APPENDIX G.6
LIQUID WASTE DISPOSAL PONDS

U AND S POND (CP-LS-5 CENTRAL PLATEAU)
B POND (CP-LS-11 CENTRAL PLATEAU)
COMBINED EVALUATION UNIT TEMPLATE

This page intentionally left blank.

TABLE OF CONTENTS

Part I. Executive Summary 1
EU Location 1
Related EUs 1
Primary Contaminants, Contaminated Media and Wastes 1
Brief Narrative Description 2
Summary Tables of Risks and Potential Impacts to Receptors 3
Support for Risk and Impact Ratings for each Population or Resource Human Health 6
Part II. Administrative Information 14
OU and/or TSDF Designation(s) 14
Common name(s) for EU 14
Key Words 14
Regulatory Status: 14
Risk Review Evaluation Information 15
Part III. Summary Description 15
Current land use 15
Designated future land use 15
Primary EU Source Components 16
Location and Layout Maps 17
Part IV. Unit Description and History 19
EU Former/Current Use(s) 19
Legacy Source Sites 19
Groundwater Plumes 22
D&D of Inactive Facilities 23
Ecological Resources Setting 23
Cultural Resources Setting 24
Part V. Waste and Contamination Inventory 27
Contamination within Primary EU Source Components 27
Part VI. Potential Risk/Impact Pathways and Events 41
Current Conceptual Model 41
Populations and Resources Currently at Risk or Potentially Impacted 41
Cleanup Approaches and End-State Conceptual Model 46
Populations and Resources at Risk or Potentially Impacted During or as a Consequence of Cleanup Actions 48
Additional Risks and Potential Impacts if Cleanup is Delayed 51
Near-Term, Post-Cleanup Status, Risks and Potential Impacts 51
Populations and Resources at Risk or Potentially Impacted After Cleanup Actions (from residual contaminant inventory or long-term activities) 52
Long-Term, Post-Cleanup Status – Inventories and Risks and Potential Impact Pathways 53
Part VII. Supplemental Information and Considerations 54
Bibliography 64

TABLE OF FIGURES

Figure G.6-1. Evaluation Unit CP-LS-5 location relative to 200-W Area and White Bluff Rd (in blue) 17
Figure G.6-2. Individual Site locations within Evaluation Unit CP-LS-5 17
Figure G.6-3. Evaluation Unit CP-LS-11 location relative to 200-E Area 18
Figure G.6-4. Individual Site locations within Evaluation Unit CP-LS-11 18

TABLE OF TABLES

Table G.6-1. Risk Rating Summary (for Human Health, unmitigated nuclear safety basis indicated, mitigated basis indicated in parentheses (e.g., “Very High” (Low)). 5

Table G.6-2. Inventory of Primary Contaminants [(a)] 36

Table G.6-3. Inventory of Primary Contaminants (cont)[(a)] 37

Table G.6-4. Inventory of Primary Contaminants (cont)[(a)] 38

Table G.6-5. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Saturated Zone (SZ) and Remaining Vadose Zone (VZ) Contamination associated with the CP-LS-5 (U and S Pond) Evaluation Unit 39

Table G.6-6. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Saturated Zone (SZ) and Remaining Vadose Zone (VZ) Contamination associated with the CP-LS-11 (B Pond) Evaluation Unit 40

Table G.6-7. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup. 52

Table G.6-8. Hanford Site-Wide Risk Review CP-LS-11 (B Pond) Waste Site and Facility List 55

Table G.6-9. Table G.6-9. Hanford Site-Wide Risk Review CP-LS-5 (U and S Ponds) Waste Site and Facility List 59

PART I. EXECUTIVE SUMMARY

EU LOCATION

The two Liquid Waste Disposal Pond evaluation units, CP-LS-5 and CP-LS-11 are located in the western and eastern areas respectively of the Central Plateau 200 Inner Area. They have been combined into this single Appendix/Template because: a) the contaminants are primarily the result of chemical sewer discharges from the separation and concentration processes at the U Plant, REDOX (S Plant), B Plant and Plutonium Finishing Plant (Z Plant) and other facilities in the 200 Area; b) the four primary TSD (treat, storage, and/or disposal) liquid waste sites within the two EUs - 216-S-10 Pond and Ditch, 216-S-11 Pond, 216-A-29 Ditch and 216-B-63 Ditch systems - are the primary components of the 200-CS-1 Chemical Sewer Group Operable Unit; and c) multiple Operable Units in the Inner and Outer areas of the 200 Area contain individual sites from both of the EUs.

RELATED EUS

CP-LS-7, CP-GW-1 and CP-GW-2

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES

Chemical sewer wastes were generated from many of the separation/concentration processes conducted at the large canyon buildings. The chemical sewers were designed to capture nonradioactive waste from operations in these process facilities, including operating galleries, service areas, aqueous makeup galleries, maintenance areas, overflow tanks, and various floor drains. Early chemical sewer wastes were combined with the larger cooling water and steam condensate streams during the bismuth phosphate (BiPO4) and uranium recovery processes, and they were discharged to ponds and ditches. With the introduction of continuous solvent extraction processes at the Hanford Site, new plants such as the REDOX Facility, PUREX Plant, and the 1970s cesium/strontium recovery operations at B Plant were designed with separated chemical sewers and separate waste disposal sites. In most cases, these sites were aboveground pond or ditch structures.

Primary contaminants in the two EUs are similar in that they were primarily the result of chemical sewer discharges from the separation and concentration processes at the U Plant, REDOX (S Plant), B Plant and Plutonium Finishing Plant (Z Plant) and other facilities in the 200 Area, but differ based on the processes being used in these canyons facilities. Wastes in the B Pond sites are of fission products (Cs-137, Sr-90), plutonium, uranium, inorganics (such as nitrates), heavy metals (e.g. cadmium, chromium) and various organic waste (e.g. PCBs). Predominant contaminants within most of the U and S Pond sites are uranium, nitrates, chromium, and to a lesser extent tritium and various fission products. For the Z-ditches, the contaminants of concern are americium, plutonium, radium, PCBs, boron, mercury, cesium and strontium. The contaminated media by and large is soil (sometimes in association with groundwater), with some small fraction of the media consisting of piping and limited concrete for spillways and flow control structures.

Although there is a widespread groundwater plume east of the U and S Ponds (CP-LS-5) site that includes hexavalent chromium, nitrates and tritium, it is not known to what degree these sites have contributed to that plume, if at all.

BRIEF NARRATIVE DESCRIPTION

The two Evaluation Units are comprised of several ponds, ditches, piping and cribs intended for percolation of liquid wastes associated with the operation of the U Plant, REDOX, and Plutonium Finishing Plant, the 1970s cesium/strontium recovery operations at the B Plant, and other facilities in the 200 Area. Most of the individual sites making up the two EUs are contained within Operable Units 200-OA-1, 200-CW-1 or 200-IS-1. Some CP-LS-11 sites are also in 200-EA-1 and some CP-LS-5 sites are in 200-WA-1 and 200-CW-5. The four large TSD (treat, storage, and/or disposal) waste sites 216-S-10 Pond and Ditch, 216-S-11 Pond, 200-A-29 Ditch and 200-B-63 Ditch systems are the primary components of the 200-CS-1 Chemical Sewer Group Operable Unit.

The216-S-10 Pond and Ditch were unlined open excavations. Chemical sewer discharges from the separation and concentration processes at the REDOX Facility discharged into the 216-S-10 Ditch which flowed into the 216-S-10 Pond, where it evaporated or infiltrated into the ground. In May 1954, additional increases in discharge to the S-10 facility necessitated the digging of the two 216-S-11 leach ponds on the southeast side of the 216-S-10 ditch. The 216-S-11 lobes were dammed in 1965, so that all of the effluent was diverted along the S-10 ditch to the 216-S-10 pond. The south lobe of the 216-S-11 pond was covered in the summer of 1975 and was free of radioactive contamination.

The site as a whole was stabilized on September 30, 1983.The 216-S-10 Pond and the southwest end of the 216-S-10 Ditch was decommissioned, backfilled, and stabilized in October 1985**.** The northern portion of the 216-S-10 Ditch was not used after October 1991. In July 1994, the effluent supply pipeline near the outfall was plugged. The remainder of the 216-S-10 Ditch was decommissioned in 1991.

The 216-U-10 Pond was constructed in a natural topographic depression in the southwest corner of the 200 West Area to act as a seepage area for infiltration of wastewater from the 216-U-14 and 216-Z Area Ditches. The 216-U-14 Ditch was an unlined, open excavation that originated about 1,600 ft. northwest of U Plant at the 284-WB Powerhouse Pond and terminated at the Pond. The Ditch and Pond were used to manage low-level radioactive wastewater by infiltration and evaporation.

The 216-Z-11 Ditch was the second of three ditches constructed to transfer wastewaters from the Plutonium Finishing Plant (PFP or Z Plant) facilities to the 216-U-10 Pond. Beginning in December 1944, the first "Z Ditch," currently designated the 216-Z-1D Ditch, received effluent from the 231-Z Building. The Ditch was constructed as an unlined, open excavation about 4,249 ft. long and 2 ft. deep.

In July 1949, as part of 234-5Z Building (PFP) construction, a vitreous clay pipeline 18 inches in diameter was installed to replace the upper portion of the 216-Z-1D Ditch, and a new headwall was constructed approximately 1,500 ft. downstream. The abandoned upper portion of the ditch was backfilled. In March 1959**,** after high plutonium contamination was discovered in the 216-Z-1D Ditch, construction began on the 216-Z-11 Ditch as a replacement. The 216-Z-11 Ditch was excavated just east of and parallel to the 216-Z-1D Ditch and was of similar design and construction. In April 1971, the 216-Z-11 Ditch was retired and replaced with a third ditch, the 216-Z-19 Ditch. The 216-Z-19 Ditch was constructed west of and parallel to the 216-Z-1D and 216-Z-11 Ditches.

Deactivation and stabilization of the Z-Ditch Complex began in 1981, following construction of the 216-Z-20 Crib as the primary PFP wastewater disposal facility. The 216-Z-19 Ditch was covered with 2-3 ft. of clean soil. At the same time, the previously buried 216-Z-1D and 216-Z-11 Ditches received an additional 1 foot of clean fill. The entire Z Ditch Complex was reposted as an Underground Radioactive Area.

In 1985, the 216-U-10 Pond and most of the 216-U-14 Ditch were stabilized with sand and gravel to control surface contamination. In 1992, the lower open end of the ditch (westernmost end of the ditch) was partially stabilized with an engineered barrier to control surface contamination. The slopes were pushed in, approximately half of the ditch was brought to grade, and the ditch was backfilled with large boulders, cobbles, and gravel. The remaining open section of the ditch received effluent from an air-sampling pump until April 1995, when it was stabilized by chemically killing all vegetation, consolidating the contaminated soil into the center of the ditch, and backfilling with clean soil.

The 216-B-3 Pond system consisted of a Main Pond and 3 expansion ponds, and operated from 1945 to 1994. The 216-B-3 Main Pond was located in a natural topographic depression and varied in size from about 14-46 acres. The Pond and the related 216-B-63 Ditch operated open and unlined. The largest contributing streams were the B Plant cooling water and steam condensate, PUREX Plant cooling water, the B Plant chemical sewer, and the PUREX Plant chemical sewer. Most of the effluent contained low concentrations of radionuclides and chemicals.

The 216-B-3 Main Pond and 216-B-63 Ditch were decommissioned in 1994 by backfilling with coarse-grained material and then covering them with fine-grained material. The 3 expansion ponds (216-B-3A, 216-B-3B and 216-B-3C) were clean closed on July 31, 1995.

The individual sites in these two EUs are being treated as past-practice sites under CERCLA remedial action and RCRA corrective action requirements or as TSD process-waste pipeline and pipeline component waste sites under RCRA.

Summary Tables of Risks and Potential Impacts to Receptors

Table G.6-1 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 U and S Pond (CP-LS-5) and B Pond (CP-LS-11) areas; a Co-located Person (CP) is an individual located 100 meters from the physical boundaries of thee; and the Public is an individual located at the closest point on the Hanford Site boundary not subject to DOE access control. The nuclear-related risks to humans are based on unmitigated (unprotected or controlled conditions) dose exposures expressed in a range of from *Not Discernible* (*ND*) to *High*. The estimated mitigated exposure, which takes engineered and administrative controls and protections into consideration, is shown in Table G.6-1 in parentheses. Insufficient information (*IS*) is available with regard to evaluating current risks to human health if unknown mitigated measures were implemented.

Groundwater and Columbia River

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

Ecological Resources[1]

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.

[1] 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.

