches (inside 200-E), PUREX, Central Plateau, 200 Area, 200-EA-1, 200-PW-3, 200-IS-1, 200-PO, 200-PO-1

REGULATORY STATUS:

Regulatory basis

The Hanford Federal Facility Agreement and Consent Order (also known as the Tri-Party Agreement or TPA) (Ecology et al., 1996) identifies the responsibilities of DOE, EPA, and the Washington State Department of Ecology under Section 120, "Federal Facilities," of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERLCA) to jointly administer remedial actions on the Hanford Site (DOE/RL-2010-49, Draft B). The CERCLA process is clearly established and described in detail at: www.epa.gov/superfund.

The TPA is a living document incorporating the remedial investigations (RIs), decisions, and actions agreed upon by DOE, EPA, and Ecology. DOE is the lead agency responsible for the remedial process at the Hanford Site, involving conducting an RI/FS, developing a plan and record of decision (ROD), and performing the remedial actions. Planning follows EPA guidance for the RI/FS, which are intended to meet RCRA facility investigation/corrective measures study (RFI/CMS) requirements. Finally, the TPA requires that the technical requirements of the Resource Conservation and Recovery Act (RCRA) corrective action process be fulfilled (DOE/RL-2010-49, Draft B).

The 200-EA-1 OU has neither an interim nor final Record of Decision (ROD).

The Remedial Investigation (DOE/RL-2006-51, Rev. 0), Feasibility Study (DOE/RL-2007-27, Rev. 0), and Record of Decision (EPA 2011) and been issued for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs. For the Cs-137 waste group (under which the 200-PW-3 OU and 216-A-31 Crib are part), the Maintain/Enhance Existing Soil Cover (MEESC) alternative was selected because it will provide a minimum 4.6-m (15-ft) cover over the waste that will break potential pathways to human and ecological receptors (EPA 2011). Because the Cs-137 contamination is considered not mobile in the 200 East subsurface, waste treatment was not considered.

There is also deep vadose zone contamination associated with CP-LS-9 waste sites (DOE/RL-92-19, Rev. 0); however, these sites are not included as part of the 200-DV-1 OU (DOE/RL-2011-104, Rev. 0). No remedial decisions have been made for the deep vadose zone and thus no regulatory documents (related to the deep vadose zone) are available (DOE/RL-2014-11, Rev. 0).

Applicable regulatory documentation

Because there are no remedial decisions have been made for the deep vadose zone, there are no regulatory documents available related to the deep vadose zone (DOE/RL-2014-11, Rev. 0). The groundwater contamination from the CP-LS-9 EU would be associated with the 200-PO GWIA. The Remedial Investigation (DOE/RL-2009-85, Rev. 1) for the 200-PO-1 OU was issued in July 2008. The Sampling and Analysis Plan (DOE/RL-2003-04, Rev. 1) was issued in 2006 and amended by TPA-CN-205, and DOE/RL-2007-31 Rev. 0, as amended by TPA-CN-2-253.

For the 200-PW-3 OU:

DOE/RL-2006-51, Rev. 0, *Remedial Investigation Report for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, U.S. Department of Energy, Richlands Operations Office, Richland, Washington.

DOE/RL-2007-27, Rev. 0, *Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, U.S. Department of Energy, Richlands Operations Office, Richland, Washington.

EPA 2011, 'Record of Decision – Hanford 200 Area Superfund Site 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units,' U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.hanford.gov/news.cfm/DOE/CW-PWRODSignedFINALRev010-5-11.pdf.

Applicable Consent Decree or TPA milestones

Federal Facility Agreement and Consent Order, 1989 and amended through June 16, 2014 (Ecology et al., 1996):

- Milestone M-015-92A; Lead Regulatory Agency: Ecology. *Submit a RCRA Facility Investigation/Corrective Measures Study & Remedial Investigation/Feasibility Study work plan for the 200-EA-1 operable unit (200 East Inner Area) to Ecology.* Due Date: 09/30/2017.
- Milestone M-015-92B; Lead Regulatory Agency: Ecology. *Submit RCRA Facility Investigation/Corrective Measures Study & Remedial Investigation/Feasibility Study Report and Proposed Corrective Action Decision/Proposed Plan for the 200-EA-1 OU (Central Plateau 200 East Inner Area) to Ecology*. Due Date: 11/30/2022.

RISK REVIEW EVALUATION INFORMATION

Completed

February 24, 2017

Evaluated by

Kevin G. Brown

Ratings/Impacts Reviewed by

Kathryn Higley

PART III. SUMMARY DESCRIPTION

CURRENT LAND USE

DOE Hanford Site for industrial use. All current land-use activities in the 200 East Area are *industrial* in nature (EPA 2012).

DESIGNATED FUTURE LAND USE

Industrial-Exclusive. All four land-use scenarios listed in the Comprehensive Land Use Plan (CLUP) indicate that the 200 East Area is denoted *Industrial-Exclusive* (DOE/EIS-0222-F). An industrial-exclusive area is "suitable and desirable for treatment, storage, and disposal of hazardous, dangerous, radioactive, and nonradioactive wastes" (DOE/EIS-0222-F).

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The CP-LS-9 waste sites primarily consist of *liquid waste disposal* sites associated with 202-A Facility operations (see CP-DD-1 EU). The CP-LS-9 liquid waste disposal sites include cribs, French drains, septic systems, unplanned release sites, and a trench.

High-Level Waste Tanks and Ancillary Equipment

Note that the CP-LS-9 EU waste sites include one pipeline related to the Single Shell Tank System (DOE/RL-2010-114, Draft A, p. A-7 – A-8) and thus the Tank and Waste Farms EU (Appendix E.1 through Appendix E.11). This and potentially other pipeline and associated equipment waste sites are treated in the Tank Waste and Farms EU (Appendix E.1 through Appendix E.11). Any remaining pipeline and related wastes sites will not be evaluated further due to a lack of inventory information. Known leaks from pipelines and associated equipment are managed as UPRs.

Groundwater Plumes

The saturated zone beneath the CP-LS-9 area (PUREX Cribs and Trenches inside 200-E) has elevated levels of I-129, nitrates, Sr-90, tritium, and total uranium based on groundwater data from 2014 (http://phoenix.pnnl.gov/apps/gw/phoenix.html). The 200 East Area plumes are described in detail as part of the CP-GW-1 EU (Appendix D.5). Sites, primarily cribs, within the CP-LS-9 EU are suspected of contributing contaminants to the saturated zone; whereas, the potential impact to groundwater from unplanned releases in the area is considered low because these sites were remediated by either removing soil or covering the area with uncontaminated fill material (DOE/RL-92-19, Rev. 0). Monitoring (but not treatment) of groundwater is being conducted within the 200-PO GWIA, which is described as part of the CP-GW-1 EU (Appendix D.5).

Operating Facilities

Not applicable

D&D of Inactive Facilities

Not applicable

LOCATION AND LAYOUT MAPS

The CP-LS-9 EU is located in the Hanford Central Plateau Inner Area (shown in Figure G.5.7-1 and Figure G.5.7-2). The PUREX Cribs and Trenches (inside 200-E) (Figure G.5.7-3) are located in the southern part of 200-E Area.

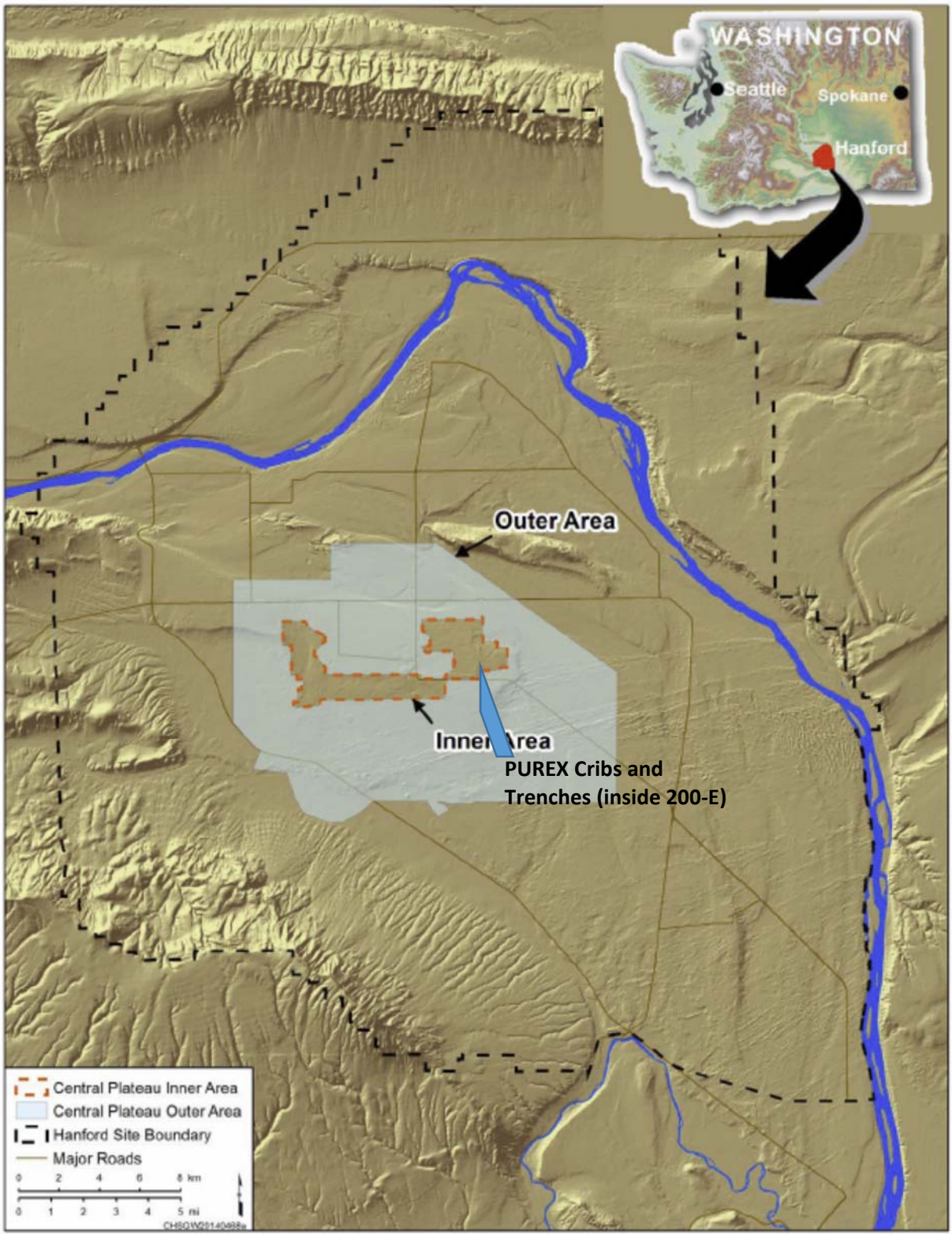

Figure G.5.7-1. The Hanford Site showing the Central Plateau Inner and Outer Areas (reproduced from (DOE/RL-2010-49, Draft B, p. 1-2))

