APPENDIX G.5.4

REDOX CRIBS AND DITCHES (CP-LS-4, CENTRAL PLATEAU) EVALUATION UNIT SUMMARY TEMPLATE

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TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

PART I. EXECUTIVE SUMMARY

EU LOCATION

Liquid waste discharge areas in the southern part of 200 West associated with historic REDOX Plant (CD-DD-4) operations.

RELATED EUS

CP-DD-4 and CP-GW-2

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES

The waste sites comprising the CP-LS-4 EU include legacy waste sites (e.g., cribs, trenches, retention basins, and unplanned releases (UPRs)) where liquid wastes were discharged, infrastructure buildings, pipelines and associated equipment, and storage tanks. The 202-S REDOX Plant (S Plant) (and waste site) is included in the CP-LS-4 Data Sheet (Attachment 1); however, the 202-S waste site is covered in the CP-DD-4 EU (Appendix F.9). Ten of the wastes sites representing pipelines and associated equipment are part of the Single Shell Tank (SST) System (DOE/RL-2010-114, Draft A, p. A-25 – A-28) and thus are assumed previously treated in the Tank Waste and Farms EU (Appendix E)[1]. Other CP-LS-4 pipelines and associated equipment may have been addressed in the TC&WM EIS and thus Tank Waste and Farms EU (Appendix E); however, the remaining pipeline and related wastes sites will not be evaluated further due to a lack of inventory information. Of the remaining waste sites, inventory information is reported for only selected legacy sites (cribs, one trench, and UPRs) in the Soil Inventory Model (SIM), Rev. 1 (Corbin, et al. 2005), which is used as the basis for analysis.

The primary contaminants listed in the SIM, Rev. 1 (Corbin, et al. 2005) for the CP-LS-4 EU include:[2]

- *Radionuclides*: Am-241, C-14, Co-60, Cs-137/Ba-137m, Eu-154, tritium (H-3), I-129, Sr-90/Y-90, Tc-99, U-All isotopes, Pu-All isotopes
- *Chemicals*: Cr/Cr-VI, Hg, nitrate (NO_3), Pb, and U-Total

BRIEF NARRATIVE DESCRIPTION

The majority of the CP-LS-4 EU legacy waste sites with non-zero reported inventories (Table G.5.4-2 through Table G.5.4-4) are included in the 200-WA-1 Operable Unit (OU) and thus the focus here will be

[1] The 200-W-141-PL pipeline that connects to the 216-S-23 Crib is part of both the CP-LS-3 and CP-LS-4 EUs. However, since the 216-S-23 Crib is part of the CP-LS-3 EU, the 200-W-141-PL pipeline will also be managed in the CP-LS-3 EU. The 200-W-230-PL waste site is considered a RCRA Hazardous Waste Treatment, Storage, Disposal (TSD) Facility (DOE/RL-2010-114, DRAFT A, p. A-28).

[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).

on that OU. The 200-WA-1 OU (where part of the 200-UW-1 OU was assigned to the 200-WA-1 OU but none of the CP-LS-4 EU sites were included in 200-UW-1) 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-WA-1 OU consists of waste sites in the 200 West Inner Area not already assigned to other OUs. The CP-LS-4 EU waste sites primarily consist of liquid waste disposal sites associated with 202-S (REDOX) Facility operations and a few other waste sites such as infrastructure buildings and pipelines and associated equipment. Liquid waste disposal sites include cribs, trenches, retention basins, and unplanned release sites. The primary radioactive contaminants include Am-241, C-14, Co-60, Cs-137, Eu-154, H-3, I-129, Sr-90, Tc-99, and isotopes of uranium and plutonium. Primary chemical contaminants include Cr, Hg, NO_3, Pb, and uranium. All current land-use activities in the 200 West and 200 East Areas (where the CP-LS-4 is located) are *industrial* in nature (Hanford 200-Area ROD[3]). Although none of the CP-LS-4 waste sites are included in the 200-UW-1 OU, the four remedial alternatives considered in the 200-UW-1 Focused Feasibility Study (FFS) are considered reasonable[4]; these alternatives are: i) No Action, ii) Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation, iii) Removal, Treatment, and Disposal, and iv) Engineered Barrier (DOE/RL-2003-23, Rev. 0; DOE/RL-2003-24, Rev. 0). 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.5.4-1 provides a summary of nuclear and industrial safety related risks to humans and impacts to important physical Hanford Site resources.

Human Health

A Facility Worker is deemed to be an individual located anywhere within the physical boundaries of the REDOX Cribs and Trenches Area (CP-LS-4); a Co-located Person (CP) is an individual located 100 meters from the physical boundaries of the REDOX Cribs and Trenches 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 Table G.5.4-1 in parentheses.

Groundwater and Columbia River

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

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

[4] The 200-UW-1 OU included 31 liquid waste disposal sites associated with 221-U Facility (many of which are included in the CP-LS-3 EU (Appendix G.5.3); however, none of these sites are included in the CP-LS-4 EU. Despite this fact, the analysis provided in the 200-UW-1 FFS will also be used here (as it was for the CP-LS-3 EU) instead of those provided in the Evaluation Unit Disposition Table (Appendix B) because 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 evaluation provided in the 200-UW-1 FFS) are used instead of those general alternatives mentioned in the Evaluation Unit Disposition Table (Appendix B). Note that the basic remedial component activities (No Action, capping, and RTD) are captured in both sets of remedial alternatives.

Ecological Resources[5]

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[5]

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

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

Table G.5.4-1. 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: Four alternatives considered
Human Health	Facility Worker	***Not Discernible (ND)-Low*** *(ND-Low)*	***Proposed Alternatives*: *ND-Low (No Action) to Low-High (RTD)*** (*ND-Low to Low (RTD)*)
	Co-located Person	***ND-Low*** *(ND-Low)*	***Proposed Alternatives: ND-Low*** (*ND* to *Low*)
	Public	***ND*** (*ND*)	***Proposed Alternatives*: *ND*** (*ND*)
Environmental	Groundwater (A&B) from vadose zone[a]	*High* – I-129 *Medium* – Cr-VI, Cr (tot) *Low* – C-14, Tc-99 *ND* – U(tot), Sr-90[c] **Overall**: *High*	*High* – I-129 *Medium* – Cr-VI, Cr (tot) *Low* – C-14, Tc-99 *ND* – U(tot), Sr-90[c] **Overall**: *High*
	Columbia River from vadose zone[a]	Benthic and Riparian: *ND* Free-flowing: *ND* **Overall**: *ND*	Benthic and Riparian: *ND* Free-flowing: *ND* **Overall**: *ND*
	Ecological Resources[b]	Low	Estimated to be Low to Medium. [e]
Social	Cultural Resources[b]	**Native American** Direct: Unknown Indirect: Known **Historic Pre-Hanford** Direct: Unknown Indirect: Known **Manhattan/Cold War** Direct: Known Indirect: Known	Estimated to be: [e] **Native American** Direct: Unknown Indirect: Known **Historic Pre-Hanford** Direct: Unknown Indirect: Known **Manhattan/Cold War** Direct: Known Indirect: Known

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

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

c. These ratings are for PCs with reported inventories (Table G.5.4-2 through Table G.5.4-4). (See **Parts V** and **VI** for additional details.) The Sr-90 and total uranium disposed of in the REDOX Cribs and Ditches EU would translate to a *Medium* and *High* rating (Table G.5.4-5); however, there is no current Sr-90 or total uranium plume in the 200-UP GWIA associated with CP-LS-4, and it would likely require more than 150 years to reach groundwater in a sufficient amount to exceed the drinking water standard over an appreciable area (**Part V**). The Sr-90 and total uranium ratings after the Active Cleanup period are *Low* to account for uncertainties.

e. No cleanup decisions have been made for this EU.

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-3 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. Although none of the CP-LS-4 waste sites are included in the 200-UW-1 OU, the four remedial alternatives considered in the 200-UW-1 Focused Feasibility Study (FFS) are considered reasonable as described above. The human health risk evaluation is thus based on the same information used for CP-LS-3 (Appendix G.5.3).

Current

To summarize, the workforce involved with characterization activities would have an unmitigated *Not Discernible* (*ND*) to *Low* risk rating (as described in **Part VI** and Appendix G.5.3 for CP-LS-3), risk to the Co-located Person would also be rated *ND* to *Low*, and the Public risk 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: To summarize, 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 have proven to be effective in reducing industrial accidents at the Hanford Site to well below that in private industry. (See Appendix G.5.3 for additional details.) Thus resulting Facility worker risks remain rated as *ND* to *Low*; ratings for 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

The cleanup alternatives considered range from no action to significant actions (e.g., removal, treatment, and disposal (RTD)) (DOE/RL-2003-23, Rev. 0). As described in Appendix G.5.3, risk ratings for Facility workers range from *ND-Low* (No Action) to *Low-High* (RTD) based on the action that would be taken. Ratings for other receptors would not be impacted.

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

Mitigation: As described in Appendix G.5.3, Facility worker risks are rated as *Low* for active cleanup actions and *ND-Low* for other actions; others remain the same.

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

Groundwater, Vadose Zone, and Columbia River

Current

The CP-LS-4 EU is located in 200-UP groundwater interest areas (GWIA) that is described in the CP-GW-2 EU (Appendix D.6). The saturated zone beneath the vicinity of the CP-LS-4 (REDOX Cribs and Ditches) area has elevated levels of total and hexavalent chromium, carbon tetrachloride (CCl_4), I-129 , nitrate, Tc-99, and tritium (H-3) and based on the 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html); sites within the CP-LS-4 EU are suspected of being

able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0). The current threats to groundwater and the Columbia River from contaminants already in the groundwater are evaluated as part of the CP-GW-2 EU (Appendix D.6). However, current threats to groundwater corresponding to only the CP-LS-4 EU contaminants *remaining* in the vadose zone (Table G.5.4-5) has an overall rating of *High* (based on I-129) as described in **Part V**. Contaminated groundwater is treated in the 200-UP GWIA using the WMA S-SX groundwater extraction system[6], the U Plant area P&T system, and the I-129 plume hydraulic control system (DOE/RL-2016-09, Rev. 0). As indicated in **Part V**, only 200-UP plumes have been linked to CP-LS-4 waste sites. Threats from contaminated groundwater in the area to contaminate additional groundwater or the Columbia River are evaluated as part of the CP-GW-2 EU (Appendix D.6).

For the 200-UP GWIA (in 200 West), no plume currently emanating from the CP-LS-4 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-4 EU waste sites include i) No Action; ii) Maintain Existing Soil Cover; iii) Removal, Treatment, and Disposal; and iv) Engineered Barrier; however, no final cleanup decisions have been made. Furthermore, no cleanup decisions have been made either for the deep vadose zone (200-DV-1), including any CP-LS-4 EU contaminants in the deep vadose zone. Because no final cleanup decisions have been made, there is no way to definitively determine the risks and potential impacts to protected resources (groundwater and Columbia River). However, final cleanup decisions will be made to be protective of human health and the environment, and thus it is likely that at least some vadose contamination will be removed to satisfy remedial goals and a cover may be installed (perhaps 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-4 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 ratings at the end of the Active Cleanup period (including *High* for I-129[7]) to account for uncertainties).

Contaminants from the CP-LS-4 EU waste sites are currently impacting the vadose zone and groundwater; the treatment processes mentioned in the previous section are not predicted to decrease all concentrations to below thresholds before the Active Cleanup phase commences although there should be significant decreases in many contaminant levels (with the exception of I-129). Secondary sources in the vadose threaten to continue to impact groundwater in the future, including during the

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

[7] The I-129 plume hydraulic control system is the basis for not increasing the rating related to I-129 assuming the plume area will not increase in size while under control; however, the effectiveness of the plume control has not yet been established (DOE/RL-2016-09, Rev. 0). This would be considered a data gap.

Active Cleanup period[8]. The *High* rating associated with the CP-LS-4 EU waste sites (Table G.5.4-5) is associated with I-129 that could continue to impact the 200-UP GWIA (which is part of CP-GW-2, Appendix G.6). As described in the TC&WM EIS and summarized in **Part V**, there appears to be insufficient impact to the overall rating from radioactive decay (since I-129 is the risk driver), recharge rate (due to large amounts of contaminants already in the groundwater), or the containment of I-129 and treatment of other contaminants in the 200-UP GWIA (using the WMA S-SX groundwater extraction system, the U Plant area P&T system, and the I-129 plume hydraulic control system) to change ratings; thus the I-129 rating would remain *High* by the end of the Active Cleanup period, especially since I-129 would only be controlled during this period while treatment options are currently being evaluated[9].

There would not be a sufficient impact on peak concentrations in near-shore region of the Columbia River during or after cleanup to modify ratings (which are already *ND*). Thus the ratings for current threats provided in Table G.5.4-5 would not be modified for I-129 but would be modified (after the Active Cleanup period) to *Low* for total uranium and Sr-90 (to address uncertainty) as described in **Part V**. The ratings for the remaining Group A and B primary contaminants remain unchanged as in Table G.5.4-5 also to address uncertainties. Thus the overall rating would be *High* at the end of the Active Cleanup period.

