APPENDIX G.5.8

PUREX AND TANK FARM CRIBS AND TRENCHES (OUTSIDE 200-EAST) (CP-LS-10 CENTRAL PLATEAU)

EVALUATION UNIT SUMMARY TEMPLATE

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PART I. EXECUTIVE SUMMARY

EU LOCATION

Liquid waste sites on the east side of 200-East (associated with PUREX and Tank Farm operations, but outside the 200-E area fence).

RELATED EUS

CP-GW-1

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES

The waste sites comprising the CP-LS-10 EU include legacy waste sites (e.g., cribs, sewers, a basin, and unplanned releases (UPRs)) where liquid wastes was discharged and pipelines and associated equipment. Pipelines and associated equipment are treated in the Tank Waste and Farms EU (Appendix E.1 through Appendix E.11)[1]. Of the remaining waste sites, inventory information is reported for selected legacy sites (i.e., four cribs) 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-10 EU include:[2]

- *Radionuclides*: Am-241, C-14, Cs-137, tritium (H-3), Sr-90, U-All isotopes, Pu-All isotopes
- *Chemicals*: carbon tetrachloride (CCl_4), Cr/Cr-VI, nitrate (NO_3), lead (Pb), and U-Total

BRIEF NARRATIVE DESCRIPTION

The CP-LS-10 EU legacy waste sites with non-zero reported inventories (Table G.5.8-2 through Table G.5.8-4) are included in the 200-EA-1 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-10 EU waste sites primarily consist of liquid waste disposal sites associated with PUREX Facility operations and pipelines and associated equipment. Liquid waste disposal sites include cribs, sewers, a basin, and unplanned release sites (UPRs). The primary radioactive contaminants include Am-241, C-14, Cs-137, H-3, Sr-90, and isotopes of uranium and plutonium. Primary chemical contaminants include CCl_4, Cr,

[1] For this Review, pipelines and associated equipment are treated in the Tank Waste and Farms EU although none of the CP-LS-10 pipelines are considered associated with the single-shell tank farms (DOE/RL-2010-114, DRAFT A, p. A-3 – A-14).

[2] 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 Data Sheets 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).

NO_3, Pb, and uranium (total). All current land-use activities in the 200-West and 200-East Areas (where the CP-LS-10 EU is located) are *industrial* in nature (Hanford 200-Area Record of Decision or ROD[3]). The following remedial actions alternatives will be considered:[4] 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). All 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.5.8-1 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 and Tank Farm Cribs and Trenches outside of 200-East Area (CP-LS-10); a Co-located Person (CP) is an individual located 100 meters from the physical boundaries of the PUREX and Tank Farm Cribs and Trenches outside of 200-East Area; 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.

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

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

[4] 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. 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.

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.5.8-1. 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*** (*ND-Low)*
	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* – Cr-VI & Cr(tot) *Medium* – I-129 & CCl_4 *ND* – Sr-90 & U(tot) *Low* – other A&B PCs **Overall**: *High*	*High* – Cr-VI & Cr(tot) *Medium* – I-129 & CCl_4 *ND* – Sr-90 & U(tot) *Low* – other A&B PCs[c] **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 to Medium	Medium to High
Social	Cultural Resources[b]	**Native American** Direct: Unknown Indirect: Known **Historic Pre-Hanford** Direct: Unknown Indirect: None **Manhattan/Cold War** Direct: None Indirect: Known	**Native American** Direct: Unknown Indirect: Known **Historic Pre-Hanford** Direct: Unknown Indirect: None **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 and Tank Farm Cribs and Trenches (Outside 200-East) EU are described in **Part V** with additional information provided in Appendix G.5 (CP-GW-1) for the 200-PO 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**, ratings for Sr-90 and total uranium are changed *after* the Current Cleanup period from *Not Discernible* (*ND*) (no plumes expected during this period) to *Low* to account for uncertainty.

d. The TC&WM EIS (Appendix O) suggests 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-10 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 (designated 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)[5]. In this case, impacts to Facility workers (i.e., those performing the cleanup actions) from potential cleanup approaches would not vary significantly because of small Cs-137 inventories in the CP-LS-10 waste sites (with reported inventories). As described below

[5] Because no DSA, Hazards Analysis, or feasibility study has been prepared for the PUREX and Tank Farms Cribs and Trenches (outside 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) 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 and Tank Farms Cribs and Trenches (outside 200-E) area (for those such areas with focused feasibility studies). 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 are *ND-Low* for any remedial action(s) that would be taken. Other ratings would not be impacted.

Unmitigated Risk: Facility Worker – *ND-Low*; CP – ND-*Low*; Public – ND

Mitigation: See description in **Section VI**. Thus resulting Facility worker risks remain *ND-Low* for the remedial actions evaluated; others remain the same.

Mitigated Risk: Facility Worker – *ND-Low*; CP – *ND-Low*; Public – *ND*

Groundwater and Columbia River

Current

The CP-LS-10 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-10 (PUREX and Tank Farms Cribs and Trenches (outside 200-E)) area has elevated levels of I-129, nitrate, and tritium (H-3) 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-10 EU contaminants *remaining* in the vadose zone (Table G.5.8-5) has an overall rating of *High* (based on total and hexavalent chromium) as described in **Part V**. Contaminated groundwater is being monitored but not treated in the 200-PO GWIA (DOE/RL-2016-09, Rev. 0). As indicated in **Part V**, no 200-PO plumes for Group A and B primary contaminants have been linked to CP-LS-10 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-10 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-10 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 the 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 (although as described in **Part VI** the reported inventories are relatively low) 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-10 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-10 EU waste sites are suspected of impacting the vadose zone but have not been tied to groundwater plumes. 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-10 EU waste sites (Table G.5.8-5) is associated with chromium (evaluated as both total and hexavalent) remaining in the vadose zone that potentially could impact 200-PO GWIA (which is part of CP-GW-1, Appendix G.5); these contaminants do not currently have 200-PO plumes. As described in the TC&WM EIS and summarized in **Part V**, radioactive decay would not impact the overall rating (*High*) for during the Active Cleanup period because total and hexavalent chromium are the risk drivers. 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*). Ratings for current threats provided in Table G.5.8-5 would be modified for Sr-90 and total uranium after the Current Cleanup period as described in **Part V**. The ratings for the remaining Group A and B primary contaminants (Table G.5.8-5) remain unchanged to account for undetermined treatment and to address uncertainties. Thus the overall rating remains *High* for all periods considered.

Ecological Resources

Current

18% of level 3 or greater resources in EU and 46% of level 3 of greater in the buffer (including 43% of level 4 resources). There has been impacts to the resources from current herbicide applications, which prevents further succession of the habitats in the area. Medium impacts are associated with continued use 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 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. Construction of temporary buildings associated with cleanup will increase pedestrian, car and truck traffic on a daily basis. Care should be taken to place the temporary buildings away from sensitive resources. Revegetation of area after remediation needs to consider the potential for competition with other level 3 resources.

Cultural Resources

Current

No known archaeological sites, inventoried historic buildings, or TCPs located within the EU. Area is heavily disturbed and only 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. Traditional cultural places are visible from EU.

National Register eligible Manhattan Project/Cold War significant resources located within 500 meters of the EU have already 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. 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-10 (PUREX and Tank Farms Cribs and Trenches (outside 200-E)) area currently has elevated levels of I-129, nitrate, tritium, and uranium based on 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). Sites within the CP-LS-10 EU (e.g., 216-A-6, 216-A-30, and 216-A-37-1/2) 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 have not been started in 200-East 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.5.8-6), the ratings for Group A and B primary contaminants are unchanged from the current ratings in Table G.5.8-5 because treatment options have not been defined. The exceptions are Sr-90 and total uranium, which are rated *Low* after the Active Cleanup period to account for uncertainties in the evaluation.

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.5.8-6).

PART II. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S)

CP-LS-10 EU. OUs include 200-EA-1 and 200-IS-1

COMMON NAME(S) FOR EU

PUREX and Tank Farms Cribs and Trenches – outside 200-E

[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

KEY WORDS

PUREX and Tank Farms Cribs and Trenches outside 200-E, PUREX, Tank Farms, Central Plateau, 200 Area, 200-EA-1, 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).