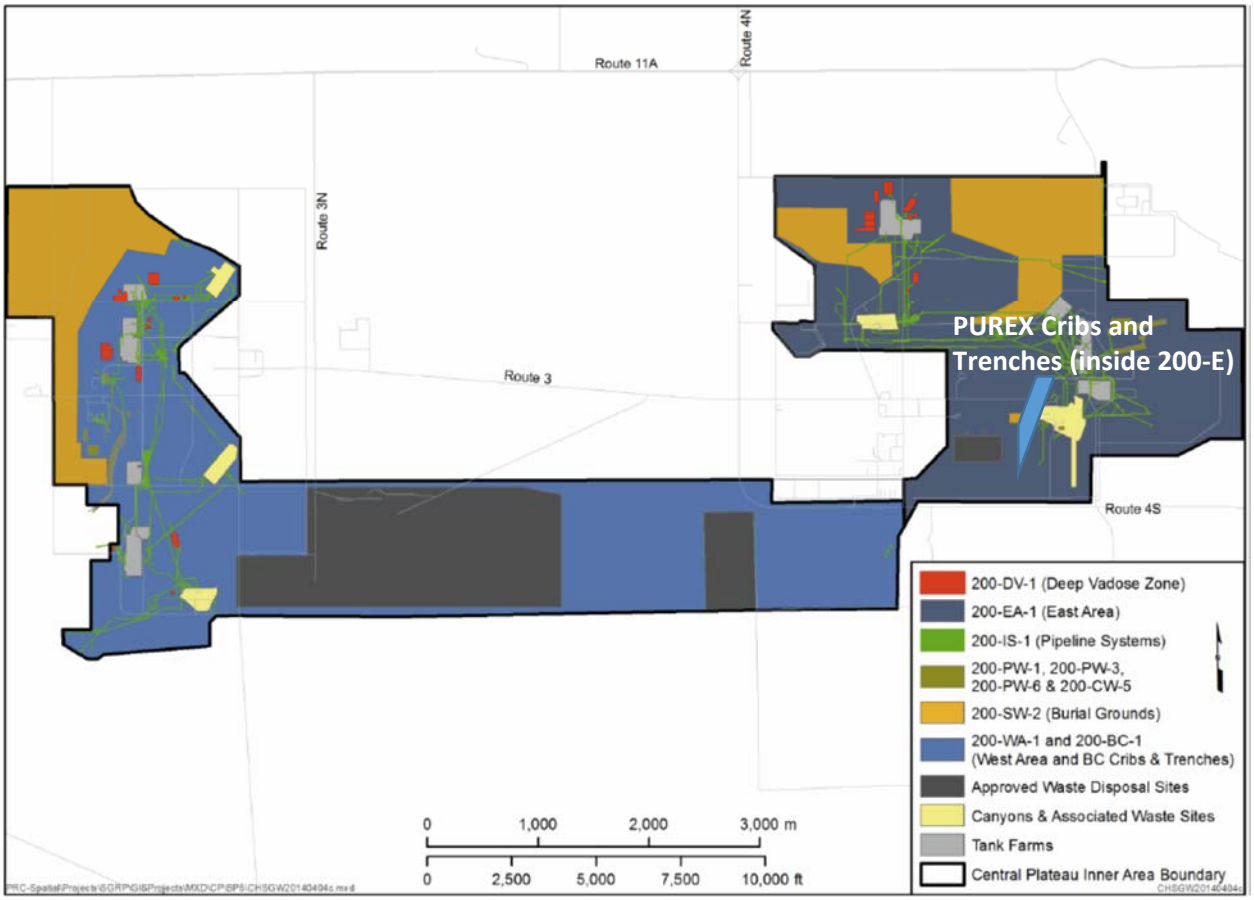

Figure G.5.7-2. Operable Units in the Hanford Central Plateau Inner Area (reproduced from (DOE/RL-2010-49, Draft B, p. 1-10))

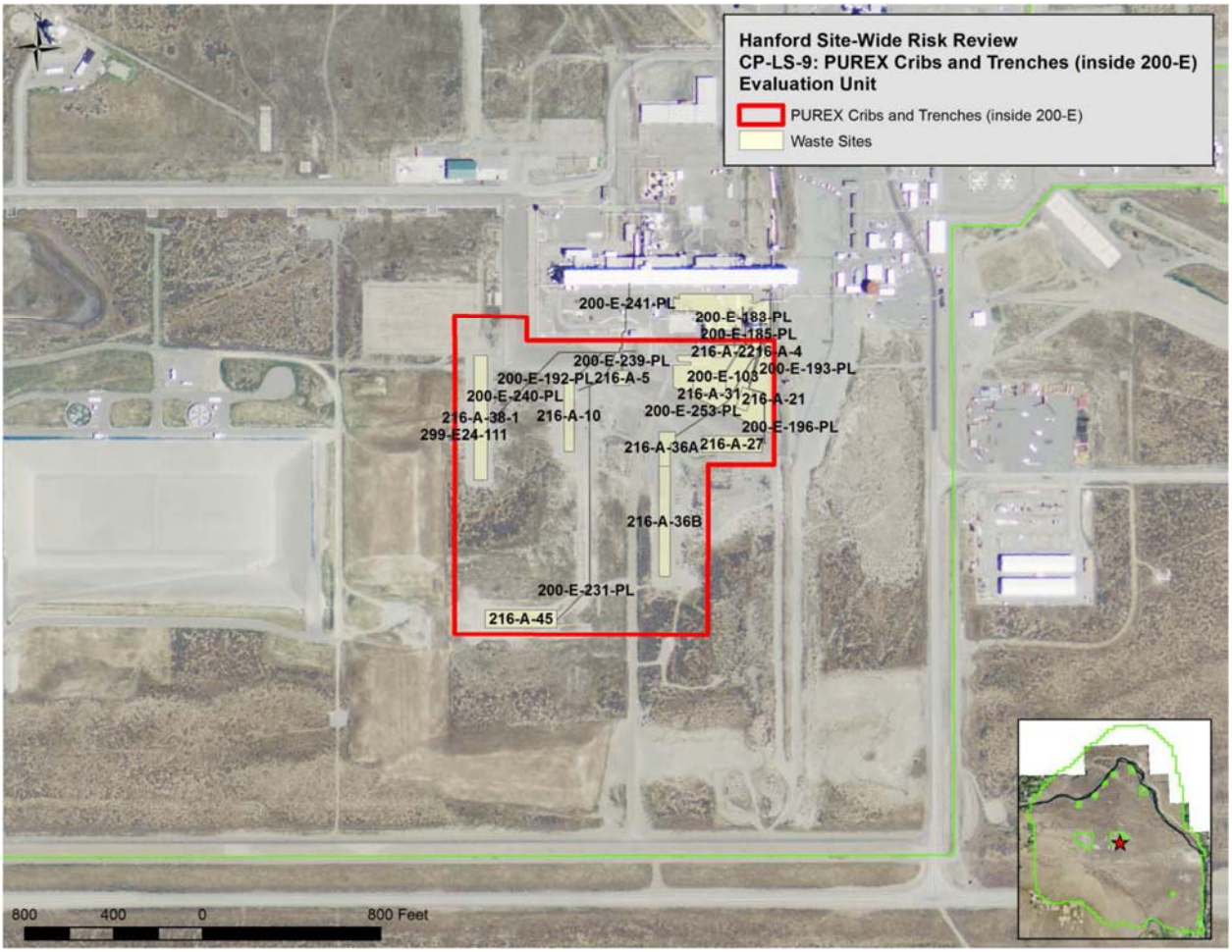

Figure G.5.7-3. CP-LS-9 (PUREX Cribs and Trenches (inside 200-E)) Site Location Map and WIDS Locations

PART IV. UNIT DESCRIPTION AND HISTORY

EU FORMER/CURRENT USE(S)

The CP-LS-9 waste sites primarily consist primarily of *liquid waste disposal* sites associated with 202-A Facility (PUREX Plant) operations (see the CP-DD-1 EU described in Appendix F.6). Between 1955 and 1972 and between 1983 and 1992, the 202-A Facility used an advanced solvent extraction process to recover uranium and plutonium from nitric acid solutions of irradiated uranium.

LEGACY SOURCE SITES

For a 4-month period in 1956, process condensate liquid waste from PUREX (202-A) operations was discharged to ground at the 216-A-10 crib south of the PUREX facility in the 200 East area (PNNL-11800, p. 4.51). The crib received PUREX effluent continuously from 1961 to 1973 and then sporadically until 1981. In 1982, discharges resumed until the crib was taken out of service and replaced by the 216-A-45 crib in 1987. As indicated in Table G.5.7-3 through Table G.5.7-5, the PUREX Cribs and Trenches (inside 200-E) EU waste sites *with reported inventory data* consists of 11 cribs, one reverse well, and one

unplanned release (UPR). These waste sites are considered representative of the major inventory sources and thus risks from this EU.

GROUNDWATER PLUMES

The saturated zone beneath the CP-LS-9 area (PUREX Cribs and Trenches inside 200-E) has elevated levels of I-129, nitrates, Sr-90, tritium, and total uranium based on the groundwater data from 2014 (http://phoenix.pnnl.gov/apps/gw/phoenix.html). The 200 East Area plumes are described in detail as part of the CP-GW-1 EU (Appendix D.5). Sites, including 216-A-4, 216-A-5, 216-A-10, 216-A-21, 216-A-27, 216-A-36A/B, and 216-A-45 cribs, within the CP-LS-9 EU are suspected of being able to contribute mobile contaminants to the saturated zone although the potential impact to groundwater from unplanned releases in the area is considered low because these sites were remediated by either removing soil or covering the area with uncontaminated fill material (DOE/RL-92-19, Rev. 0). Monitoring of groundwater is being conducted within the 200-PO GWIA as described as part of the CP-GW-1 EU (Appendix D.5).

D&D OF INACTIVE FACILITIES

Not applicable

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification

About 44% of the PUREX Cribs and Trenches EU is characterized as level 0 resources, although approximately 10% is actually dunes of coarse sand that are naturally have very sparse vegetation. Overall, roughly 71% of the habitat in the EU is classified as resource level 2 or below (Appendix J, Table J.24 reproduced here as Table G.5.7-2).

The amount and proximity of biological resources surrounding the PUREX Cribs and Trenches EU were examined within the adjacent landscape buffer area, which extends 1953 ft (595 m) from the geometric center of the EU. Approximately 68% of the combined EU and adjacent landscape buffer area is characterized as level 2 resources or lower (Appendix J, Table J.24). Level 3 and 4 resources comprise 32% of the EU with climax shrub cover (i.e., sagebrush) up to 35% in places.

Table G.5.7-2. Area and Proportion of Each Biological Resource Level Within the PUREX Cribs and Trenches (inside 200-E) Evaluation Unit in Relation to Adjacent Landscape and Potential Maximum Change in Resources. (Reproduced Table J.24 from Appendix J)

Resource Level[a]	Evaluation Unit Area (ac)	Adjacent Landscape Buffer (ac)	Combined Total Area (ac)	Percent of Resource Level in Combined Total Area	Percent of Resource Level in Combined Total Area After Cleanup[b]	Percent Difference at Landscape Scale After Cleanup[b]
0	17.4	98.8	116.1	42.21%	50.16%	7.96%
1	0.4	34.5	34.9	12.69%	12.54%	-0.15%
2	10.1	25.1	35.1	12.77%	9.11%	-3.66%
3	11.4	77.0	88.4	32.13%	27.98%	-4.15%
4	0	0.6	0.6	0.20%	0.20%	0.00%
5	0	0	0	0.00%	0.00%	0.00%
Total	39.2	235.8	275.1	100.00%	100.00%	

a. Resource levels for both the evaluation unit and adjacent landscape boundary were reviewed in the field and via imagery during May-August 2015 and revised to reflect current habitats conditions.

b. Potential maximum change in area of a given resource level within the combined total area (Evaluation Unit + Adjacent Landscape Buffer) that would occur assuming that all habitat within the evaluation unit is destroyed by remediation activities and the resource level of the evaluation unit is level 0.

Field Survey

Level 0 resources in the PUREX Cribs and Trenches EU occur primarily in the north (Appendix J, Figure J.24) and are mostly kept vegetation-free through use of herbicides. However, approximately 10% of the level 0 habitat is covered by small sand dunes with a low density of native grasses and in good years also has a few native annual forbs. Areas between those sprayed with herbicides and existing vegetation further away usually have a higher incidence of Russian thistle (*Salsola tragus*). Abutting the sand dune area in the northeast corner of the EU is an area containing mature successional vegetation with scattered gray rabbitbrush (*Ericameria nauseosa*) as the dominant shrub and native Sandberg's bluegrass (*Poa secunda*) and introduced cheatgrass (*Bromus tectorum*) the dominant understory species (Appendix J, Table J.23).

Habitat in the southwest corner of the EU contains a mosaic of areas with and without gray rabbitbrush; both have an understory of native and introduced grasses and Russian thistle. Big sagebrush (*Artemisia tridentata*) is starting to spread into this area from nearby climax shrub habitat.

In the southeast corner and in an area along the west side are remnants of climax vegetation with big sagebrush providing up to 35% cover; the understory was dominated in 2015 by cheatgrass. Circular patches of level 3 resources (Appendix J, Figure J.26) are locations of a state sensitive species observed in past years, although none were noted in the 2015 survey. Percentages of dominant vegetation in Table J.23 (Appendix J) are based on field observations and photographs taken during the June 16, 2015 survey and on older 2009 and 2010 ECAP data.

CULTURAL RESOURCES SETTING

Small portions of the CP-LS-9, PUREX Cribs and Trenches (inside 200-E) EU have been inventoried for cultural resources by two cultural resource inventory surveys, each with negative results. It is unknown if an NHPA Section 106 review has been completed specifically for the remediation of the CP-LS-9, PUREX Cribs and Trenches (inside 200-E) EU. No cultural resources have been documented within the CP-LS-9 PUREX Cribs and Trenches (inside 200-E) EU. It is unlikely that intact archaeological material is present in the EU, which has been extensively disturbed by building and utilities construction.