Ecological Resources

Current

0% of EU and 45% of the buffer is level 3 or greater. Higher resource in the buffer are continuous with large patches of level 3 and 4 resources. Low impacts are based on truck traffic and herbicide applications.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

No cleanup decisions have been made for deep vadose zone, and as a result, the potential effects of cleanup on ecological resources is uncertain for the active cleanup evaluation period. Cleanup decision for surface may change based on cleanup for deep vadose zone. The range of plausible remediation options increases the uncertainty in estimating the impacts to ecological resources. Reducing impacts to medium risk is possible if cleanup activity is focused within in the existing EUs, and staying away from the eastern portion of the buffer area.

Cultural Resources

Current

Area is heavily disturbed and only small portions have been inventoried for archaeological resources, however, it has a low potential to contain intact archaeological resources on the surface and/or subsurface. National Register eligible property within 500 meters of the EU. Two TCPs within the viewshed of the EU.

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

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[8] Note that Sr-90 and total uranium, which have large remaining vadose zone sources, are not considered significant threats to groundwater due to their limited mobility in the Hanford subsurface and decay. See **Part V** for details.

[9] The effectiveness of the I-129 plume control in the 200-UP GWIA has not yet been established (DOE/RL-2016-09, Rev. 0) representing a data gap.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Archaeological investigations and monitoring may need to occur prior to remediation. Although the area is heavily disturbed, based on geomorphological indicators, there is a moderate potential for intact archaeological resources. Remediation disturbance may result in impacts to archaeological resources if they are present in the subsurface.

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

Considerations for Timing of the Cleanup Actions

The saturated zone beneath the CP-LS-4 area (REDOX Cribs and Ditches) is approximately 255 ft below ground surface and currently has elevated levels of total and hexavalent chromium, carbon tetrachloride (CCl_4), I-129 , nitrate, Tc-99, and tritium (H-3) based on 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). Sites within the CP-LS-4 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0); although carbon tetrachloride (CCl_4) and trichloroethene (TCE) are not reported for the CP-LS-4 EU waste sites (Table G.5.4-4). Monitoring and treatment of groundwater (using the WMA S-SX groundwater extraction system, the U Plant area P&T system, and the I-129 plume hydraulic control system) is being conducted within the 200-UP GWIA, which is described as part of the CP-GW-2 EU (Appendix D.6). Treatment efforts indicate a general downward trend in contaminant concentrations; however, some plume areas have increased and concentrations still exceed maximum contaminant levels. Thus groundwater cleanup actions continue to be warranted for this EU; actions may also be required to contain or remove vadose zone sources.

There is potential for additional contaminant release and migration through the vadose that may eventually impact additional groundwater if cleanup activities are delayed (e.g., for I-129[10]). 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 **Parts V** and **VI** and Table G.5.4-6), the ratings for the Group A and B primary contaminants are *High* for I-129 (because hydraulic control is assumed to keep the plume from getting significantly larger while treatment options are being considered), *Low* for Sr-90 and total uranium to address uncertainties, and the others remain the same as the current ratings in Table G.5.4-5.

Columbia River: As indicated in **Part V**, no radionuclides or chemicals from the 200 West Area (that includes the CP-LS-4 EU waste sites) are predicted to have concentrations exceeding screening values in this evaluation period. Thus the rating will not be modified and all ratings are *Not Discernible* (*ND*) as is the overall rating (Table G.5.4-6).

[10] Because the injection wells being used to control the I-129 plume have only operated for a short time, it is too early to assess their effectiveness in controlling hydraulic gradients in the area and the migration of the I-129 plume in the 200-UP GWIA (Section 11.12.3, DOE/RL-2016-09, Rev. 0).

PART II. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S)

CP-LS-4 EU. The *Operable Unit Cross-Walk* in Attachment 1 indicates 200-DV-1 and 200-WA-1. Other Operable Units mentioned in Attachment 1 (for WIDS codes included in the evaluation) are 200-IS-1 and 200-CR-1.

COMMON NAME(S) FOR EU

REDOX Cribs and Ditches

KEY WORDS

REDOX Cribs and Ditches, REDOX Plant, S Plant, Central Plateau, 200 Area, 200-WA-1, 200-UP, 200-UP-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 CERCLA process for the remediation and closure of the 200-WA-1 (formerly contained within the 200-UW-1 OU and which contains many of the CP-LS-4 waste sites) and 200-BC-1 OUs consists of the following major activities (represented as documents):

- Develop an RI/FS work plan and RI/FS report.
- Develop a final proposed plan.
- Develop and approve a ROD.
- Develop a final remedial design/remedial action (RD/RA) work plan.
- Develop a remedial action report.
- Develop and implement a monitoring program (if required).
- Perform a cyclic 5-year review of the remedy effectiveness, as required by CERCLA.

A work plan has been developed identifying the activities needed to complete the RI/FS and make a remedial decision for the 200-WA-1 and 200-BC-1 OU waste sites. A proposed plan summarizing the RI/FS and identifying the preferred remedial alternative will be issued for public review and comment. The Record of Decision (ROD) will be issued by EPA and signed by DOE, EPA, and Ecology.

There are also CP-LS-4 waste sites included in the 200-MG-1 (DOE/RL-2008-44, Rev. 0) and 200-MG-2 OUs (DOE/RL-2008-45, Rev. 0):

- 200-MG-1 waste sites are the 218-W-9, 200-W-54, 200-W-75, 200-W-1, 200-W-101, 200-W-2, 200-W-22, 207-SL, UPR-200-W-116, -41, -46, and -96 unplanned releases.
- 200-MG-2 waste sites are the 207-S, 216-S-12, and 216-S-18.

Action memoranda have been issued for non-time-critical actions for selected sites within the 200-MG-1 and 200-MG-2 OUs (DOE/RL-2009-37, Rev. 0; DOE/RL-2009-48, Rev. 0; DOE/RL-2009-86, Rev. 0). None of the 200-MG-1 waste sites selected for action are in the CP-LS-4 EU. The three 200-MG-2 waste sites in the CP-LS-4 EU are slated for action (DOE/RL-2009-37, Rev. 0).

There is also deep vadose zone contamination associated with CP-LS-4 waste sites (DOE/RL-92-16, Rev. 0) that will be treated as part of the 200-DV-1 OU. However, no remedial decisions have been made for the deep vadose zone and thus no regulatory documents are available (DOE/RL-2014-11, Rev. 0).

Applicable regulatory documentation

- DOE/RL-91-60, Rev. 0, *S Plant Source Aggregate Area Management Study Report*, U.S. Department of Energy, Richlands Operations Office, Richland, Washington.
- DOE/RL-92-16, Rev. 0, *200 West Groundwater Aggregate Area Management Study Report*, U.S. Department of Energy, Richlands Operations Office, Richland, Washington.
- BHI-00176, Rev. 00, *S Plant Aggregate Area Management Study Technical Baseline Report*, Bechtel Hanford, Inc., Richland, Washington.
- DOE/RL-2008-45 Rev. 0, *Engineering Evaluation/Cost Analysis for the 200-MG-2 Operable Unit Waste Sites*, U.S. Department of Energy, Richlands Operations Office, Richland, Washington.
- DOE/RL-2009-37, Rev. 0, *Action Memorandum for Non-Time-Critical Removal Action for 200-MG-2 Operable Unit*, U.S. Department of Energy, Richlands Operations Office, Richland, Washington. [Involved 207-U, 216-U-14, UPR-200-W-111, and UPR-200-W-112 waste sites]
- DOE/RL-2009-122, Rev. 0, *Remedial Investigation/Feasibility Study for the 200-UP-1 Groundwater Operable Unit*, U.S. Department of Energy, Richlands Operations Office, Richland, Washington.
- DOE/RL-2010-49, Draft B, *Remedial Investigation/Feasibility Study Work Plan 200-WA-1 and 200-BC-1 Operable Units*, U.S. Department of Energy, Richlands Operations Office, Richland, Washington.
- DOE/RL-2011-102, Draft A, *Remedial Investigation/Feasibility Study and RCRA Facility Investigation/Corrective Measures Study Work Plan for the 200-DV-1 Operable Unit*, U.S. Department of Energy, Richlands Operations Office, Richland, Washington.
- DOE/RL-2011-104, Rev. 0, *Characterization Sampling and Analysis Plan for the 200-DV-1 Operable Unit*, U.S. Department of Energy, Richlands Operations Office, Richland, Washington.

As described in Part I, the following two reports are included as analogous information:

- DOE/RL-2003-23, Rev. 0, *Focused Feasibility Study for the 200-UW-1 Operable Unit*, U.S. Department of Energy, Richlands Operations Office, Richland, Washington.

- DOE/RL-2003-24, Rev. 0, *Proposed Plan for the 200-UW-1 Operable Unit*, U.S. Department of Energy, Richlands Operations Office, Richland, Washington.

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-085-00; Lead Agency: Dual. *Complete response actions for the canyon facilities/associated past practice waste sites, other Tier 1 Central Plateau facilities not covered by existing milestones, and Tier 2 Central Plateau facilities*. Due Date: TBD.
- Milestone M-085-90; Lead Agency: EPA. *Submit Remedial Investigation/Feasibility Study Work Plan for 200-CR-1 to EPA*. Due Date: 09/30/2021.
- Milestone M-015-91B; Lead Regulatory Agency: EPA. *Submit Feasibility Study Report(s) and Proposed Plan(s) for the 200-BC-1/200-WA-1 operable units (200 West Inner Area) to EPA.* Due Date: 07/31/2021.
- Milestone M-015-92C; 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-IS-1 OU to Ecology.* Due Date: 03/31/2023.
- Milestone M-015-110B; Lead Regulatory Agency: Ecology. *Submit Corrective Measures Study & Feasibility Study Report and Proposed Plan/Proposed Corrective Action Decision for the 200-DV-1 OU to Ecology.* Due Date: 09/30/2023
- Milestone M-015-112; Lead Regulatory Agency: Ecology. *Submit Draft B, 200-IS-1 Operable Unit Pipeline System Waste Sites RFI/CMS/RI/FS Work Plan to Ecology, including a schedule of completion dates for major tasks and deliverables.* Due Date: 02/28/2014.
- Milestone M-016-193; Lead Agency: EPA. *Complete the remedial design investigation of the southeast chromium plume, including the installation of new wells and evaluation of groundwater monitoring data and install monitoring wells needed for remedy performance monitoring as defined in the 200-UP-1 RD/RA WP*. Due Date: 09/30/2017.

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 West 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 West 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-4 waste sites primarily consist of *liquid waste disposal* sites often associated with 202-S (or REDOX) Facility operations (see CP-DD-4 EU in Appendix F.9). The CP-LS-4 liquid waste disposal sites include legacy waste sites (e.g., cribs, trenches, retention basins, and unplanned releases (UPRs)) where liquid wastes was discharged, infrastructure buildings, pipelines and associated equipment, and storage tanks.

High-Level Waste Tanks and Ancillary Equipment

Note that the CP-LS-4 EU waste sites include ten pipelines and associated equipment waste sites that are part of the Single Shell Tank (SST) System (DOE/RL-2010-114, Draft A, p. A-25 – A-28) that were assumed treated in the Tank Waste and Farms EU (Appendix E.1 through Appendix E.11). Other CP-LS-4 pipelines and associated equipment may have been addressed in the TC&WM EIS and thus Tank Waste and Farms EU (Appendix E.1 through Appendix E.11); however, the remaining pipeline and related wastes sites will not be evaluated further due to a lack of inventory information.

Groundwater Plumes

The saturated zone beneath the CP-LS-4 (REDOX Cribs and Ditches) area is approximately 255 ft below ground surface and currently has elevated levels of total and hexavalent chromium, carbon tetrachloride (CCl_4), I-129 , nitrate, Tc-99, and tritium (H-3) and based on the 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html. Sites within the CP-LS-4 EU are suspected of being able to contribute mobile contaminants (e.g., chromium and Tc-99) to the saturated zone (DOE/RL-92-16, Rev. 0); however, carbon tetrachloride is not reported for the CP-LS-4 EU waste sites (Table G.5.4-4). Monitoring and treatment of groundwater (using the WMA S-SX groundwater extraction system, the U Plant area P&T system, and the I-129 plume hydraulic control system) is being conducted within the 200-UP GWIA, which is described as part of the CP-GW-2 EU (Appendix D.6).

Operating Facilities

Not applicable

D&D of Inactive Facilities

Not applicable

LOCATION AND LAYOUT MAPS

The 200-WA-1 OU (which contains many of the waste sites comprising the CP-LS-4 EU) is located in the Hanford Central Plateau Inner Area (shown in Figure G.5.4-1 and Figure G.5.4-2). The REDOX (S Plant) Cribs and Ditches (Figure G.5.4-3) are located in the southern part of 200 West Area.