There is also deep vadose zone contamination associated with CP-LS-10 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-10 EU would be associated with the 200-PO GWIA / 200-PO-1 OU. The Remedial Investigation (DOE/RL-2009-85, Rev. 1) for the 200-PO-1 OU 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.

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-10 waste sites primarily consist of *liquid waste disposal* sites associated with 202-A Facility operations. The CP-LS-10 liquid waste disposal sites include cribs, a basin, sewers, and unplanned release sites.

High-Level Waste Tanks and Ancillary Equipment

Not applicable.

Note that the CP-LS-10 EU waste sites include no pipelines related to the Single Shell Tank System (DOE/RL-2010-114, Draft A, p. A-3 – A-8) and thus the Tank and Waste Farms EU. Furthermore, no CP-LS-10 pipeline waste sites have reported inventories (Table G.5.8-2 through Table G.5.8-4). Pipelines and associated equipment waste sites are considered 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-10 area (PUREX and Tank Farms Cribs and Trenches outside 200-E) has elevated levels of I-129, nitrate, tritium, and 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). Waste sites (cribs) within the CP-LS-10 EU are suspected of being able to contribute mobile contaminants to the saturated zone[7] 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-1 OU, 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-10 EU is located in the Hanford Central Plateau Inner Area (shown in Figure G.5.8-1 and Figure G.5.8-2). The PUREX and Tank Farms Cribs and Trenches (outside 200-E) (Figure G.5.8-3) are located in the southern part of 200-E Area.

[7] No current plumes have been linked to CP-LS-10 wastes sites (DOE/RL-2016-09, Rev. 0).

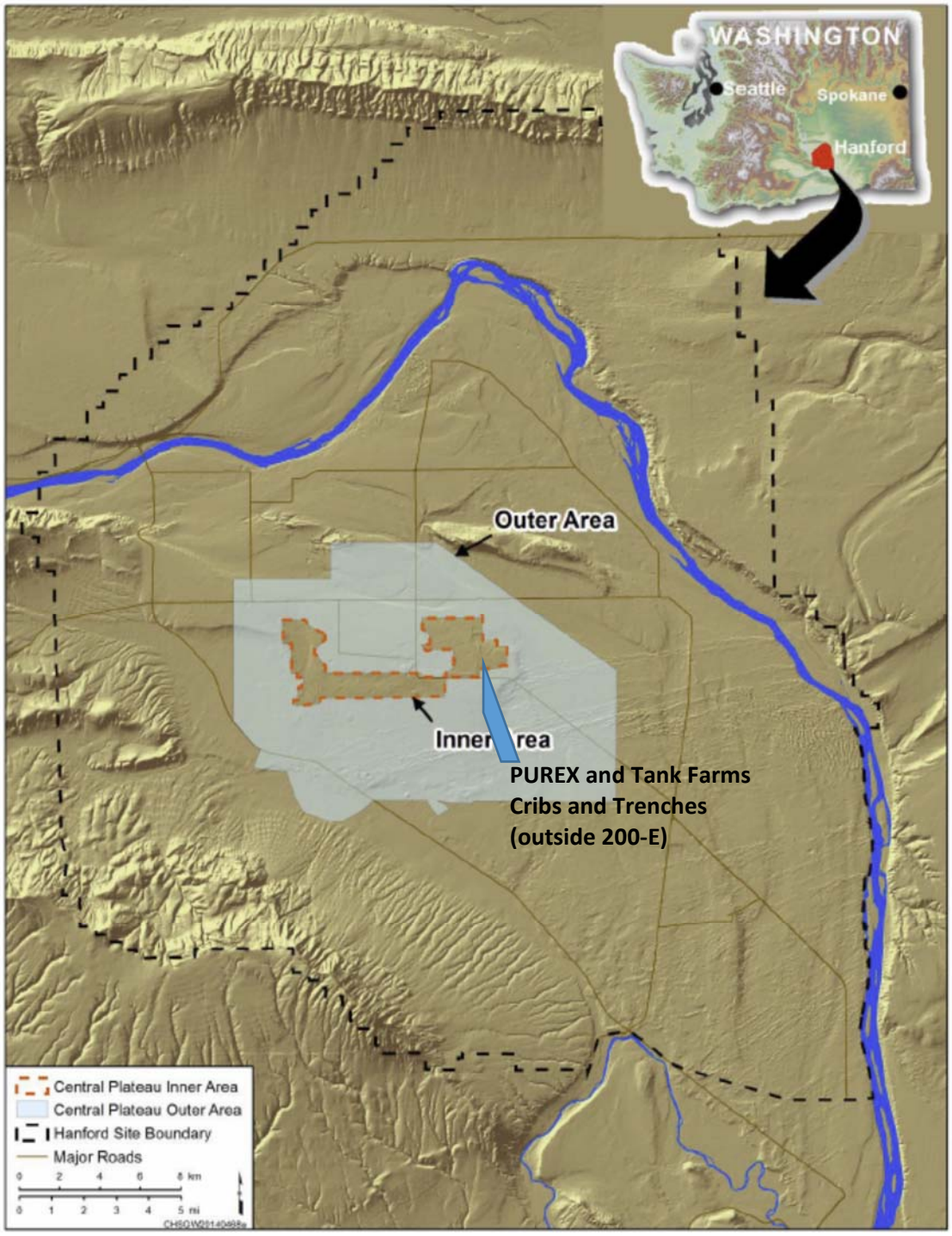

Figure G.5.8-1. The Hanford Site showing the Central Plateau Inner and Outer Areas (reproduced from (DOE/RL-2010-49, Draft B, p. 1-2))