Two archaeological isolates associated with the Pre-Hanford Early Settlers/Farming Landscape have been recorded within 500 meters of the CP-LS-9, PUREX Cribs and Trenches (inside 200-E) EU. These resources have not been formally evaluated for listing in the National Register of Historic Places, however, it should be noted that isolates are typically considered not eligible. Segments of the National Register-eligible Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District with documentation required have also been recorded within 500 meters of the EU. Lastly, 9 National Register-eligible buildings that are contributing properties within the Manhattan Project and Cold War Era Historic District have been recorded within 500 meters of the EU (all 9 are contributing within the Manhattan Project and Cold War Era Historic District, 5 with individual documentation required, and 4 with no additional documentation required). All National-Register-eligible Manhattan Project and Cold War Era buildings and properties have been documented as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE-RL 1998).

Historic maps for this area do not indicate any cultural features within or in the vicinity of the EU suggesting a low potential for the presence of archaeological resources associated with the Pre-Hanford Early Settlers/Farming Landscape within the EU. Geomorphology suggests a low potential for the presence of archaeological resources associated with the Native American Precontact and Ethnographic Landscape to be present within the CP-LS-9, PUREX Cribs and Trenches (inside 200-E) EU. Moderate ground disturbance within the EU suggests low potential for intact cultural resources at or below ground surface. Resources, if present, would likely be limited to areas of intact or undisturbed soils.

Because only small portions of the CP-LS-9, PUREX Cribs and Trenches (inside 200-E) EU have been inventoried for cultural resources, it may be appropriate to conduct surface archaeological investigations prior to the initiation of 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 associated with these landscapes (e.g. East Benton Historical Society, the Franklin County Historical Society and the Prosser Cemetery Association, the Reach, and the B-Reactor Museum Association) may 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

There are 13 waste sites in the CP-LS-9 EU that have reported inventory information in the SIM, Rev. 1 (Corbin, et al., 2005) (i.e., Table G.5.7-3 through Table G.5.7-5) and are considered representative of the major inventory sources and risks from this EU. These waste sites (with reported inventories) consist of 10 cribs, one French drain, one reverse well, and one UPR (DOE/RL-92-19, Rev. 0):

- The 216-A-10 Crib is 84 m (275 ft) long and 14 m (45 ft) deep and received 3.21E+09 L of process distillate discharge waste streams consisting of aliphatic hydrocarbon compounds, organic complexes, and radionuclides including plutonium, uranium, Sr-90, Co-60, Ce-134, Cs-137, Ru-103/106, and tritium from 1956 to 1987 when it was replaced by the 216-A-45 Crib.
- The 216-A-15 French drain operated from 1955 to 1972 and received 1E+07 L of drainage from 216-A-10 Process Condenser Sampler Pit.
- The 216-A-2 Crib operated from 1956 to 1964 and received 230,000 L of organic wastes from the 202-A Building.
- The 216-A-21 Crib operated from 1957 to 1965 and received 7.79E+07 L of sump waste from 293-A Building, laboratory cell drainage from the 202-A Building, and 291-A-1 Stack drainage.
- The 216-A-27 Crib operated from 1965 to 1970 and received 2.32E+07 L of sump waste from 293-A Building, lab cell drainage from 202-A Building, and 291-A-1 Stack drainage.
- The 216-A-31 Crib operated from 1964 to 1966 and received 10,000 L of organic waste from 202-A Building.
- The 216-A-36A Crib operated from 1965 to 1966 and received 1.07E+06 L of ammonia scrubber waste from 202-A Building.
- The 216-A-36B Crib operated from 1966 to 1987 and received 3.17E+08 L of ammonia scrubber waste from 202-A Building.
- The 216-A-4 Crib operated from 1955 to 1958 and received 6.21E+06 L of laboratory cell drainage from 201-A Building and 291-A-1 Stack drainage.
- The 216-A-45 Crib operated from 1987 and 1989 and received 1.03E+08 L of process condensate from 202-A Building.
- The 216-A-5 Crib operated from 1955 to 1966 and received 1.63E+09 L of process condensate from 202-A Building.
- The 200-E-72 reverse well operated from 1955 to 1997 (Corbin, 2005) and received non-contaminated steam condensate (DOE/RL-88-30, Rev. 23).
- The UPR-200-E-117 unplanned release occurred in 1972 when an excavation exposed liquid (containing Sr-90 and Cs-137) spurting up out of ground in the 200 East / PUREX Area (PNL-6456, Vol. 3, p. 120).

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The CP-LS-9 EU waste sites with reported inventories are legacy sites and the corresponding inventory information is provided in Table G.5.7-3 through Table G.5.7-5.

Vadose Zone Contamination

Since the CP-LS-9 EU waste sites are legacy sites that represent soil and other vadose zone contamination, the (reported) vadose zone inventory information provided in Table G.5.7-3 through

Table G.5.7-5 represent the reported contamination originally discharged (without decay correction[7]) to the vadose zone from the CP-LS-9 EU waste sites. These values are used to estimate the inventory remaining in the vadose zone using the process described in the Methodology Report (CRESP 2015a) 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 2015a) in the vadose zone due to their mobility and persistence and potential threats to groundwater (a protected resource). To summarize (where the current 200-PO (Group A and B) plume for Tc-99 is not associated with the PUREX Cribs and Trenches (inside 200-E) EU waste sites as described below) (DOE/RL-2016-09, Rev. 0)[8]:

- *Chromium* – There are reported inventories for chromium in the CP-LS-9 waste sites (Table G.5.7-5) but no current plumes in the 200-PO GWIA. The inventory is dominated by three cribs.
- *Carbon tetrachloride (CCl_4) and trichloroethene (TCE)* – There are no plumes or reported vadose zone inventories for these contaminants for the CP-LS-9 waste sites (Table G.5.7-5).
- *I-129* – There are reported inventories for I-129 (Table G.5.7-3) as well as a very large plume in the vicinity that straddles both the 200-BP and 200-PO GWIAs. The BY Cribs, 216-B-8 Crib, and UPR from tank 241-BX-102 (covered in CP-TF-6) are 200-BP sources of I-129; however, primary sources were located in the 200-PO GWIA: 216-A-10 Crib vicinity (CP-LS-9), 216-A-29 Ditch (CP-LS-11 (B Pond)[9]), and B Pond (or 216-B-3 as part of CP-LS-11). The CP-LS-9 vadose zone inventory is dominated by 216-A-10 Crib and 216-A-5 Crib.
- *Tc-99* – There are reported inventories for Tc-99 (Table G.5.7-4) and plumes near the A-AX Tank and Waste Farms (CP-TF-5), which have sources both in WMA C (200-BP) and WMA A-AX (200-PO), but none related to CP-LS-9. The vadose zone inventory is dominated by numerous cribs.
- *Uranium* – There is a plume in the vicinity to the east of the 216-A-27 Crib and reported vadose zone inventories for uranium (Table G.5.7-4 and Table G.5.7-5). A small uranium plume has been identified near the PUREX Cribs and Trenches in the near-field region and adjacent to the 618-10 Burial Ground in the far-field area. The source of this plume has not been specifically identified, but it is assumed to be from the PUREX Cribs and Trenches (inside 200-E) EU. The vadose zone inventory is dominated by various cribs (with the majority from the 216-A-4 Crib).
- *Sr-90* – There is a plume in the vicinity near the 216-A-36A/B Cribs and reported vadose zone inventories (Table G.5.7-4). Like for uranium, the source of the plume was not specifically identified but is assumed to be from the PUREX Cribs and Trenches with continuing contribution from the vadose zone (assumed also from PUREX Cribs and Trenches (inside 200-E) EU). The times required for the remaining vadose zone inventory from the CP-LS-9 EU sources to decay to values that would result in *Medium* and *Low* ratings are approximately 90 and 190 years,

[7] As described in the Methodology Report (CRESP 2015a) 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 2015a).

[8] 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.

[9] This waste site is listed as part of both CP-LS-11 (B Pond) and CP-LS-16 (Grout Vaults) but addressed in CP-LS-11.

respectively, indicating that the vadose zone source is not excessively high and that decay could significantly impact the risk during the evaluation period.

- *Other Group A&B Primary Contaminants (PCs)* – There are no current plumes for other Group A and B PCs not mentioned above (i.e., C-14, Cl-36, or CN) in the vicinity; however, there are reported vadose zone inventories C-14 (Table G.5.7-3) but not for Cl-36 (Table G.5.7-3) or CN (Table G.5.7-5). The relatively small, reported C-14 inventory is dominated by 216-A-10 and 216-A-5 Cribs and no plumes have been observed in the 200-PO GWIA (and no measured vales approached the 2000 pCi/L standard). Thus the remaining Group A and B PCs are not considered significant threats to the Hanford groundwater during the first 150 years.

Using the process outlined in Chapter 6 of the Methodology Report (CRESP 2015a) for the 2013 groundwater results as revised for the 2015 Groundwater Monitoring Data (DOE/RL-2016-09, Rev. 0) described in Appendix D.1, the remaining vadose zone inventories in Table G.5.7-6 are estimated by difference and used to calculate Groundwater Threat Metric (GTM) values for the Group A and B contaminants remaining in the vadose zone as illustrated in Table G.5.7-6. Note that the vadose zone (VZ) ratings range from *High* for Sr-90 and I-129 to *Medium* for total uranium to *Low* for the other Group A and B PCs with reported inventories. The overall current rating is defined as the highest over all the ratings and thus *High*.

Groundwater Plumes

Sites within the CP-LS-9 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0) and (of the Group A and B primary contaminants) chromium, C-14, Tc-99, uranium, Sr-90, and I-129 (i.e., not CN, Cl-36, CCl_4 or TCE) have reported inventories for the CP-LS-3 waste sites (Table G.5.7-3 through Table G.5.7-5). Monitoring of groundwater is being conducted within the 200-PO GWIA, which is described as part of the CP-GW-1 EU (Appendix D.5). The saturated zone inventories related to the CP-LS-9 EU are provided in Table G.5.7-6; the process for deriving these inventories is described in CRESP Methodology Report (CRESP 2015a) originally for the 2013 groundwater plume information as revised for the 2015 Groundwater Monitoring Data (DOE/RL-2016-09, Rev. 0) described in Appendix D.1.

In general the 2015 groundwater plumes are evaluated in separate EUs (see Appendix D.1 through Appendix D.6); however, portions of the groundwater plumes can be associated with the PUREX Cribs and Trenches (inside 200-E) EU based on source information in the Groundwater Monitoring Report (DOE/RL-2016-09, Rev. 0), and these partial plume areas will be evaluated to provide a better idea of the saturated zone versus remaining vadose zone threats to groundwater. The estimated inventory for the saturated zone contamination is provided in Table G.5.7-6 where Photoshop was used to estimate the fraction of plumes considered associated with the PUREX Cribs and Trenches (inside 200-E) EU (Attachment 6-4 in the Methodology Report (CRESP 2015a) as revised for the 2015 Groundwater Monitoring Data (DOE/RL-2016-09, Rev. 0) described in Appendix D.1). This information is also used to estimate amounts treated and remaining in the vadose zone. For the groundwater plumes described in the 200-PO GWIA, apportionment of plumes and ratings to the PUREX Cribs and Trenches (inside 200-E) EU would be as follows (DOE/RL-2016-09, Rev. 0):

- *I-129* – There is a very large in the vicinity of the CP-LS-9 EU waste sites (where the plume straddles both the 200-BP and 200-PO GWIAs) and vadose zone inventories (Table G.5.7-3). The primary sources for the plume were located in the 200-PO GWIA: 216-A-10 Crib vicinity (CP-LS-9) and 216-A-29 Ditch and B Pond (CP-LS-11). Because the 216-A-10 Crib is part of CP-LS-9 (and a major source), the portion of the 200-PO part of the plume area is 91% (Appendix D.1).

- *Tc-99* – There are reported vadose zone inventories (Table G.5.7-4) and plumes in 200-PO near the A-AX Tank and Waste Farms (CP-TF-5). These plumes have sources both in WMA C (200-BP) and WMA A-AX (200-PO), but none related to CP-LS-9. Since no sources were associated with CP-LS-9 waste sites, no portions of plumes are apportioned to CP-LS-9.
- *Sr-90* – There is a plume in the vicinity and reported vadose zone inventories (Table G.5.7-4). The source of this plume has not been specifically identified, but it is assumed to be from the PUREX Cribs and Trenches (inside 200-E) EU. The portion of the 200-PO plume area assigned is 100% (Appendix D.1).
- *Uranium* – There is a plume in the vicinity to the east of the 216-A-27 Crib and reported vadose zone inventories for uranium (Table G.5.7-4 and Table G.5.7-5). The source of this plume has not been specifically identified, but it is assumed to be from the PUREX Cribs and Trenches (inside 200-E) EU. The portion of the 200-PO plume area assigned is 100% (Appendix D.1).
- *Group C&D Contaminants* – There are plumes and reported inventories for nitrate and tritium; however, these are not the focus of this discussion.