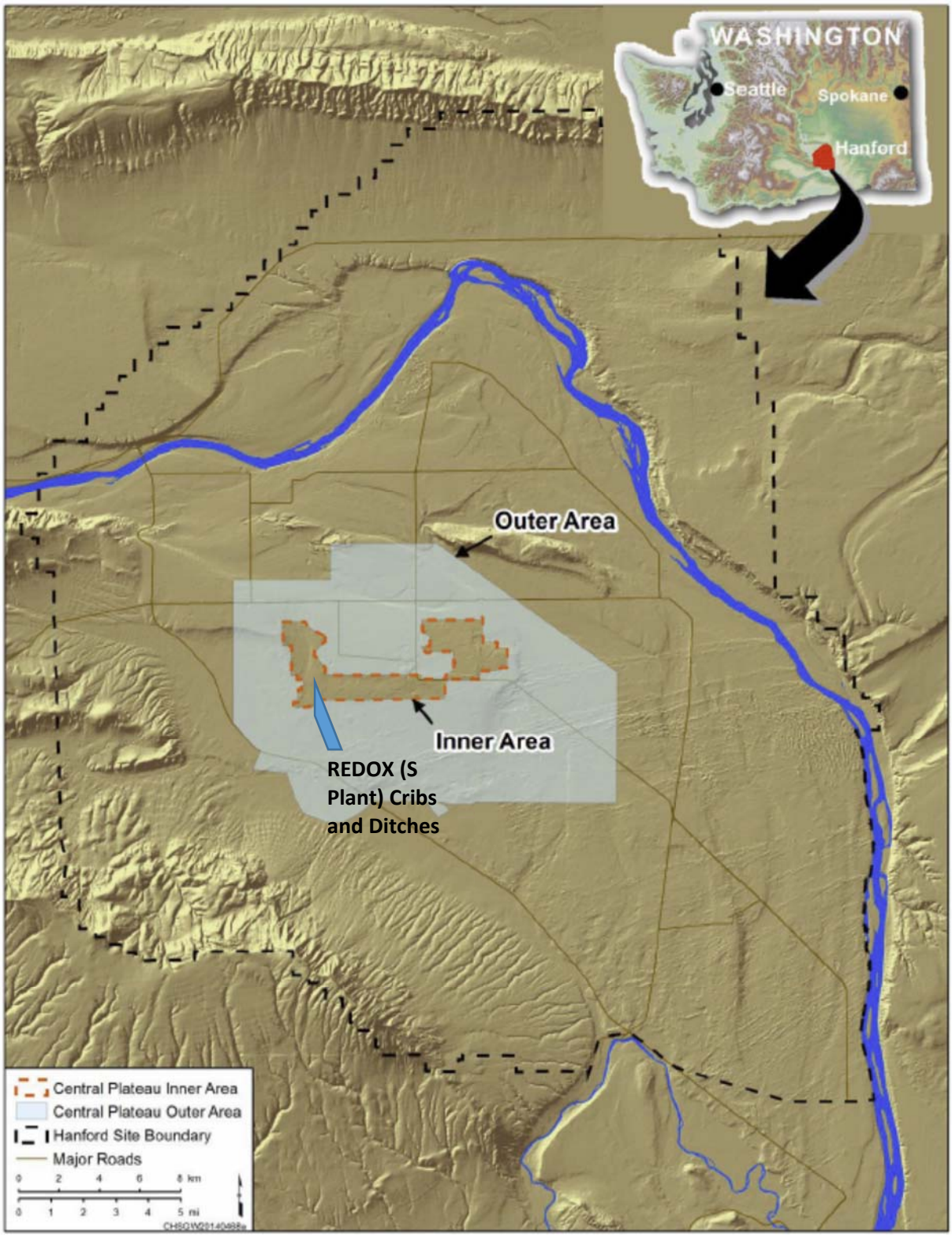

Figure G.5.4-1. The Hanford Site showing the Central Plateau Inner and Outer Areas (reproduced from (DOE/RL-2010-49, Draft B, p. 1-2))

Figure G.5.4-2. Operable Units in the Hanford Central Plateau Inner Area (reproduced from (DOE/RL-2010-49, Draft B, p. 1-10))

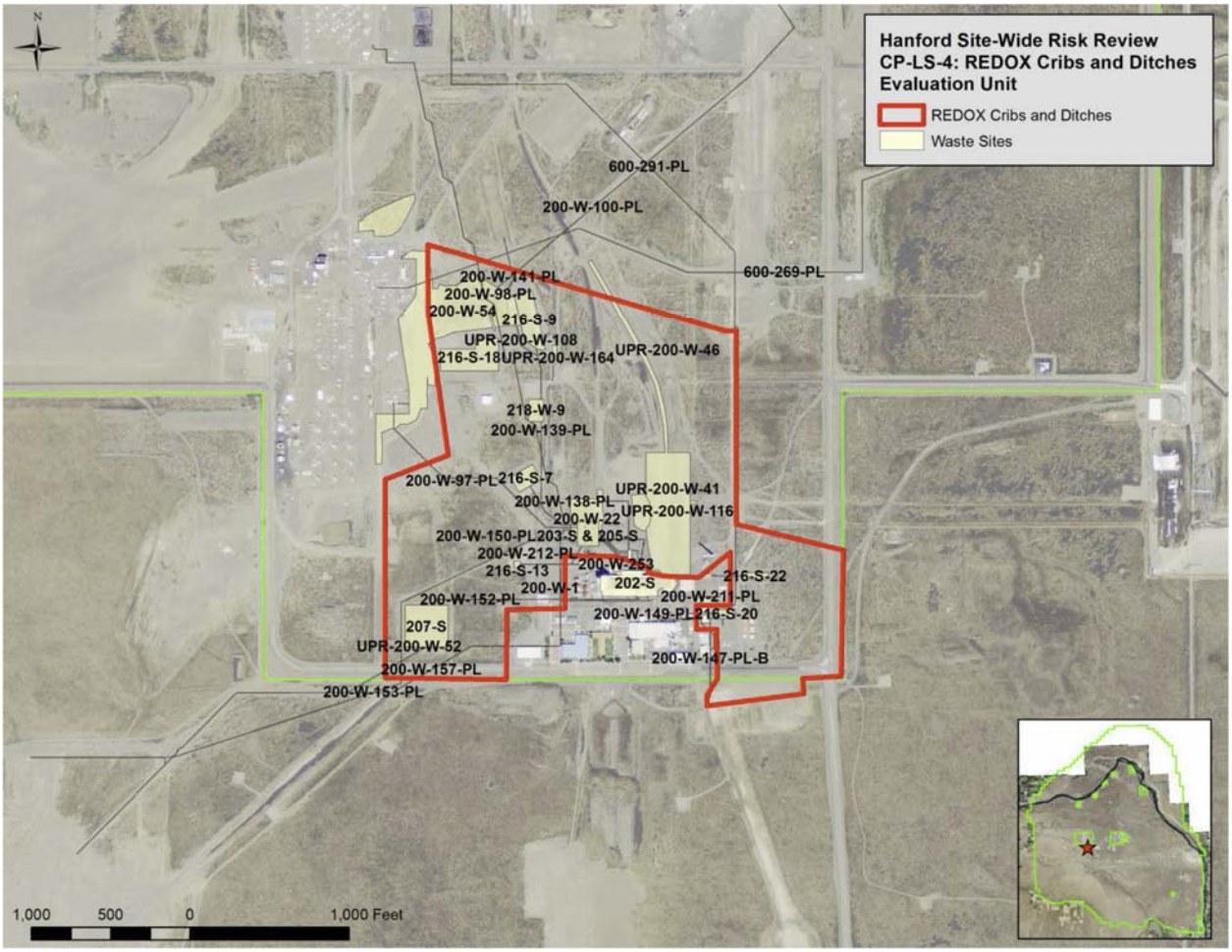

Figure G.5.4-3. CP-LS-4 (REDOX Cribs and Ditches) Site Location Map and WIDS Locations

PART IV. UNIT DESCRIPTION AND HISTORY

EU FORMER/CURRENT USE(S)

The CP-LS-4 waste sites primarily consist of *liquid waste disposal* sites associated with 202-S Facility operations (see the CP-DD-4 EU described in Appendix F.9). The 202-S (REDOX or S Plant) canyon facility was operated from 1950 to 1967 to recover both plutonium and uranium from fission products as a replacement for the initial bismuth phosphate plutonium separations process (EPA 2012, pp. 26-27).

LEGACY SOURCE SITES

The 202-S process generated significant amounts of liquid waste that were discharged to various legacy waste sites (i.e., waste ponds, cribs, ditches, French drains, and trenches) (EPA 2012, p. 27). Ponds and ditches received the highest volumes of contact cooling water and steam condensates that were typically non-radioactive. Condensed process vapors and cell drainage (which were typically higher in radionuclide and chemical contaminants) were sent to cribs. French drains received the relatively very low-volume radioactive waste streams. Nonradioactive and lower volume chemical sewer wastes were typically discharged to ponds and ditches and septic systems used tile fields for nonradioactive wastes.

As indicated in Table G.5.4-2 through Table G.5.4-4, the REDOX Cribs and Ditches EU waste sites *with reported inventory data* consists of five cribs, a trench, and five unplanned releases (UPRs). These waste sites are considered representative of the major inventory sources and thus risks and potential impacts from this EU.

GROUNDWATER PLUMES

The saturated zone beneath the CP-LS-4 area (REDOX Cribs and Ditches) has elevated levels of total and hexavalent chromium, carbon tetrachloride (CCl_4), I-129, nitrate, Tc-99, and tritium (H-3) based on 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). Associated plumes are described as part of the 200-UP GWIA described in CP-GW-2 EU (Appendix D.6). Waste sites within the CP-LS-4 EU, including the 216-S-7, 216-S-9, 216-S-13, 216-S-20, and 216-S-26 Cribs are suspected of being able to contribute mobile contaminants to the saturated zone (i.e., representing migration of contaminants from the waste site to the uppermost aquifer) (DOE/RL-92-16, Rev. 0, Table 2-2). However, the inventory information in Table G.5.4-4 indicates that carbon tetrachloride (CCl_4) was not reported for the CP-LS-4 waste sites, and CP-LS-4 waste sites have not been linked to the 200-UP Tc-99 or total uranium plumes (DOE/RL-2016-09, Rev. 0) (where the focus is on Group A and B contaminants). Monitoring and treatment of groundwater is being conducted within the 200-UP GWIA using the WMA S-SX groundwater extraction system, U Plant area P&T system, and I-129 plume hydraulic control system.

D&D OF INACTIVE FACILITIES

Not applicable

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification

All of the REDOX Cribs and Ditches EU is classified as resource level 2 or below (Figure J.16 and Table J.14 in Appendix J). Areas of level 2 resources are contiguous to the north with a patchwork of similar habitat. To south and east the EU is separated from higher quality habitat (resource levels 3 and 4) by large roads and the 200 West Area fence (Figure J.16 in Appendix J).

The amount and proximity of biological resources surrounding the REDOX Cribs and Ditches EU were examined within the adjacent landscape buffer area, which extends 3768 ft (1148 m) from the geometric center of the EU (Figure J.16 in Appendix J). The buffer area north and northwest of the EU encompasses large industrial areas and successional vegetation broken into smaller patches by numerous waste sites and roads. A little over 60% of the combined EU and buffer area is classified as resource level 2 or below (Table J.14 in Appendix J). Additional details about biological resources can be found in sections of this report for the U and S Pond EU and U Plant Cribs and Trenches EU which are encompassed by the adjacent landscape buffer area.

On the west, south and east portions of the EU, the buffer area is dominated by level 3 resources (approximately 31% of the combined EU and buffer area), with smaller amounts of level 4 resources on the east and level 5 resources on the south (Figure J.16 and Table J.14 in Appendix J). These higher quality habitats are contiguous with similar habitats extending across the Hanford Site.

Field Survey

The REDOX Cribs and Ditches EU consists of patches of habitat disturbed years ago between the REDOX industrial area to the south and the S-SX tank farms to the northwest (Figure J.16 in Appendix J). A little over half of the EU contains successional vegetation with 10% cover by gray rabbitbrush (*Ericameria nauseosa*) and the understory dominated by 20% each of the native Sandberg's bluegrass (*Poa secunda*) and introduced cheatgrass (*Bromus tectorum*) along with variable amounts of native and introduced forbs (Table J.13 in Appendix J). These patches of successional vegetation are cut by more disturbed areas adjacent to small roads or the old railroad and are predominantly Russian thistle (*Salsola tragus*) with some cheatgrass. Areas containing buildings, larger roads, and waste sites are concentrated in the south, central and northwest parts of the EU and are kept free of vegetation (Figure J.16 in Appendix J). Field data records at the end of this section provide lists of plants and animals observed during the May 2015 survey.

CULTURAL RESOURCES SETTING

A very small portion of the CP-LS-4, REDOX Cribs and Ditches EU has been inventoried for archaeological resources. It is unknown if an NHPA Section 106 review has been completed specifically for the remediation of the CP-LS-4, REDOX Cribs and Ditches EU. Much of the land within the EU is extensively disturbed from 200 West area operations, suggesting a low potential for intact archaeological deposits to exist within the surface and subsurface components of the EU.

The National Register-eligible Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required is the only cultural resource that has been recorded within the 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. No additional archaeological sites and/or TCPs are known to be located within the boundary of the EU.

There are 4 recorded archaeological resources located within 500 meters of the EU; two associated with the Native American Precontact and Ethnographic Landscape (1 site & 1 isolate), one with the Pre-Hanford Early Settlers/Farming Landscape (1 isolate) and one multi-component archaeological site with elements from both landscapes represented. This multi-component site has been determined not eligible for inclusion in the National Register of Historic Places. The remaining archaeological resources (1 site & 2 isolates) have not been formally evaluated for listing in the National Register of Historic Places, however, it should be noted that isolates are typically considered not eligible. In addition, there are 10 National Register-eligible Manhattan Project and Cold War Era buildings located within 500 meters of the EU (1 recommended for individual documentation and 9 with no additional documentation required). Mitigation for contributing buildings/structures has been completed as per the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE-RL 1998) and building demolition is ongoing.