Cultural Resources[1]

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

Table G.6-1. Risk Rating Summary (for Human Health, unmitigated nuclear safety basis indicated, mitigated basis indicated in parentheses (e.g., "Very High" (Low)).

		Evaluation Time Period	
		Active Cleanup (to 2064)	
Population or Resource		**Current Condition:** Inactive[a]	**From Cleanup Actions:** Final Remediation[a]
Human Health	Facility Worker	Not Discernible (ND)-Low (IS)	Medium (Low)
	Co-located Person	ND (IS)	ND (IS)
	Public	ND (IS)	ND (IS)
Environmental	Groundwater (A&B) from vadose zone[b]	*CP-LS-5:* *Very High* – CCl_4 *High* – Cr-tot & Cr-VI *Medium* – I-129 & U(tot) *ND* – Sr-90[c] *Low* – other PCs **Overall**: *Very High* *CP-LS-11:* *Very High* – CCl_4 *High* – Sr-90 *Medium* – C-14, Cr-tot & Cr-VI, *ND* – U(tot)[c] *Low* – other PCs **Overall**: *Very High*	*CP-LS-5:* *Very High* – CCl_4 *High* – Cr-tot & Cr-VI *Medium* – I-129 & U(tot) *ND* – Sr-90[c] *Low* – other PCs **Overall**: *Very High* *CP-LS-11:* *Very High* – CCl_4 *High* – Sr-90 *Medium* – C-14, Cr-tot & Cr-VI, *ND* – U(tot)[c] *Low* – other PCs **Overall**: *Very High*
	Columbia River from vadose zone[b]	CP-LS-5 and CP-LS-11: Benthic and Riparian: *ND* Free-flowing: *ND* **Overall**: *ND*	CP-LS-5 and CP-LS-11: Benthic and Riparian: *ND* Free-flowing: *ND* **Overall**: *ND*
	Ecological Resources[d]	CP-LS-5: Low CP-LS-11: Low to Medium	CP-LS-5: Medium to Very High CP-LS-11: Low to High
Social	Cultural Resources[d] *Same ratings for CP-LS-5 and CP-LS-11*	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Known **Manhattan/Cold War:** Direct: None Indirect: Known	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Known **Manhattan/Cold War:** Direct: None Indirect: Known

a. Remediation Risk Ratings are for 216-A-29 Ditch, 216-63 Trench, 216-S-10 Ditch, 216, S-10 Pond and 216-S-11 Ponds. No information is available on other sites within the two EUs.

b. 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.

c. There is no current Sr-90 plume associated with CP-LS-5 or total uranium plume associated with CP-LS-11 and thus current ratings are *Not Discernible* (*ND*). The corresponding ratings after the Active Cleanup period are *Low* to account for uncertainties in the evaluation. Groundwater is being treated in the 200 West Area; however, this treatment does not impact the vadose zone threats or ratings. Final remedial actions that have not been made to control vadose zone source could impact these ratings.
d. 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.

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

Current [2,3]

The DOE has conducted a remedial investigation for the 200-CS-1 OU, as specified in the RI/FS work plan and associated sampling and analysis plan approved by EPA. During the remedial investigation phase, four of the five waste sites (216-A-29 Ditch, 216-B-63 Trench, 216-S-10 Ditch, and 216-S-10 Pond) were chosen for field investigation. One of these four sites, the 216-S-10 Pond, is very similar to the remaining site, 216-S-11 Pond. The 216-S-10 Pond serves as a representative site for the 216-S-11 Pond for the purposes of alternative evaluation and remedy selection.

The 216-A-29 Ditch was found to contain Cesium-137 at a depth of about 4-5 feet below the ground surface which should not represent a human health risk to a Facility Worker in its current location, but the 216-S-10 Ditch was found to have Benzo(a)pyrene (listed as a Group 1 carcinogen by IARC) at greater than human health cleanup at the surface to 1.5 feet below.

There are no risk drivers present at the 216-B-63 Trench and the 216-S-10 and 216-S-11 Ponds.

An Unmitigated Risk Rating of Low was chosen for the Facility Worker who might have occasion to be in the area of the 216-S-10 Ditch, and ND for the other sites.

No information is available regarding contaminant levels and human health risk for other sites within the two EUs.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches [1,2]

Because the 216-A-29 Ditch and 216-B-63 Trench waste sites are located within an area that is anticipated to remain industrial-exclusive with existing institutional controls for the foreseeable future, the remediation goals and preferred remedial alternative were developed based on industrial land-use exposures and worker risks. For the 216-S-10 Ditch, 216-S-10 Pond, and 216-S-11 Pond that lie outside the industrial-exclusive boundary, residential land-use exposures and worker risk scenarios were conducted to evaluate the unit for clean closure. The Facility Worker exposure scenario considered a hypothetical excavation scenario in which the contaminants that are currently located at 0-15 feet in depth are excavated and placed on the ground surface. The industrial worker scenario includes an evaluation of external gamma radiation, incidental soil ingestion, and inhalation of dust particulates for the direct contact pathway.

The 216-A-29 Ditch and 216-S-10 Ditch contain contaminants that are greater than human health cleanup and ecological screening levels at depths of 0-8.5 feet below ground surface. Peak exposure for

---

[2] *Feasibility Study for the 200-CS-1 Chemical Sewer Group Operable Unit*, DOE/RL-2005-63, Revision 0, p 7-6, US Department of Energy, September 2008.
[3] *Proposed Plan for the 200-CS-1 Chemical Sewers Group Operable Unit*, DOE/RL-2005-64, Revision 0, US Department of Energy, September 2008.

a Facility (industrial) Worker in a hypothetical excavation scenario at the 216-A-29 Ditch would translate to an excess lifetime cancer risk (ELCR) of approximately 5.9×10^{-4} at time zero with the primary contributor to risk being Cs-137, which exceeds the CERCLA "action limit" of 1×10^{-4}. The ELCR related to the peak exposure for a Facility Worker at the 216-S-10 Ditch would be 4.9×10^{-5} at time zero.

There are no risk drivers present at the 216-B-63 Trench and the 216-S-10 and 216-S-11 Ponds.

Of the remediation alternatives evaluated in the 200-CS-1 OU FS Report[1], the preferred alternative as selected by the DOE, the EPA and the Washington State Department of Ecology (Ecology) is to mitigate the source of the contamination as follows:

- 216-A-29 Ditch- Removal, Treatment, and Disposal
- 216-B-63 Trench- No Action
- 216-S-10 Ditch- Removal, Treatment, and Disposal
- 216-S-10 Pond- No Action
- 216-S-11 Pond- No Action.

The levels of contamination at the 216-A-29 and 216-S-10 Ditches are not expected to pose a health risk to remediation workers when typical mitigation practices are followed from a health and safety plan. Typical practices should include enclosed excavation equipment and water-based dust suppression. These practices limit the worker risk, with minimal impact on schedule and cost because excavation with dust suppression and health and safety controls have been proven effective in excavating soil sites. There would not be any short-term risks to the public from existing DOE site-access measures. Thus a Medium Unmitigated rating (because the peak ELCR exceeds the CERCLA "action limit") and Low Mitigated rating were assigned for the Facility Worker.

No information is available regarding human health risks associated with remediation strategies for other sites within the two EUs.

Groundwater, Vadose Zone, and Columbia River

Current

The CP-LS-5 (U and S Pond) EU is in the 200 West Area to the east of the S-SX Tank and Waste Farms EU (CP-TF-2 in Appendix E.3) and overlays the northern most part of the 200-UP groundwater interest area (GWIA) near the intersection with the 200-ZP GWIA. The 200-UP and 200-ZP GWIAs are described in the CP-GW-2 EU (Appendix D.6). The saturated zone beneath the CP-LS-5 (U and S Pond) area overlaying the 200-UP GWIA has elevated levels of total and hexavalent chromium, carbon tetrachloride (CCl_4), I-129, nitrate, Tc-99, tritium (H-3), and uranium (total) based on the 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html); sites within the CP-LS-5 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0). The current threats to groundwater and the Columbia River from contaminants already in the 200-UP groundwater are evaluated as part of the CP-GW-2 EU (Appendix D.6). However, current threats to groundwater corresponding to only the CP-LS-5 EU contaminants *remaining* in the vadose zone (Table G.6-5) has an overall rating of *Very High* (related to carbon tetrachloride) as described in **Part V**. In the 200 West Area, contaminated 200-UP groundwater is treated using the WMA S-SX groundwater extraction system[4], the U Plant area P&T system (uranium plume), and the I-129 plume hydraulic control system and 200-ZP

[4] 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).

groundwater is treated using the 200 West Pump and Treat (P&T) system[5] (DOE/RL-2016-09, Rev. 0). As indicated in **Part V**, only 200-UP plumes have been linked to CP-LS-5 waste sites (where the carbon tetrachloride is managed in the 200-ZP GWIA). Threats from contaminated groundwater in the 200 West Area to contaminate additional groundwater or the Columbia River are evaluated as part of the CP-GW-2 EU (Appendix D.6).

The CP-LS-11 (B Pond) EU is in the 200 East Area north of the C Tank and Waste Farms EU (CP-TF-7 in Appendix E.8) and to the east of the B-BX-BY Tank and Waste Farms EU (CP-TF-6 in Appendix E.7). The CP-LS-11 EU primarily overlays the extreme southern part of the 200-BP GWIA but also overlays a small part of the 200-PO GWIA; these GWIAs are described in the CP-GW-1 EU (Appendix D.5). The saturated zone beneath the CP-LS-11 area has elevated levels of cyanide (CN), I-129, nitrate, Sr-90, Tc-99, tritium (H-3), and uranium (total) based on the 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html); sites within the CP-LS-11 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0). Current threats to groundwater and the Columbia River from contaminants already in the 200-BP and 200-PO groundwater are evaluated as part of the CP-GW-1 EU (Appendix D.5). However, current threats to groundwater corresponding to only the CP-LS-11 EU contaminants *remaining* in the vadose zone (Table G.6-6) have an overall rating of *Very High* (based on carbon tetrachloride) as described in **Part V**. In the 200 East Area, contaminated 200-UP groundwater is currently not being treated although there is a treatability study underway unrelated to CP-LS-11 to evaluate removal of uranium from the perched water zone beneath B Complex). As indicated in **Part V**, both 200-BP and 200-PO plumes have been linked to CP-LS-11 waste sites. Threats from contaminated groundwater in the 200 East Area to contaminate additional groundwater or the Columbia River are evaluated as part of the CP-GW-1 EU (Appendix D.5).

For the 200-UP and 200-ZP GWIAs (in 200 West), no plume currently emanating from the CP-LS-5 waste sites intersects the Columbia River at concentrations exceeding the corresponding water quality standard (WQS) as described in **Part V**. Thus current impacts to the Columbia River benthic and riparian ecology would be rated as *Not Discernible* (*ND*) for CP-LS-5. For the 200-BP and 200-PO GWIAs (in 200 East), no plume emanating from the CP-LS-11 waste sites intersects the River at sufficient concentrations to exceed WQS, and impacts are also rated *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 plausible remedial actions for the CP-LS-5 EU waste sites include (Appendix B): i) RTD contaminated soil sites to achieve RAOs comparable to 100 Areas; backfill, contour, and revegetate excavations; ii) RTD all sites except ponds; allow MNA for large pond sites with presence of existing vegetated soil covers; iii) allow MNA to proceed for all sites with appropriate ICs. For the CP-LS-11 waste sites, the plausible remedial actions for the outer area soil sites are the same as for CP-LS-5, for the inner soil sites the plausible actions include (Appendix B)[6]: i) RTD approximately half of waste sites

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

[6] For the CP-LS-11 pipelines and associated equipment, the plausible remedial actions include (Appendix B): i) RTD all contaminated equipment, materials, debris and soil to a depth that is determined by the Tri-Party agencies to be protective of human health and ecological resources (depth TBD); backfill and revegetate; ii) RTD all contaminated equipment, materials, debris and soil; backfill and revegetate.; iii) stabilize select equipment in place using technologies yet to be determined; iv) leave everything in place; maintain under LTS with appropriate ICs; v)

and cap remainder; ii) RTD all waste sites; backfill and revegetate; iii) cap and maintain under LTS with monitoring and appropriate ICs; and iv) if residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including ICs and 5-year reviews of remedy effectiveness. No final cleanup decisions have been made for either CP-LS-5 or CP-LS-11.

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) from the CP-LS-5 and CP-LS-11 waste sites. However, final cleanup decisions will be made to be protective of human health and the environment and thus it is likely that at least some vadose contamination will be removed to satisfy remedial goals and a cover will be installed (at least in places) to limit infiltrating water that tends to be the primary motive force to mobilize contamination in the vadose zone. Thus even though there would be risks to workers associated with the cleanup of the CP-LS-5 and CP-LS-11 waste sites (described above and in **Part VI**), there is unlikely any discernible impact from likely cleanup actions on groundwater or the Columbia River.