The groundwater plumes (i.e., I-129, Sr-90, and total uranium) associated with the Group A and B PCs from the PUREX Cribs and Trenches (inside 200-E) EU are described in detail in the Appendix G.5 for the CP-GW-1 EU (200-PO GWIA). Note that I-129 is the primary risk driver for the 200-PO GWIA although there are CP-LS-9 waste sites linked to other primary contaminants, Sr-90 and total uranium (i.e., primary sources for relatively small current plumes).

Impact of Recharge Rate and Radioactive Decay on Groundwater Ratings

As described in Appendix E.6 for the CP-TF-5 (A-AX Tank and Waste Farms) EU, the TC&WM EIS screening groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that there may be large impacts resulting from emplacing an engineered surface barrier (and resulting reduction of infiltrating water) on the predicted peak groundwater concentrations at the A Barrier[10]. To summarize, the screening groundwater results including sources in addition to those for the PUREX Cribs and Trenches (inside 200-E) EU (Appendix O, DOE/EIS-0391 2012) include[11]:

- Tc-99 peak concentration is 41,700 pCi/L (CY 2121) for the No Action Alternative versus 774 pCi/L (CY 2102) for Landfill Closure where the threshold value is 900 pCi/L.
- I-129 peak concentration is 38.5 pCi/L (CY 2123) for the No Action Alternative versus 1.5 pCi/L (CY 2104) for Landfill Closure where the threshold value is 1 pCi/L.

[10] 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 A Barrier is the closest to the PUREX Cribs and Trenches (inside 200-E) EU. Despite including sources other than those for the PUREX Cribs and Trenches (inside 200-E) EU, the analysis in the TC&WM EIS was considered a reasonable source of information to assess the impact of the engineered surface barrier emplacement.

[11] 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. These results do not indicate that the sources for the high concentrations of future contaminants in question are primarily from the PUREX Cribs and Trenches (inside 200-E) EU.

- Chromium peak concentration is 323 µg/L (CY 3710) for the No Action Alternative versus 81 µg/L (CY 2168) for Landfill Closure where the threshold value is 100 µg/L (total) or 48 µg/L (hexavalent).
- No values are reported at the A Barrier for uranium and Sr-90 for either scenario, which indicates that peak fluxes that were less than 1×10^{-8} Ci/yr for Sr-90 or 1×10^{-8} g/yr for uranium (Appendix O, DOE/EIS-0391 2012, p. O-2).

Despite the large impacts on the predicted peak concentrations, the peak value for I-129 was predicted to exceed its threshold[12] at the A Barrier within 150-200 years and thus the saturated and vadose ratings will not be altered (i.e., remain *High*) even though the impacts may be large. The peak predicted concentration for Tc-99 does not exceed the threshold during the TC&WM EIS evaluation period (10,000 years) and current 200-PO plumes are associated with WMA C (200-BP) and WMA A-AX (200-PO) sources. It is assumed that any contamination that would be entering groundwater from CP-LS-9 sources would be sporadic and dispersed (as in the past), and thus the Tc-99 rating for the Near-term, Post-Cleanup period would remain *Low* to address uncertainty in the evaluation.

Based on the TC&WM EIS results, it is predicted that uranium would not reach the A Barrier during the evaluation period (10,000 years) and is thus assumed to remain localized to the east if the 216-A-27 Crib. Thus based on this evaluation, the current rating of *Medium* for total uranium for the Active Cleanup and Near-term, Post-Cleanup periods would not be changed to account for the fact that remedial actions have not been defined for the 200-PO GWIA and to address uncertainty in the evaluation.

The TC&WM EIS results indicate that the Sr-90 plume is expected to remain localized. The times required for the remaining vadose zone inventory to decay to values that would result in *Medium* and *Low* ratings are approximately 90 and 190 years, respectively. Thus the rating for Sr-90 is *High* for the Active Cleanup periods (because remedial actions have not been defined for the GWIA) and *Medium* for the Near-term Post-Cleanup period to address uncertainty in the evaluation.

Columbia River

Threats to the Columbia River similar to those presented by the PUREX Cribs and Trenches (inside 200-E) EU were evaluated in Section 6.5 of Appendix E.6 for CP-TF-5 (A-AX Single-shell Tank and Waste Farms in 200 East) where all risks and potential impacts were rated *Not Discernible* (*ND*)[13].

[12] The chromium value (as hexavalent chromium) also exceeded its corresponding threshold; however, no plume has been associated with the CP-LS-9 waste sites and thus it is assumed that the source would be from elsewhere. The peak total chromium value is below the standard; thus there would be no plume after cleanup.

[13] The results of the procedure defined in Chapter 6 of the Methodology Report (CRESP 2015a) actually led to *Medium* (benthic zone) and *High* (riparian zone) ratings during the Active Cleanup and Near-term, Post-Cleanup periods based on predicted hexavalent chromium values along the Columbia River (Section 6.5 in Appendix E.6). However, well data suggest that chromium is not moving toward the Columbia River at the predicted rate; thus a rating of *Not Discernible* is ascribed for these zones.

Table G.5.7-3. 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]			130	0.025	NR	1.5	1600	0.024	2.1	78000	2.7
216-A-10	Cribs	2001	SIM	75	0.011	NR	0.071	28	0.0047	0.4	58000	1.7
216-A-15	French drain	2001	SIM	2.00E-08	3.90E-05	NR	NR	NR	NR	NR	NR	5.50E-07
216-A-2	Cribs	2001	SIM	1.80E-01	2.20E-03	NR	5.40E-03	1.9	4.10E-03	3.00E-01	1.40E-03	1.80E-05
216-A-21	Cribs	2001	SIM	4.60E+00	NR	NR	7.70E-02	6.40E+01	9.80E-05	1.10E-02	4.90E+01	NR
216-A-27	Cribs	2001	SIM	3.20E-02	4.80E-04	NR	3.20E-03	2.90E+01	5.00E-04	3.60E-02	5.00E-02	7.40E-08
216-A-31	Cribs	2001	SIM	2.30E-02	3.50E-04	NR	1.40E-03	3.70E+02	4.90E-04	3.90E-02	5.50E-04	5.20E-06
216-A-36A	Cribs	2001	SIM	2.40E+00	NR	NR	1.20E-01	6.90E+02	7.70E-03	8.50E-01	1.00E+02	NR
216-A-36B	Cribs	2001	SIM	2.30E-01	NR	NR	1.10E+00	290	1.10E-03	1.20E-01	2.00E+02	8.60E-03
216-A-4	Cribs	2001	SIM	5.40E-03	8.00E-05	NR	5.40E-04	4.9	8.40E-05	6.00E-03	6.40E+01	NR
216-A-45	Cribs	2001	SIM	1.2	4.00E-05	NR	6.80E-04	1.6	1.30E-04	0.016	3200	3.30E-02
216-A-5	Cribs	2001	SIM	4.30E+01	1.00E-02	NR	5.00E-02	12	4.50E-03	3.30E-01	1.70E+04	9.60E-01
200-E-72	Injection well	2001	SIM	3.80E-10	7.30E-07	NR	NR	NR	NR	NR	NR	1.00E-08
UPR-200-E-117	UPR	2001	SIM	2.20E-03	6.40E-04	NR	6.10E-03	96	3.40E-04	2.70E-02	3.50E-03	1.30E-05

a. NR = Not reported for indicated EU
b. EIS-S = DOE/EIS-0391 2012
c. SIM = RPP-26744, Rev. 0 (Corbin, et al. 2005)
d. Radionuclides are summed without decay correction since the uncertainties in inventories are large.

Table G.5.7-4. 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]			0.0067	0.63	400	1200	2	5.2
216-A-10	Cribs	2001	SIM	3.80E-03	0.37	210	18	0.49	0.25
216-A-15	French drain	2001	SIM	NR	NR	0.0043	2.40E-06	NR	0.00035
216-A-2	Cribs	2001	SIM	8.00E-06	7.50E-04	1.70E+01	0.89	2.70E-02	1.60E-01
216-A-21	Cribs	2001	SIM	NR	NR	1.60E+01	6.10E+00	7.50E-03	1.40E-01
216-A-27	Cribs	2001	SIM	9.00E-05	8.70E-03	5.30E+01	2.50E+01	8.60E-03	5.10E-01
216-A-31	Cribs	2001	SIM	2.30E-06	2.20E-04	2.60E-01	1.30E+00	7.90E-03	4.20E-02
216-A-36A	Cribs	2001	SIM	NR	NR	2.00E+01	7.90E+02	4.90E-01	1.20E-01
216-A-36B	Cribs	2001	SIM	NR	NR	5.70E-01	280	6.30E-02	1.10E-01
216-A-4	Cribs	2001	SIM	1.50E-05	1.40E-03	8.80E+00	4.1	5.70E-01	3.70E+00
216-A-45	Cribs	2001	SIM	3.60E-05	3.50E-03	8.9	0.07	0.0058	0.0069
216-A-5	Cribs	2001	SIM	2.50E-03	2.30E-01	6.90E+01	3.00E+01	3.10E-01	1.30E-01
200-E-72	Injection well	2001	SIM	NR	NR	0.00014	4.50E-08	NR	7.30E-06
UPR-200-E-117	UPR	2001	SIM	1.80E-04	1.70E-02	4.40E-03	0.82	2.40E-02	8.50E-06

a. NR = Not reported for indicated EU
b. EIS-S = DOE/EIS-0391 2012
c. SIM = RPP-26744, Rev. 0 (Corbin, et al. 2005)
d. Radionuclides are summed without decay correction since the uncertainties in inventories are large.

Table G.5.7-5. 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	19	NR	0.17	5.50E+06	0.02	170000	NR	6800
216-A-10	Cribs	SIM	NR	NR	NR	NR	NR	1.90E+06	NR	NR	NR	360
216-A-15	French drain	SIM	NR	NR	NR	NR	NR	5.6	NR	NR	NR	0.48
216-A-2	Cribs	SIM	NR	NR	4.60E-03	NR	NR	2400	NR	150000	NR	2.30E+02
216-A-21	Cribs	SIM	NR	NR	NR	NR	NR	320000	NR	NR	NR	1.90E+02
216-A-27	Cribs	SIM	NR	NR	11	NR	1.20E-07	11000	6.00E-05	NR	NR	6.50E+01
216-A-31	Cribs	SIM	NR	NR	0.0006	NR	NR	1.90E+02	NR	20000	NR	6.00E+01
216-A-36A	Cribs	SIM	NR	NR	NR	NR	NR	4400	NR	NR	NR	150
216-A-36B	Cribs	SIM	NR	NR	NR	NR	NR	1.30E+06	NR	NR	NR	120
216-A-4	Cribs	SIM	NR	NR	2.30E+00	NR	2.30E-02	9.50E+04	NR	NR	NR	5.40E+03
216-A-45	Cribs	SIM	NR	NR	5.5	NR	1.50E-01	800000	4.80E-03	NR	NR	7.8
216-A-5	Cribs	SIM	NR	NR	NR	NR	NR	1.10E+06	NR	NR	NR	2.00E+02
200-E-72	Injection well	SIM	NR	NR	NR	NR	NR	1.10E-01	NR	NR	NR	0.0091
UPR-200-E-117	UPR	SIM	NR	NR	2.90E-01	NR	1.10E-04	6.2	0.015	NR	NR	0.01

a. NR = Not reported for indicated EU
b. EIS-S = DOE/EIS-0391 2012
c. SIM = RPP-26744, Rev. 0 (Corbin, et al. 2005)

Table G.5.7-6. 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	0.25	0	1.82	2.50E-02 Ci	---	---	2.50E-02 Ci	1.25E-02	*Low*
I-129	A	1 pCi/L	0.25	0.2	1.82	2.74E+00 Ci	1.52E+00 Ci	---	1.22E+00 Ci	4.95E+02	*High*
Sr-90	B	8 pCi/L	0.25	22	1.82	1.15E+03 Ci	6.03E-04 Ci	---	1.15E+03 Ci	8.93E+02	*High*
Tc-99	A	900 pCi/L	0.25	0	1.82	2.00E+00 Ci	---	---	2.00E+00 Ci	2.22E+00	*Low*
CCl4	A	5 µg/L	0.25	0	1.82	---	---	---	---	---	*ND*
Cr	B	100 µg/L	0.25	0	1.82	1.87E+01 kg	---	---	1.87E+01 kg	1.87E-01	*Low*
Cr-VI	A	48 µg/L[b]	0.25	0	1.82	1.87E+01 kg	---	---	1.87E+01 kg	3.90E-01	*Low*
TCE	B	5 µg/L	0.25	2	1.82	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.25	0.8	1.82	6.77E+03 kg	6.90E+00 kg	---	6.76E+03 kg	3.30E+01	*Medium*

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

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 2015a).