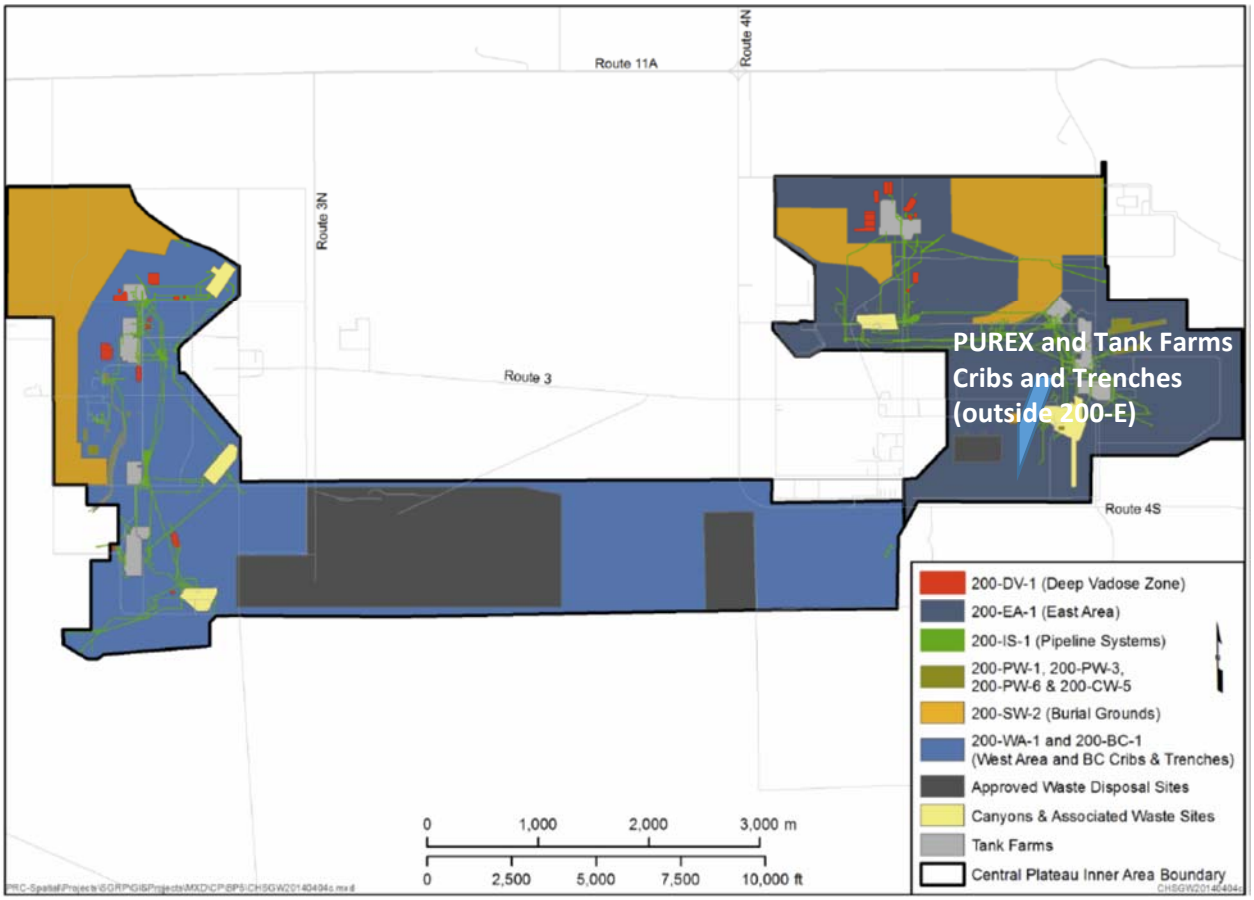

Figure G.5.8-2. Operable Units in the Hanford Central Plateau Inner Area (reproduced from (DOE/RL-2010-49, Draft B, p. 1-10))

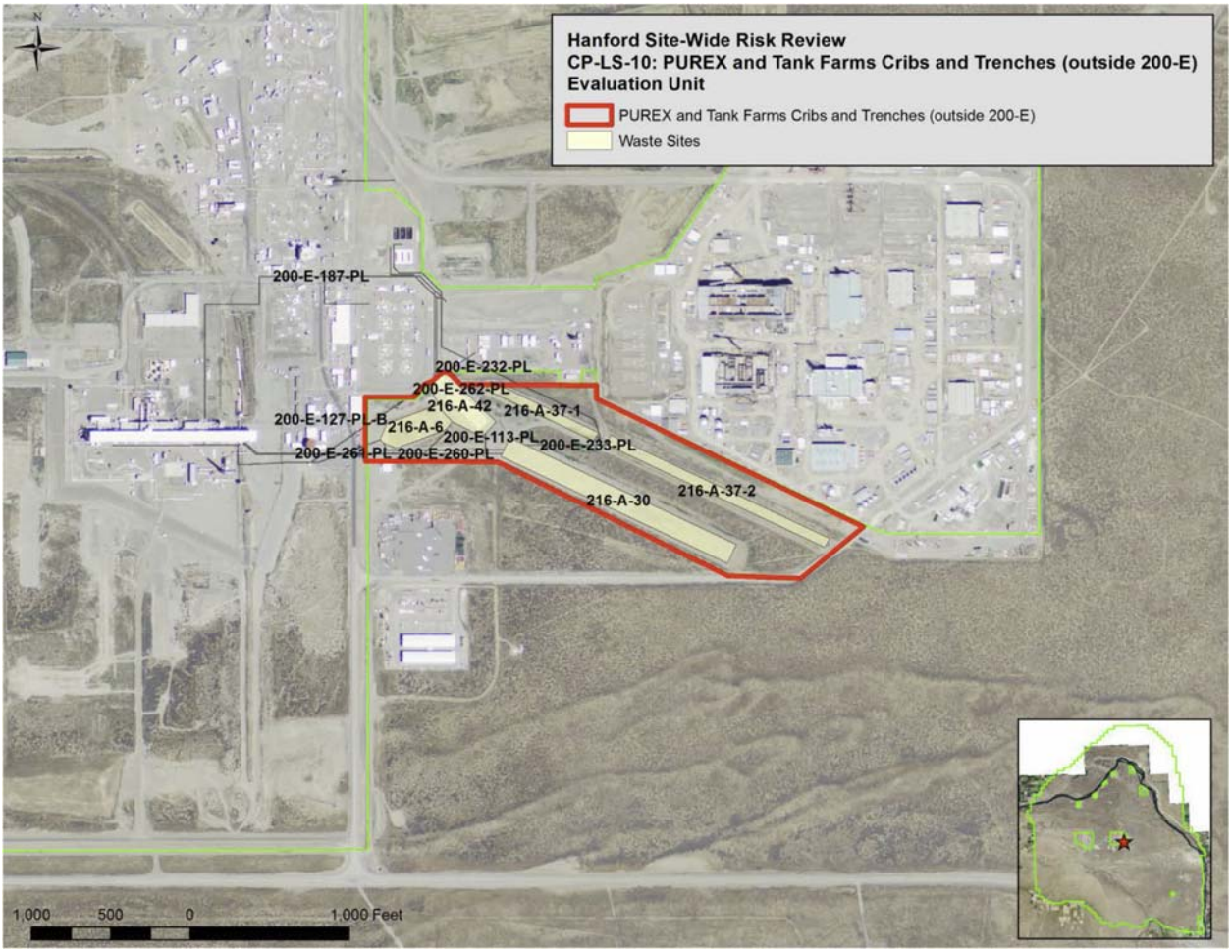

Figure G.5.8-3. CP-LS-10 (PUREX and Tank Farms Cribs and Trenches (outside 200-E)) Site Location Map and WIDS Locations

PART IV. UNIT DESCRIPTION AND HISTORY

EU FORMER/CURRENT USE(S)

The CP-LS-10 waste sites primarily consist primarily of *liquid waste disposal* sites associated with 202-A Facility (PUREX Plant) operations. 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

Cribs 216-A-37-1/2 and 216-A-30 received PUREX Plant steam condensate and 202-A Evaporator condensate until 1992. These cribs received approximately 8.58 x 10^9 L (2.27 x 10^9 gal) of effluent during their operating life (WHC-SD-EN-EV-032, Rev. 0). As indicated in Table G.5.8-2 through Table G.5.8-4, the PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU waste sites *with reported inventory data* consists of four cribs. 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-10 area (PUREX and Tank Farms Cribs and Trenches outside 200-E) has elevated levels of I-129, nitrate, tritium, and 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). Cribs within the CP-LS-10 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). No current plumes have been linked to the CP-LS-10 EU waste sites. Monitoring of groundwater is being conducted within the 200-PO-1 OU, which is 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

The PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU encompass several inactive and active waste sites and roadways. Over half of the EU is bare or graveled ground where vegetation is controlled by use of herbicides and another quarter of the EU has been disturbed in the past and is now dominated by non-native species such as Russian thistle (*Salsola tragus*) (Appendix J, Table J.26). Approximately 7% of the EU contains remnants of climax community shrub-steppe containing big sagebrush (*Artemisia tridentata*), although the quality of the habitat where these patches abut bare areas has been significantly impacted by disturbances that have killed most of the understory and some of the sagebrush.

The amount and proximity of biological resources surrounding the PUREX and Tank Farms Cribs and Trenches EU were examined within the adjacent landscape buffer area, which extends 3240 ft (988 m) from the geometric center of the EU (Appendix J, Figure J.28). Of the 757 acres within the combined EU and adjacent buffer area, 43% is classified as level 0 and almost 56% of the habitat is classified as level 2 or below (Appendix J, Table J.26). Most of this lower quality habitat lies to the north, east and west of the EU. To the south and southeast of the EU higher quality habitat dominated by sagebrush and various native and introduced forbs and grasses is contiguous with level 3 resources inside the EU. These level 3 and level 4 resources in the southeast portion of the buffer area are contiguous with similar high-quality habitat extending across the Hanford Site and include an area considered habitat for black-tailed jackrabbits (*Lepus californicus*), a Washington state candidate species (MSA 2014).

Field Survey

In the PUREX and Tank Farms Cribs and Trenches EU, nearly 82% consists of several elongate waste sites and access roads kept free of all vegetation (Appendix J, Figure J.28). On the west side of the EU a few native grasses such as Indian ricegrass (*Achnatherum hymenoides*) and needle-and-thread grass (*Hesperostipa comata*) are growing in a wind-blown sandy area.