Contaminants from the CP-LS-5 and CP-LS-11 EU waste sites are suspected of impacting the vadose zone and groundwater; treatment using the actions mentioned in the previous section (only in the 200 West Area) is not predicted to decrease all concentrations to below thresholds before the Active Cleanup phase commences although there should be significant decreases in contaminant levels in 200 West. Secondary sources in the vadose also threaten to continue to impact groundwater in the future, including the Active Cleanup period[7]. The *High* and *Very High* ratings for the CP-LS-5 EU waste sites (Table G.6-5) are associated with total and hexavalent chromium and carbon tetrachloride (CCl_4), respectively, that could potentially impact groundwater in the 200 West Area (CP-GW-2, Appendix G.6). The *Very High* and *High* ratings for the CP-LS-11 waste sites (Table G.6-6) are associated with CCl_4 and Sr-90, respectively, that could impact groundwater in the 200 East Area (CP-GW-1, Appendix G.5).

As described in the TC&WM EIS and summarized in **Part V**, even though there appears to be insufficient impact to the overall rating for CP-LS-5 from radioactive decay (since carbon tetrachloride is the risk driver) and recharge rate (due to large amounts of contaminants already in the groundwater), treatment of contaminants in 200 West (using the WMA S-SX groundwater extraction system, the U Plant area P&T system, and the I-129 plume hydraulic control system) and 200-ZP GWIA (via the 200 West Pump and Treat System) would support that groundwater ratings could be reduced to *Low* for most CP-LS-5 contaminants by the end of the Active Cleanup period[8]; however, treatment of groundwater does not impact the ratings associated with vadose zone contamination. There would not be a sufficient impact on peak concentrations in near-shore region of the Columbia River during or after cleanup to modify ratings (which are already *ND*). Thus the ratings for current threats provided in Table G.6-5 would not be modified (because there is still a large carbon tetrachloride source in the vadose zone) except for Sr-90 to *Low* (to address uncertainty) as described in **Part V**. The overall rating remains *Very High* (CCl_4) for the

---

if residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including ICs and 5-year reviews of remedy effectiveness.

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

[8] As described in Part V, the exception is I-129 where hydraulic control is assumed to prevent additional spreading of the groundwater plumes, but is not treating the plume. Other remedial actions in the area involve treating groundwater but have not addressed the vadose zone sources to date. Thus the vadose zone ratings do not change.

Active Cleanup and Near-term Post-Cleanup periods because final remedial decisions have not been made. However, as also described in **Part V** for CP-LS-11, ratings are not changed (except for total uranium to *Low*) because no remedial actions are currently being conducted in the 200 East Area.

Ecological Resources

Current

CP-LS-5: The field evaluation of the EU indicates that the resources are higher quality than previously mapped, including a small region (2%) of level resources. The level 5 resources are continuous with the 19% level 5 in the buffer. Further, the field evaluation identified loggerhead shrikes (Federal species of concern and Washington State candidate species). The EU and buffer are recovering from a fire and now have a diverse plant species list, which suggests that plant succession is occurring and successful. Past revegetation has not increased quality habitat or added resource value to the area. Continued monitoring with vehicle traffic has the potential of introducing exotic species and disrupting bird activity.

CP-LS-11: 20% of EU and 79% of the buffer area are level 3 or higher resources. The highest quality resources are on the eastern end of the EU, and those areas are continuous with similar or higher habitat quality outside the buffer. Black-tailed rack rabbits and Piper's daisy are common. Impact rating is dependent on the level of activity in the EU and the potential for disturbing nesting birds and other sensitive wildlife.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

CP-LS-5: Personnel, car and pickup truck traffic through the non-target and target (remediation) area, truck and heavy equipment traffic on roads through the non-target and target area, soil removal and contamination in the soil, dust suppression, vegetation control, and Irrigation (for revegetation) will cause the following disturbance from remediation activities: Carry seeds or propagules (pieces of vegetation or other biological parts that can grow and/or reproduce) on person (boots, clothes, equipment), from tires of vehicles or blowing from heavy equipment; injure or kill vegetation or small invertebrates or small animals; vehicle traffic can make paths, compact soil, scare or displace animals, can impact animal behavior or reproductive success; affect animal dispersion and habitat use (e.g., some birds avoid nesting near roads because of song masking); displacement of animals from near roads due to increased noise or other disturbances; and heavy equipment may permanently destroy areas of the site with intense activity. Soil removal causes complete destruction of existing ecosystem, but these effects are potentially more severe because of blowing soil (and seeds); and potential for exposure of dormant seeds. In the revegetation stage, there is the potential for invasion of exotic species, changing the species diversity of native communities. During remediation, radionuclides or other contaminants could be released or spilled on the surface, and depending upon the type and quantity, could have adverse effects on the plants and animals onsite. Additional water from dust suppression could lead to more diverse and abundant vegetation in areas that receive water, which could encourage invasion of exotic species; the latter could displace native plant communities; excessive dust suppression activities could lead to compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Use of nonspecific herbicides for vegetation control results in some mortality of native vegetation (especially native forbes), and allows exotic species to move in; it may change species composition of native communities, but it also could make it easier for native species to move in; improved methods could yield positive results. Irrigation requires a system of pumps and water, resulting in physical disturbance; repeated irrigation from the same locations could result in some soil compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. These effects will be higher in the EU itself.

CP-LS-11: Remove, Treat and Dispose of waste involves personnel through the target (remediation) area, car and pickup truck traffic through the non-target and target (remediation) area, truck, heavy equipment (including drill rigs) traffic on roads through the non-target and target area, caps (and other containment), soil removal and contamination in the soil, vegetation control, and irrigation (for revegetation) will cause the following disturbance from remediation activities: Carry seeds or propagules (pieces of vegetation or other biological parts that can grow and/or reproduce) on tires of vehicles or blowing from heavy equipment; injure or kill vegetation or small invertebrates or small animals; vehicle traffic can make paths, compact soil, scare or displace animals, can impact animal behavior or reproductive success; affect animal dispersion and habitat use (e.g., some birds avoid nesting near roads because of song masking); displacement of animals from near roads due to increased noise or other disturbances; and heavy equipment may permanently destroy areas of the site with intense activity. Soil removal can cause more severe effects because of blowing soil (and seeds). During remediation, radionuclides or other contaminants could be released or spilled on the surface, and depending upon the type and quantity, could have adverse effects on the plants and animals on-site. Use of non-specific herbicides for vegetation control results in some mortality of native vegetation (especially native forbes), and allows exotic species to move in; it may change species composition of native communities, but it also could make it easier for native species to move in; improved methods could yield positive results. Irrigation requires a system of pumps and water, resulting in physical disturbance; repeated irrigation from the same locations could result in some soil compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Alternatively, barriers could be the remediation option and involves personnel car and pickup truck traffic through the non-target and target (remediation) area, truck and heavy equipment traffic on roads through the non-target and target area, dust suppression, and irrigation (for revegetation) will cause the following disturbance from remediation activities: Carry seeds or propagules (pieces of vegetation or other biological parts that can grow and/or reproduce) on person (boots, clothes, equipment) or tires of vehicles or blowing from heavy equipment; injure vegetation or small invertebrates or small animals (e.g., insects, snakes); make paths or compact soil; scare or displace animals. Caps and other containment can cause compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Destruction of soil invertebrates at depths of pits. Potential bringing up of dormant seeds from soil layers; disruption of ground-living small mammals and hibernation sites of snakes and other animals on-site of containment; often disrupts local aquatic environment and drainage; often non-native plants used on caps (which can become exotic/alien adjacent to the containment site). Additional water from dust suppression could lead to more diverse and abundant vegetation in areas that receive water, which could encourage invasion of exotic species; the latter could displace native plant communities; excessive dust suppression activities could lead to compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Irrigation requires a system of pumps and water, resulting in physical disturbance; repeated irrigation from the same locations could result in some soil compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. These effects will be higher in the EU itself.

Cultural Resources

Current

CP-LS-5:

Native American – Area is relatively undisturbed and only small portions have been inventoried for archaeological resources. Geomorphology indicates a moderate potential to contain intact archaeological resources on the surface and/or subsurface. Two TCPs are visible from the EU.

Historic Pre-Hanford – Known archaeological resources located within and within 500 meters of the EU.

Manhattan/Cold War – Manhattan Project/Cold War Era significant resources have been mitigated (located within 500 meters of the EU). No Manhattan Project/Cold War Era buildings located within the EU.

CP-LS-11:

Native American & Historic Pre-Hanford – Known archaeological isolates (unevaluated for the National Register) located within the EU. Area is heavily disturbed and only portions of the EU have been inventoried for archaeological resources. Geomorphology indicates a moderate potential to contain intact archaeological resources on the surface and/or subsurface. Traditional cultural places are visible from EU. Known archaeological resources located within 500 meters of the EU.

Manhattan/Cold War – National Register eligible Manhattan Project/Cold War significant resources located within 500 meters of the EU have already been mitigated.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

CP-LS-5:

Native American & Historic Pre-Hanford – Archaeological investigations and monitoring may need to occur prior to remediation. The area remains relatively undisturbed, suggesting a high potential for intact archaeological resources. Remediation disturbance may result in impacts to archaeological resources if they are present in the subsurface.

Manhattan/Cold War – Manhattan Project/Cold War Era significant resources have been mitigated. No Manhattan Project/Cold War Era buildings located within the EU.

CP-LS-11:

Native American & Historic Pre-Hanford – Archaeological investigations and monitoring may need to occur prior to remediation. The geomorphology indicates a moderate potential for intact archaeological resources. Remediation disturbance may result in impacts to archaeological resources if they are present in the subsurface. Permanent indirect effects to viewshed are possible from capping. Temporary indirect effects to viewshed are possible during remediation.

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

Considerations for Timing of the Cleanup Actions

The saturated zone beneath the CP-LS-5 area currently has elevated levels of total and hexavalent chromium, carbon tetrachloride (CCl_4), I-129, nitrate, Tc-99, tritium (H-3), and uranium (total) based on the 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). Sites within the CP-LS-5 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0) and are likely currently contributing contamination to the vadose zone.

Monitoring and treatment of groundwater is being conducted within the 200-UP GWIA (via the WMA S-SX groundwater extraction system, the U Plant area P&T system, and the I-129 plume hydraulic control system) and 200-ZP GWIA (via the 200 West Pump and Treat System); these actions are described as part of the CP-GW-2 EU (Appendix D.6). Treatment efforts indicate a general downward trend in contaminant concentrations; however, some plume areas have increased (e.g., carbon tetrachloride, chromium, and TCE in 200-ZP and all plumes except for nitrates and uranium in 200-UP) and concentrations continue to exceed cleanup levels. Thus additional cleanup actions are likely warranted for this EU.

The saturated zone beneath the CP-LS-11 area currently has elevated levels of cyanide (CN), I-129, nitrate, Sr-90, Tc-99, tritium (H-3), and uranium (total) based on the 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). Sites within the CP-LS-11 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0) and are likely currently contributing contamination to the vadose zone. Monitoring of groundwater is being conducted within the 200-BP and 200-PO GWIAs as described in CP-GW-1 EU (Appendix D.5). Several plume areas have increased since 2013 and concentrations in 200 East groundwater continue to exceed cleanup levels; thus additional cleanup actions are likely warranted for this EU.

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

Near-Term, Post-Cleanup Risks and Potential Impacts

Excavation of the 216-A-29 and 216-S-10 Ditches would continue until the contaminated soil in each that is greater than the remediation action objective (RAO) is removed. The first two CERCLA criteria are overall protection of human health and the environment and compliance with ARARs. The waste site will then be backfilled with clean material. The surface would be recontoured and revegetated to be compatible with surrounding natural areas or other features.

No information is available regarding remediation strategies for other sites within the two EUs not described above.

Groundwater: During the Near-term, Post-Cleanup period (described in **Parts V** and **VI** and Table G.6-7), ratings are maintained for the primary contaminants because groundwater treatment does not change the threat and rating associated with the remaining vadose zone contamination sources. The ratings for the CP-LS-11 Group A and B contaminants are also unchanged because remedial actions have not yet been started in the 200 East Area. Sr-90 and total uranium have ratings of *Low* to address uncertainties during this period.

Columbia River: As indicated in **Part V**, no radionuclides or chemicals from the 200 West or 200 East Area (associated with either CP-LS-5 or CP-LS-11) 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.6-7).