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 waste sites were covered in soil, which is maintained as needed to prevent release to the air or intrusion by biological receptors or humans. The primary accident scenarios are direct human and ecological contact as well as continued groundwater impact. There is little remedial work being done in the 200-East Area; thus risk to workers would tend to be related to standard industrial risks ("slips, trips, and falls") and those related to monitoring activities including sampling and well drilling.

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

Not applicable.

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

Not applicable.

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

The primary barriers to release and transport from the waste sites, include sorption to vadose zone and saturated zone media and soil cover (EPA 2011). However, contaminants that tend to be strongly sorbed to the soil have reached groundwater in the 200-PO GWIA. The soil is still in place although waste sites within the CP-LS-9 EU are contaminating the surrounding vadose zone media and may be leading to additional saturated zone contamination. There is a deep vadose zone beneath the 200 East Area through which contaminants must travel to reach groundwater and then to off-site areas (e.g., Columbia River) where receptors could be exposed. Restrictions on use of site groundwater also represent a barrier to exposure. Because of relatively long travel times, natural attenuation of the radionuclides with relatively short half-lives (when compared to travel times) can also be considered a barrier. Furthermore, the large flow in the Columbia River tends to dilute the concentration of any contaminants to which receptors might be exposed via the surface water pathway. Thus there are currently no complete pathways to human or ecological receptors; however, there is a complete path to the saturated zone (via the vadose zone), which is treated as a protected resource.

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

Those events (e.g., significant water line break or increased infiltration including temporary cover degradation) that could provide sufficient water to the CP-LS-9 waste sites to cause additional release and migration of the relatively more mobile species (e.g., Cr, Tc-99, and I-129) in the Hanford subsurface environment.

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

The primary pathway from the CP-LS-9 EU waste sites is release to the vadose zone (primarily from contact with infiltrating water) that then migration to the saturated zone (groundwater), which is considered a protected resource (and thus receptor) and ultimately the Columbia River (which is also considered a protected resource and thus a receptor for the purpose of this study). Either contaminated groundwater (after use restrictions are lifted) or surface water (Columbia River) may be used by human or ecological receptors.

There are complete pathways for the exposure of ecological receptors to vadose zone contaminants in the legacy source areas. There will also be other possible pathways (ingestion, external radiation and dermal, inhalation) from residual wastes to human and ecological receptors after institutional controls are lifted.

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

As described in the CP-GW-1 (Appendix D.5), the relatively long residence times in Hanford groundwater are consistent with recharge conditions for a semi-arid site; however, there is variation in expected residence times (PNNL-6415 Rev. 18, p. 4-72). Groundwater travel time from 200 East to the Columbia River is ~10-30 years, which limits impacts to the Columbia River to very mobile contaminants over very long time frames. Travel times from the 200 Areas to the Columbia River are expected to decrease because of the reduced hydraulic gradient from the discontinued wastewater recharge in the 200 Areas.

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

Waste sites in the CP-LS-9 EU pose a current risk (where constituents have already migrated to the saturated zone) and continuing risk to protected natural resources in the area including groundwater and perhaps the Columbia River in the long-term. However, since there is prohibition on the use of groundwater through the Active and Near-term, Post-Cleanup periods, there is no risk to humans. Furthermore, the risks to benthic, riparian zone, and free-flowing ecology are minimal as described in **Part V** of Appendix D.5 (CP-GW-1 EU).

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

As mentioned in **Part I**, there is no Documented Safety Analysis (DSA) or hazard analysis (HA) for the CP-LS-9 waste sites because they do not currently satisfy the requirements for performing these types of analyses. Thus evaluations of risk for this type of site (i.e., a legacy site) are often more qualitative in nature than those with a formal safety analysis.

The Department of Energy and contractor site-specific safety and health planning that includes work control, fire protection, training, occupational safety and industrial hygiene, emergency preparedness and response, and management and organization—which are fully integrated with nuclear safety and radiological protection—have proven to be effective in reducing industrial accidents at the Hanford Site to well below that in private industry. Further, the safety and health program must effectively ensure that ongoing task-specific hazard analyses are conducted so that the selection of appropriate PPE can be made and modified as conditions warrant. Task-specific hazard analyses must lead to the development of written work planning documents and standard operating procedures (SOPs) [DOE uses the term work planning documents in addition to procedures] that specify the controls necessary to safely perform each task, to include continuous employee exposure monitoring. Last, ICs will be used to

control access to residual contaminants in soil and groundwater as long as they exceed the cleanup levels (CULs). As such, mitigation actions will generally lead to reduced risks.

Facility Worker

Facility workers are at risk when working in or around areas with contaminated soils, including working on active remedial activities involving these legacy sources, which are currently not being conducted. Exposure to such contaminants is currently limited because waste sites and contaminated soils are located below grade (EPA 2011). However, during maintenance and monitoring operations near the CP-LS-9 waste sites (e.g., drilling and sampling), there may be the potential for limited exposure to hazardous and radioactive contaminants; however, risks would be minimal and short-term resulting from monitoring and maintenance activities conducted by experienced workers and appropriate safety precautions (DOE/RL-2004-66, Draft A ; DOE/RL-2007-27, Rev. 0). Thus current risks to workers are considered not an issue due to protective soil covers over most waste sites and the safety measures taken for work activities in the area.

Facility Worker: Risks are thus rated as *Not Discernible* (*ND*) to *Low* because of the soil cover over most sites, with mitigated risk of *ND* to *Low* due to both soil cover and employed safety measures (as described above).

Co-Located Person (CP)

For this EU, co-located persons would be expected to have similar reduced exposures as for facility workers.

Co-Located Person: Risks are thus rated as *ND* to *Low*, with mitigated risk of *ND* as described above.

Public

The public would be expected to have significantly reduced exposure, even lower than that for facility workers and co-located persons, due to the remote distance to the site, depth from ground surface to soil contamination, and depth to groundwater contamination (and required lack of use).

Public: Risks are rated as *ND*; mitigated risk is rated as *ND*.

Groundwater

Table G.5.7-6 represents the risks and associated ratings for the saturated zone (groundwater) from vadose zone contamination associated with the CP-LS-9 waste sites. Sites within the CP-LS-9 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0). The current risk and potential impact ratings for the CP-LS-9 EU (Table G.5.7-6) are *High* (Sr-90 and I-129), *Medium* (total uranium), and *Low* (other Group A and B PCs with reported inventories). Monitoring of groundwater is being conducted within the 200-PO GWIA, which is described as part of the CP-GW-1 EU (Appendix D.5). As described in **Part V**, plumes within only the 200-PO GWIA have been linked to CP-LS-9 EU waste sites.

Columbia River

As described in Appendix D.5 (CP-GW-1 EU, **Part V**), although tritium (Group C) from the 200-PO GWIA currently intersects the Columbia River, current ratings for all contaminants for the benthic, riparian, and free-flowing ecology are *ND*.

Ecological Resources

Summary of Ecological Review:

- Approximately 34% (~13 acres) of the PUREX Cribs and Trenches EU (over waste sites and roads) is kept at resource level 0 by applications of herbicides. Another 10% (~4 acres) of the EU is characterized as level 0 because of its very low plant density, but is actually wind-blown, relatively coarse sand with very sparse perennial and annual native vegetation.
- 29% of the EU is classified as level 3 habitat most of which occurs along the south side of the EU, where it is contiguous with similar habitat outside the EU. Loss of all habitat within the EU is not expected to impact connectivity to habitats outside the 200 East Area.
- In the past, Piper's daisy, a state sensitive species, has been observed at numerous locations within the EU, and although none were observed in 2015, it is considered likely to occur in the area. Loss of individual Piper's daisies is not expected to affect population viability.
- Over 32% of the combined EU and adjacent landscape buffer area are classified as level 3 habitat. Wide roadways to the south of the EU may restrict some species movement to habitat outside the 200 East Area.

Cultural Resources

The CP-LS-9, PUREX Cribs and Trenches (inside 200-E) EU is located within the 200 East Area of the Hanford Site, an area known to have low potential to contain Native American Precontact and Ethnographic archaeological resources and Pre-Hanford Early Settlers/Farming resources. Much of the 200 Areas were addressed in a cultural resources report entitled *Archaeological Survey of the 200 East and 200 West Areas, Hanford Site* (Chatters and Cadoret 1990). The focus of this archaeological survey was on inventorying all undisturbed portions of the 200 East and 200 West Areas. This report concluded that much of the 200 East and 200 West Areas can be considered areas of low archaeological potential with the exception of intact portions of an historic/ethnohistoric trail/road corridor which runs through the 200 West Area.

Small portions of the EU have been inventoried for archaeological resources under two cultural resource reviews: HCRC#87-200-001 (Chatters 1987a), and HCRC#87-200-046 (Chatters 1987b). Neither of these cultural resource reviews resulted in the identification of any cultural resources within the CP-LS-9, PUREX Cribs and Trenches (inside 200-E) EU. It is unknown if an NHPA Section 106 review has been completed specifically for remediation of the CP-LS-9, PUREX Cribs and Trenches (inside 200-E) EU. It is possible but unlikely that intact archaeological material is present in the areas that have not been inventoried for archaeological resources (both on the surface and in the subsurface), because soils in the majority of the EU appear to have been heavily disturbed by Hanford Site activities.

Archaeological sites, buildings and Traditional Cultural Properties (TCPs) located within the EU[14]

- There are no known archaeological sites, inventoried historic buildings, or TCPs located within the CP-LS-9, PUREX Cribs and Trenches (inside 200-E) EU.

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

- Two archaeological isolates associated with the Pre-Hanford Early Settlers/Farming Landscape have been documented within 500 meters of the EU. While these resources have not been formally

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

evaluated for listing in the National Register of Historic Places, it should be noted that isolates are typically considered not eligible.

- Segments of the National Register-eligible Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required, are located within 500-meters of the CP-LS-9, PUREX Cribs and Trenches (inside 200-E) EU. In accordance with the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE-RL 1998), all documentation requirements have been completed for this property.
- There are 9 National Register-eligible buildings that are contributing properties within the Manhattan Project and Cold War Era Historic District located within 500-meters of the CP-LS-9, PUREX Cribs and Trenches (inside 200-E) EU (all 9 are contributing with the Manhattan Project and Cold War Era Historic District, 5 with individual documentation required, and 4 with no additional documentation required. In accordance with the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE-RL 1998), all documentation requirements have been completed for these properties.

Table K.12 (Appendix K) has more information about the nine buildings that are National Register-eligible Manhattan Project and Cold War Era buildings located within 500-meters of the CP-LS-9, PUREX Cribs and Trenches (inside 200-E) EU.

Closest Recorded TCP

There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from the CP-LS-9, PUREX Cribs and Trenches (inside 200-E) EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

Final cleanup decisions for the CP-LS-9 EU waste sites have not been made (DOE/RL-2014-11, Rev. 0)[15] and will be included in future remedial decision documents (e.g., Records of Decision). A set of five *plausible* remedial alternatives is provided in the Evaluation Unit Disposition Table (Appendix B) for CP-LS-9 EU[16]. However, a draft Focused Feasibility Study (FFS) was prepared for the BC Cribs and Trenches Area waste sites (DOE/RL-2004-66, Draft A), which is also in 200 East. It was decided by the author to use the evaluation provided in the draft *Focused Feasibility Study for the BC Cribs and Trenches Area Waste Sites* (FFS) (DOE/RL-2004-66, Draft A) for CP-LS-9 remedial alternatives because the hazards (associated with buried liquid waste legacy sites) are considered similar enough for the rough order of magnitude analysis provided in this Risk Review. The alternatives (and the analysis) provided in the BC

[15] Remedial decisions, including a RI/FS (DOE/RL-2006-51, Rev. 0; DOE/RL-2007-27, Rev. 0) and ROD (EPA 2011), have been made for the 200-PW-3 OU that includes the CP-LS-9 216-A-31 Crib. An *In Situ* Vitrification (ISV) option was considered (DOE/RL-2009-117, Rev. 0); however, because the 216-A-31 waste site was not directly evaluated in the corresponding feasibility study (DOE/RL-2007-27, Rev. 0), the ISV alternative is not included here for CP-LS-9. The dose analysis in the feasibility study (DOE/RL-2007-27, Rev. 0) for the Cs-137 waste site (216-A-8) used as an analogue for 216-A-31 will be evaluated for completeness.