Between and adjacent to the linear stretches of bare ground are patches of shrub-steppe where big sagebrush (*Artemisia tridentata*), a climax shrub, provides up to 30% canopy cover (Appendix J, Table J.25). Cheatgrass (*Bromus tectorum*) and Russian thistle (*Salsola tragus*) are both introduced species and

comprise the dominant understory species. The outer 10 to 20 ft (3 to 6 m) of these patches has lost most of the understory species resulting in sagebrush above bare dirt and/or Russian thistle. It appears sand from the adjacent waste site has blown in and may have covered the previous understory plants. Field data records in the discussion of this EU in Appendix J provide lists of plant and animal species observed during the June 2015 survey.

CULTURAL RESOURCES SETTING

Portions of the CP-LS-10, PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU have been inventoried for cultural resources, all with negative results. It is unknown if an NHPA Section 106 review has been completed specifically for the remediation of the CP-LS-10, PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU. No cultural resources have been documented within the CP-LS-10, PUREX and Tank Farms Cribs and Trenches (outside 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.

While no cultural resources are known to be located within the EU, several have been recorded within 500 meters of the CP-LS-10, PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU. They include: Segments of the National Register-eligible Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District with documentation required; six National Register-eligible buildings that are contributing properties within the Manhattan Project and Cold War Era Historic District, with documentation required; and five National Register-eligible buildings that are contributing properties within the Manhattan Project and Cold War Era Historic District, with no documentation required. All National-Register-eligible Manhattan Project and Cold War Era buildings have been documented as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE-RL 1998).

Historic maps of the EU indicate a low potential for the presence of archaeological resources associated with the Pre-Hanford Early Settlers/Farming Landscape within the EU. Geomorphology indicates a low potential for the presence of Native American Precontact and Ethnographic cultural resources to be present within the CP-LS-10, PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU. Further, extensive ground disturbance within the EU suggests little to no potential for intact cultural resources at or below ground surface.

Because the CP-LS-10, PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU has not been completely inventoried for cultural resources, it may be appropriate to conduct surface archaeological investigations in these areas prior to initiating any remediation activities. Indirect effects are always possible when TCPs are known to be located in the general vicinity. Consultation with Hanford Tribes (Confederated Bands of the Yakama Nation, Wanapum, Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce) and other groups 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 four waste sites in the CP-LS-10 EU that have reported inventory information in the SIM, Rev. 1 (Corbin, et al., 2005) (i.e., Table G.5.8-2 through Table G.5.8-4) and are considered representative of

the major inventory sources and risks from this EU. These waste sites (with reported inventories) consist of four cribs (DOE/RL-92-19, Rev. 0):

- The 216-A-6 Crib operated from 1955 to 1970 and received 3.4E+09 L of steam condensate, equipment disposal tunnel floor drainage, water-filled door drainage, and waste from 202-A Building.
- The 216-A-30 Crib operated from 1961 to 1991 and received 7.11E+09 L of steam condensate, equipment disposal tunnel floor and water-filled door drainage, and slug storage basin overflow waste from the 202-A Building.
- The 216-A-37-1 Crib operated from 1977 to 1991 and received 3.77E+08 L of process condensate from 241-A Evaporator.
- The 216-A-37-2 Crib operated from 1983 to (before) 1994 and received 1.09E+09 L of steam condensate from PUREX Plant.

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The CP-LS-10 EU waste sites with reported inventories are legacy sites and the inventory information is provided in Table G.5.8-2 through Table G.5.8-4.

Vadose Zone Contamination

Since the CP-LS-10 EU waste sites are legacy sites that represent soil and other vadose zone contamination, the inventory information is provided in Table G.5.8-2 through Table G.5.8-4 represent the reported contamination originally discharged (without decay correction[8]) to the vadose zone from the CP-LS-10 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 no current 200-PO (Group A and B) plumes are associated with the PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU waste sites as described below) (DOE/RL-2016-09, Rev. 0)[9]:

- *Chromium* – There are reported inventories for chromium in the CP-LS-10 waste sites (Table G.5.8-4) but no current 200-PO plumes in the vicinity.[10] The vadose zone inventory is dominated by the 216-A-30 and 216-A-6 Cribs and thus chromium originally discharged into the vadose

[8] 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).

[9] 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.

[10] There are total and hexavalent chromium plumes that begin in 200-UP and extend into 200-PO that are managed as part of the 200-UP GWIA (Appendix E.6).

would have to travel through the vadose zone until potentially impacting groundwater. The TC&WM EIS groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that chromium from all Central Plateau sources considered is expected to reach the A Barrier[11] at a peak concentration of 323 µg/L in CY3710 for the No Action Alternative versus 81 µg/L in CY2168 for Landfill Closure, where the threshold value is 100 µg/L (total) or 48 µg/L (hexavalent). Thus appreciable chromium plumes might be reasonable to expect in the next 150 years, especially since there are no current remedial actions for groundwater and final decisions are pending. Thus the current (*High*) rating would appear reasonable to maintain during the Active Cleanup or Near-term, Post Cleanup periods.

- *Carbon tetrachloride (CCl_4) and trichloroethene (TCE)* – There are no 200-PO plumes for these contaminants or reported TCE vadose zone inventory for the CP-LS-10 waste sites and a vadose zone inventory for CCl_4 in the 216-A-37-1 Crib (Table G.5.8-4).
- *I-129* – There are reported inventories for I-129 (Table G.5.8-2) as well as a very large plume in the vicinity that straddles both the 200-BP and 200-PO GWIAs. Primary sources were located in the 200-PO GWIA but none are related to CP-LS-10. The relatively small CP-LS-10 vadose zone inventory is dominated by the 216-A-6 Crib. The TC&WM EIS groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that a high concentration of I-129 might be anticipated at the A Barrier, including many Central plateau sources; however, relatively little of this contamination would likely be from CP-LS-10 waste sites.
- *Tc-99* – There are reported inventories for Tc-99 (Table G.5.8-3) 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-10. The vadose zone inventory is dominated by the 216-A-6 Crib. Like for I-129, the TC&WM EIS groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that a high concentration of I-129 might be anticipated at the A Barrier from many sources in the Central Plateau; however, relatively little of this contamination would likely be from CP-LS-10 waste sites.
- *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.5.8-3 and Table G.5.8-4). 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 and not CP-LS-10. The vadose zone inventory is dominated by the 216-A-30 Crib and thus the uranium originally discharged into the vadose would have to travel through the vadose zone until potentially impacting groundwater. The TC&WM EIS groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that uranium is also not expected to reach the A Barrier. Furthermore, the average water travel time through the vadose zone for a recharge rate of 100 mm/yr is 63 years for the 200-East Area (Table N-52, DOE/EIS-0391 2012), or the uranium travel time might be more than 100 years (i.e., 63 yr × 4.6) for an appreciable amount of uranium to move through the vadose zone. It would likely require almost 300 years (from the original discharge) to reach groundwater in a sufficient amount to exceed the drinking water standard over an appreciable area. Thus an appreciable uranium plume would not be expected

[11] 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 and Tank Farms Cribs and Trenches (outside 200-E) EU. Despite including sources other than those for the PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU, the analysis in the TC&WM EIS was considered reasonable to assess the rate of movement of contaminants to groundwater through the vadose zone.

in the next 150 years but perhaps during the 1,000-year period after cleanup. Thus total uranium is not considered a significant threat to the Hanford groundwater during the Active Cleanup or Near-term, Post Cleanup periods.