Historic maps and aerial imagery indicate that the area was relatively undeveloped aside from one historic trail/road in the general vicinity of the EU. This suggests a low potential for the presence of archaeological resources associated with the Pre-Hanford Early Settlers/Farming Landscape to be present within the EU. Geomorphology indicates a moderate potential for the presence of archaeological resources associated with the Native American Precontact and Ethnographic Landscape to be present within the EU boundary. Recent aerial imagery of the area indicate extensive ground disturbance across large portion of the EU; however, pockets of undisturbed soil do appear to exist in

several areas, suggesting a moderate potential for intact archaeological resources to exist. Resources, if present, would likely be limited to these areas of intact or undisturbed soils.

Because of the potential for intact archaeological deposits within portions of the CP-LS-4, REDOX Cribs and Ditches EU, it may be appropriate to conduct surface and subsurface archaeological investigations in these areas prior to initiating any remediation activities. Indirect effects are always possible when TCPs are known to be located in the general vicinity. Consultation with Hanford Tribes (Confederated Bands of the Yakama Nation, Wanapum, Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce) and other groups who may have an interest in the areas (e.g. East Benton Historical Society, Prosser Cemetery Association, Franklin County Historical Society, the Reach, and the B-Reactor Museum Association) may need to occur. Consultation with Hanford Tribes may also be necessary to provide input on indirect effects to both recorded and potential unrecorded TCPs in the area and other cultural resource issues of concern.

PART V. WASTE AND CONTAMINATION INVENTORY

As indicated in the Attachment 1, there are 11 waste sites in the CP-LS-4 EU that have reported inventory information in the SIM, Rev. 1 (Corbin, et al., 2005) (i.e., Table G.5.4-2 through Table G.5.4-4) and are considered representative of the major inventory sources and risks from this EU. These waste sites (with reported inventories) consist of five cribs, one trench, and five UPRs (DOE/RL-92-16, Rev. 0) and selected sites include:

- The 216-S-13 Crib operated from 1952 to 1972 and received 5000 m^3 of liquid waste (discharged to soil) from the 203-S, 204-S, and 276-S Facilities. Waste is low-salt and neutral/basic.
- The 216-S-20 Crib operated from 1952 to 1973 and received 135,000 m^3 of miscellaneous waste from laboratory hoods and decontamination sinks in the 222-S Building and via the 207-SL Retention Basin and 219-S Retention Basin and 300 Area laboratory waste via the manhole as well as miscellaneous waste from laboratory hoods and decontamination sinks in 222-S. This included discharges to soil.
- The 216-S-22 Crib operated from 1957 to 1967 and received 98 m^3 of liquid waste (discharged to soil) from the acid recovery facility in 293-S.
- The 216-S-7 Crib operated from 1956 to 1965 and received 390,000 m^3 of cell drainage (liquid waste discharged to soil) from the D-1 Receiver Tank, process condensate (liquid waste discharged to soil) from the D-2 Receiver Tank, and condensate from the H-6 Condenser.
- The 216-S-9 Crib operated from 1965 to 1969 and received 50,300 m^3 of process condensate (liquid waste discharged to soil) from the D-2 Receiver Tank in the 202-S Building. Waste is radioactive and acidic.
- The 216-S-12 Trench operated from 1954 to 1975 and received 76 m^3 of flush waste (discharged to soil) containing ammonium nitrate from the 291-S Stack.

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The CP-LS-4 EU waste sites with reported inventories are legacy sites and the inventory information is provided in Table G.5.4-2 through Table G.5.4-4.

Vadose Zone Contamination

Because the CP-LS-4 EU waste sites are primarily legacy sites that represent soil and other vadose zone contamination (including discharges to the soil), the inventory information is provided in Table G.5.4-2 through Table G.5.4-4. The inventories (Table G.5.4-2 through Table G.5.4-4) represent the reported contamination originally discharged (without decay correction[11]) to the vadose zone from the CP-LS-4 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 (with corresponding groundwater plumes) due to their mobility and persistence and potential threats to groundwater (a protected resource). To summarize (where the current 200-UP GWIAs plumes for CCl_4, total uranium, Tc-99 are not associated with the REDOX Cribs and Ditches EU waste sites as described below)[12]:

- *Chromium* – There are reported inventories for chromium in the CP-LS-4 waste sites (Table G.5.4-4) and current total and hexavalent chromium plumes in the 200-UP GWIAs in the vicinity. The vadose zone inventory is dominated by the 216-S-20 Crib.
- *Carbon tetrachloride (CCl_4)* – There are no reported vadose zone inventories for this contaminant in the CP-LS-4 waste sites (Table G.5.4-4).
- *I-129* – There are reported inventories for I-129 (Table G.5.4-2) as well as small and one large plume in the general vicinity. The vadose zone inventory is dominated by cribs (including 216-S-7, 216-S-9, and 216-S-20).
- *Tc-99* – There are reported inventories for Tc-99 (Table G.5.4-3) as well as a series of plumes in the vicinity. The vadose zone inventory is dominated by two cribs (216-S-7 and 216-S-13).
- *Uranium* – There is a plume to the east of the 241-U tank farm and reported vadose zone inventories for uranium (Table G.5.4-3 and Table G.5.4-4). The vadose zone inventory is dominated by cribs (216-S-7, 216-S-20, and 216-S-9). However, the plume east of the 241-U Tank Farm is not associated with the CP-LS-4 EU aster sites. Furthermore, uranium would not be expected to significantly move through the environment in the next 150 years (Section 2.5 in Appendix E.3). Thus uranium from the CP-LS-4 EU waste sites is not considered a significant threat to the Hanford groundwater.
- *Sr-90 and other Group A&B Primary Contaminants (PCs)* – There are no current plumes for Sr-90 or other Group A&B PCs not mentioned above (i.e., C-14, Cl-36, TCE, or CN) in the vicinity of CP-LS-4; however, there are reported vadose zone inventories for Sr-90 (Table G.5.4-3) and C-14 (Table G.5.4-2) but none for Cl-36 (Table G.5.4-2) or CN and TCE (Table G.5.4-4). The reported Sr-90 vadose zone inventory is dominated by three cribs (216-S-7, 216-S-9, and 216-S-20). The

[11] 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).

[12] 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.

reported C-14 inventory is dominated by the 216-S-20 Crib. The C-14 inventory may have already migrated from the 216-S-20 Crib (like for chromium), which may indicate why it has not been observed in groundwater in 2015 above the drinking water standard. The majority of the Sr-90 originally discharged into the vadose zone (via cribs and UPRs) would have had to travel through much of the vadose zone to impact groundwater. Using an analysis similar to that in Section 2.5 (Appendix E.2) for Sr-90 in the WMA T (200-West)[13], a Sr-90 plume is not expected in the next 150 years due to retardation in the vadose zone or afterwards due to radioactive decay (+99.9% reduction in Sr-90 inventory). Thus Sr-90 (and the remaining Group A and B PCs for the reasons mentioned above) are not considered significant threats to the Hanford groundwater during the first 150 years.

Using the process outlined in Chapter 6 of the Methodology Report (CRESP 2015a) for the 2013 groundwater results as revised for the 2015 Groundwater Monitoring Data (DOE/RL-2016-09, Rev. 0) described in Appendix D.1, the remaining vadose zone inventories in Table G.5.4-5 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.5.4-5. Note that the vadose zone (VZ) ratings range from *High* for I-129 to *Medium* to *Low* for the other Group A and B PCs with reported inventories with the exceptions of Sr-90 and total uranium. Because there is no current Sr-90 or total uranium plume (associated with the CP-LS-4 EU waste sites) nor one expected for the next 150 years as described above, the current rating for Sr-90 and total uranium is *Not Discernible* (*ND*). The overall current rating is defined as the highest over all the ratings and thus *High*.

Groundwater Plumes

Sites within the CP-LS-4 EU are suspected of contributing contamination to the saturated zone (DOE/RL-92-16, Rev. 0). Monitoring and treatment of groundwater (via the WMA S-SX groundwater extraction system, U Plant area P&T system, and I-129 plume hydraulic control system) is being conducted within the 200-UP GWIA, which is described as part of the CP-GW-2 EU (Appendix D.6). The saturated zone inventories related to the CP-LS-4 EU are provided in Table G.5.4-5; the process for deriving these inventories is described in CRESP Methodology Report (CRESP 2015a) originally for the 2013 groundwater plume information as revised for the 2015 Groundwater Monitoring Data (DOE/RL-2016-09, Rev. 0) described in Appendix D.1.

In general the 2015 groundwater plumes are evaluated in separate EUs (see Appendix D.1 through Appendix D.6); however, portions of the groundwater plumes can be associated with the REDOX Cribs and Ditches EU based on source information in the Groundwater Monitoring Report (DOE/RL-2016-09, Rev. 0), and these partial plume areas will be evaluated to provide a better idea of the saturated zone versus remaining vadose zone threats to groundwater. The estimated inventory for the saturated zone contamination is provided in Table G.5.4-5 where Photoshop was used to estimate the fraction of plumes considered associated with the REDOX Cribs and Ditches EU (Attachment 6-4 in the Methodology Report (CRESP 2015a) as revised for the 2015 Groundwater Monitoring Data (DOE/RL-2016-09, Rev. 0) described in Appendix D.1). This information is also used to estimate contaminant amounts treated and remaining in the vadose zone. For the groundwater plumes described in the 200-UP GWIA, apportionment of plumes and ratings to the REDOX Cribs and Ditches EU would be as follows (DOE/RL-2016-09, Rev. 0):

[13] The analysis in Section 2.5 of Appendix E.2 for the WMA T is referenced instead of that for the more proximate WMA S (or S Barrier in Appendix E.5) because the WMA T analysis is more detailed and is essentially repeated for the WMA S (or S Barrier) Sr-90 evaluation.

- *Chromium* – There are reported inventories (Table G.5.4-4) and plumes in the 200-UP GWIA: two chromium plumes near WMA S-SX and another larger plume in the 600 Area east and southeast of the 200 West Area (i.e., the southeast chromium plume). These plumes are treated as either total chromium or hexavalent chromium, where the maximum impact for either is used for the purpose of this Review. The southeast plume originated primarily from effluent disposed to the 216-S-20 Crib during the 1950s, although discharges to the 216-S-10 Pond and Ditch and 216-S-19 Pond south of the 200 West Area may also have contributed[14] (DOE/RL-2016-09, Rev. 0, Sections 11.8.1&2; DOE/RL-2009-122, Rev. 0, p. 4-46). Because the 216-S-20 waste site is part of CP-LS-4, the portion of the 200-UP plume area is 99% (Appendix D.1); this percentage is applied to both total chromium and hexavalent chromium.
- *Carbon tetrachloride (CCl_4) and trichloroethene (TCE)* – The CCl_4 and TCE plumes "straddle" the 200-UP and 200-ZP GWIAs, and these plumes are "managed" in the 200-ZP GWIA (Appendix G.6). The source of the TCE plume is unknown and the CCl_4 plume originated from PFP waste disposal sites (CP-LS-2) in the 200-ZP GWIA although some of the ditches from PFP extended to U Pond (CP-LS-5), which may also have been a carbon tetrachloride source. Furthermore, there are no inventories for CCl_4 or TCE reported for the CP-LS-4 EUs (Table G.5.4-4) and thus no portions of these plumes are associated with the CP-LS-4 EU.
- *I-129* – There are plumes in the vicinity of the CP-LS-4 EU waste sites) and reported vadose zone inventories (Table G.5.4-2). Plumes in the 200-UP GWIA originated from U Plant (216-U-1/2 Cribs in CP-LS-3) and REDOX Plant (Cribs and Ditches) waste sites in the southern portion of the 200 West Area, where the latter were the primary sources. East of the 200 West Area, these plumes merge. Because the REDOX Cribs and Ditches waste sites are part of CP-LS-4 and are the major sources of the I-129 plume in the 200-UP GWIA, the portion of the 200-UP plume area is 99% (Appendix D.1).
- *Tc-99* – There are multiple plumes in the vicinity of the CP-LS-4 EU waste sites and reported vadose zone inventories (Table G.5.4-3). Within 200-UP, the plume near the SX Tank Farm is attributed primarily to a large leak from tank SX-115 in 1965. Between 1966 and 1970, a large volume of waste was released from tank S-104 in an overfill event resulting in Tc-99 reaching the groundwater. The plume near U Plant originated from the 216-U-1&2 Cribs, which were active in the 1950s and 1960s. The groundwater contamination at WMA U is believed to result from multiple sources (primarily tank leaks and overflows) in this WMA. Because no sources mentioned are part of CP-LS-4, no portion of the 200-UP plume area is assigned (Appendix D.1).
- *Uranium* -- There is a plume in the 200-UP GWIA to the east of the 241-U tank farm (and reported vadose zone inventories in Table G.5.4-4 and Table G.5.4-4). The 216-U-1&2 Cribs were a source for the 200-UP plume, and uranium may also be leaching from the vadose zone beneath U Pond; however, neither of these sources are part of CP-LS-4 and thus no portion of the 200-UP plume area assigned (Appendix D.1).
- *Group C&D Contaminants* – There are plumes and reported inventories for nitrates and tritium; however, these are not the focus of this discussion.