[16] The range of plausible alternatives suggested in Appendix B is i) RTD approximately half of waste sites and cap remainder; ii) RTD all waste sites; backfill and revegetate; iii) cap and maintain under LTS with monitoring and appropriate institutional controls; iv) if residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

Cribs and Trenches FFS are used instead of those provided in the Evaluation Unit Disposition Table (Appendix B) for this EU[17]. The remedial action alternatives developed in the BC Cribs and Trenches FFS are (DOE/RL-2004-69, Draft A):

- Alternative 1 - No Action
- Alternative 2 - Maintain Existing Soil Cover, Institutional Controls (ICs), and Monitored Natural Attenuation (MNA)
- Alternative 3 - Removal, Treatment, and Disposal (RTD)
- Alternative 4 - Capping
- Alternative 5 - Partial Removal, Treatment, and Disposal with Capping.

The alternatives were considered as standalone alternatives; however, impacts from remedial activities at adjacent sites should also be considered during implementation. These alternatives provide a range of remedial responses deemed appropriate to address site-specific conditions. The alternatives were evaluated and compared to the nine CERCLA criteria (DOE/RL-2004-69, Draft A).

The following descriptions of the four alternatives are abridged versions of those provided in the BC Cribs and Trenches FFS (DOE/RL-2004-69, Draft A).

Alternative 1: No Action. No further actions, including legal restrictions, access controls, or active remedial measures, would be taken at the site other than periodic review to ensure continued protection. This alternative implies allowing wastes to remain in their current configuration, affected only by natural processes.

Alternative 2: Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation. Any existing soil covers (e.g., to stabilize the site or clean fill placed during construction) are maintained to continue to provide protection from intrusion by human and biological receptors. In addition, institutional controls (ICs)[18] are put in place to further prevent human access to the site. Where appropriate, monitored natural attenuation (MNA) is relied upon to reduce risk over time. Monitoring would be conducted to demonstrate attenuation and contamination containment.

Alternative 3: Removal, Treatment, and Disposal. Any soil and structures with contaminant concentrations above PRGs would be excavated[19]. Because near-surface contamination levels at the majority of the waste sites pose a significant dose threat to workers, specialized equipment and activities would be required to protect workers, the local environment, and the public that could be exposed. Less-contaminated material would be needed to blend with more contaminated material to allow safe excavation, loading, transporting, and disposal. Excavated material above PRGs would be disposed of at ERDF. Excavation would continue until contaminated material exceeding the cleanup goal was removed, and then the site would be backfilled with clean material.

Alternative 4: Capping. A surface barrier (e.g., evapotranspiration barrier) would be installed over the contaminated waste site to reduce infiltrating water into the waste site and to prevent intrusion by human or ecological receptors. Details of the barrier design would be determined later. ICs would be

[17] Note that the basic remedial component activities (No Action, capping, and RTD) are captured in both sets of remedial alternatives.

[18] ICs include deed restrictions, land-use zoning, excavation permits, etc.

[19] The 216-B-20 through 216-B-34 and 216-B-52 Trenches would be excavated to a depth of -46 m (-150 ft); the 216-B-53A, 216-B-53B, 216-B-54, and 216-B-58 Trenches would be excavated to a depth of -7.6 m (-25 ft); and the cribs would be excavated to a depth of -67 m (-220 ft).

required to further minimize the potential for exposure to contamination and to ensure barrier integrity (where the IC period may have to be extended to maintain the cap). Performance monitoring is included to ensure that the cap is performing adequately, and groundwater monitoring is included to detect movement of mobile contaminants.

Alternative 5: Partial Removal, Treatment, and Disposal with Capping. The near-surface soil with high concentrations of Cs-137 would be removed to reduce intruder risk. This alternative would remove soil to a lesser depth than Alternative 3 although risk to remediation workers would be similar. After near-surface contamination has been removed and the excavation backfilled, a simple evapotranspiration barrier would be constructed to provide protection to the groundwater from contaminants that remain deeper in the soil column. Performance monitoring would be included to ensure that the cap performs as expected, and groundwater monitoring is included to detect movement of more mobile contaminants. Extension of ICs beyond 150 years is considered because of the need to maintain the cap.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

The remedial actions that have either been identified for 200-PW-3 (including the 216-A-31 Crib) (EPA 2011) or are being evaluated BC Cribs and Trenches FFS (DOE/RL-2004-69, Draft A) would leave existing contamination in CP-LS-9 waste sites as well as that contamination that has been released from CP-LS-9 waste sites into shallow and deep vadose zones. Waste sites within the CP-LS-9 EU have likely contributed to groundwater contamination in the 200-PO GWIA (DOE/RL-92-19, Rev. 0). Remedial decisions for the remaining CP-LS-9 waste sites have not been made; 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

There is a range of risks and potential impacts associated with the cleanup activities being evaluated in the BC Cribs and Trenches FFS (DOE/RL-2004-66, Draft A) that were selected to represent plausible remedial actions for the CP-LS-9 waste sites; these risks are bounded by the *No Action* and *RTD* alternatives[20]. For example, there would be no *additional* worker and public risks associated with the *No Action* alternative because no remedial activities would be conducted. These risks are the same as those expected for the *Maintain Existing Soil Cover, MNA, and ICs* alternative that involve only minimal, short-term risks from monitoring and maintenance activities conducted by experienced workers and appropriate safety precautions (DOE/RL-2004-66, Draft A, p. 6-12). These monitoring and maintenance actions are also assumed to be currently conducted (as described above for *Current* conditions). For the *RTD* alternative, excavation would be required that would also potentially expose remedial workers (especially during excavation, transportation, and disposal activities) to highly contaminated soils with substantial dose rates (DOE/RL-2004-66, Draft A, p. 6-14). Proposed remedial actions, especially excavation below 7.6 m (25 ft) bgs, may require sophisticated digging techniques and also requires the need to address industrial hazards (DOE/RL-2004-66, Draft A, p. 6-15).

The BC Cribs and Trenches FFS results will be used to evaluate *possible* radiological impacts to workers during selected remedial alternatives. However, because the selected FFS evaluation is not done

[20] One CP-LS-9 EU waste site (216-A-31) was included in the 200-PW-3 OU, which was evaluated in the FS for the Pu/Organic-Rich Process Condensate/Process Group OU (DOE/RL-2007-27, Rev. 0). However, an analogous Cs-137 waste site (216-A-8 in the CP-TF-5 EU) was evaluated in place of 216-A-31. Thus the results from the Pu/Organic-Rich Process Condensate/Process Group OU FS will be considered in the evaluation of CP-LS-9 waste sites.

according to the same standard as for a DSA (DOE-STD-3009-2014), these FFS results should not be considered of the same quality of those for a DSA and should not be represented as such (i.e., FFS dose estimates should only be tabulated with appropriate caveats and should not be plotted on the same graphs as DSA results to avoid confusion).

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

Facility Worker

In term of potential impacts to workers, the cleanup alternatives that are being evaluated for the BC Cribs and Trenches range from *No Action* (monitoring and natural attenuation) to installation of an engineered barrier to significant actions, including removal, treatment, and disposal (RTD) (DOE/RL-2004-66, Draft A). Thus impacts to facility workers (i.e., those performing cleanup actions) from potential cleanup activities would also vary significantly.

For example, the estimated unmitigated dose for a *construction worker* (exposed to contaminated soil that relates to a facility worker for the purpose of this evaluation) for all the BC Cribs and Trenches would be approximately 127 person-rem (DOE/RL-2004-66, Draft A, p. F-iv), which is here considered a *High* rating because it significantly exceeds the 25-rem limit for a "worker" from Table 2-4 (although this limit is for a single, unmitigated event), the 100-rem limit for a co-located worker (DOE-STD-3009-2014), the 65-rem limit from NCRP (Table 2-3), and the 100-rem lifetime dose from ICRP (Table 2-3). The measured borehole soil concentrations for the representative BC Cribs and Trenches waste sites are:

- 216-B-26 Trench -- Cs-137 and Sr-90 maximum concentrations are 529,000 and 974,000 pCi/g, respectively at 4.0 m (13 ft) bgs (DOE/RL-2004-66, Draft A, p. 2-21)
- 216-B-58 Trench -- Cs-137 and Sr-90 maximum concentrations are 14,600 and 18,400 pCi/g, respectively at 4.6 m (15 ft) bgs (DOE/RL-2004-66, Draft A, p. 2-21).
- 216-B-46 Crib -- Cs-137 and Sr-90 maximum concentrations are 364,000 and 353,000 pCi/g, respectively at 5.5 m (18 ft) bgs (DOE/RL-2004-66, Draft A, p. 2-25)

where Cs-137 and Sr-90 were the dominant radionuclides. For this evaluation, it is assumed that the worker risk is strongly related to the measured soil concentration[21] and is dominated by the external dose from Cs-137 (DOE/RL-2004-66, Draft A). The measured soil concentrations for selected CP-LS-9 sites are:

- 216-A-4 Crib -- Maximum Cs-137 concentration of approximately 2.36×10^8 pCi/g at 20-ft (DOE/RL-2006-47, Rev. 0, p. A-5).
- 216-A-10 Crib -- Maximum Cs-137 concentration of 10,000 pCi/g between 18 to 23 m (59 to 76 ft) bgs (DOE/RL-2000-60, Rev. 0, p. 3-40).
- 216-A-36B Crib -- Cs-137 concentrations are highest (1.6×10^6 pCi/g) at a depth of 10 m (36 ft); (DOE/RL-2000-60, Rev. 0, p. 3-9).

[21] In the BC Cribs and Trenches FFS, the exposure and thus dose for excavation is assumed roughly proportional to the Cs-137 inventory in the waste site (DOE/RL-2004-66, Draft A, p. F-6); however, the relationship of dose to soil concentration is much stronger, especially for different types of legacy sites.

Thus the measured Cs-137 concentrations for CP-LS-9 waste sites exceed those (even considering decay) used to estimate risks in the BC Cribs and Trenches FFS. These results are reinforced by the analysis in the Pu/Organic-Rich Process Condensate/Process Group FS for 216-A-8 waste site (analogue for 216-A-31 in the CP-LS-9) (DOE/RL-2007-27, Rev. 0), which suggest that the total [22] *risk* (opposed to dose evaluated for the BC Cribs and Trenches) for construction workers from soil is 5E-02 that significantly exceeds the EPA "action limit" of 1E-04. *As described above, these dose estimates are not computed to the same standard as for a DSA and should be treated accordingly.* For the No Action alternative, the monitoring and maintenance actions are also assumed to be conducted (as described above for *Current* conditions) with an *ND-Low* risk rating. The unmitigated risk ratings for facility workers range from *Low* to *High* based on the action that would be taken (or not taken) (i.e., *ND-Low* for *No Action*, which is the same as for current conditions, to *High* for RTD).

Unmitigated Consequences: Facility Worker – *ND-Low* (No Action) to *High* (RTD)

Mitigation: The *collective* dose to excavate, transport, and dispose (RTD alternative) of contaminated soil with representative radiological controls is 76 person-rem for all the BC Cribs and Trenches (assuming a single worker performing all the work in the CP-LS-9 waste sites) exceeds the 25-rem limit for a "worker" from Table 2-4 and the 65-rem limit from NCRP (Table 2-3). Thus the calculated doses are assumed for a single receptor, when in reality, multiple personnel would be performing the tasks. For example, most ALARA exposure goals for DOE sites limit worker doses to 500 to 1,000 mrem/year (DOE/RL-2003-23, Rev. 0); therefore, multiple laborers would be required to share incurred doses. Additional radiological controls would also be implemented to maintain ALARA exposure goals, which would result in *Low* rating. Risk ratings for other scenarios would be *Low*.

Mitigated Consequences: Facility Worker – *ND-Low* (No Action) to *Low* (RTD)

Co-located Person

The only workers at increased risks (over those for *Current* conditions as described above) are facility workers. Thus the ratings for co-located persons are the same as those for *Current* conditions.

Unmitigated Consequences: Co-located Person – *ND-Low*

Mitigation: No *additional* mitigation actions (to those described above for *Current* conditions) are required.

Mitigated Consequences: Co-located Person – *ND-Low*

Public

Only workers would be at risk due to distance and soil cover.

Unmitigated Consequences: Public – *ND*

Mitigation: No *additional* mitigation actions (to those described above for *Current* conditions) are required.

Mitigated Consequences: Public – *ND*

[22] This value represents primarily external radiation from Cs-137. The doses from external beta emitters (e.g., Sr-90) were determined to be negligible (DOE/RL-2004-66, Draft A, p. F-21).

Groundwater

As described in **Part V**, there will be a continuing impact during this period to groundwater (as a protected resource) from mobile primary contaminants from the PUREX Cribs and Trenches (inside 200-E) EU currently with plumes that exceed thresholds. These impacts are described in more detail in Appendix G.5 for the CP-GW-1 EU.