- *Sr-90* – There is a plume in the vicinity near the 216-A-36A/B Cribs and reported vadose zone inventories (Table G.5.8-3). Like for uranium, the source of the plume was not specifically identified but is assumed to be from the PUREX Cribs and Trenches (inside 200-E) and not CP-LS-10. The TC&WM EIS groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that Sr-90, despite there already being a small plume, is not expected to reach the A Barrier, which is interpreted here to indicate that Sr-90 is not very mobile in the vadose zone near the PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU relative to it decay. Furthermore, the average water travel time through the vadose zone for a recharge rate of 100 mm/yr is 63 years for the 200-East Area (Table N-52, DOE/EIS-0391 2012) and thus the resulting average Sr-90 travel time accounting for retardation would be more than 300 years (i.e., 63 yr × 4.6 or 10+ half-lives leaving less than 0.10%) to move through the vadose zone.[12] It would likely require more time to reach groundwater in a sufficient amount to exceed the drinking water standard over an appreciable area. Thus a Sr-90 plume is not expected in the next 150 years due to retardation in the vadose zone or after due to radioactive decay (+99.9% reduction in Sr-90 inventory that would already translate to a *Low* rating). Thus Sr-90 from the CP-LS-10 EU is not considered a significant threat to the Hanford groundwater.
- *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.5.8-2) but not for Cl-36 (Table G.5.8-2) or CN (Table G.5.8-4). The relatively small, reported C-14 inventory is dominated by the 216-A-37-1/2 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.5.8-5 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.5.8-5. Note that the vadose zone (VZ) ratings range from *High* for total and hexavalent chromium to *Medium* for I-129 and carbon tetrachloride (CCl_4) to *Low* for the other Group A and B PCs with reported inventories with the exceptions of Sr-90 and total uranium. Because there are no current Sr-90 or total uranium plumes and (as described above) none expected during the evaluation period being considered here, these are ascribed current ratings of *Not Discernible* (*ND*) during and *Low* after the Active Cleanup period to account for uncertainties in the evaluation. The overall current rating is defined as the highest over all the ratings and thus *High*.

Groundwater Plumes

Sites within the CP-LS-10 EU are suspected of being able to eventually contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0) and (of the Group A and B primary contaminants)

[12] The minimum best-estimate K_d for Sr-90 for WMA C (proximate to A-AX) is 1 mL/g (PNNL-17154, p. 3.43), which translates to a retardation factor of ~4.6.

chromium, C-14, Tc-99, uranium, Sr-90, CCl_4, and I-129 (i.e., not CN, Cl-36, or TCE) have reported inventories for the CP-LS-10 waste sites (Table G.5.8-2 through Table G.5.8-4). However, no portions of the existing 200-PO groundwater plumes are associated with the PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU based on the 2015 Groundwater Monitoring Report (DOE/RL-2016-09, Rev. 0). Thus the saturated zone inventories related to the CP-LS-10 EU are zeros as indicated in Table G.5.8-5. 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 process for deriving vadose zone and saturated zone 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.

The 200-PO groundwater plumes are described in detail in the Appendix D.5 for the CP-GW-1 EU (200-PO GWIA). Note that I-129 is the primary risk driver for the 200-PO GWIA; however, there are no CP-LS-10 EU sources associated with these plumes and the remaining vadose zone sources from other EUs would drive future risks to groundwater.

Impact of Recharge Rate and Radioactive Decay on Groundwater Ratings

As described in Appendix E.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. To summarize, the screening groundwater results including sources in addition to those for the CP-LS-10 EU (Appendix O, DOE/EIS-0391 2012) include[13]:

- 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.
- 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 at the A Barrier within 150-200 years and thus the saturated and vadose ratings will not be altered (i.e., remain *Medium*) even though expected 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) for the Landfill closure scenario 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-10 sources would be sporadic and dispersed (as in the past), and thus

[13] 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 and Tank Farms Cribs and Trenches (outside 200-E) EU.

the Tc-99 rating for the Near-term, Post-Cleanup period would remain *Low* to address uncertainty in the evaluation.

The chromium value (as hexavalent chromium) exceeded its corresponding threshold even under the Landfill Closure scenario; however, no plume has been associated with the CP-LS-10 waste sites and it is assumed that either the primary source would be from elsewhere or any contamination entering groundwater from CP-LS-10 sources would be disperse as for Tc-99. The peak total chromium value is below the standard for the Landfill scenario; thus there would be no plume after cleanup.

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 (which has a source no related to CP-LS-10). Thus based on this evaluation, a rating of *Low* (corresponding to the remaining vadose zone GTM in Table G.5.8-5) for total uranium for the Active Cleanup and Near-term, Post-Cleanup periods would be used 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 also expected to remain localized. The remaining vadose zone GTM in Table G.5.8-5 for Sr-90 corresponds to a *Low* rating; this rating will be maintained for the Active Cleanup and Near-term Post-Cleanup periods to address uncertainty in the evaluation. Despite the fact that radioactive decay will significantly decrease the concentration remaining in the vadose zone, the rating will not be changed because any non-zero GTM value corresponds to a *Low* rating (CRESP 2015a).

Columbia River

Threats to the Columbia River similar to those presented by the PUREX and Tank Farms Cribs and Trenches (outside 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*)[14].

[14] 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* (*ND*) is ascribed for these zones.

Table G.5.8-2. Inventory of Primary Contaminants [a]

WIDS	Description	Decay Date	Ref[b]	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			3.10E+00	2	NR	0.0037	3.90E+00	3.30E-04	2.50E-02	1800	0.082
216-A-30	Cribs	2001	SIM	0.0015	0.029	NR	0.00025	2.8	2.60E-05	0.0019	0.018	0.0089
216-A-37-1	Cribs	2001	SIM	0.12	1.5	NR	NR	NR	NR	NR	590	NR
216-A-37-2	Cribs	2001	SIM	0.036	0.45	NR	NR	NR	NR	NR	9.5	5.40E-05
216-A-6	Cribs	2001	SIM	2.9	0.013	NR	0.0035	1.1	0.00031	0.023	1200	7.30E-02

a. NR = Not reported for indicated EU

b. SIM = RPP-26744, Rev. 0 (Corbin, et al. 2005)

Table G.5.8-3. Inventory of Primary Contaminants (cont)[a]

WIDS	Description	Decay Date	Ref[b]	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)
All	Sum			0.0004	0.038	2.60E+02	3.40E+00	2.20E-02	2.80E+00
216-A-30	Cribs	2001	SIM	0.00022	0.021	250	1.1	0.00074	2.6
216-A-37-1	Cribs	2001	SIM	NR	NR	1.1	0.19	NR	0.00017
216-A-37-2	Cribs	2001	SIM	NR	NR	1.3	0.056	NR	0.042
216-A-6	Cribs	2001	SIM	0.00018	0.017	8.8	2.1	0.021	0.15

a. NR = Not reported for indicated EU

b. SIM = RPP-26744, Rev. 0 (Corbin, et al. 2005)

Table G.5.8-4. Inventory of Primary Contaminants (cont)[(a)]

WIDS	Description	Ref[(b)]	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
All	Sum		67	NR	1.10E+04	NR	0.06	410000	2.9	NR	NR	8.70E+02
216-A-30	Cribs	SIM	NR	NR	6000	NR	0.0073	210000	0.37	NR	NR	660
216-A-37-1	Cribs	SIM	67	NR	NR	NR	0.039	200	1.9	NR	NR	0.19
216-A-37-2	Cribs	SIM	NR	NR	NR	NR	0.012	620	0.56	NR	NR	48
216-A-6	Cribs	SIM	NR	NR	5000	NR	0.0027	200000	0.14	NR	NR	170

a. NR = Not reported for indicated EU

b. SIM = RPP-26744, Rev. 0 (Corbin, et al. 2005)

Table G.5.8-5. 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	2.00E+00 Ci	---	---	2.00E+00 Ci	9.99E-01	*Low*
I-129	A	1 pCi/L	0.25	0.2	1.82	8.20E-02 Ci	---	---	8.20E-02 Ci	3.34E+01	*Medium*
Sr-90	B	8 pCi/L	0.25	22	1.82	3.43E+00 Ci	---	---	3.43E+00 Ci	2.66E+00	*ND*[(e)]
Tc-99	A	900 pCi/L	0.25	0	1.82	2.18E-02 Ci	---	---	2.18E-02 Ci	2.42E-02	*Low*
CCl4	A	5 µg/L	0.25	0	1.82	6.68E+01 kg	---	---	6.68E+01 kg	1.34E+01	*Medium*
Cr	B	100 µg/L	0.25	0	1.82	1.10E+04 kg	---	---	1.10E+04 kg	1.10E+02	*High*
Cr-VI	A	48 µg/L[b]	0.25	0	1.82	1.10E+04 kg	---	---	1.10E+04 kg	2.30E+02	*High*
TCE	B	5 µg/L	0.25	2	1.82	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.25	0.8	1.82	8.75E+02 kg	---	---	8.75E+02 kg	4.27E+00	*ND*[(e)]

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).

e. As discussed in **Part V**, no appreciable Sr-90 or total uranium plume would be expected in the next 150 years. The *Low* rating would apply to the period at the end of the Active Cleanup is complete to account for uncertainties.