The groundwater plumes (i.e., chromium and I-129) associated with the Group A and B PCs from the REDOX Cribs and Ditches EU are described in detail in the Appendix G.6 for the CP-GW-2 EU (200-UP

[14] The 216-S-10 Pond and Ditch are part of CP-LS-5 and 216-S-19 Pond (CP-LS-5) is closed out and not considered in this Review.

GWIA). Note that nitrate, chromium (hexavalent), tritium (H-3), and I-129 are risk drivers (*Medium* ratings) for the 200-UP GWIA, where CP-LS-4 waste sites are primary contributors to both the chromium and I-129 plumes (Appendix D.1).

Impact of Recharge Rate and Radioactive Decay on Groundwater Ratings

As described in Appendix E.3 for the CP-TF-2 (S-SX Tank and Waste Farms) EU, the TC&WM EIS screening groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that there is an impact of emplacing the engineered surface barrier (and resulting reduction of infiltrating water) on the predicted peak groundwater concentrations at the S Barrier[15]; however, not an overwhelming impact. This result may be due to the large amounts of contaminants already in the vadose zone and groundwater and not due to an ineffective surface barrier. To summarize, the Group A and B PC results for Central Plateau sources (including those in addition to the REDOX Cribs and Ditches EU) are (Appendix O, DOE/EIS-0391 2012):

- Tc-99 peak concentration is 22,800 pCi/L (CY 3072) for the No Action Alternative versus 1,510 pCi/L (CY 2051) for the Landfill Scenarios where the threshold value is 900 pCi/L.
- I-129 peak concentration is 29.1 pCi/L (CY 3136) for the No Action Alternative versus 2.8 pCi/L (CY 2050) for the Landfill Scenarios versus a threshold value of 1 pCi/L.
- Chromium peak concentration is 541 µg/L (CY 3242) for the No Action Alternative versus 156 µg/L (CY 2050) for the Landfill Scenarios versus a threshold value of 100 µg/L (total) or 48 µg/L (hexavalent).
- Uranium peak concentration is 41 µg/L (CY 11,778) for the No Action Alternative versus 0 µg/L (CY 11,850) for the Landfill Scenarios versus a threshold value of 100 µg/L (total) or 48 µg/L (hexavalent).
- No values are reported at the S Barrier for Sr-90 or carbon tetrachloride for either scenario, which indicates that the appropriate sources were not considered in the analysis (e.g., for carbon tetrachloride), or peak fluxes that were less than 1×10^{-8} Ci/yr for radioactive contaminants or 1×10^{-8} g/yr for chemicals (Appendix O, DOE/EIS-0391 2012, p. O-2).

Despite the large impacts on the predicted peak concentrations, peak values at the S Barrier exceed threshold values within 50 years and thus the saturated and vadose ratings will not be altered even though predicted impacts due to barrier emplacement may be large (however, there are already large amounts of contaminants in the deep vadose zone and groundwater). Thus the ratings for the Near-term Post-Cleanup period would be *Not Discernible* (*ND*) for CCl_4 and TCE, *Low* for Tc-99, Sr-90, and total uranium (where the *Low* ratings for the last two account for uncertainty), *Medium* for total and hexavalent chromium, and *High* for I-129[16]. As indicated in **Part II**, the injection wells used to control the 200-UP I-129 plume have only operated for a short time, and it is too early to assess their effectiveness

[15] This barrier represents the edge of the infiltration barrier to be constructed over disposal areas that are within 100 meters [110 yards] of facility fence lines (DOE/EIS-0391 2012). The S Barrier is the closest to the REDOX Cribs and Ditches EU. Despite including sources other than those for the REDOX Cribs and Ditches EU, the analysis in the TC&WM EIS was considered a reasonable source of information to assess the impact of the engineered surface barrier emplacement.

[16] 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 REDOX Cribs and Trenches EU.

(Section 11.12.3, DOE/RL-2016-09, Rev. 0); however, it is assumed that the 200-UP I-129 plume would not grow significantly larger until remedial actions (that are currently being investigated) commence. Thus the overall rating for these periods would also be *High*.

Columbia River

Threats to the Columbia River similar to those presented by the REDOX Cribs and Ditches EU were evaluated in Section 3.5 of Appendix E.3 for CP-TF-2 (S-SX Single-shell Tank and Waste Farm in 200 West) where all risks and potential impacts were rated *Not Discernible* (*ND*).

Table G.5.4-2. Inventory of Primary Contaminants [a]

WIDS	Description	Decay Date	Ref[b, c]	Am-241 (Ci)	C-14 (Ci)	Cl-36 (Ci)	Co-60 (Ci)	Cs-137 (Ci)	Eu-152 (Ci)	Eu-154 (Ci)	H-3 (Ci)	I-129 (Ci)
All	Sum[d]			74	2.7	NR	1.3	1300	0.025	3.1	9600	0.39
216-S-13	Cribs	2001	SIM	0.94	0.00019	NR	0.0019	140	0.00041	0.027	43	NR
216-S-20	Cribs	2001	SIM	56	2.7	NR	1.2	89	0.0015	0.11	0.15	0.0081
216-S-22	Cribs	2001	SIM	9.8E-09	0.000000002	NR	9.8E-09	0.0000017	5.4E-10	0.000000036	2.2	0.0000064
216-S-7	Cribs	2001	SIM	17	NR	NR	0.091	980	0.022	2.8	8400	0.35
216-S-9	Cribs	2001	SIM	0.033	NR	NR	0.011	60	0.001	0.13	1200	0.029
216-S-12	Trenches	2001	SIM	0.035	0.00000016	NR	0.00003	1.2	0.000032	0.0041	0.11	0.0004
200-W-22	UPR	2001	SIM	NR	NR	NR	NR	NR	NR	NR	0.0009	NR
UPR-200-W-32	UPR	2001	SIM	NR	NR	NR	NR	NR	NR	NR	0.0077	NR
UPR-200-W-82	UPR	2001	SIM	NR	NR	NR	1.3E-09	6.9E-10	NR	NR	0.045	NR
UPR-200-W-95	UPR	2001	SIM	0.00027	0.00006	NR	0.000081	3	0.000012	0.0008	0.0011	0.0000017
UPR-200-W-96	UPR	2001	SIM	0.000000012	2.5E-09	NR	0.000000012	0.0002	6.6E-10	0.000000044	0.00000015	1E-10

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

Table G.5.4-3. Inventory of Primary Contaminants (cont)[a]

WIDS	Description	Decay Date	Ref[b, c]	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)
All	Sum[d]			0.00022	0.021	220	1700	3.1	3.4
216-S-13	Cribs	2001	SIM	0.000063	0.0059	2	0.42	0.44	0.0021
216-S-20	Cribs	2001	SIM	0.00015	0.015	57	75	0.026	0.57
216-S-22	Cribs	2001	SIM	1.6E-09	0.00000015	0.000000017	0.0000033	0.000000054	3.3E-11
216-S-7	Cribs	2001	SIM	NR	NR	150	1500	2.5	2.6
216-S-9	Cribs	2001	SIM	NR	NR	8.9	120	0.1	0.23
216-S-12	Trenches	2001	SIM	0.00000012	0.000012	0.2	1.4	0.0038	0.0022
200-W-22	UPR	2001	SIM	NR	NR	NR	NR	0.0000021	0.000019
UPR-200-W-32	UPR	2001	SIM	NR	NR	NR	NR	0.000016	0.00019
UPR-200-W-82	UPR	2001	SIM	NR	NR	0.0000026	2.8E-10	NR	3.9E-10
UPR-200-W-95	UPR	2001	SIM	0.0000071	0.00064	0.00038	0.098	0.0011	0.00000083
UPR-200-W-96	UPR	2001	SIM	1.9E-09	0.00000018	0.00000002	0.000004	0.000000065	4E-11

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

Table G.5.4-4. Inventory of Primary Contaminants (cont)[a]

WIDS	Description	Ref[b, c]	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)[d]	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
All	Sum		NR	NR	5900	NR	2.6	660000	63	NR	NR	4300
216-S-13	Cribs	SIM	NR	NR	12	NR	0.0056	35000	NR	NR	NR	3
216-S-20	Cribs	SIM	NR	NR	5900	NR	2.6	150000	63	NR	NR	560
216-S-22	Cribs	SIM	NR	NR	NR	NR	NR	64	NR	NR	NR	0.000000045
216-S-7	Cribs	SIM	NR	NR	NR	NR	NR	430000	NR	NR	NR	3400
216-S-9	Cribs	SIM	NR	NR	NR	NR	NR	42000	NR	NR	NR	280
216-S-12	Trenches	SIM	NR	NR	0.0064	NR	0.0000003	310	0.000049	NR	NR	3.2
200-W-22	UPR	SIM	NR	NR	0.0000035	NR	0.00000012	0.49	NR	NR	NR	0.028
UPR-200-W-32	UPR	SIM	NR	NR	0.000036	NR	0.0000012	5	NR	NR	NR	0.28
UPR-200-W-82	UPR	SIM	NR	NR	0.00078	NR	0.000031	0.0008	0.0000082	NR	NR	0.00000046
UPR-200-W-95	UPR	SIM	NR	NR	0.11	NR	0.000013	5.5	NR	NR	NR	0.0012
UPR-200-W-96	UPR	SIM	NR	NR	0.000098	NR	4.5E-09	0.0018	0.00000075	NR	NR	0.000000055

a. NR = Not reported for indicated EU
b. EIS-S = DOE/EIS-0391 2012
c. SIM = RPP-26744, Rev. 0 (Corbin, et al. 2005)
d. Hexavalent chromium is typically not reported apart from the total chromium. All chromium is considered hexavalent or total chromium depending on which has the largest risk.

Table G.5.4-5. Summary of the Evaluation of Threats to Groundwater as a Protected Resource from Saturated Zone (SZ) and Remaining Vadose Zone (VZ) Contamination associated with the Evaluation Unit

PC	Group	WQS	Porosity[a]	K_d (mL/g)[a]	ρ (kg/L)[a]	VZ Source M^{Source}	SZ Total M^{SZ}	Treated[c] M^{Treat}	VZ Remaining M^{Tot}	VZ GTM (Mm^3)	VZ Rating[d]
C-14	A	2000 pCi/L	0.23	0	1.84	2.69E+00 Ci	---	---	2.69E+00 Ci	1.34E+00	*Low*
I-129	A	1 pCi/L	0.23	0.2	1.84	3.89E-01 Ci	7.39E-02 Ci	---	3.16E-01 Ci	1.21E+02	*High*
Sr-90	B	8 pCi/L	0.23	22	1.84	1.67E+03 Ci	---	---	1.67E+03 Ci	1.18E+03	*ND*[(e)]
Tc-99	A	900 pCi/L	0.23	0	1.84	3.05E+00 Ci	---	---	3.05E+00 Ci	3.39E+00	*Low*
CCl_4	A	5 µg/L	0.23	0	1.84	---	---	---	---	---	*ND*
Cr	B	100 µg/L	0.23	0	1.84	5.89E+03 kg	5.68E+02 kg	3.57E+01 kg	5.29E+03 kg	5.29E+01	*Medium*
Cr-VI	A	10 µg/L[b]	0.23	0	1.84	5.89E+03 kg	3.35E+03 kg	3.57E+01 kg	2.50E+03 kg	5.21E+01	*Medium*
TCE	B	5 µg/L	0.23	2	1.84	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.23	0.8	1.84	4.26E+03 kg	---	---	4.26E+03 kg	1.92E+01	*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). The WMA S-SX Groundwater Extraction System is treating contaminants in the area.

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 uranium plume would be expected in the next 150 years related to the CP-LS-4 EU waste site due to transport and decay considerations. Thus the *Low* rating would apply after the Active Cleanup period to account for uncertainties.

PART VI. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

Pathways and Barriers

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

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

The waste sites were covered in clean soil, and soil cover 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 (DOE/RL-2003-24, Rev. 0).

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

Active controls include monitoring and treatment of groundwater is being conducted within the 200-UP GWIA using the WMA S-SX groundwater extraction system, U Plant area P&T system, and I-129 plume hydraulic control system. There are no active safety class or safety significant systems and controls.

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

Passive controls include the clean soil cover placed over the waste sites to prevent human and biological intrusion. There are no passive safety class or safety significant systems and controls.

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 temporary soil and gravel cover. The soil and gravel covers are still in place although waste sites within the CP-LS-4 EU are still contaminating the surrounding vadose zone media and may be leading to additional saturated zone contamination. The saturated zone in the area is currently being treated using the WMA S-SX groundwater extraction system, U Plant area P&T system, and I-129 plume hydraulic control system (DOE/RL-2016-09, Rev. 0), which act as additional barriers. 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-4 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-4 EU waste sites is release to the vadose zone (primarily from contact with infiltrating water) that then migrates 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 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-2 (Appendix D.6), 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-West to 200-East (50+ years) and then from 200 East to the Columbia River is (~10-30 years) 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-4 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 very long-term, which is outside the scope of this evaluation. 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. Contaminated groundwater in the area is also being treated using the WMA S-SX groundwater extraction system, U Plant area P&T system, and I-129 plume hydraulic control system (DOE/RL-2016-09, Rev. 0), which decreases the risks to both the groundwater and the Columbia River. Furthermore, the risks to benthic, riparian zone, and free-flowing ecology are minimal as described in **Part V** of Appendix D.6 (CP-GW-2 EU).