Furthermore, there are contaminant sources (legacy source sites) in the vadose zone that pose continuing risk to groundwater (via the vadose zone). The vadose zone (VZ) GTM values for the Group A and B primary contaminants for the PUREX Cribs and Trenches (inside 200-E) EU translate to ratings of *High* (I-129 and Sr-90 because treatment has not been defined and the Sr-90 inventory is large); *Medium* (total uranium because treatment has not been defined); *Low* (other Group A and B primary contaminants with reported inventories to represent uncertainty in the evaluation). As indicated in **Part V**, Sr-90 and total uranium from CP-LS-9 waste sites are linked to existing plumes that are likely to impact the groundwater in sufficient quantities to exceed the drinking water standard over this evaluation period and thus their ratings are not changed. Radioactive decay will impact the remaining Sr-90 in the vadose zone over this period, and thus its rating is changed to *Medium* for the Near-term, Post-Cleanup period. The ratings for all the Group A and B primary contaminants correspond to an overall rating of *High* for both the Active and Near-term, Post-Cleanup periods.

There are no treatment actions currently associated with groundwater contamination from the CP-LS-9 EU waste sites. Treatment options for groundwater in 200-PO are still being considered. 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 PUREX Cribs and Trenches (inside 200-E) waste sites are described in Appendix G.5 for the CP-GW-1 EU (200-PO GWIA). It is considered unlikely that additional benthic or riparian resources would be impacted as a result of either interim remedial actions (e.g., pump and treat) or final closure activities (that are not covered in the Ecological or Cultural Resources results).

Ecological Resources

Remove, Treat and Dispose of waste involves personnel through the target (remediation) area, car and pickup truck traffic through the non-target and target (remediation) area, truck, heavy equipment (including drill rigs) traffic on roads through the non-target and target area, caps (and other containment), soil removal and contamination in the soil, vegetation control, and irrigation (for revegetation) will cause the following disturbance from remediation activities: Carry seeds or propagules (pieces of vegetation or other biological parts that can grow and/or reproduce) on tires of vehicles or blowing from heavy equipment; injure or kill vegetation or small invertebrates or small animals; vehicle traffic can make paths, compact soil, scare or displace animals, can impact animal behavior or reproductive success; affect animal dispersion and habitat use (e.g., some birds avoid nesting near roads because of song masking); displacement of animals from near roads due to increased noise or other disturbances; and heavy equipment may permanently destroy areas of the site with intense activity. Soil removal can cause more severe effects because of blowing soil (and seeds). During remediation, radionuclides or other contaminants could be released or spilled on the surface, and

depending upon the type and quantity, could have adverse effects on the plants and animals on-site. Use of non-specific herbicides for vegetation control results in some mortality of native vegetation (especially native forbes), and allows exotic species to move in; it may change species composition of native communities, but it also could make it easier for native species to move in; improved methods could yield positive results. Irrigation requires a system of pumps and water, resulting in physical disturbance; repeated irrigation from the same locations could result in some soil compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area.

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

Cultural Resources

Potential direct effects are possible from personnel, car, pick-up, truck and heavy equipment traffic/use through both target (remediation) and non-target areas during active cleanup. These activities may inadvertently expose resources close to the surface. Additionally, traffic through these areas may lead to the introduction of invasive species and/or a decrease in the presence of native plants used for medicinal or tribal religious purposes. Heavy equipment use for remedial activities (such RTD of contaminated soils) 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 traffic through target (remediation) areas as well as car, pick-up, truck and heavy equipment traffic/use through both target (remediation) and non-target areas. It is possible that these activities may decrease viewshed values and/or impact viewshed through the introduction of increased dust, the creation of trails, etc. Heavy equipment use for remedial

actions/soil removal and the utilization of caps and/or other containments could potentially cause alterations to the landscape and impacts to viewsheds. Lastly, during remediation, radionuclides or other contamination released or spilled on the surface could have long-term effects if the contamination remains and resources become contaminated and/or plants having cultural importance to Tribes do no recolonize or thrive.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

Sites within the CP-LS-9 EU have contaminated the vadose zone and are suspected of contributing mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0). Vadose zone contamination will likely continue and some contaminant plumes in the 200 East Area may continue to increase in size and impact additional groundwater.

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

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

Table G.5.7-7. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup.

Population or Resource		Risk/Impact Rating	Comments
Human	Facility Worker	ND-Low	Only risks during monitoring and maintenance activities (assumed similar to current risks)
	Co-located Person	ND	*De minimus* risks related to residual contamination (after capping or retrieval), which will be remedied to acceptable levels.
	Public	ND	*De minimus* risks related to residual contamination (after capping or retrieval), which will be remedied to acceptable levels. Access restrictions and ICs in place, when required.
Environmental	Groundwater (A&B) from vadose zone[(a)]	*High* (I-129) *Medium* (U(tot), Sr-90) *Low* (Other PCs) **Overall**: *High*	*Current* GTM values for Group A&B primary contaminants (Table G.5.7-6): *High* (I-129 and Sr-90); *Medium* (U(tot)) and *Low* (other A&B PCs with reported inventories). No treatment in 200-PO and decay to only impact Sr-90 (*Medium* by end of Active Cleanup period). Also predicted impact from changes in recharge rates large but not sufficient to change 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**). Chromium moving slower that in TC&WM EIS predictions. Dilution factor of greater than 100 million

			between Columbia River and upwellings.
	Ecological Resources[(b)]	Low	Post-cleanup monitoring might pose a risk to level 3 resources in the EU and buffer area.
Social	Cultural Resources[(b)]	**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. Permanent indirect effects to viewshed are possible from capping, installation of surface barriers and from residual contamination that may remain. National Register eligible Manhattan Project/Cold War Era buildings within 500 meters of the EU will be demolished, but they have already been mitigated.

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 PUREX Cribs and Trenches (inside 200-E) EU are described in **Part V** with more detailed evaluation in Appendix G.5 (CP-GW-1).

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

The long-term, post-cleanup status is dependent on the selected remedial alternative. Regardless of that alternative selected, long-term site use restriction, vadose zone and groundwater monitoring, and maintenance must remain due to the presence of persistent contaminants in the deep vadose zone that are not amendable to excavation and the likely continued release and migration of contaminants through the vadose zone to the groundwater. DOE is expected to continue industrial exclusive activities for at least 50 years (DOE/EIS-0222-F).

PART VII. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS ~

The PUREX Cribs and Trenches (inside 200 East) area needs to remain under DOE control to maintain a safety buffer for all remedial alternatives, including RTD, because of the deep vadose zone contamination in the area.

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ATTACHMENT A

Hanford Site-Wide Risk Review

Evaluation Unit:	PUREX Cribs and Trenches (inside 200-E)
ID:	CP-LS-9
Group:	Legacy Source
Operable Unit Cross-Walk:	200-EA-1, 200-PW-3
Related EU:	CP-DD-1, CP-GW-1
Sites & Facilities:	Liquid waste sites on the east side of 200-East (associated with PUREX Operations and immediately surrounding PUREX).
Key Data Sources Docs:	Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (DOE-RL-2007-27_Rev0_AppH) Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (DOE-RL-2007-27_Rev0_AppI) Proposed Plan for the Remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (DOE-RL-2009-117) Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (DOE-RL-2007-27_Rev0_AppG) Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (DOE-RL-2007-27_Rev0_AppF) Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (DOE-RL-2007-27_Rev0_AppE) Feasibility Study for the Plutonium/Organic Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (DOE-RL-2007-27_Rev0_AppA-2) Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (DOE-RL-2007-27_Rev0_AppB) Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (DOE-RL-2007-27_Rev0_AppC) Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (DOE-RL-2007-27_Rev0_AppD)

Hanford Site-Wide Risk Review

Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (DOE-RL-2007-27_Rev0_AppA)
Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (DOE-RL-2007-27_Rev0)
Site-Specific Field-Sampling Plans for the 216-A-5 Crib and 216-S-1 & 2 Cribs, 200-PW-2/4 Operable Unit (DOE-RL-2007-02_Rev0_Vol2_Add5)
Sampling and Analysis Plan for Supplemental Remedial Investigation Activities at the 216-A-2 Crib and 216-A-21 Crib (DOE-RL-2006-77_Rev0)
Sampling and Analysis Plan for Additional Remedial Investigation Activities at the 216-A-4 Crib and 200-E-102 Trench (DOE-RL-2006-47_DraftA)