PART VI. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

Pathways and Barriers

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

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

The 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). The soil is still in place although waste sites within the CP-LS-10 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-10 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-10 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-10 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 or hazard analysis for the CP-LS-10 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. Because of similarities among waste sites within CP-LS-10 and CP-LS-9, **Part VI** in Appendix G.5.7 (CP-LS-9) has additional information. The evaluations and ratings in the section below are summaries of those developed for the CP-LS-9 EU (**Part VI** in Appendix G.5.7).

Facility Worker

Facility workers are at risk when working in or around areas with contaminated soils, where exposure is limited because waste sites and contaminated soils are located below grade. However, during maintenance and monitoring operations near the CP-LS-10 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. 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.

Co-Located Person (CP)

Co-located persons would be expected to have similar reduced exposures as for facility workers.

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

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.5.8-5 represents the risks and associated ratings for the saturated zone (groundwater) from vadose zone contamination associated with the CP-LS-10 waste sites. Sites within the CP-LS-10 EU are suspected of eventually being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0); however, no current 200-PO plumes have been linked to CP-LS-10 EU waste sites (DOE/RL-2016-09, Rev. 0). The current risk and potential impact ratings for inventories remaining in the vadose zone (Table G.5.8-5) are *High* (total and hexavalent chromium), *Medium* (I-129 and carbon tetrachloride), and *Low* (other Group A and B PCs with reported inventories) with the exceptions of Sr-90 and total uranium that have *ND* ratings. 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).

Columbia River

As described in Appendix D.5 (CP-GW-1 EU, **Part V**), although tritium (Group C) from the 200-PO-1 OU (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:

- Nearly 82% of the resources in the PUREX and Tank Farms Cribs and Trenches EU are classified as level 1 or below. There is no level 2 habitat identified in the EU.
- 18% of the EU is classified as level 3 habitat, although over half of this has been significantly impacted by herbicide or other disturbance factors.
- Loss of habitat within the EU is not like to impact connectivity between fragmented habitats in the EU and high-quality habitats outside the 200-East Area.

Cultural Resources

The CP-LS-10, PUREX and Tank Farms Cribs and Trenches (outside 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.

Portions of the CP-LS-10, PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU have been inventoried for archaeological resources under four cultural resource reviews: HCRC#88-200-055 (Cadoret 1988), HCRC#2003-200-044 (Kennedy 2003), HCRC#2011-200-063 (Clark and Mendez 2011), and HCRC#2012-600-031a (Gilmour, Solimano and Daniels, 2013). None of these cultural resource reviews resulted in the identification of any cultural resources within the CP-LS-10 PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU. It is unknown if an NHPA Section 106 review has been completed specifically for the remediation of CP-LS-10, PUREX and Tank Farms Cribs and Trenches (outside 200-E). It is 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 the soils in the EU appear to be heavily disturbed by the PUREX and Tank Farms Cribs and Trenches themselves.

Archaeological sites, buildings and Traditional Cultural Properties (TCPs) located within the EU[15]

- There are no known archaeological sites, inventoried historic buildings, or TCPs located within the CP-LS-10, PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU.

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

- 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-10 PUREX and Tank Farms Cribs and Trenches (outside 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 11 National Register-eligible buildings that are contributing properties within the Manhattan Project and Cold War Era Historic District are located within 500 meters of the EU (all 11 are contributing within the Manhattan Project and Cold War Era Historic District, 6 with individual documentation required, and 5 with no additional documentation required). Mitigation for contributing buildings/structures has been completed in accordance with the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE-RL 1998).

Table K.13 (Appendix K) has more information about the 11 buildings that are National Register-eligible Manhattan Project and Cold War Era buildings located within 500 meters of the CP-LS-10, PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU.

[15] 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).

Closest Recorded TCP

There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from the CP-LS-10, PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

There is no Documented Safety Analysis, hazards analysis, or feasibility study that includes the CP-LS-10 EU waste sites. It was decided by the author to use the evaluation provided in the *Focused Feasibility Study for the BC Cribs and Trenches Area Waste Sites* (FFS) (DOE/RL-2004-66, Draft A) for CP-LS-10 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. Thus the alternatives (and corresponding 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.

As described in the BC Cribs and Trenches FFS, remedial action alternatives were developed, including:[16] No Action (Alternative 1); Maintain Existing Soil Cover, Institutional Controls (ICs), and Monitored Natural Attenuation (MNA) (Alternative 2); Removal, Treatment, and Disposal (RTD) (Alternative 3); Capping (Alternative 4); and Partial Removal, Treatment, and Disposal with Capping (Alternative 5). 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-2004-66, Draft A).

More detailed descriptions of the alternatives provided in the BC Cribs and Trenches FFS (DOE/RL-2004-66, Draft A) are summarized in **Part VI** of Appendix G.5.7 (CP-LS-9 EU).

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

The remedial actions that were proposed for CP-LS-10 (Appendix B) or were evaluated above would leave existing contamination in CP-LS-10 waste sites as well as that contamination that has been released from CP-LS-10 waste sites into some shallow and deep vadose zones. Waste sites within the CP-LS-10 EU have likely contributed to groundwater contamination in the 200-PO GWIA/200-PO-1 GW OU (DOE/RL-92-19, Rev. 0). Remedial decisions for the remaining CP-LS-10 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 no Documented Safety Analysis, hazards analysis, or feasibility study that includes the CP-LS-10 EU waste sites. The risks and potential impacts associated with cleanup actions are assumed to be the same as those described for the CP-LS-9 EU (Appendix G.5.7, **Part VI**). As for the CP-LS-9 impacts, the BC

[16] Non-time-critical actions have also been defined for selected 200-MG-2 OU waste sites that are also within the CP-LS-10 EU (DOE/RL-2009-37, Rev. 0).

Cribs and Trenches FFS results are used to evaluate *possible* radiological impacts to workers during selected remedial alternatives. However, because the FFS evaluation is not done according to the same standard as for a DSA (DOE-STD-3009-2014), 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 an *unprotected 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). The inventories and measured borehole soil concentrations for the representative BC Cribs and Trenches waste sites are:

- 216-B-26 Trench -- Cs-137 and Sr-90 with inventories of 585 and 488 Ci, respectively, (Corbin 2005) and maximum soil concentrations of 529,000 and 974,000 pCi/g, respectively at 4.0 m (13 ft) bgs (DOE/RL-2004-66, Draft A, p. 2-21). The estimated unprotected worker collective dose for this waste site is 13.4 person-rem (DOE/RL-2004-66, Draft A, p. F-16) with an estimated protected worker dose of 8 person-rem (DOE/RL-2004-66, Draft A, p. F-17). This waste site has the highest Cs-137 inventory and corresponding risk.
- 216-B-58 Trench -- Cs-137 and Sr-90 with inventories of 4.9 and 4.2 Ci, respectively, (Corbin 2005) and maximum soil concentrations of 14,600 and 18,400 pCi/g, respectively at 4.6 m (15 ft) bgs (DOE/RL-2004-66, Draft A, p. 2-21). The estimated unprotected worker collective dose for this waste site is 0.12 person-rem (DOE/RL-2004-66, Draft A, p. F-16) with an estimated protected worker dose of 0.07 person-rem (DOE/RL-2004-66, Draft A, p. F-17).

Cs-137 and Sr-90 were the dominant radionuclides in the BC Cribs and Trenches.