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

As mentioned in **Part I**, there is no Documented Safety Analysis (DSA) or hazard analysis (HA) for the CP-LS-4 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-4 and CP-LS-3, **Part VI** in Appendix G.5.3 (CP-LS-3) has additional information. The evaluations and ratings in the section below are summaries of those developed for the CP-LS-3 EU (**Part VI** in Appendix G.5.3).

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 certain maintenance and monitoring operations (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.

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 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 thus 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 lack of use).

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

Groundwater

Table G.5.4-5 represents the current risks and associated ratings for the saturated zone (groundwater) from vadose zone contamination associated with the CP-LS-4 waste sites. Sites within the CP-LS-4 EU have likely contaminated both the shallow and deep vadose zone and are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0, Table 2-2). Monitoring and treatment of groundwater (using the WMA S-SX groundwater extraction system, the U Plant area P&T system, and the I-129 plume hydraulic control system) is being conducted within the 200-UP GWIA, which is described as part of the CP-GW-2 EU (Appendix D.6). Only plumes within the 200-UP GWIA have been linked to CP-LS-4 EU waste sites.

Columbia River

As described in Appendix D.6 (CP-GW-2 EU) and **Part V**, no plumes from the 200 West Area (that includes the CP-LS-4 waste sites) currently intersect the Columbia River, thus current ratings for all contaminants for the benthic, riparian, and free-flowing ecology are *ND*.

Ecological Resources

Summary of Ecological Review:

- 100% of the EU consists of resources classified as level 2 or below. Loss of this habitat during cleanup activities is not likely to impact connectivity with biological resources outside the 200-West Area.
- Approximately 60% of the combined EU and adjacent landscape buffer area is dominated by habitats classified as level 2 or below. These habitats occur primarily within the 200-West Area, but are also found in the U and S Pond EU to the south and west of the REDOX Cribs and Ditches EU.
- Nearly 31% of the adjacent landscape buffer area is classified as level 3 biological resources. Another 6% of the buffer on the east is classified as a level 4 resource, and a little over 3% to the south is classified as a level 5 biological resource.

Cultural Resources

The CP-LS-4, REDOX Cribs and Ditches EU is located in the 200 West Area of the Hanford Site, an area known to have low potential to contain Native American Precontact and Ethnographic archaeological resources and Pre-Hanford Early Settlers/Farming resources. Much of the 200 Areas were addressed in a cultural resources report entitled *Archaeological Survey of the 200 East and 200 West Areas, Hanford*

Site (Chatters and Cadoret 1990). The focus of this archaeological survey was on inventorying all undisturbed portions of the 200 East and 200 West Areas. This report concluded that much of the 200 East and 200 West Areas can be considered areas of low archaeological potential with the exception of intact portions of an historic/ethnohistoric trail/road corridor which runs through the 200 West Area. Only a small portion of the EU has been inventoried for cultural resources under HCRC# 95-200-013 (Stapp & Woodruff 1994) and HCRC# 2013-600-012b (Hay et al. 2014). It is unknown if an NHPA Section 106 review has been completed specifically for the remediation of the CP-LS-4, REDOX Cribs and Ditches EU. Much of the land within the EU is extensively disturbed from 200 West Area operations, suggesting a low potential for intact archaeological deposits to exist within the surface and subsurface components of the EU.

Archaeological sites, buildings and Traditional Cultural Properties (TCPs) located within the EU[17]

- A segment of the National Register-eligible Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required, is located within the boundary of the CP-LS-4, REDOX Cribs and Ditches EU. In accordance with the 1998 *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE-RL 1998), all documentation requirements have been completed for this property.
- No additional archaeological sites, buildings, and/or TCPs are known to be located within the EU.

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

- There are 4 archaeological sites/isolates located within 500 meters of the CP-LS-4, REDOX Cribs and Ditches EU. Two of these are associated with the Native American Precontact and Ethnographic Landscape (1 isolate and 1 site), one is associated with the Pre-Hanford Early Settlers/Farming Landscape (1 isolate) and one is a multi-component site associated with both the Native American Precontact and Ethnographic and Pre-Hanford Early Settlers/Farming Landscapes that has been determined not eligible for the National Register of Historic Places. The other recorded archaeological resources (1 site and 2 isolates) have not been evaluated for listing in the National Register of Historic Places, however, it should be noted that isolates are typically assumed not eligible.
- There are 10 National Register-eligible Manhattan Project and Cold War Era buildings located within 500 meters of the EU (all 10 are contributing within the Manhattan Project and Cold War Era Historic District, 1 recommended for individual documentation and 9 with no additional documentation required). Mitigation for contributing buildings/structures has been completed as per the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE-RL 1998) and building demolition is ongoing.

Table K.5 (Appendix K) has more information about the 10 buildings that are National Register-eligible Manhattan Project and Cold War Era buildings located within 500 meters of the CP-LS-4, REDOX Cribs and Ditches EU.

[17] 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 (a) rooted in the history of a community, and (b) 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-4, REDOX Cribs and Ditches EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

There is no DSA, HA, or feasibility study that includes the CP-LS-4 EU waste sites. It was decided by the author to use the evaluation provided in the *Focused Feasibility Study for the 200-UW-1 Operable Unit* (FFS) (DOE/RL-2003-23, Rev. 0) for CP-LS-4 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 four alternatives (and the analysis) provided in the 200-UW-1 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 *200-UW-1 FFS*, remedial action alternatives were developed, including:[18] No Action (Alternative 1), Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation (Alternative 2), Removal, Treatment, and Disposal (Alternative 3), and Engineered Barrier (Alternative 4). 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-2003-23, Rev. 0).

More detailed descriptions of the four alternatives provided in the 200-UW-1 FFS (DOE/RL-2003-23, Rev. 0) are summarized in **Part VI** of Appendix G.5.3 (CP-LS-3 EU).

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

The remedial actions that have either been identified (i.e., those non-time-critical actions for the CP-LS-4 waste sites also in the 200-MG-2 OU (DOE/RL-2009-37, Rev. 0)) or are being evaluated using the 200-UW-1 FFS (DOE/RL-2003-23, Rev. 0)) would leave existing contamination in CP-LS-4 waste sites as well as that contamination that has been released from CP-LS-4 waste sites into shallow and deep vadose zones. Waste sites within the CP-LS-4 EU have likely contributed mobile contaminants to groundwater contamination in the 200-UP GWIA (DOE/RL-92-16, Rev. 0), which are being treated or controlled using the WMA S-SX groundwater extraction system, the U Plant area P&T system, and I-129 plume hydraulic control system (DOE/RL-2016-09, Rev. 0). However, remedial actions will be taken until resulting residual contamination levels satisfy remedial objectives and monitoring of both vadose and saturated zone contamination will continue to assess remedial action performance. These residual concentrations cannot be determined at this time.

Risks and Potential Impacts Associated with Cleanup

The risks and potential impacts associated with cleanup actions are assumed to be the same as those described for the CP-LS-3 EU (Appendix G.5.3, **Part VI**). As for the CP-LS-3 impacts, the 200-UW-1 FFS results are used to evaluate *possible* radiological impacts to workers during selected remedial

[18] Non-time-critical actions have also been defined for selected 200-MG-2 OU waste sites that are also within the CP-LS-4 EU (DOE/RL-2009-37, Rev. 0).

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

As described above, the decision was made to use the 200-UW-1 FFS to describe the potential risks and potential impacts to workers. For example, the estimated dose for *maximally exposed* workers range from approximately 2 to 800 person-rem for a single receptor (DOE/RL-2003-23, Rev. 0, p. G-13) that correspond to *Low* and *High* ratings, respectively as described in Appendix G.5.3 (CP-LS-3, **Part VI**). Other estimated doses for active remedial actions are lower. *As described above, these dose estimates are not computed to the same standard as for a DSA and should be treated accordingly.* When compared to CP-LS-3 inventories for Cs-137 and Sr-90 (that tend to drive the worker risks presented in the FFS), the CP-LS-4 inventories (Table G.5.4-2 to Table G.5.4-4) are larger for some CP-LS-4 waste sites[19]; however, the radiological concentrations and not inventories tend to drive risk. The Cs-137 and Sr-90 concentrations for the 216-U-1/2 cribs (which pose the highest doses) are $1.1x10^5$ (95% UCL) / $1.4x10^6$ (maximum) pCi/g and $1.4x10^5$ (95% UCL) / $2.4x10^6$ (maximum) pCi/g, respectively (DOE/RL-2003-23 Rev. 0, p. C-T24). In comparison, the 216-S-7 crib (CP-LS-4) had a measured Cs-137 concentration of approximately $2x10^6$ pCi/g at 7.8 m (25 ft) bgs (PNNL-23666, p. 14), which exceeded the Cs-137 concentration in the 216-U-1/2 Cribs. Thus it would appear reasonable that the doses from the CP-LS-4 waste sites might pose comparable doses to those from CP-LS-3 and thus the same ratings are used. For the *No Action* alternative, the monitoring and maintenance actions are also assumed to be conducted (as described above for *Current* conditions) with an *ND-Low* risk rating. The unmitigated risk ratings for facility workers range from *Low* to *High* based on the action that would be taken (or not taken) (i.e., *ND-Low* for *No Action*, which is the same as for current conditions, to *Low-High* for RTD).

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

Mitigation: Although calculated doses to all receptors are "high" for the RTD scenario (DOE/RL-2003-23, Rev. 0, p. G-6), the analysis assumed a single receptor for each task, when in reality, multiple personnel would be performing the tasks. Additional radiological controls (e.g., a water cannon to prevent laborers from entering the active exhumation area or additional shielding) could also be implemented to maintain ALARA exposure goals, which would result in *Low* rating. Risk ratings for other scenarios would be *ND-Low*.

Mitigated Consequences: Facility Worker – *ND-Low* to *Low* (RTD)

Co-located Person

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

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

[19] Furthermore, the CP-LS-3 Cs-137 and Sr-90 inventories are 1600 and 870 Ci, respectively, where approximately 88% are in a single MUST.

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 impact during this period to groundwater (as a protected resource) from mobile primary contaminants from the REDOX Cribs and Ditches currently with plumes that exceed thresholds. These impacts are described in more detail in Appendix G.6 for the CP-GW-2 EU. Furthermore, there are contaminant sources (legacy source sites) in the vadose zone that pose continuing risk to groundwater (via the vadose zone). Ratings (Table G.5.4-5) do not change for the Active Cleanup period. For the Near-term, Post-Cleanup period, the vadose zone (VZ) GTM values for the Group A and B primary contaminants for the REDOX Cribs and Ditches EU translate to ratings that range from *Not Discernible* (no reported inventories nor plumes linked to CP-LS-4 waste sites, including Sr-90 and total uranium) to *Low* (C-14 and Tc-99) to *Medium* (total and hexavalent chromium) to *High* (I-129) (insufficient impact of surface barrier and large amounts of contaminants already in the ground). As indicated in **Part V**, Sr-90 and total uranium from the CP-LS-4 waste sites are unlikely to impact the groundwater in sufficient quantities to exceed the drinking water standard and thus are not considered significant future threats to groundwater as a protected resource. These ratings correspond to an overall rating of *High* for both the Active and Near-term, Post-Cleanup periods.

The WMA S-SX groundwater extraction system, the U Plant area P&T system, and the I-129 plume hydraulic control system in the 200-UP GWIA are assumed to be operational during this evaluation period, which will be treating groundwater contamination in the 200 West area.

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

Columbia River

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

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

No cleanup decisions have been made for the deep vadose zone, and as a result, the potential effects of cleanup on ecological resources is uncertain.

Cultural Resources

No cleanup decisions have been made for the deep vadose zone, and as a result, the potential effects of cleanup on cultural resources is uncertain.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

Sites within the CP-LS-4 EU have contaminated the vadose zone and are suspected of contributing contaminants to the saturated zone (DOE/RL-92-16, Rev. 0). Despite on-going treatment (WMA S-SX groundwater extraction system, U Plant area P&T system, and I-129 plume hydraulic control system), vadose zone contamination may continue (depending on the control of infiltrating water to the waste sites) and some contaminant plumes in the 200-West Area may continue to increase in size and impact additional groundwater.

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.5.4-6. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup.