PART II. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S)

The four large TSD (treat, storage, and/or disposal) waste sites 216-S-10 Pond and Ditch, 216-S11 Pond, 200-A-29 Ditch and 200-B-63 Ditch systems are the primary components of the 200-CS-1 Chemical Sewer Group Operable Unit. Most of the individual sites making up the two EUs are also contained within Operable Units 200-OA-1, 200-CW-1 or 200-IS-1. Some CP-LS-11 sites are also in 200-EA-1 and some CP-LS-5 sites are in 200-WA-1 and 200-CW-5.

COMMON NAME(S) FOR EU

Liquid waste disposal sites; B, S and U waste ponds and ditches,

KEY WORDS

Liquid waste disposal

REGULATORY STATUS:

Regulatory basis

The individual sites in these two EUs are being treated as past-practice sites under CERCLA remedial action and RCRA corrective action requirements or as TSD process-waste pipeline and pipeline component waste sites under RCRA.

Applicable regulatory documentation

Remediate Remaining 200 East Inner Area Contaminated Soil Sites (200-EA-1 OU): Action memoranda (DOE/RL-2009-37, DOE/RL-2009-86) are in place to remove contaminated soil, structures, and debris from 200 West Inner Area soil sites with disposal at ERDF. Future cleanup decisions for remaining waste sites will be included in decision documents (e.g., action memoranda, RODs).
Remediate Remaining Outer Area Contaminated Soil Sites (200-OA-1, 200-CW-1, and 200-CW-3 OUs): An interim ROD, ESD, and action memoranda are in place to remove contaminated soil, structures, and debris with disposal at ERDF.

> EPA/ROD/R10-99/039,
> EPA, 2009a, *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision,*
> DOE/RL-2009-37; DOE/RL-2009-48; DOE/RL-2009-86

Future cleanup decisions for remaining soil sites will be included in decision documents (e.g., action memoranda, RODs).

Applicable Consent Decree or TPA milestones

M-015-92B: Submit RCRA Facility Investigation/Corrective Measures Study & Remedial Investigation/Feasibility Study Report and Proposed Corrective Action Decision/Proposed Plan for the 200-EA-1 OU (Central Plateau 200 East Inner Area) to Ecology. Due November 30, 2022

M-015-92C: 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 March 31, 2023

M-15-38B: Submit a Feasibility Study Report and Proposed Plan(s) for the 200-CW-1, 200-CW-3, and 200-0A-1 Operable Units for Waste Sites in the Outer Area of the Central Plateau to EPA. Due July 31, 2023

M-037-10: Complete Unit-Specific Closure Requirements according to the closure plan(s) for six (6) TSD Units: 207-A South Retention Basin, 216-A-29 Ditch, 216-A-368 Crib, 216-A-37-1 Crib, 216-8-63 Trench, and Hexane Storage and Treatment Facility (276-S-141/142). Due date September 30, 2020

M-037-11: Complete unit-specific closure requirements for two (2) TSD Units: 216-B-3 Main Pond system and 216-S-10 Pond and Ditch. Due September 30, 2024

RISK REVIEW EVALUATION INFORMATION

Completed

August 26, 2016

Evaluated by

Henry Mayer, Joanna Burger, Jennifer Salisbury, Amoret Bunn and Kevin Brown

Ratings/Impacts Reviewed by

Kathyrn Higley

PART III. SUMMARY DESCRIPTION

CURRENT LAND USE

Both 216-A-29 Ditch and 216-B-63 Trench are located in the 200 Areas, which are inside the industrial exclusive area. The 216-S-10 Ditch, 216-S-10 Pond and the 216-S-11 Pond are allocated outside the 200 Area industrial-exclusive boundary in the conservation (mining) area [DOE/RL-2005-63 Rev 0].

DESIGNATED FUTURE LAND USE

Industrial land use for 200 Areas is favored by the US DOE, Richland Operations Office, EPA and Ecology. This preferred land use is consistent with “industrial-exclusive” land use selected by DOE through the National Environmental Policy Act process and finalized in the Record of Decision 1999 (64 FR 61615). Outside 200 Areas, the preferred land-use is preservation and conservation (DOE 1999).

Three of the waste sites, 216-S-10 Ditch, 216-S-10 Pond and 216-S-11 Pond are located outside the industrial-exclusive land use boundary. The land use outside the Central Plateau boundary is considered conservation/mining. The ROD identifies conservation (mining) as an area reserved for the management and protection of archeological, cultural, ecological, and natural resources. Limited and managed mining (e.g., quarrying for sand, gravel, basalt, and topsoil for governmental purposes only) could occur as a special use (i.e., a permit [issued by the DOE Realty Officer] would be required) within appropriate areas.[9]

---

[9] *Proposed Plan for the 200-CS-1 Chemical Sewers Group Operable Unit*, DOE/RL-2005-64, Revision 0, US Department of Energy, September 2008.

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

The two Evaluation Units are comprised of several ponds, ditches, piping and cribs intended for percolation of liquid wastes primarily associated with chemical sewer discharges from the separation and concentration processes at the of the U Plant, REDOX (S Plant), and Plutonium Finishing Plant, the 1970s cesium/strontium recovery operations at the B Plant, and other facilities in the 200 Area. Wastes in the B Pond sites are of fission products (Cs-137, Sr-90), plutonium, uranium, inorganics (such as nitrates), heavy metals (e.g. cadmium, chromium) and various organic waste (e.g. PCBs). Predominant contaminants within most of the U and S Pond sites are uranium, nitrates, chromium, and to a lesser extent tritium and various fission products. For the Z-ditches, the contaminants of concern are americium, plutonium, radium, PCBs, boron, mercury, cesium and strontium. The contaminated media by and large is soil (sometimes in association with groundwater), with some small fraction of the media consisting of piping and limited concrete for spillways and flow control structures.

High-Level Waste Tanks and Ancillary Equipment

Not Applicable

Groundwater Plumes

The saturated zone beneath the CP-LS-5 (U and S Pond) area currently has elevated levels of total and hexavalent chromium, carbon tetrachloride (CCl_4), I-129, nitrate, Tc-99, tritium (H-3), and total uranium based on 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). The 200 West Area plumes are described in detail in the CP-GW-2 EU (Appendix D.6). Waste sites within the CP-LS-5 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0) and have been linked as sources for some plumes (e.g., uranium and carbon tetrachloride) in the 200 West area (DOE/RL-2016-09, Rev. 0). Monitoring and treatment of groundwater is being conducted within the 200-UP (using the WMA S-SX groundwater extraction system, the U Plant area P&T system, and the I-129 plume hydraulic control system) and 200-ZP (in the 200 West P&T facility) GWIAs, which are described as part of the CP-GW-2 EU (Appendix D.6).

The saturated zone beneath the CP-LS-11 (B Pond) area currently has elevated levels of cyanide (CN), I-129, nitrate, Sr-90, Tc-99, tritium (H-3), and total uranium based on 2014 groundwater monitoring results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). The 200 East Area plumes are described in detail in the CP-GW-1 EU (Appendix D.5). Waste sites within the CP-LS-11 EU are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0) and have been linked as sources for some plumes (e.g., I-129 and Sr-90) in the 200 East Area (DOE/RL-2016-09, Rev. 0). Monitoring of groundwater is being conducted as part of the CP-GW-1 EU (Appendix D.5).

Operating Facilities

Not Applicable

D&D of Inactive Facilities

The only facilities identified in these two EUs are 216A271, an inactive Valve Control House, and 2508W9 and W11 which are active Sirens. No information is available on need or timing of D4.

LOCATION AND LAYOUT MAPS

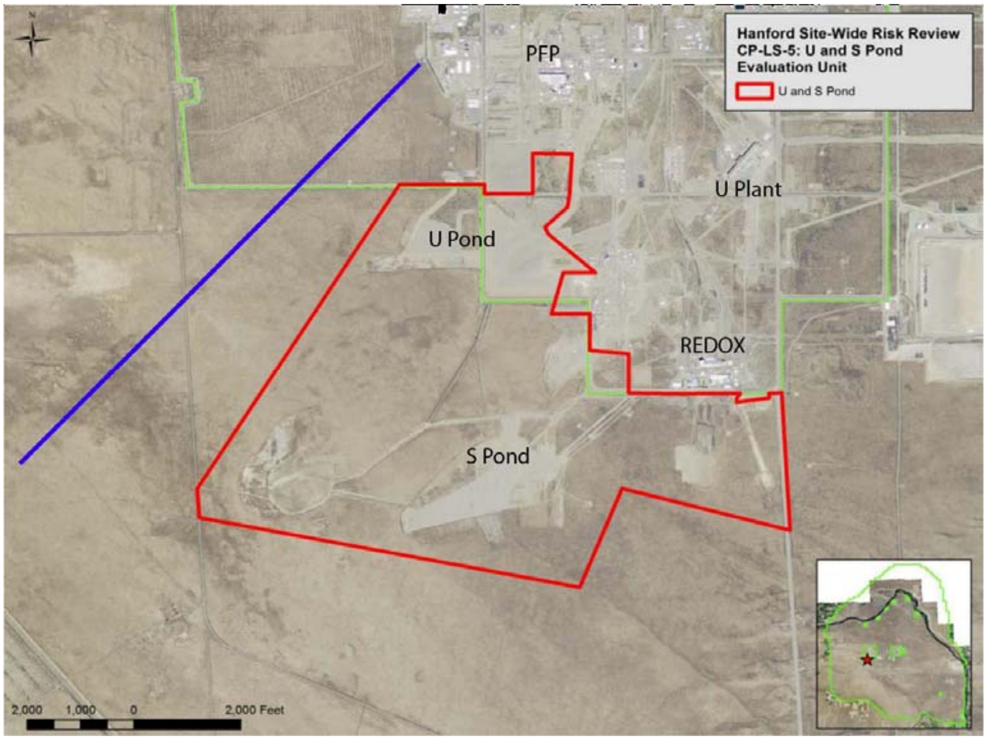

Figure G.6-1. Evaluation Unit CP-LS-5 location relative to 200-W Area and White Bluff Rd (in blue)