For this evaluation, it is assumed that the worker risk is strongly related (i.e., proportional) to inventory[17] and would be dominated by the external dose from Cs-137. The Cs-137 inventories for the CP-LS-10 (with reported values from the SIM, Rev. 1) are found in Table G.5.8-2 and range from *not reported* to 2.8 Ci for 216-A-30. Thus the Cs-137 inventories for CP-LS-10 waste sites (with reported values) are more than two orders of magnitude less than that for the 216-B-26 Trench that was the basis for assessing excavation risks in the BC Cribs and Trenches FFS (DOE/RL-2004-66, Draft A, p. F-6). Using the

[17] 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 would be stronger, especially for different types of legacy sites. Measured soil concentrations could not be located for the CP-LS-10 so the assumed proportionality to inventory will be used.

proportionality assumption from the BC Cribs and Trenches FFS (DOE/RL-2004-66, Draft A, p. F-16) and assuming the excavation risks are related to the Cs-137 inventory, the estimated unprotected worker collective dose for the 216-A-30 waste site would be 0.08 person-rem and the total for all CP-LS-10 waste sites with reported inventories would be 0.1 person-rem with protected workers having lower risks. Based on uncertainties in the inventories and the proportionality assumption used, these values are rated ND-Low considering the "worker" limit from Table 2-4 (although this limit is for a single, unmitigated event). *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 are also *ND-Low* regardless of the action that would be taken. These ratings could vary based on assessment of the risks associated with other radionuclides present in the CP-LS-10 waste sites (e.g., transuranic); such assessments were not available at the time of this Review.

Unmitigated Consequences: Facility Worker – *ND-Low*

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, albeit the calculated risks would be more than two orders of magnitude lower for the CP-LS-10 waste sites. Additional radiological controls would also be implemented to maintain ALARA exposure goals, if necessary. These conditions and potential actions result in an *ND-Low* rating for excavation. Risk ratings for other scenarios would also be *ND-Low*.

Mitigated Consequences: Facility Worker – *ND-Low*

Co-located Person

The only workers with potentially increased risks (over those for *Current* conditions as described above) are facility workers; however, based on the above analysis the risks would still be seen as low. 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*

Groundwater

As described in **Part V**, there will be a continuing threat during this period to groundwater (as a protected resource) from mobile primary contaminants in the vadose zone related to the PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU; however, no plumes are currently liked to CP-LS-10 waste sites and future contamination from these waste sites is expected to be sporadic. These impacts are described in more detail in Appendix G.5 for the CP-GW-1 EU. The vadose zone (VZ) GTM values for

the Group A and B primary contaminants remaining in the vadose zone related to the PUREX and Tank Farms Cribs and Trenches (outside 200-E) EU translate to ratings of *High* (total and hexavalent chromium because treatment has not been defined and inventories are large); *Medium* (I-129 and carbon tetrachloride 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-10 waste sites are assigned ratings of *Low* after this period to account for uncertainties in the evaluation. 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 as remove, treat and dispose 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 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-10 EU have contaminated the vadose zone and are suspected of contributing 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.5.8-6. 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* (Cr-VI and Cr(tot)) *Medium* (I-129 and CCl_4) *Low* (other PCs) **Overall**: *High*	*Current* GTM values for Group A&B primary contaminants (Table G.5.8-5): *High* (Cr-Vi and Cr(tot)); *Medium* (I-129 and CCl_4) and *Low* (other A&B PCs with reported inventories). No treatment in 200-PO and decay does not change Sr-90 (*Low*) rating. Also predicted impact from changes in recharge rates large but final cleanup decisions have not been made.
	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 than 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 and above resources in the buffer area.
Social	Cultural Resources[(b)]	**Native American** Direct: Unknown Indirect: Known **Historic Pre-Hanford** Direct: Unknown Indirect: None **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 and from residual contamination that may remain. 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.

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 (outside 200-East) 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 and Tank Farms Cribs and Trenches (outside 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 and Tank Farms Cribs and Trenches (outside 200-E)
ID:	CP-LS-10
Group:	Legacy Source
Operable Unit Cross-Walk:	200-EA-1
Related EU:	CP-GW-1
Sites & Facilities:	Liquid waste sites on the east side of 200-East (associated with PUREX and Tank Farm operations, but outside the 200-E area fence).
Key Data Sources Docs:	Interim Status Groundwater Monitoring Plan for the 216-A-36B PUREX Plant Crib (DOE-RL-2010-93_Rev1) Interim Status Groundwater Monitoring Plan for the 216-A-37-1 PUREX Plant Crib (DOE-RL-2010-92_Rev1) Closure Plan for the 216-A-10 Crib (DOE-RL-2006-37_DraftA) Interim Status Groundwater Monitoring Plan for the 216-A-37-1 PUREX Plant Crib (DOE-RL-2010-92_Rev0) Closure Plan for the 216-A-37-1 Crib (DOE-RL-2005-88_DraftA) Closure Plan for the 216-A-36B Crib (DOE-RL-2005-90_DraftA)

Figure 1. CP-LS-10 (PUREX and Tank Farms Cribs and Trenches (outside 200-E)) Site Location Map

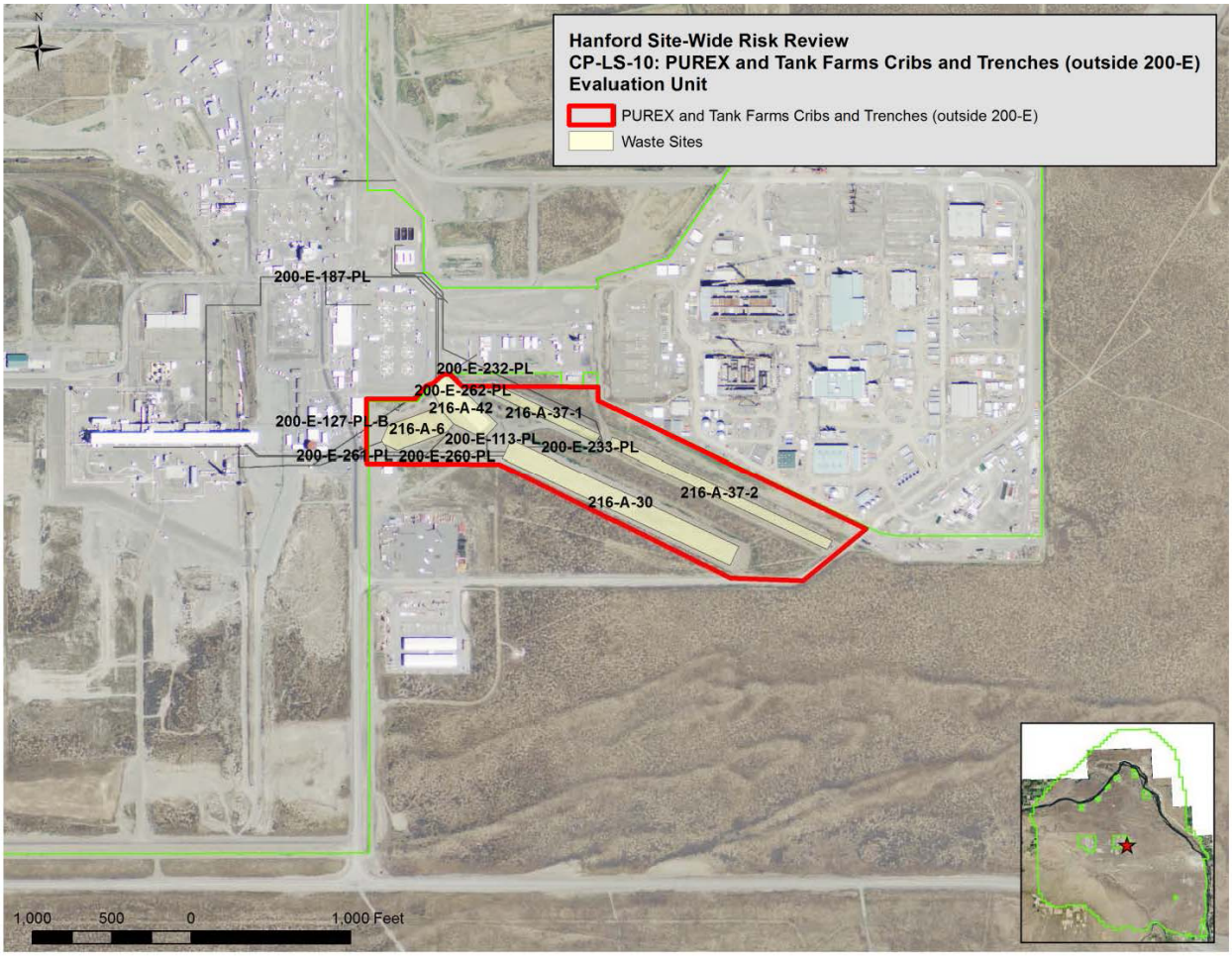

Figure 2. CP-LS-10 (PUREX and Tank Farms Cribs and Trenches (outside 200-E)) Site Location Map and WIDS Locations