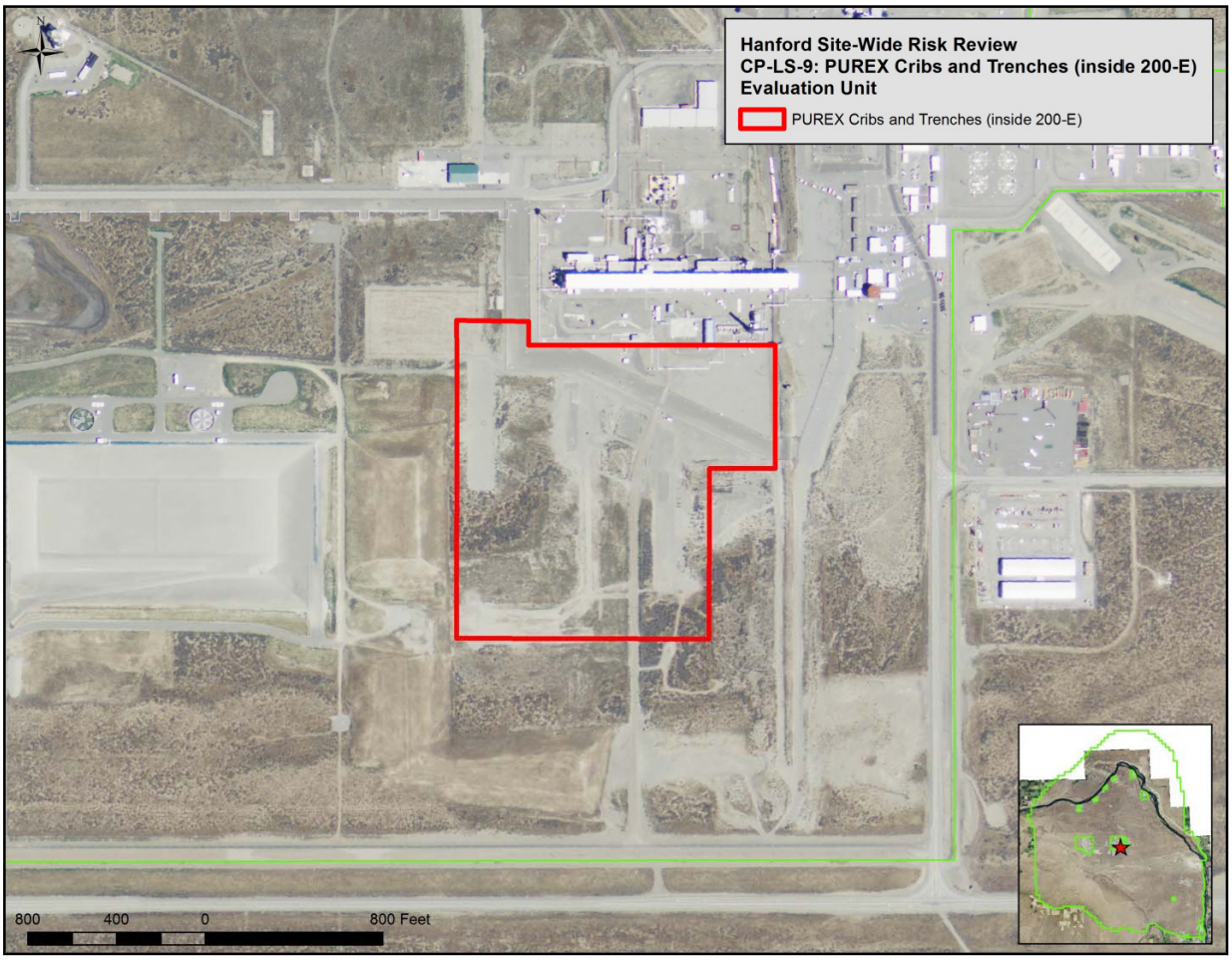

Figure 1. CP-LS-9 (PUREX Cribs and Trenches (inside 200-E)) Site Location Map

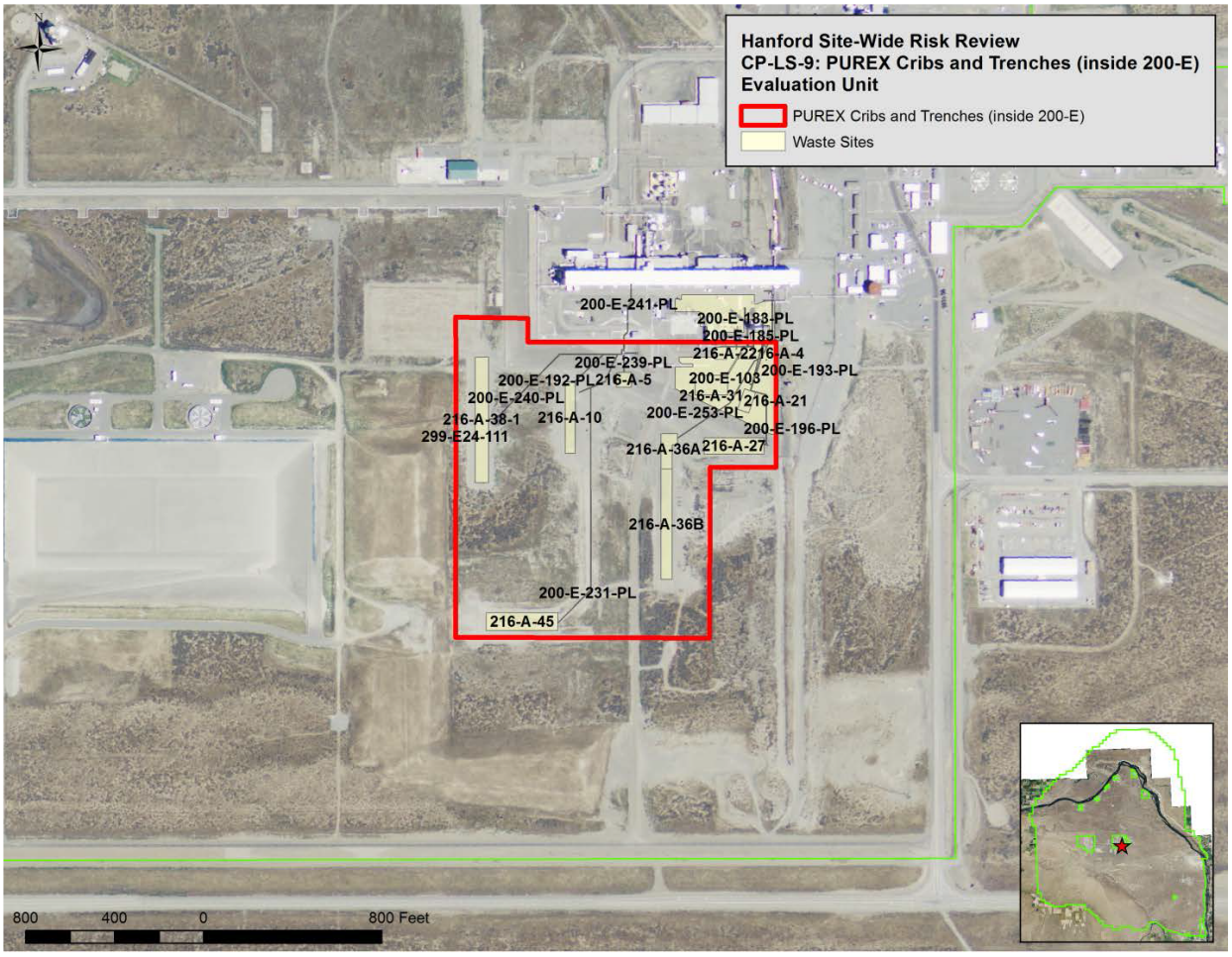

Figure 2. CP-LS-9 (PUREX Cribs and Trenches (inside 200-E)) Site Location Map and WIDS Locations

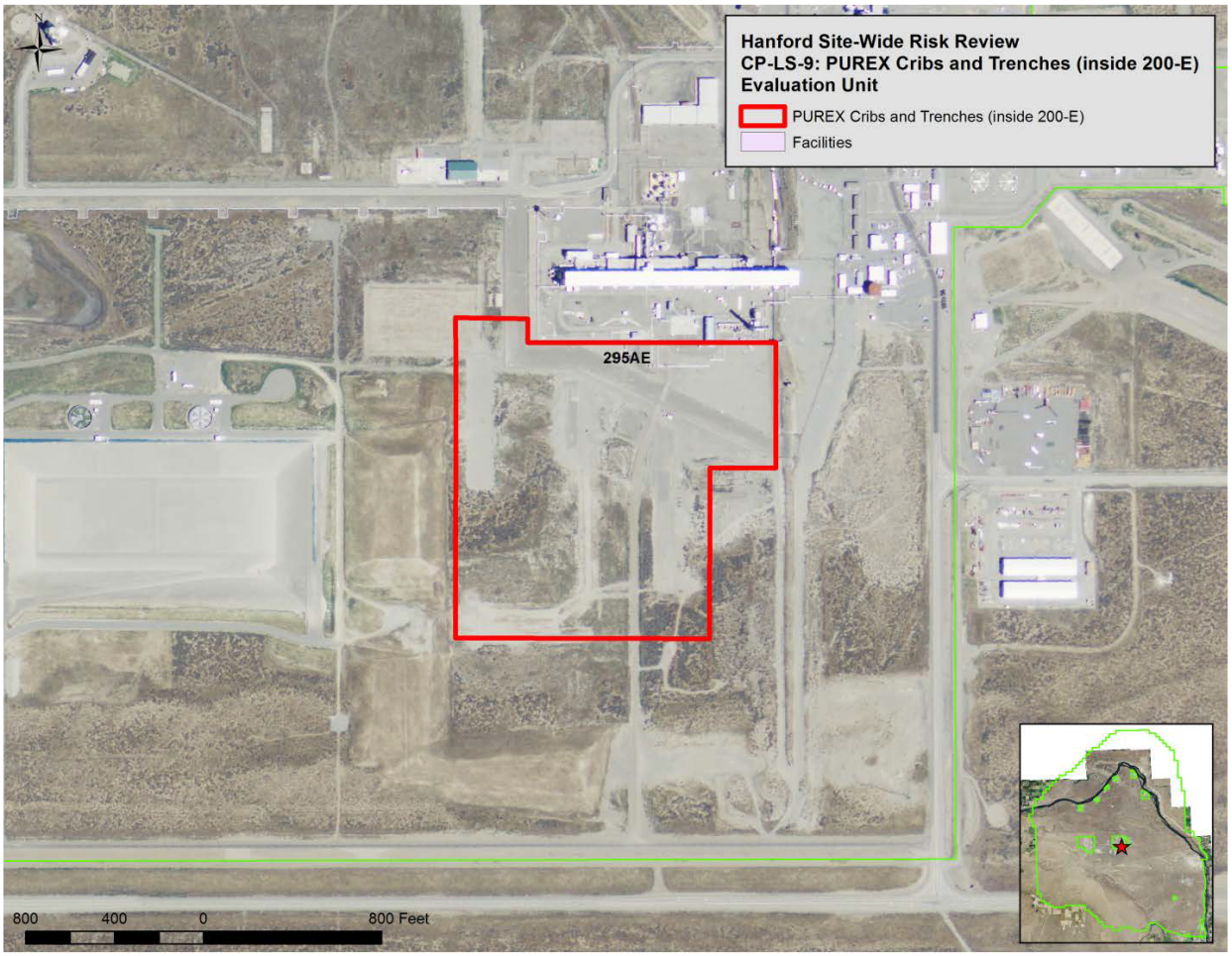

Figure 3. CP-LS-9 (PUREX Cribs and Trenches (inside 200-E)) Site Location Map and Facility Locations

EU Designation: CP-LS-9

Hanford Site-Wide Risk Review
CP-LS-9 (PUREX Cribs and Trenches - inside 200-E)
Waste Site and Facility List

Site Code	Name, Aliases, Description	Feature Type	Site Status	ERS Classification	ERS Reclassification	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation	Comments
216-A-10	216-A-10; 216-A-10 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-2	216-A-2; 216-A-2 Cavern; 216-A-2 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-21	216-A-21; 216-A-21 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-27	216-A-27; 216-A-27 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-31	216-A-31; 216-A-31 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-PW-3		
216-A-36A	216-A-36A; 216-A-36 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-36B	216-A-36B; Purex Ammonia Scrubber Distillate (ASD); 216-A-36 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-38-1	216-A-38-1; 216-A-38 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-4	216-A-4; 216-A-4 Cavern	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-45	216-A-45; 216-A-45 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-5	216-A-5; 216-A-5 Cavern	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-15	216-A-15; Miscellaneous Stream #461	Waste Site	Inactive	Accepted	None	French Drain	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-26	216-A-26; 216-A-26 French Drain; 216-A-26B; Miscellaneous Stream #464	Waste Site	Inactive	Accepted	None	French Drain	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-26A	216-A-26A; 291-A French Drain; 216-A-25 Crib; 216-A-26 French Drain	Waste Site	Inactive	Accepted	None	French Drain	Crib - Subsurface Liquid Disposal Site	200-EA-1		
200-E-72	200-E-72; Injection Well (G); Line #8801 Steam Condensate; Miscellaneous Stream #60	Waste Site	Inactive	Accepted	None	Injection/Reverse Well	Crib - Subsurface Liquid Disposal Site	Not Applicable		
299-E24-111	299-E24-111; Experimental Test Well Site; Lysimeter Test Site; Miscellaneous Stream #803	Waste Site	Active	Accepted	None	Injection/Reverse Well	Field Test Site	200-EA-1		
200-E-183-PL	200-E-183-PL; Lines V010 and V011; Pipelines from 241-A-151 Diversion Box to 216-A-2	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-184-PL	200-E-184-PL; Lines V010 and V011; Pipeline from 241-A-151 Diversion Box to 216-A-2 Crib	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-185-PL	200-E-185-PL; Lines V014 and V016; Pipeline from 241-A-151 Diversion Box to 216-A-4 Crib	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-186-PL	200-E-186-PL; Lines V010 and V011; Pipeline from 241-A-151 Diversion Box to 216-A-31 crib	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-192-PL	200-E-192-PL; 216-A-10 Pipelines; Lines from Sample Pit 4 to 216-A-10 Crib	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-193-PL	200-E-193-PL; Line X015; Pipeline from 202-A and 293-A to 216-A-21 Crib	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-196-PL	200-E-196-PL; 216-A-21 and 216-A-27 Cribs; Lines T167 and T022; Stainless Steel Line to 216-A-4	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD		
200-E-231-PL	200-E-231-PL; Pipeline from 202-A to 216-A-45 crib	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-239-PL	200-E-239-PL; Pipeline from 216-A-5 Sample Pit #4 to 216-A-5 Crib	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-240-PL	200-E-240-PL; Pipeline from Valve Pit West of Sample Pit 4 to the 216-A-38-1 Crib	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-241-PL	200-E-241-PL; Lines 7717 and 7718; Pipeline from 200-E-58 Neutralization Tank to the 216-A-5 Sample Pit #4	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-242-PL	200-E-242-PL; Pipeline from 216-A-5 Sample Pit #4 to 216-A-15 French Drain	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-253-PL	200-E-253-PL; Pipeline from 202-A to 216-A-36A and 216-A-36B Cribs	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-270-PL	200-E-270-PL; Line T022; Pipeline from 291-A Fan Control House to 216-A-26 and 216-A-26A French Drains	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-102	200-E-102; Contaminated Soil Trench	Waste Site	Inactive	Accepted	None	Trench	Crib - Subsurface Liquid Disposal Site	TBD		
200-E-103	200-E-103; PUREX Stabilized Area; Radiologically Controlled Area - South Side of PUREX	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1		
UPR-200-E-117	UPR-200-E-117; Contaminated Liquid Spill; UN-200-E-117	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable		
UPR-200-E-15	UPR-200-E-15; Overflow at 216-A-4; UN-200-E-15; UPR-200-E-13	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable		
UPR-200-E-97	UPR-200-E-97; Contamination Near PUREX Railroad Tunnel; Ground Contamination Around Cribs South of PUREX; UN-200-E-97; UN-216-E-25	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable		
295AE	PDD MONITORING BUILDING	Facility	INACTIVE			BUILDING	Infrastructure Building			
217A	SAMCONS SURVEILLANCE FOR PUREX BLDG.	Facility	INACTIVE			BUILDING	Infrastructure Building		X	Included in PUREX Eval.
291AE	FILTER HOUSE #4 SOUTH OF PUREX	Facility	INACTIVE			BUILDING	Process Building		X	Included in PUREX Eval.
MO399	FIELD/CHANGE SOUTH OF 234-5 IN LAYDOWN YARD	Facility	INACTIVE			BUILDING	Infrastructure Building		X	Mobile Office

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).