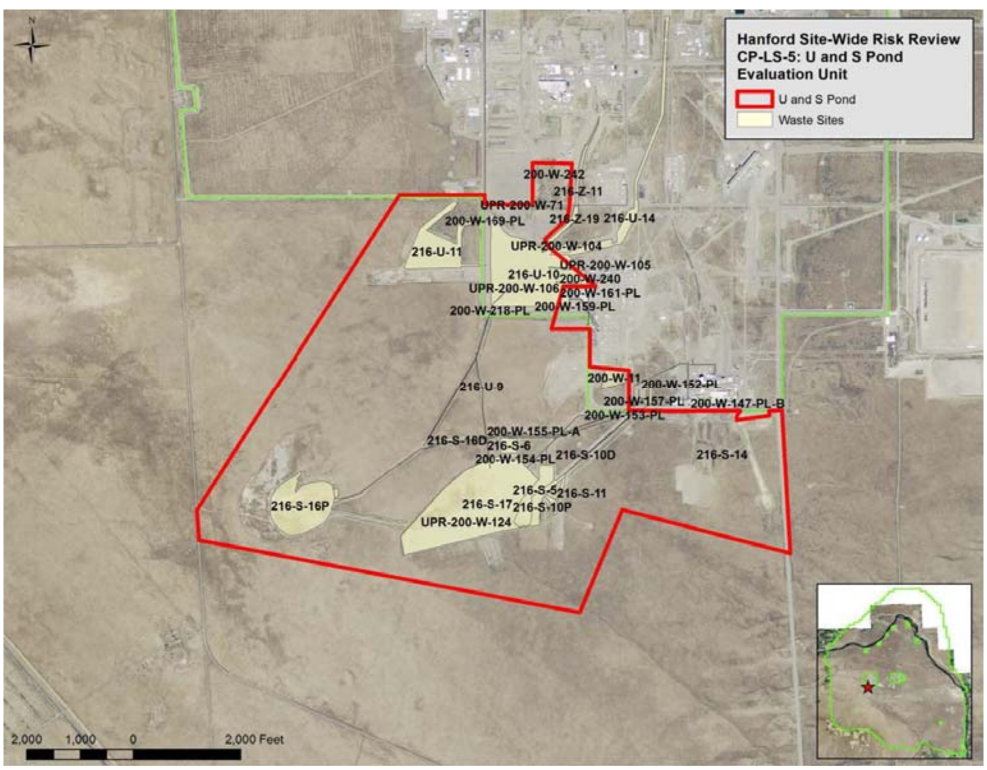

Figure G.6-2. Individual Site locations within Evaluation Unit CP-LS-5

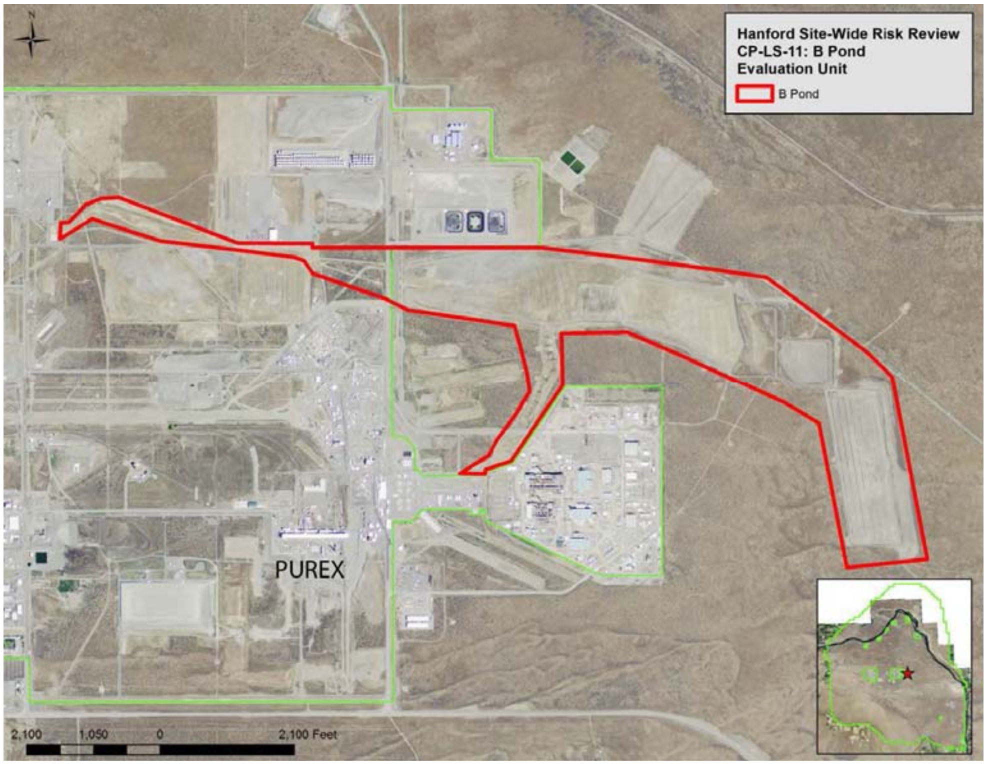

Figure G.6-3. Evaluation Unit CP-LS-11 location relative to 200-E Area

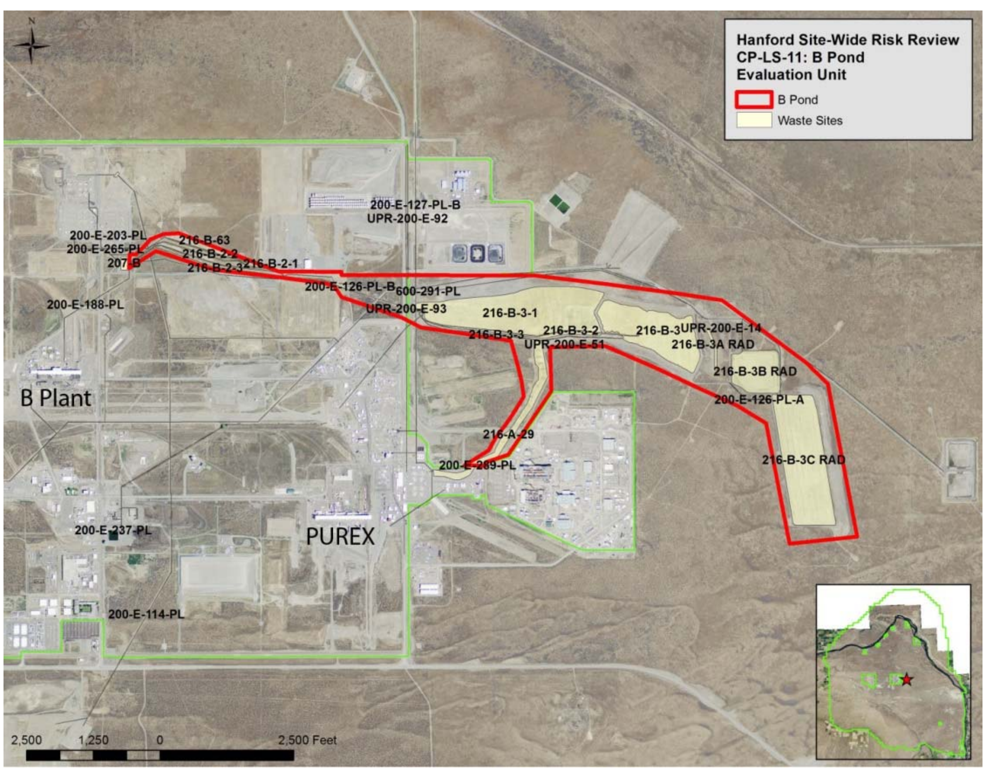

Figure G.6-4. Individual Site locations within Evaluation Unit CP-LS-11

PART IV. UNIT DESCRIPTION AND HISTORY

EU FORMER/CURRENT USE(S)

The two Evaluation Units are comprised of several ponds, ditches, piping and cribs intended for percolation of liquid wastes primarily associated with chemical sewer discharges from the separation and concentration processes at the of the U Plant, REDOX (S Plant), and Plutonium Finishing Plant, the 1970s cesium/strontium recovery operations at the B Plant, and other facilities in the 200 Area. Most of the individual sites making up the two EUs are contained within Operable Units 200-OA-1, 200-CW-1 or 200-IS-1. Some CP-LS-11 sites are also in 200-EA-1 and some CP-LS-5 sites are in 200-WA-1 and 200-CW-5. There is also some overlap, with the four TSD (treat, storage, and/or disposal) waste sites 216-S-10 Pond and Ditch, 216-S-11 Pond, 200-A-29 Ditch and 200-B-63 Ditch also being part of the 200-CS-1 Operable Units.

The 200 Area chemical sewers were designed to be uncontaminated, but often contained limited quantities of radionuclides and chemicals. These contaminants accumulated in the sediment over time, and vegetation and algae within ponds and ditches tended to collect and concentrate the radionuclides. Commonly reported contaminants include plutonium, cesium, uranium, and strontium. The most significant contamination of the sites was caused by unplanned releases originating from both inside and outside of the generating facilities. Contaminants from these releases have migrated below the waste sites and have accumulated in the soil column.[10]

LEGACY SOURCE SITES

216-S-10 Pond and Ditch[11,12]

The 216-S-10 Pond and Ditch were unlined open excavations. They begin about 1,460 feet southwest of the REDOX building and 133 feet south of 10th street, and ends about 4,364 feet southwest of the REDOX building. The 216-S-10 Pond covered about 5 acres and was 8 feet deep at its deepest point. The initial configuration of the 216-S-10 Ditch was approximately 4 feet wide at its base, at least 6 feet deep and about 2,250 long. See Figures 1 and 2.

Chemical sewer discharges from the separation and concentration processes at the Reduction Oxidation (REDOX) Facility discharged into the 216-S-10 Ditch which flowed into the 216-S-10 Pond, where it evaporated or infiltrated into the ground. The 216-S-10 Ditch began receiving wastewater from the REDOX Facility chemical sewer in August 1951. After an unplanned release of uranium in May 1954, the ditch was dredged and then covered with 2 feet of soil. Additional increases in discharge to the S-10 Ditch and Pond necessitated the digging of the two 216-S-11 leach ponds on the southeast side of the 216-S-10 ditch that same year. The 216-S-11 lobes were dammed in 1965, so that all of the effluent was diverted along the S-10 ditch to the 216-S-10 pond. The south lobe of the 216-S-11 pond was covered in the summer of 1975 and was free of radioactive contamination.

Approximately 50 waste streams contributed to the 216-S-10 Ditch. The routine waste stream sources include the compressor cooling water from the 202-S Canyon and the sanitary water overflow from the

---

[10] *200-CS-1 Operable Unit RI/FS Work Plan and RCRA TSD Unit Sampling Plan*, DOE/RL-99-44, Rev. 0, US Department of Energy, April 2000.
[11] *216-S-10 Pond and Ditch Closure Plan*, DOE/RL-2006-12, Draft B, US Department of Energy, April 2013.
[12] *Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch*, PNNL-14070, Pacific Northwest National laboratory for US Department of Energy, October 2002.

water tower. The remaining sources were infrequent additions and include the Canyon floor drains, chemical sewer line manholes, and 276-S Solvent Handling Facility floor drains. The effluent to the chemical sewer was composed of approximately 60 percent REDOX Facility raw water, 20 percent sanitary water, and 20 percent steam condensate.

In September 1954, an inadvertent discharge of ammonium nitrate nonahydrate solution reduced the infiltration capacity. To improve infiltration, 2 ft. of sediment was dredged from the bottom of the ditch in 1955. The contaminated sediment was buried in excavation pits along the sides of the ditch.

The216-S-10 Pond and Ditch was also used as the disposal site for the Chemical Engineering Laboratory between 1980 and 1983. One documented discharge of dangerous waste (simulated double-shell tank slurry) in September, 1983 was received from the Laboratory. This discharge was sent via the sewer to the pond and ditch and consisted of 1,000 lbs of sodium nitrate (46 percent), sodium hydroxide (41 percent), and small quantities of sodium phosphate, sodium fluoride, sodium chloride, and potassium dichromate.

The 216-S-10 pond and southwest end of the 216-S-10 ditch were decommissioned, backfilled, and stabilized in October 1985; the northern portion of the ditch remained operational and received nonhazardous (i.e., not regulated under RCRA) chemical sewer waste from the REDOX Plant until October 1991. The effluent supply pipeline was plugged with concrete near the outfall in July 1994. The remaining portion of the S-10 ditch was decommissioned and backfilled in 1991.

216-U-10 Pond System[13]

The 216-U-14 Ditch began operating in 1944 and was used mainly to channel effluent to the 216-U-10 Pond. The Ditch was an unlined, open excavation approximately 9 feet deep and 5,680 ft. long. It originated about 1,600 ft. northwest of U Plant at the 284-WB Powerhouse Pond and terminated at the Pond. The Ditch and Pond were used to manage low-level radioactive wastewater by infiltration and evaporation. See Figures 1 and 2.

During the useful life of the Ditch, the growth of live plants and the accumulation of dead plant material caused localized damming. Buildup of fly ash, scale, and lint from the powerhouse laundry discharge reduced the infiltration capacity of the ditch. To prevent discharge backups, the Ditch was dredged periodically. Sediments removed during dredging activities were piled on a berm on the west bank of the Ditch. The berm was removed and buried in a low-level burial ground in 1979 to reduce the spread of contamination.

The 216-U-10 Pond was constructed in a natural topographic depression in the southwest corner of the 200 West Area to act as a seepage area for infiltration of wastewater from the 216-U-14 and 216-Z Area Ditches. The pond later was diked on the south and west edges, and three overflow trenches were added on the east side in approximately 1952-53 to increase volume capacity. With overflow trenches the Pond covered an area of about 30 acres. In 1985 the pond was deactivated and interim stabilized. Stabilization activities included scraping contaminated pond sediments from peripheral areas to a depth of 1 foot or more and placing the sediments in the center of the pond. The peripheral areas were covered with a minimum of 2 feet of clean soil, and the central pond area was covered with a minimum of 4 ft. of clean soil and seeded. In 1990, 1.5 acres of contaminated soil on the south side of the pond was covered with an additional 2 ft. of clean fill to stabilize surface contamination. In November 1994,

[13] *Remedial Investigation Report for the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2- S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units*, DOE/RL-2003-11, Revision 0, US Department of Energy, August 2004.

In 1985, the 216-U-10 Pond and most of the 216-U-14 Ditch were stabilized with sand and gravel to control surface contamination. After stabilization in 1985**,** approximately 1,410 ft. on the west end of the ditch remained. It was used mainly for percolation of effluent. In 1992, the lower open end of the ditch (westernmost end of the ditch) was partially stabilized with an engineered barrier to control surface contamination. The slopes were pushed in, approximately half of the ditch was brought to grade, and the ditch was backfilled with large boulders, cobbles, and gravel. The remaining open section of the ditch received effluent from an air-sampling pump until April 1995, then was stabilized by chemically killing all vegetation, consolidating the contaminated soil into the center of the ditch, and backfilling with clean soil.

216-Z-11 Ditch[5]

The 216-Z-11 Ditch was the second of three ditches constructed to transfer wastewaters from the Plutonium Finishing Plant (PFP or Z Plant) facilities to the 216-U-10 Pond. Beginning in December 1944, the first "Z Ditch," currently designated the 216-Z-1D Ditch, received effluent from the 231-Z Building. The Ditch was constructed as an unlined, open excavation about 4,249 ft. long and 2 ft. deep, with a bottom width of 4 feet. The original headwall of the 216-Z-1D Ditch was located 196 ft. east of the 231-Z Building.