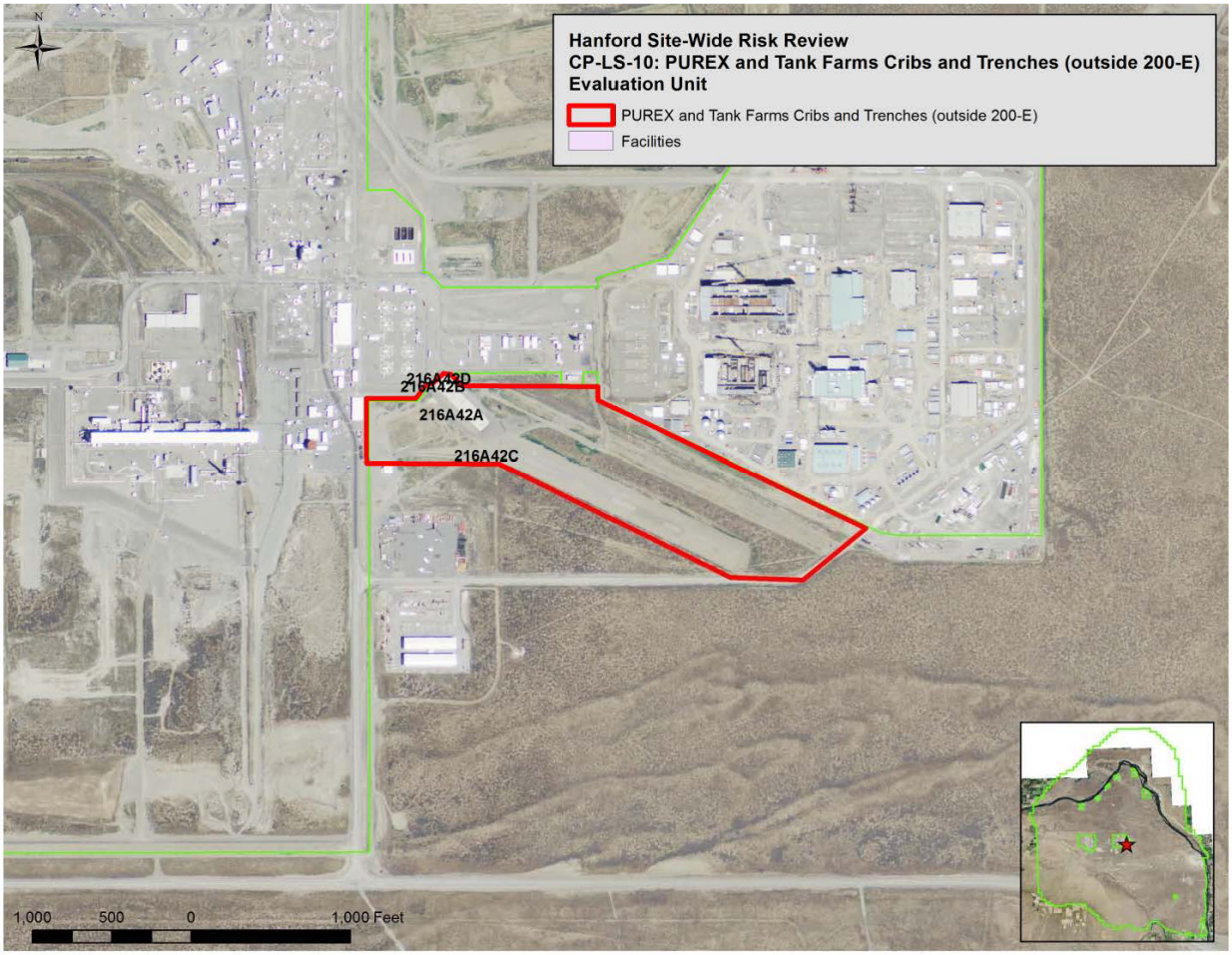

Figure 3. CP-LS-10 (PUREX and Tank Farms Cribs and Trenches (outside 200-E)) Site Location Map and Facility Locations

Hanford Site-Wide Risk Review
CP-LS-10 (PUREX and Tank Farms Cribs and Trenches - outside 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-30	216-A-30; 216-A-30 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-37-1	216-A-37-1; 216-A-37 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-37-2	216-A-37-2; 216-A-37-2 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1		
216-A-6	216-A-6; 216-A-6 Cavern; 216-A-6 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-EA-1		
200-E-113-PL	200-E-113-PL; 216-A-42C Valve Box; Line 8824; Pipeline from PUREX to 216-A-6 and 216-A-30 Crib	Waste Site	Inactive	Accepted	None	Process Sewer	Pipeline and associated valves, etc.	TBD 200-IS-1		
200-E-127-PL-B	200 E 127 PL B; Segments of Gable Mountain Pond Pipeline Located in the Inner Area	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200 E 187 PL	200-F-187-PL ; Chemical Sewer from 207-A to 216-A-29 Ditch; Lines 8819, 5802 and 5701; PUREX Chemical Sewer (CSL)	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD 200 IS 1		
200-E-232-PL	200 E 232 PL; Pipeline from 207 A Basins to 216 A 30 and 216 A 37 1 Cribs	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200 E 233 PL	200-F-233-PL ; Pipeline from 216-A-30 Crib Distribution Box to the 216-A-37-2 Crib Distribution Box	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD 200 IS 1		
200-E-260-PL	200-E-260-PL; Line 8824A; Steam Condensate By-Pass Line from PUREX to 216 A 30	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-261-PL	200-E-261-PL; Effluent Recycle Line from 216-A-42 Basin to PUREX	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200 E 262 PL	200-F-767-PL ; 216-A-47A Pump Station; 216-A-47B Valve Box and 216-A-42C Diversion Box; Pipelines Associated with 216-A-42 Basin	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200 IS 1		
200 E 263 PL	200 E 263 PL; 216 A 42 Basin Pipeline to 216 A 42C Diversion Box	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD 200 IS 1		
216-A-42	216-A-42; 216-A-42 Retention Basin; 216-A-42 Trench; 207-AA Retention Basin	Waste Site	Inactive	Accepted	None	Retention Basin	Crib - Subsurface Liquid Disposal Site	200-EA-1		
UPR-200-E-21	UPR-200-E-21; 216-A-6 Overflow; UN-200-E-21	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1		
UPR-200-F-79	UPR-200-F-79; 216-A-6 Overflow; UN-200-F-79	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1		
UPR-200-E-66	UPR-200-E-66; 216-A-42 Basin Contamination Release; UN-200-E-66; UN-216-F-66	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-EA-1		
216A42A	PUREX EFFLUENT DIVERSION PUMP STATION	Facility	INACTIVE			STRUCTURE	Pipeline and associated valves, etc.			
216A42B	PUREX EFFLUENT DIVERSION VALVE BOX	Facility	INACTIVE			STRUCTURE	Pipeline and associated valves, etc.			
216A42C	PUREX EFFLUENT DIVERSION VALVE BOX	Facility	INACTIVE			STRUCTURE	Pipeline and associated valves, etc.			
216A42D	PUREX EFFLUENT DIVERSION BOX	Facility	INACTIVE			STRUCTURE	Pipeline and associated valves, etc.			
216A42	PUREX EFFLUENT RETENTION BASIN	Facility	INACTIVE			STRUCTURE	Crib Subsurface Liquid Disposal Site		X	Duplicative

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