Population or Resource		Risk/Impact Rating	Comments
Human	Facility Worker	*Not Discernible* (*ND*)-*Low*	Only risks during monitoring and maintenance activities (assumed similar to current risks)
	Co-located Person	*ND*	*De minimus* risks related to residual contamination (after capping or retrieval), which will be remedied to acceptable levels.
	Public	*ND*	*De minimus* risks related to residual contamination (after capping or retrieval), which will be remedied to acceptable levels. Access restrictions and ICs in place, when required.
Environmental	Groundwater (A&B) from vadose zone[(a)]	*High* (I-129) *Medium* (Cr-VI & Cr(tot)) *Low* (C-14, Tc-99, Sr-90, U(tot)) **Overall**: *High* (I-129)	*Current* GTM values for Group A&B primary contaminants (Table G.5.4-5): *High* (I-129), *ND* (CCl_4, TCE, Sr-90 and U(tot)), *Low* (C-14, Tc-99), *Medium* (Cr-VI and Cr(tot)). Sr-90 and U(tot) not likely to impact groundwater

			but given *Low* ratings here to address uncertainties (**Part V**). Treatment in 200-UP or impact from changes in recharge (surface barrier) assumed to not change ratings.
	Columbia River from vadose zone[(a)]	Benthic: *ND* Riparian: *ND* Free-flowing: *ND* **Overall**: *ND*	TC&WM EIS screening results indicate that exposure to radioactive and chemical contaminants from peak groundwater discharge below benchmarks for both benthic and riparian receptors (**Part V**). Dilution factor of greater than 100 million between Columbia River and upwellings.
	Ecological Resources[(b)]	No cleanup decisions have been made for this EU. Estimated to be Low	Monitoring activities for post-closure conditions are expected to occur. Low impacts are likely if exotic species are introduced to buffer area with level 3 and 4 resources.
Social	Cultural Resources[(b)]	No cleanup decisions have been made for this EU. Estimated to be: **Native American** Direct: Unknown Indirect: Known **Historic Pre-Hanford** Direct: Unknown Indirect: Known **Manhattan/Cold War** Direct: None Indirect: None	Potential direct impacts are unknown and difficult to estimate without further information on the remediation. Any remediation activity has potential for indirect impacts.

a. Threat to groundwater or Columbia River for Group A and B contaminants remaining in the vadose zone. Threats from existing plumes associated with the REDOX Cribs and Ditches EU are described in **Part V** with more detailed evaluation in Appendix G.6 (CP-GW-2).

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

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

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 REDOX Cribs and Ditches 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:	REDOX Cribs and Ditches
ID:	CP-LS-4
Group:	Legacy Source
Operable Unit Cross-Walk:	200-DV-1, 200-WA-1
Related EU:	CP-DD-4, CP-GW-2
Sites & Facilities:	Liquid waste discharges in the southern part of 200-W Area associated with REDOX (S Plant) operations.
Key Data Sources Docs:	Remedial Investigation/Feasibility Study for the 200-UP-1 Groundwater Operable Unit (DOE-RL-2009-122_DraftA) Geologic Cross Section Development in the Vicinity of S-Complex and T-Complex to Support the 200-DV-1 Operable Unit Conceptual Models (SGW-50900) Conceptual Site Models for the 200-DV-1 Operable Unit Waste Sites in the S Complex Area, Central Plateau, Hanford, Washington (SGW-50280_Rev1) Geophysical Logging Report for 200-DV-1 Operable Unit Waste Sites in the S Complex Area (SGW-50194) Remedial Investigation/Feasibility Study and RCRA Facility Investigation/Corrective Measures Study Work Plan for the 200-DV-1 Operable Unit (DOE-RL-2011-102_DFT-A) 216-S-10 Pond and Ditch Closure Plan (DOE-RL-2006-12-DraftB) Proposed Plan for the 200-CS-1 Chemical Sewer Group Unit (DOE-RL-2005-64) Feasibility Study for the 200-CS-1 Chemical Sewer Group Operable Unit (DOE-RL-2005-63) 200 West Groundwater Aggregate Area Management Study Report (DOE-RL-92-16) Remedial Investigation/Feasibility Study for the 200-UP-1 Groundwater Operable Unit (DOE-RL-2009-122_Rev0) Characterization Sampling and Analysis Plan for the 200-DV-1 Operable Unit (DOE_RL-2011-104, Rev 0)

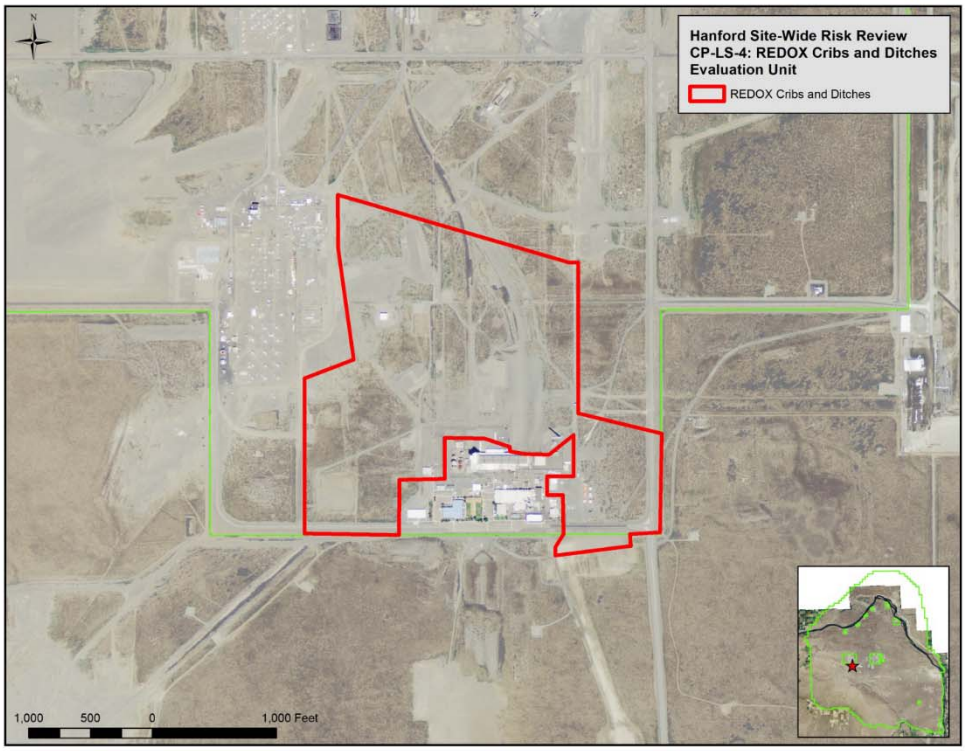

Figure 1. CP-LS-4 (REDOX Cribs and Ditches) Site Location Map

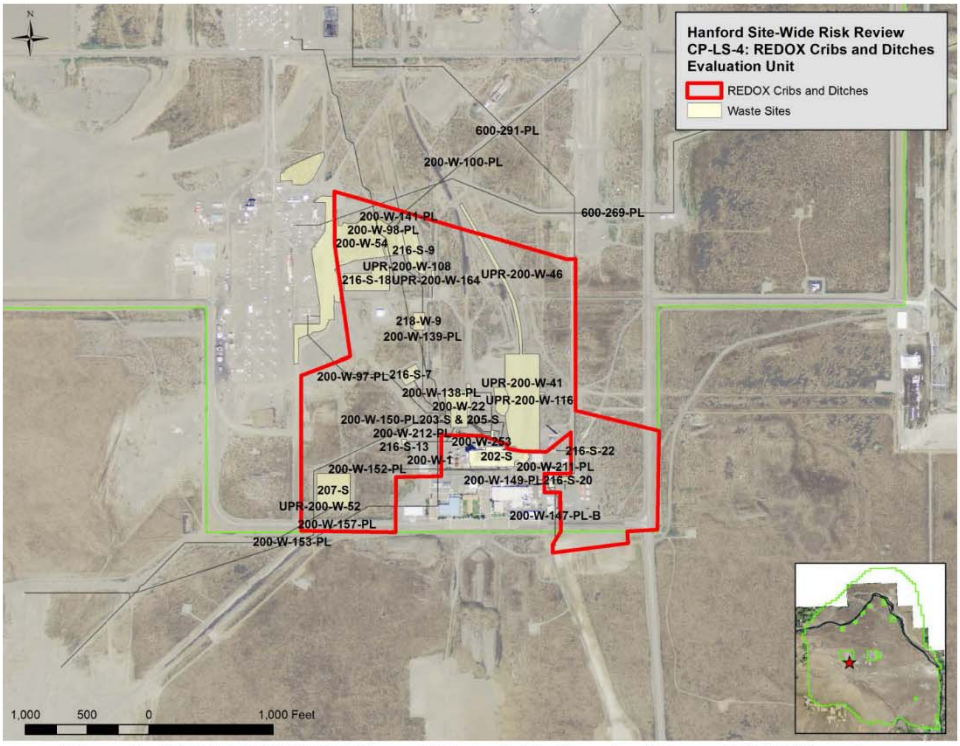

Figure 2. CP-LS-4 (REDOX Cribs and Ditches) Site Location Map and WIDS Locations

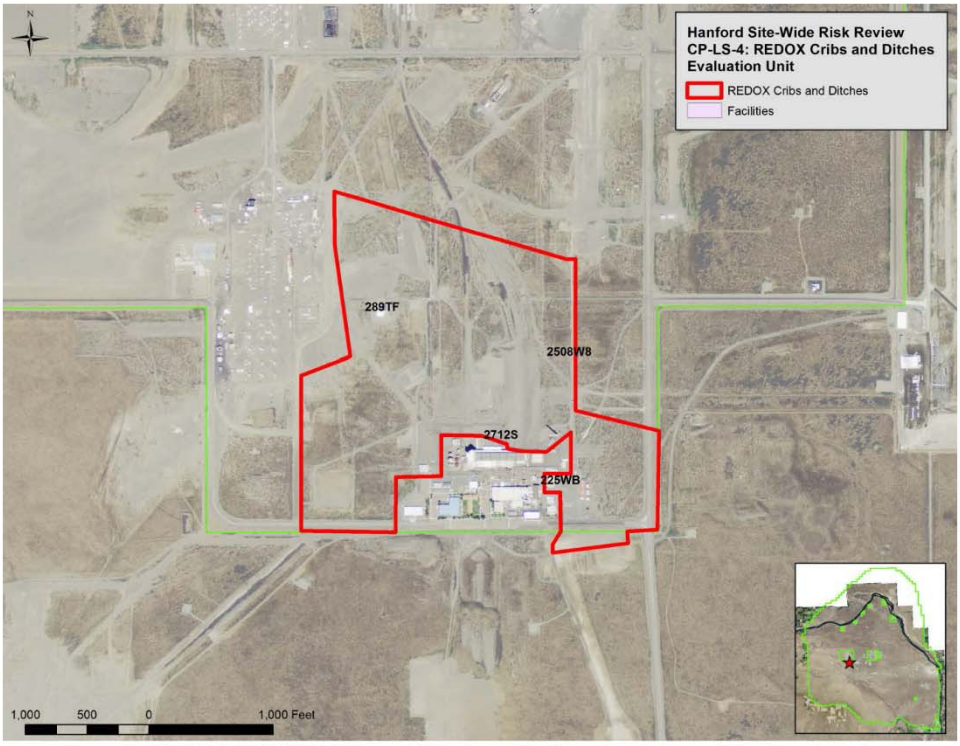

Figure 3. CP-LS-4 (REDOX Cribs and Ditches) Site Location Map and Facility Locations