In July 1949, as part of 234-5Z Building (PFP) construction, a vitreous clay pipeline 18 inches in diameter was installed to replace the upper portion of the 216-Z-1D Ditch, and a new headwall was constructed approximately 1,500 ft. downstream. The abandoned upper portion of the ditch was backfilled. In March 1959**,** after high plutonium contamination was discovered in the 216-Z-1D Ditch, construction began on the 216-Z-11 Ditch as a replacement. The 216-Z-11 Ditch was excavated just east of and parallel to the 216-Z-1D Ditch and was of similar design and construction. Material removed during excavation was used to backfill the 216-Z-1D Ditch to existing grade. The 216-Z-11 Ditch merged back into the original 216-Z-1D Ditch at the lower end between the 216-U-10 Pond delta region and 16th Street crossing. The entire ditch was redesignated as the 216-Z-11 Ditch.

In April 1971, the 216-Z-11 Ditch was retired and replaced with a third ditch, the 216-Z-19 Ditch. The 216-Z-19 Ditch was constructed west of and parallel to the 216-Z-1D and 216-Z-11 Ditches.

Deactivation and stabilization of the Z-Ditch Complex began in 1981, following construction of the 216-Z-20 Crib as the primary PFP wastewater disposal facility. Live, woody vegetation in the 216-Z-19 Ditch was killed with herbicides (glyphosate and dicamba) before backfill operations were initiated. The 216-Z-19 Ditch was covered with 2-3 ft. of clean soil. The concrete headwalls, vegetation, and miscellaneous unsalvageable equipment were incorporated into the ditch bottom. At the same time, the previously buried 216-Z-1D and 216-Z-11 Ditches received an additional 1 foot of clean fill. The entire Z Ditch Complex was reposted as an Underground Radioactive Area.

216-B-3 Main Pond System[14,15,16]

The 216-B-3 Pond system consisted of a Main Pond and 3 expansion ponds, and operated from 1945 to 1994. The 216-B-3 Main Pond was located in a natural topographic depression and varied in size from about 14-46 acres (see Figures 3 and 4). The Pond and the related 216-B-3-3 Ditch operated open and

---

[14] *216-B-3 Main Pond Closure Plan*, DOE/RL-2013-24, Draft A, US Department of Energy, April 2013.
[15] *Draft-Hanford Facility Dangerous Waste Permit (Site-Wide Permit), Revision 9-WA7890008967, Part V-Closure Units,* Department of Ecology, State of Washington, May 2012
[16] *Feasibility Study for the 200-CS-1 Chemical Sewer Group Operable Unit*, DOE/RL-2005-63, Revision 0, p 7-6, US Department of Energy, September 2008.

unlined. The largest contributing streams were the B Plant cooling water and steam condensate (nondangerous waste source), PUREX Plant cooling water (nondangerous waste source), the B Plant chemical sewer (potentially dangerous waste source), and the PUREX Plant chemical sewer (dangerous waste source). Most of the effluent contained low concentrations of radionuclides and chemicals.

The 216-A-29 Ditch received discharge from the PUREX Plant (A Plant) chemical sewer between November 1955 and October 1991. The Ditch was uncovered and unlined and followed the natural topography. It originated from the southeastern side of the A Tank Farm (east of the AP Tank Farm). It passed beneath the 200 East Area perimeter fence and ran northeast to the 216-B-3 Ditches, which discharged to the 216-B-3 Pond. Approximately 6,000,000 gallons a day of waste flow reached the ditch. The 216-A-29 Ditch is estimated to be 6 feet wide, 3,600 ft. long, and varies from 2 to 3 ft. deep at the south end to approximately 16 ft. deep at the north end. Both portions of the 216-A-29 Ditch, located inside and outside the 200 East security fence have been stabilized and revegetated, and the appropriate signage posted (the 216-A-29 Ditch is an underground radioactive material area).

Stabilization of the 216-A-29 Ditch was performed in three phases from July to October 1991. In the first phase, the top layers of soil were pushed from within the surface contamination zone and the ditch spoil piles into the bottom of the Ditch. The concrete spillway was covered with clean soil, and the ends of the culvert were filled with concrete. In the second phase, the consolidated soils were covered with clean material and brought up to the surrounding grade. The fill was placed in a series of terraces progressing down the ditch. The third phase consisted of revegetating and reposting the area disturbed by stabilization activities. The area was posted as an Underground Radioactive Material Area.

The 216-B-63 Trench was constructed before 1970 as a percolation trench to receive emergency cooling water and chemical sewer waste from the B Plant (221-B Plant Canyon Building). It was an open, unlined earthen trench that was closed at one end. The trench was about 1,400 feet long, 4 ft. wide, and an average of 10 ft. in depth. This unit also includes a 15-inch pipe extending from the 207-B Retention Basin to the trench. Discharges to the trench ended in February 1992. The 216-B-63 Trench was isolated in December 1994 and interim stabilized in January 1995. The weir box at the head end of the trench was filled with concrete and the valve stems cut off at the 207-B Retention basin. It was covered with clean soil and marked it with concrete posts.

The 216-B-3 Main Pond and 216-B-3-3 Ditch were decommissioned in 1994 by backfilling with coarse-grained material and then covering them with fine-grained material. The 3 expansion ponds (216-B-3A, 216-B-3B and 216-B-3C) were clean closed on July 31, 1995.

GROUNDWATER PLUMES

The saturated zone beneath the CP-LS-5 area (U and S Pond) currently has elevated levels of total and hexavalent chromium, carbon tetrachloride (CCl_4), I-129, nitrate, Tc-99, tritium (H-3), and total uranium based on 2014 groundwater results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). Plumes in the 200 West Area are described as part of the 200-UP and 200-ZP GWIAs described in CP-GW-2 EU (Appendix D.6). Sites within the CP-LS-5 EU with reported inventories (Table G.6-2 through Table G.6-4), including 216-S-5 and 216-S-6 Cribs; 216-S-10D and 216-S-16D ditches; and 216-S-16D and 216-S-17 ponds are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0). Monitoring and treatment of groundwater is being conducted within the 200-UP GWIA (using the WMA S-SX groundwater extraction system, U Plant area P&T system, and I-129 plume hydraulic control system) and in the 200-ZP GWIA (using the 200 West P&T facility).

The saturated zone beneath the CP-LS-11 area (B Pond) currently has elevated levels of cyanide (CN), I-129, nitrate, Sr-90, Tc-99, tritium (H-3), and total uranium based on 2014 groundwater results (http://phoenix.pnnl.gov/apps/gw/phoenix.html). Plumes in the 200 East Area are described as part of the 200-BP and 200-PO GWIAs described in CP-GW-1 EU (Appendix D.5). Sites within the CP-LS-11 EU with reported inventories (Table G.6-2 through Table G.6-4), including 216-B-3 and 216-A-25 Ponds and 216-A-29 and 216-B-63 Ditches are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0). Monitoring of groundwater is being conducted within the 200 East Area.

D&D of Inactive Facilities

The only facilities identified in these two EUs are 216A271, an inactive Valve Control House, and 2508W9 and W11 which are active Sirens. No information is available on need or timing of D4.

Ecological Resources Setting

Landscape Evaluation and Resource Classification

CP-LS-5: The EU was originally characterized as containing habitats classified as levels 0, 1, 2, and 3 and 5 (DOE/RL-96-32 2013). However, based on field observations and data collected during the 20-May 2015 field visit, portions of those areas of the EU originally classified as level 1 habitat were reclassified in this assessment as level 2 (successional shrubs are recolonizing the borrow areas), and portions of level 2 habitats were reclassified as level 3 (containing climax shrubs or predominantly characterized by native bunchgrasses). Resource levels within the landscape buffer area outside the EU were not reclassified for this assessment. More than 60% of the EU consists of resources of level 3 or greater.

CP-LS-11: The B Pond EU follows the paths of ditches within the 200-East Area that led to ponds outside the 200-East Area fence. More than 71% of the EU has been remediated and the surface stabilized by revegetating with crested wheatgrass, and is therefore classified as level 1 habitat. Overall, 80% of the EU is classified as resource level 2 or below.

Level 3 resources comprise 20% of the EU, and include one isolated patch inside the 200-East Area, strips around the exterior of the easternmost waste sites/remediated areas, and clusters of individual locations of a state sensitive plant species within the 200-East Area. These resources are dominated by big sagebrush and a mixture of native and introduced grasses and forbs.

The amount and proximity of biological resources surrounding the B Pond EU were examined within the adjacent landscape buffer area. A circular buffer area around such a long and narrow EU was not reasonable; therefore a strip 2 times the average width of the EU (1675 ft [511 m]) was added to all sides of the EU boundary. The combined EU and adjacent landscape buffer area encompass 1170 acres (approximately 58%) classified as resource level 2 or below.

The combined area also encompasses 688.1 acres (34%) of level 3 habitat, primarily in the eastern half between the EU boundary and the buffer boundary. There are two concentrations of Piper's daisy (*Erigeron piperianus*) within the 200-East Area near the western end of the buffer area, shown as clusters of small circular level 3 patches representing previously noted locations of this Washington state sensitive species. Piper's daisy was not actively searched for during the 2015 surveys and was not observed. However it is considered like to still occur in the area. Around the eastern edge of the buffer area are patches of level 4 resources which comprise about 8% of the combined EU and buffer area.

Level 3 and 4 resources in the eastern portion of the combined EU and buffer area are contiguous with similar or better habitat covering much of the Hanford Site. No habitat characterized as a level 5 resource was identified within the EU or buffer area.

Field Survey

CP-LS-5:The U and S Ponds EU consists of several large waste site areas, borrow pit areas, buried pipelines, and revegetated areas surrounded by native shrub-steppe that has burned several times in the past 15 years. The EU boundary encompasses a relatively large amount of land around the disturbed and revegetated areas. Native vegetation on sandy soils outside the disturbed areas associated with waste sites generally has not recovered a climax shrub component, but consists of a mixture of green and gray rabbitbrush (*Chrysothamnus vicidiflorous* and *Ericameria nauseousa*) growing with varying amounts of native bunchgrasses such as Indian ricegrass (*Achnatherum hymenoides*), needle-and-thread grass (*Stipa comata*), and prairie junegrass (*Koeleria macrantha*). Sandberg's bluegrass (*Poa secunda*) is very sparse on the sandy soils of the EU, and the introduced annual cheatgrass (*Bromus tectorum*) was common with percent canopy cover ranging from 10% to 50% of the understory. Numerous native perennial forbs were observed within the EU and are listed in the field data sheets at the end of this section.

A variety of wildlife or wildlife signs were observed within the EU including signs of badger (*Taxidea taxus*) and coyote (*Canis latrans*), pygmy short-horned lizards (*Phrynosoma douglasii*) and side-blotch lizards (*Uta stansburiana*), and northern pocket gopher (*Thomomys talpoides*) along with tracks and burrows of small mammals and rabbits. Numerous birds were observed in the area with the most common being the horned lark (*Eremophila alpestris*) and western meadowlark (*Sturnella neglecta*); other species observed are noted in the field data sheets at the end of this section. Loggerhead shrikes (*Lanius ludovicianus*), a state candidate species and federal species of concern, were also observed within the EU.

CP-LS-11: The B Pond EU encompasses waste sites that already have undergone various levels of remedial action. The majority of the remediated sites (over 71%) have undergone stabilization or revegetation of the surface with crested wheatgrass (*Agropyron cristatum*). These areas typically include varying amounts of cheatgrass and Russian thistle (*Bromus tectorum* and *Salsola tragus*, respectively), both invasive introduced species.

A berm of gravelly soil at the far east end of the EU is being colonized by successional shrubs, primarily gray rabbitbrush (*Ericameria nauseosa*) and a mixture of native grasses and forbs and is classified as level 2 habitat. Field data records at the end of this section provide a complete list of species observed.

There are several areas between or around the edges of waste sites where shrub-steppe habitat still occurs that is dominated by big sagebrush (*Artemisia tridentata*) with an understory of native grass (mostly Sandberg's bluegrass [*Poa secunda*]), Russian thistle and cheatgrass. Evidence for the presence of black-tailed jackrabbits (*Lepus californicus*) was observed on the southeast side of the EU. Black-tailed jackrabbits are a Washington state candidate species.

Cultural Resources Setting

CP-LS-5: Only small portions of the CP-LS-5, U and S Pond EU have been inventoried for archaeological resources. These survey efforts have identified and recorded 2 archaeological isolates within the EU boundary. Both of these isolates are associated with the Pre-Hanford Early Settlers/Farming landscape and remain unevaluated for listing in the National Register of Historic Places (although it should be noted that isolates are typically assumed not eligible). An NHPA Section 106 review has not been completed specifically for the remediation of the CP-LS-5, U and S Pond EU. The EU remains relatively undisturbed, with isolated areas of surface disturbances associated with Hanford Site remediation activities and operations evident within the EU boundary, suggesting a high potential for intact archaeological resources to exist within the EU.

There are 9 archaeological sites/isolates recorded within 500 meters of the CP-LS-5, U and S Pond EU. Two of these resources are associated with the Native American Precontact and Ethnographic Landscape (1 isolate and 1 site) and 7 are associated with the Pre-Hanford Early Settlers/Farming landscape (6 isolates and 1 site). Only one of these sites (associated with the Native American Precontact and Ethnographic Landscape) has been formally evaluated for listing in the National Register of Historic Places, and it has been determined not eligible. The remaining archaeological resources have not been formally evaluated (7 isolates and 1 site), however, it should be noted that isolates are typically considered not eligible. In addition to the 9 archaeological sites/isolates, a non-contributing segment of a National Register-eligible historic/ethnohistoric Trail/Road is located within 500 meters of the CP-LS-5, U and S Pond EU.

Also, several resources associated with the Manhattan Project and Cold War Era Landscape are located within 500 meters of the CP-LS-5, U and S Pond EU. These resources include segments of the National Register-eligible Hanford Site Plant Railroad and 18 National Register-eligible Manhattan Project and Cold War Era buildings. All of these resources are considered as contributing properties within the Manhattan Project and Cold War Era Historic District. Of the 18 buildings, 10 have been recommended for individual documentation and 8 with no additional documentation required. In accordance with the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56) (DOE-RL 1998), all mitigation and documentation requirements have been completed for these properties.

Historic maps and aerial imagery indicate that the area was largely undeveloped. This suggests a low potential for 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, primarily in areas with Holocene deposits (which extend over the central and southern portions of the EU). These resources would likely be limited to areas of intact, undisturbed soils. A review of recent aerial imagery of the area suggest that large portions of the EU remain relatively undisturbed; aside from isolated surface disturbances associated with Hanford Site remediation efforts and ongoing operations. This information suggests a high potential for intact archaeological resources to be present within the EU.

Because of the potential for intact archaeological deposits within portions of the CP-LS-5, U and S Pond 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.

CP-LS-11: Portions of the CP-LS-11, B Pond EU have been inventoried under 10 cultural resource inventory surveys. Two archaeological isolates associated with the Pre-Hanford Early Settlers/Farming Landscape were located within the EU, one of which was collected during the archaeological survey. These isolates have not been formally evaluated for listing in the National Register of Historic Places, however, isolates are typically considered not eligible. It is unknown if an NHPA Section 106 review has been completed specifically for the remediation of CP-LS-11, B Pond EU. Portions of the EU have not been inventoried for cultural resources. It is possible, but not likely that intact archaeological material is present in the EU, which has been extensively disturbed by Hanford Site activities.

Cultural resources within 500 meters of the CP-LS-11, B Pond EU include: one archaeological site associated with the Native American Precontact and Ethnographic Landscape. This site has not been evaluated for listing in the National Register of Historic Places. Four additional archaeological isolates have been documented within 500 meters of the EU (2 associated with the Native American Precontact and Ethnographic Landscape and 2 associated with the Pre-Hanford Early Settlers/Farming Landscape. None of these isolates have been formally evaluated for listing in the National Register of Historic Places, however, isolates are typically considered not eligible. In addition, there are 4 National Register-eligible buildings that are contributing properties within the Manhattan Project and Cold War Era Historic District are located within 500-meters of the CP-LS-11, B Pond EU (all 4 are contributing properties within the Manhattan Project and Cold War Era Historic District, 1 with individual documentation required, and 3 with no additional documentation required). Mitigation of contributing buildings/structures has been completed in accordance with the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56) (DOE-RL 1998).

Historic maps indicate a low potential for archaeological resources associated with the Pre-Hanford Early Settlers/Farming Landscape to be present within the EU boundary. Geomorphology suggests a moderate to low potential for the presence of archaeological resources associated with the Native American Precontact and Ethnographic Landscape to be present within the CP-LS-11, B Pond EU. Extensive ground disturbance within most of the EU suggest a low potential for intact cultural resources at or below ground surface, except at the outer margins of the eastern one-third of the EU where some intact Holocene dune sands may be present.

Because portions of the EU have not been inventoried for cultural resources and because of the potential for buried archaeological deposits within the CP-LS-11, B Pond 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 associated with these landscapes (e.g. East Benton Historical Society, the Franklin County Historical Society and the Prosser Cemetery Association, the Reach, and the B-Reactor Museum Association) may be necessary to provide input on indirect effects to both recorded and potential unrecorded TCPs in the area and other cultural resource issues of concern.

PART V. WASTE AND CONTAMINATION INVENTORY

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites[17,18]

Waste sites in the 200-CS-1 Operable Unit (OU) received liquid waste streams (principally nonradioactive dilute chemicals) from the B Plant, A Plant (PUREX), and S Plant (REDOX). Virtually every process step in the separation and radionuclide-recovery projects required the addition of solid chemicals or, more routinely, pre-mixed chemical solutions. Liquid concentrated nitric, phosphoric, and formic acids; sodium hydroxide; and aluminum nitrate were taken to the canyon buildings in railcar quantities and unloaded into the 211 Chemical Storage Tank Farm at each separations building. Most other chemical solutions were mixed onsite to pre-established concentrations and volumes in the aqueous or solvent makeup sections of the plant. Dry chemicals that were weighed and added to demineralized water also were produced in the plants. Liquids, such as acids and caustics, were piped into large tanks in the same area.

Chemical sewer wastes consisted primarily of makeup tank rinses, with lesser quantities of off-specification batches of chemicals, or overflow chemicals from tanks during aqueous makeup. Improper valving at outdoor chemical storage tanks during chemical unloading or transfer operations also may have yielded chemical sewer wastes.

The construction of separate waste sites for chemical sewer wastes generally emerged as a development in the REDOX Plant's waste treatment system, and later was applied to the PUREX and waste fractionization processes. These wastes were discharged to separate ditches or ditch/pond systems.

Most of the chemicals disposed to these streams are expected to have broken down or reacted in the environment and are expected to be largely undetectable. Some inorganic compounds (e.g., cadmium, chromium, and nitrate) could remain sufficiently intact and would be detectable in the environment.

In all cases, the waste streams were run in a noncontact manner; that is, a barrier separated the waste-stream liquids from contaminated process liquids, reducing the potential for radiological contamination of the waste streams. However, occasional waste-stream contamination did occur. Over time, coils that circulated steam and cooling water inside chemical process tanks were known to develop pinholes and hairline cracks because of the corrosive chemicals and high thermal gradients in these tanks. These minor defects usually did not lead to contamination of the steam and cooling water, because the pressure in the pipe coils was greater than the pressure in the process or condenser vessels; however, on occasions when pressure in the coils was reduced or suspended, minor leakage through the flaws led to waste stream contamination. Other accidental releases (such as operator error) also have contributed to contamination of the effluents discharged to the waste facilities in this OU.

Most plants continuously ran raw water in the main plant chemical sewer pipes to dilute any released concentrated discharges, thus references of the volumes released per day should consider this.

---

[17] Feasibility Study for the 200-CS-1 Chemical Sewer Group Operable Unit, DOE/RL-2005-63, Revision 0, US Department of Energy, September 2008

[18] Proposed Plan for the 200-CS-1 Chemical Sewers Operable Unit, DOE/RL-2005-64, Revision 0, US Department of Energy, September 2008

Vadose Zone Contamination

The most significant contamination of the sites was caused by unplanned releases originating from both inside and outside of the generating facilities. Contaminants from these releases have migrated below the waste sites and have accumulated in the soil column.[19] The CP-LS-5 and CP-LS-11 waste sites with reported inventories (Table G.6-2 through Table G.6-4) are primarily legacy sites that represent soil and other vadose zone contamination. The inventories provided in Table G.6-2 through Table G.6-4 represent the reported contamination originally discharged (without decay correction[20]) to the vadose zone from the CP-LS-5 and CP-LS-11 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[21]:

- *Chromium* – There are reported inventories for chromium in the CP-LS-5 and CP-LS-11 waste sites (Table G.6-4) and current plumes in the 200-UP GWIA (200 West) in the vicinity. Discharges to the 216-S-10 Pond and Ditch (CP-LS-5) and 216-S-19 Pond are considered to the source of the small plume to the east of the 216-S-10 Pond (DOE/RL-2016-09, Rev. 0)[22]. The CP-LS-5 inventory is dominated by the 216-U-10 and 216-S-10P Ponds. There are no current plumes in the 200-PO or 200-BP GWIAs in the vicinity of the CP-LS-11 waste sites[23]. The CP-LS-11 inventory is dominated by the 216-B-3 Pond.
- *Carbon tetrachloride (CCl_4)* – There are reported vadose zone inventories in the CP-LS-5 and CP-LS-11 waste sites (Table G.6-4) and a current plume that straddles the 200-UP and 200-ZP GWIAs (200 West) (managed as part of the 200-ZP GWIA) but no plume in 200 East. The 200 West plume originated from PFP waste disposal sites in 200-ZP; some of the ditches from PFP extended to U Pond, which is considered to be a source. The CP-LS-5 and CP-LS-11 inventories are dominated by the 216-U-10 and 216-B-3 Ponds, respectively.

---

[19] *200-CS-1 Operable Unit RI/FS Work Plan and RCRA TSD Unit Sampling Plan*, DOE/RL-99-44, Rev. 0, US Department of Energy, April 2000.

[20] 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).

[21] 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.

[22] The northern plume near the 241-S Tank Farm originated from an overfill event at tank S-104 between 1966 and 1970, the plume near the 241-SX Tank Farm from a 190,000 L (51,000 gal) leak from tank SX-115 in 1965, and the southeastern plume originated primarily from effluent disposed to the 216-S-20 Crib during the 1950s.

[23] There is a relatively large plume that emanates from the 200-UP GWIA (assumed to be from the 216-S-20 Crib) that is managed as part of the REDOX Cribs and Ditches EU (CP-LS-4 in Appendix G.5.4). Furthermore, the 2014 plume near the B Complex in the 200-BP GWIA had dissipated by 2015.

- *Cyanide* (*CN*) and *trichloroethene (TCE)* – There are no reported vadose zone inventories for these contaminants for the CP-LS-5 or CP-LS-11 waste sites (Table G.6-4). Thus the 200-BP cyanide plume, which has sources in the B Complex, in the 200 East Area is not associated with the CP-LS-11 EU.
- *I-129* – There are reported inventories for both the CP-LS-5 and CP-LS-11 EUs (Table G.6-2). There are 200-UP plumes to the east of the CP-LS-5 EU waste sites with sources from U Plant and REDOX Plant waste sites, where the latter were the primary sources. Thus plumes are thus not associated with the CP-LS-5 EU and thus no parts of the plumes are attributed to the EU. The CP-LS-5 EU inventory source is dominated by the 216-U-10 Crib. There is also a very large plume straddling the 200-BP and 200-PO (200 East) with 200-BP sources including the BY Cribs, 216-B-8 Crib, and 216-BX-102 tank UPR although primary sources were located in 200-PO and included the 216-A-10 Crib, 216-A-29 Ditch, and B Pond. Because B Pond (216-B-3) is a part of CP-LS-11, a part of the 200 East I-129 plume is associated with the CP-LS-11 waste sites. The CP-LS-11 vadose zone inventory is very small (0.003 Ci) and is dominated by the 216-B-3 Crib.
- *Tc-99* – There are reported vadose zone inventories for both CP-LS-5 and CP-LS-11 EUs (Table G.6-3). There are plumes in both 200 East and 200 West area in the vicinity of the wastes sites. In the 200 West Area, plumes are attributed to a large leak from tank SX-115, an overfill event related to tank S-104, discharges to the 216-U-1&2 Cribs, and WMA U. None of these sources (and thus the 200 West plumes) are related to CP-LS-5 EU waste sites. The CP-LS-5 vadose zone inventory is distributed over six ponds and cribs. There are also plumes in the 200 East area with 200-BP sources including past releases from cribs and tanks in the B Complex, WMA C, and the 216-B-5 injection well and 200-PO sources including WMA A-AX. None of these sources (and thus the 200 East plumes) are associated with the CP-LS-11 EU waste sites.
- *Uranium* – There are reported vadose zone inventories for both CP-LS-5 and CP-LS-11 EUs (Table G.6-3 and Table G.6-4). In the 200 West Area (CP-LS-5), there is a larger plume to the east of the 241-U tank farm with 216-U-1/2 Cribs as sources and a smaller plume to the southeast of U Pond (216-U-10) where uranium has been interpreted to be leaching from the vadose zone beneath U Pond. Thus U Pond is considered the source for the smaller plume. The largest vadose zone inventory in CP-LS-5 is U Pond (216-U-10). There are also multiple plumes in the 200-BP GWIA with sources including the UPR from tank 241-BX-102, 216-B-12 Crib, and 216-B-5 injection well, which are not related to CP-LS-11; thus no 200-BP (or 200 East) plumes are associated with this EU. The CP-LS-11 vadose zone inventory is dominated by the 216-B-3 and 216-A-25 Ponds. The TC&WM EIS groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that uranium, which already has 200-BP plumes, is predicted to exceed the drinking water standard at the B Barrier within the 10,000-year TC&WM EIS evaluation period (Appendix O, DOE/EIS-0391 2012, p. O-59)). Thus it is possible that uranium from CP-LS-11 waste sites could impact groundwater over the evaluation period considered in this Review. Furthermore, a significant quantity of uranium was discharged to the Gable Mountain Pond (216-A-25) where the vadose zone is relatively thin (less than 12 m (39 ft)). Thus a future plume associated with Gable Mountain Pond may be considered possible (where uranium has been measured at 9.49 and 12 µg/L in well 699-53-48A in 2015 and 2016, respectively). For the purpose of this evaluation, it is considered likely that the area of the suspected future uranium plume would be bounded by the existing Sr-90 (described below); thus the same groundwater are would be contaminated by both uranium and Sr-90.
- *Sr-90 and other Group A&B Primary Contaminants (PCs)* – There are no current plumes for Sr-90 or other Group A&B PCs not mentioned above (i.e., C-14, Cl-36, or CN) in the vicinity of CP-LS-5;