Hanford Site-Wide Risk Review
CP-LS-4 (REDOX Cribs and Ditches)
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
218-W-9	218-W-9; Dry Waste Burial Ground No. 9; Non-TRU Dry Waste No. 009	Waste Site	Inactive	Accepted	None	Burial Ground	Burial Ground	200-WA-1		
240-S-302	240-S-302; 240-S-302 Catch Tank; IMUST; Inactive Miscellaneous Underground Storage Tank; Line V556 and V557	Waste Site	Inactive	Accepted	None	Catch Tank	Underground Storage Tank	200-IS-1		
200-W-54	200-W-54; Contamination Migration from 241-SX Tank Farm	Waste Site	Inactive	Accepted	None	Contamination Migration	Unplanned Release - Surface/Near Surface	200-WA-1		
216-S-13	216-S-13; 216-S-6; 276-S Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1		
216-S-20	216-S-20; 216-SL-1&2 Crib; 216-SL-2	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-WA-1		
216-S-22	216-S-22; 216-S-22 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-WA-1		
216-S-7	216-S-7; 216-S-7 Crib; 216-S-15	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-WA-1		
216-S-9	216-S-9; 216-S-9 Crib	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface Liquid Disposal Site	200-DV-1		
200-W-190-PL	200-W-190-PL; Discharge Line from 240-S-151 Diversion Box to 240-S-302 Catch Tank; Line V554	Waste Site	Inactive	Accepted	None	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD_200-IS-1		
600-269-PL	600-269-PL; Cross Site Transfer Line Replacement; Lines SNL-3150 and 3160; New Cross-Site Transfer Line	Waste Site	Active	Accepted	None	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	Not Applicable		
240-S-151	240-S-151; 240-S-151 Diversion Box	Waste Site	Inactive	Accepted	None	Diversion Box	Pipeline and associated valves, etc.	200-IS-1		
240-S-152	240-S-152; 240-S-152 Diversion Box	Waste Site	Inactive	Accepted	None	Diversion Box	Pipeline and associated valves, etc.	200-IS-1		
200-W-101	200-W-101; Contaminated Material West of 216-S-12 Crib	Waste Site	Inactive	Accepted	None	Dumping Area	Burial Ground	200-WA-1		
200-W-100-PL	200-W-100-PL; Encased Pipeline from 241-UX-154 to 241-SX-152 and 241-S-151 Diversion Boxes, Lines V762/4853, V503/4700 and V505/4701	Waste Site	Inactive	Accepted	None	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-186-PL	200-W-186-PL; Lines 1006 and 1045; Transfer Lines from 240-S-152 Diversion Box to 204-S and 205-S	Waste Site	Inactive	Accepted	None	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-187-PL	200-W-187-PL; Lines V552, V553 and V555; Transfer Lines Between 240-S-151 and 240-S-152 Diversion Boxes	Waste Site	Inactive	Accepted	None	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-212-PL	200-W-212-PL; Encased Transfer Line from 240-S-151 Diversion Box to Pipeline 200-W-153-PL; Lines V550, V551, V548, V546, V548 and V549	Waste Site	Inactive	Accepted	None	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-97-PL	200-W-97-PL; Encased Pipeline from 240-S-151 Diversion Box to 241-S-151 Diversion Box; Lines V508, V509, V512, V513, V514, V515, V516, V517/3603 and V519/1115	Waste Site	Inactive	Accepted	None	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-98-PL	200-W-98-PL; Encased Pipeline from 240-S-151 to 241-U-153 Diversion Box; V458, V459, and V460	Waste Site	Inactive	Accepted	None	Encased Tank Farm Pipeline	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-75	200-W-75; Radiological Logging System (RLS) Calibration Silos	Waste Site	Inactive	Accepted	None	Experiment/Test Site	Field Test Site	200-WA-1		
200-W-1	200-W-1; REDOX Mud Pit West	Waste Site	Inactive	Accepted	None	Mud Pit	Burial Ground	200-WA-1		
200-W-157-PL	200-W-157-PL; Pipeline from 202-S to 200-W-152-PL and 216-S-10 Ditch; Pipeline from 205-S to REDOX Chemical Sewer; REDOX Chemical Sewer	Waste Site	Inactive	Accepted	None	Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
600-291-PL	600-291-PL; LERF Line; TEDF Line; 200 Area Treated Effluent Disposal Facility Pipeline	Waste Site	Active	Accepted	None	Process Sewer	Pipeline and associated valves, etc.	Not Applicable		
202-S	202-S; 202-S REDOX; S Plant	Waste Site	Inactive	Accepted	None	Process Unit/Plant	Process Building	200-CR-1		
203-S & 205-S	203-S & 205-S; 203-S Uranyl Nitrate Hexahydrate Tank Farm; 204-S; 204-S Tank Farm & Pumphouse; 205-S Process Vault & Chemical Makeup Building; 205-S Stabilized Area; 205-S Uranyl Nitrate Hexahydrate Processing Facility; 203-S	Waste Site	Inactive	Accepted	Consolidated	Process Unit/Plant	Process Building	Not Applicable		
200-W-138-PL	200-W-138-PL; Pipeline from 240-S-151 to 216-S-7 Crib; V547	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-139-PL	200-W-139-PL; Pipeline from 200-W-138-PL to 216-S-9 Crib; V547	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-141-PL	200-W-141-PL; Pipeline Connecting 200-W-139-PL Pipeline to 216-S-23 Crib; V547	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-146-PL	200-W-146-PL; Pipeline from 293-S to 216-S-22 Crib	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-147-PL-B	200-W-147-PL-B; Portion of Pipeline in the 200 West Inner Area	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-149-PL	200-W-149-PL; Pipelines Related to 216-S-20 Crib	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-150-PL	200-W-150-PL; Pipelines Associated with 216-S-13 Crib	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-152-PL	200-W-152-PL; Pipeline from 202-S to 2904-S-170 Control Structure and 216-S-17 Pond; REDOX Process Sewer	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-153-PL	200-W-153-PL; Steel Pipeline from 240-S-151 Diversion Box to the 2904-S-172 and 2904-S-171 Control Structures via 200-W-212-PL	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-211-PL	200 W 211 PL; 207 SL Retention Basin Sewer Pipelines; Pipelines from Boiler Annex and Pump Lift Station to 207-SL Basin; Retention Waste Sewer from 219-S and 222-S to 207-SL Basin	Waste Site	Active	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	Not Applicable		

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Hanford Site-Wide Risk Review
CP-LS-4 (REDOX Cribs and Ditches)
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
200-W-230-PL	200-W-230-PL; Pipeline from Railroad Unloading Station to 276-S-141 and 276-S-142 Hexone Tanks	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	T3D_200-IS-1		
207-S	207-S; 207-S Retention Basin; REDOX Retention Basin	Waste Site	Inactive	Accepted	None	Retention Basin	Crib - Subsurface Liquid Disposal Site	200-WA-1		
207-SL	207 SL; 207 SL Retention Basin; 222 S Retention Basin; REDOX Lab Retention Basin	Waste Site	Active	Accepted	None	Retention Basin	Crib - Subsurface Liquid Disposal Site	200-WA-1		
200-W-2	200-W-2; REDOX Berms West	Waste Site	Inactive	Accepted	None	Spoils Pile/Berm	Burial Ground	200-WA-1		
276-S-141	276-S-141; 276-S-141 Solvent Storage Tank; 276-S-306A; 276-S-TK-141; Hexone Storage Tank; IMUST; Inactive Miscellaneous Underground Storage Tank; Tank 276-141; 244-SX 15	Waste Site	Inactive	Accepted	None	Storage Tank	Process Building	200-IS-1		
276-S-142	276-S-142; 276-S-142 Solvent Storage Tank; 276-S-306B; 276-S-TK-142; Hexone Storage Tank; IMUST; Inactive Miscellaneous Underground Storage Tank; Tank 276-142; 244-SX-15	Waste Site	Inactive	Accepted	None	Storage Tank	Process Building	200-IS-1		
216-S-12	216-S-12; 291-S Stack Wash Sump; REDOX Stack Flush Trench; UPR-200-W-30	Waste Site	Inactive	Accepted	None	Trench	Crib - Subsurface Liquid Disposal Site	200-WA-1		
216-S-18	216-S-18; 241-SX Steam Cleaning Pit; 216-S-14 Steam Cleaning Pit	Waste Site	Inactive	Accepted	None	Trench	Crib - Subsurface Liquid Disposal Site	200-WA-1		
200-W-22	200-W-22; 203-S/204-S/205-S Stabilized Area	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-WA-1		
200-W-253	200-W-253; 233-S and 233-SA Contaminated Soil Footprint	Waste Site	Inactive	Discovery	None	Unplanned Release	Unplanned Release - Surface/Near Surface	T3D		
UPR-200-W-10	UPR-200-W-10; Contamination Spread at 203-S UNH Tanks; UN-200-W-10	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable		
UPR-200-W-108	UPR-200-W-108; Line Leak at 216-S-9 Crib; UN-200-W-108; UN-216-W-18	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-IS-1		
UPR-200-W-109	UPR-200-W-109; Waste Line Leak Near 218-W-9; UN-200-W-109; UN-216-W-19	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-IS-1		
UPR-200-W-116	UPR-200-W-116; Ground Contamination North of 202-S; UN-200-W-116; UN-216-W-26	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-WA-1		
UPR-200-W-123	UPR-200-W-123; 204-S Unloading Facility Frozen Discharge Line; UN-200-W-123	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable		
UPR-200-W-13	UPR-200-W-13; Liquid Release from REDOX to 207-S and 216-S-17 Pond; UN-200-W-13	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable		
UPR-200-W-15	UPR-200-W-15; Liquid Release from REDOX to 207-S and 216-S-17 Pond; UN-200-W-15	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable		
UPR-200-W-154	UPR-200-W-154; Overhead UNH Line Leak; UN-216-W-24	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-IS-1		
UPR-200-W-32	UPR-200-W-32; UN-200-W-32; UNH Transfer Line Break	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Subsurface	200-IS-1		
UPR-200-W-35	UPR-200-W-35; Ground Contamination Near UNH Process Line; REDOX to 224-U UNH Line Leak; UN-200-W-35	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-IS-1		
UPR-200-W-41	UPR-200-W-41; Railroad Contamination; REDOX Railroad Cut Contamination; UN-200-W-41	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-WA-1		
UPR-200-W-42	UPR-200-W-42; Contamination found at 2706-S; UN-200-W-42	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable		
UPR-200-W-46	UPR-200-W-46; Contaminated Railroad Track; H-2 Centrifuge Burial; UN-200-W-46	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-WA-1		
UPR-200-W-52	UPR-200-W-52; Release from 241-S Diversion Box; UN-200-W-52	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable		
UPR-200-W-82	UPR-200-W-82; Contamination Spread at 240-S-151; UN-200-W-82	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	T3D		
UPR-200-W-83	UPR-200-W-83; Radioactive Spill Near 204-S Radiation Zone; UN-200-W-83; UN-216-W-82	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable		
UPR-200-W-95	UPR-200-W-95; 207-S Retention Basin; UN-216-W-2	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable		
UPR-200-W-96	UPR-200-W-96; 233-S Floor Overflow; 233-SA Floor Overflow; UN-216-W-4	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release - Surface/Near Surface	200-CR-1		
216-S-26	216-S-26; 216-S-26 Crib; 216-S-19 Replacement Facility	Waste Site	Inactive	Accepted	Interim Closed Out	Crib	Crib - Subsurface Liquid Disposal Site	200-OA-1	X	Closed Out
200-W-189-PL	200-W-189-PL; Lines SNL-5350 and SNL-5351; Transfer Lines from 219-S to 241-SY Tank Farm	Waste Site	Active	Accepted	None	Direct Buried Tank Farm Pipeline	Pipeline and associated valves, etc.	Not Applicable	X	Included in REDOX Eval.
2711-S	2711-S; 2711-S Stack Monitoring Building	Waste Site	Inactive	Accepted	Rejected	Process Unit/Plant	Infrastructure Building	Not Applicable	X	Rejected
291-S	291-S; 291-S Fan and Filter Building; 291-S Fan Control Building; 291-S Fan House	Waste Site	Active	Not Accepted	None	Process Unit/Plant	Infrastructure Building	Not Applicable	X	Not Accepted
291-S-1	291-S-1; 291-S-1 Stack; REDOX Process and Canyon Exhaust; 202-S Stack	Waste Site	Active	Not Accepted (Proposed)	None	Stack	Process Building	Not Applicable	X	Not Accepted
200-W-17	200-W-17; S Plant Project W-087 Aluminum Silicate Discovery	Waste Site	Inactive	Accepted	Rejected	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable	X	Rejected
200-W-18	200-W-18; S Plant Project W-087 Aluminum Oxide Discovery	Waste Site	Inactive	Accepted	Rejected	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable	X	Rejected
UPR-200-W-69	UPR-200-W-69; Railroad Contamination; UN-200-W-69	Waste Site	Inactive	Accepted	Rejected	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable	X	Rejected

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Hanford Site-Wide Risk Review
CP-LS-4 (REDOX Cribs and Ditches)
Waste Site and Facility List

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UPR-200-W-86	UPR-200-W-86; Contaminated Pigeon Feces at 221-U and 204-S; UN-200-W-86; UN-216-W-86	Waste Site	Inactive	Accepted	Rejected	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable	X	Rejected
225WB	LAB LOCAL CONTROL UNIT 55C-22	Facility	ACTIVE			BUILDING	Infrastructure Building			
2907F	EXTRACTION BUILDING NO 3	Facility	ACTIVE			BUILDING	Infrastructure Building			
2503W8	SIREN NORTH OF 18TH BETWEEN CANYON AND BELT	Facility	ACTIVE			STRUCTURE	Infrastructure Building			
2712S	ELECTRICAL/INSTRUMENTATION BUILDING	Facility	INACTIVE			STRUCTURE	Infrastructure Building			
2025	REDOX CANYON AND SERVICE FACILITY	Facility	INACTIVE			BUILDING	Process Building		X	Duplicative
2711S	STACK GAS MONITORING STATION	Facility	INACTIVE			BUILDING	Infrastructure Building		X	Duplicative
291S	EXHAUST FAN CONTROL HOUSE AND SAND FILTER EXHAUST	Facility	INACTIVE			BUILDING	Infrastructure Building		X	Duplicative
MO40W	MOBILE UNIT CB WEST OF 2025	Facility	ACTIVE			BUILDING	Infrastructure Building		X	Mobile Office
MO54W	2225 CONSTRUCTION SUPPORT TRAILER	Facility	ACTIVE			BUILDING	Infrastructure Building		X	Mobile Office
207S	WATER RETENTION BASIN	Facility	INACTIVE			STRUCTURE	Crib - Subsurface Liquid Disposal Site		X	Duplicative
207SL	WATER RETENTION BASIN	Facility	INACTIVE			STRUCTURE	Crib - Subsurface Liquid Disposal Site		X	Duplicative
2403S1	DIVERS ON BOX AT 2025	Facility	INACTIVE			STRUCTURE	Pipeline and associated valves, etc.		X	Duplicative
2403S2	DIVERS ON BOX AT 2025	Facility	INACTIVE			STRUCTURE	Pipeline and associated valves, etc.		X	Duplicative
2913001	2025 MAIN STACK	Facility	INACTIVE			STRUCTURE	Process Building		X	Duplicative
2403S02	CATCH TANK IN SUPPORT OF 2403S1	Facility	INACTIVE			TANK	Underground Storage Tank		X	Duplicative

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