however, there are reported vadose zone inventories for Sr-90 (Table G.6-3) and C-14 (Table G.6-2) but none for Cl-36 (Table G.6-2) or CN (Table G.6-4). The reported Sr-90 vadose zone inventory is dominated by 216-S-5 and 216-S-6 Cribs and 216-S-17 Pond. The reported C-14 inventory is dominated by 216-S-10P Pond. The majority of the Sr-90 originally discharged into the vadose zone (via cribs and a pond) 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)[24], 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 in CP-LS-5 for the reasons mentioned above) are not considered significant threats to the Hanford groundwater during the first 150 years. There are two 200-BP plumes: a small one northeast of B Plant (221-B) associated with the 216-B-5 injection well (covered in the CP-LS-8 EU for the B Plant Cribs and Trenches) and a much larger plume associated with Gable Mountain Pond (216-A-25) that has been added to CP-LS-11[25]. Despite being strongly sorbed to typical Hanford vadose zone materials, the Sr-90 reached groundwater in 200 East locations where the vadose zone was relatively thin (e.g., less than 12 m (39 ft) at Gable Mountain Pond); e.g., there is no plume associated with B Pond (216-B-3) despite a large vadose zone inventory (Table G.6-3). The plume area near Gable Mountain Pond has been fairly stable over the last few years and is considered unlikely to increase an order of magnitude in size (that would change corresponding ratings (CRESP 2015a)). The CP-LS-11 vadose zone inventory is dominated by the 216-B-3 and 216-A-25 Ponds.

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 for CP-LS-5 and CP-LS-11 in Table G.6-5 and Table G.6-6, respectively, 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. Note that the CP-LS-5 vadose zone (VZ) ratings range from *Very High* for carbon tetrachloride (CCl_4) to *High* for total and hexavalent chromium to *Medium* for I-129 and total uranium to *Low* for the other Group A and B PCs with reported inventories with the exception of Sr-90. Because there is no current Sr-90 plume nor one expected for the next 150 years related to CP-LS-5 as described above, the current rating for Sr-90 is *Not Discernible* (*ND*). The overall current rating is defined as the highest over all the ratings and thus *Very High* for CP-LS-5. The CP-LS-11 vadose zone (VZ) ratings range from *Very High* for carbon tetrachloride (CCl_4) to *High* for Sr-90 to *Medium* for total and hexavalent chromium to *Low* for the other Group A and B PCs with reported inventories with the exception of total uranium. Because there is no current total uranium plume related to CP-LS-11 as described above, the current rating for total uranium is *Not Discernible* (*ND*); however, as described above, it is considered plausible that a uranium plume may appear during the evaluation period (next 150 years) and thus the rating of *Low* is given for the

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

[25] The Gable Mountain Pond (216-A-25) waste site has significant vadose inventories (Corbin, et al. 2005) and large associated Sr-90 and nitrate plumes. Because this site has not been remediated and was not included in any Evaluation Units, it has been included in the CP-LS-11 EU because of its type (pond) and proximity to similar waste sites.

subsequent times. The overall current rating is defined as the highest over all the ratings and thus *Very High* for CP-LS-11.

Groundwater Plumes

Sites within the CP-LS-5 and CP-LS-11 EUs are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0; DOE/RL-92-19, Rev. 0). Monitoring and treatment of groundwater is being conducted within the 200 West Area (CP-LS-5) in 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) and in the 200-ZP GWIA using the 200 West P&T facility; these actions are described as part of the CP-GW-2 EU (Appendix D.6). In the 200 East Area (CP-LS-11), monitoring of groundwater is being conducted within the 200-BP GWIA, which is described as part of the CP-GW-1 EU (Appendix D.5). The saturated zone inventories related to the CP-LS-5 and CP-LS-11 EUs are provided in Table G.6-5 and Table G.6-6, respectively; 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, as described in the previous sections, portions of the groundwater plumes can be associated with the CP-LS-5 and CP-LS-11 EUs 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.6-5 for Table G.6-6 for CP-LS-5 and CP-LS-11, respectively, where Photoshop was used to estimate the fraction of plumes considered associated with the U Plant 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 amounts treated and remaining in the vadose zone. For the groundwater plumes described in the 200 West (200-UP and 200-ZP) and 200 East (200-BP and 200-PO), apportionment of plumes and ratings would be as follows (DOE/RL-2016-09, Rev. 0):

- *I-129* – There are 200-UP plumes to the east of the CP-LS-5 EU waste sites with sources from U Plant and REDOX Plant waste sites, where the latter were the primary sources. Thus plumes are thus not associated with the CP-LS-5 EU and thus no parts of the plumes are attributed to the EU. There is also a very large plume straddling the 200-BP and 200-PO (200 East) with 200-BP sources including the BY Cribs, 216-B-8 Crib, and 216-BX-102 tank UPR although primary sources were located in 200-PO and included the 216-A-10 Crib, 216-A-29 Ditch, and B Pond. Because B Pond (216-B-3) is a part of CP-LS-11, a part of the 200 East I-129 plume is associated with the CP-LS-11 waste sites. Because the 200 East I-129 plume has multiple sources over the 200-BP and 200-PO GWIAs and there is no reasonable way to split up the plume areas, the ratio of vadose zone inventory is used to apportion the plume area. The CP-LS-11 vadose zone inventory is very small (0.003 Ci) and is dominated by the 216-B-3 Crib; the ratio of the CP-LS-11 vadose zone inventory to other plume sources indicates the plume area attributable to CP-LS-11 is also small (less than 1% as described in Appendix D.1).
- *Tc-99* – In the 200 West Area (CP-LS-5), plumes are attributed to a large leak from tank SX-115, an overfill event related to tank S-104, discharges to the 216-U-1&2 Cribs, and WMA U. None of these sources (and thus the 200 West plumes) are related to CP-LS-5 EU waste sites. The CP-LS-5 vadose zone inventory is distributed over six ponds and cribs. There are also plumes in the 200 East area with 200-BP sources including past releases from cribs and tanks in the B Complex,

WMA C, and the 216-B-5 injection well and 200-PO sources including WMA A-AX. None of these sources (and thus the 200 East plumes) are associated with the CP-LS-11 EU waste sites.

- *Uranium* – In the 200 West Area (CP-LS-5), there is a larger plume to the east of the 241-U tank farm with 216-U-1/2 Cribs as sources and a smaller plume to the southeast of U Pond (216-U-10) where uranium has been interpreted to be leaching from the vadose zone beneath U Pond. Thus U Pond is considered the source for the smaller plume and 2% of the plume area is attributed to CP-LS-5 as described in Appendix D.1. There are also multiple plumes in the 200-BP GWIA with sources including the UPR from tank 241-BX-102, 216-B-12 Crib, and 216-B-5 injection well, which are not related to CP-LS-11; thus no 200-BP (or 200 East) plumes are associated with this EU.
- *Sr-90* – There are no current plumes in the vicinity of CP-LS-5 (or attributed to this EU) and thus no saturated zone inventory associated with CP-LS-5. There are two 200-BP plumes: a small one northeast of B Plant (221-B) associated with the 216-B-5 injection well (covered in the CP-LS-8 EU for the B Plant Cribs and Trenches) and a much larger plume associated with Gable Mountain Pond (216-A-25) that has been added to CP-LS-11. Because the 216-A-25 Pond is part of the CP-LS-11 EU, the 200-BP plume near the Gable Mountain Pond is assumed associated with the EU, and portion of the 200-BP plume area assigned is 90% (Appendix D.1).
- *Carbon tetrachloride* (*CCl_4)* – There is a current plume that straddles the 200-UP and 200-ZP GWIAs (200 West) (managed as part of the 200-ZP GWIA) but no plume in 200 East (and thus no percentage of the plume attributed to CP-LS-11). The 200 West plume originated from PFP waste disposal sites in 200-ZP; some of the ditches from PFP extended to U Pond, which is considered to be a source. Because U Pond is considered a source, the portion of the plume area (5%) near the U Pond is attributed to CP-LS-5 as described in Appendix D.1.
- *Chromium* – There are current plumes in the 200-UP GWIA (200 West) in the vicinity of the CP-LS-5 EU. Discharges to the 216-S-10 Pond and Ditch (CP-LS-5) and 216-S-19 Pond are considered to the source of the small plume to the east of the 216-S-10 Pond; the portion of the 200-UP plumes attributed to CP-LS-5 is less than 1%. There are no current (2015) plumes in the 200-PO or 200-BP GWIAs in the vicinity of the CP-LS-11 waste sites and thus no portion of the plumes is attributed to CP-LS-11.
- *Cyanide* (*CN*) – There are no plumes near CP-LS-5 and thus no plume area is attributed. There is a plume near the B Complex with sources in the BY Cribs and B Tank Farm, which are managed in CP-TF-6 (B-BX-BY Tank and Waste Farms). There are also no inventories for CP-LS-11 (or CP-LS-5) and thus the plume is not associated with CP-LS-11 and thus no portion of plume area is associated with this EU.
- *Group C&D Contaminants* – There are plumes and reported inventories for nitrate and tritium; however, these are not the focus of this discussion.

Thus portions of some of the 200 West and 200 East plumes are associated with the CP-LS-5 and CP-LS-11 EU waste sites. The groundwater plumes (i.e., carbon tetrachloride, total and hexavalent chromium, and total uranium) associated with the Group A and B PCs from the CP-LS-5 EU are described in detail in Appendix G.6 for the CP-GW-2 EU and those plumes (i.e., I-129 and Sr-90) for CP-LS-11 are described in Appendix G.5 for the CP-GW-1 EU. Note that nitrate, hexavalent chromium, tritium (H-3), and I-129 are risk drivers (*Medium* ratings) for the 200-UP GWIA and carbon tetrachloride (*Very High*) is the primary risk driver for the 200-ZP GWIA; however, there are no *major* Cp-LS-5 EU sources associated with these plumes (e.g., 5% of the total plume area for CCl_4), and the remaining vadose zone sources from other

EUs would drive future risks to groundwater. Sr-90 (*High*) is the primary risk driver for the 200-BP GWIA and I-129 (*Very High*) is the primary risk driver for the 200-PO GWIA where the major source for Sr-90 in the 200-BP GWIA is from CP-LS-11 EU waste sites.

Impact of Recharge Rate and Radioactive Decay on Groundwater Ratings

For waste sites in the northern part of CP-LS-5, the TC&WM EIS screening groundwater transport analysis (Appendix O, DOE/EIS-0391 2012) indicates that there is a significant impact of emplacing the engineered surface barrier (and resulting reduction of infiltrating water) on the predicted peak groundwater concentrations at the U Barrier[26]. To summarize, the results for Central Plateau sources including those in addition to CP-LS-5 (Appendix O, DOE/EIS-0391 2012) include:

- Tc-99 peak concentration is 9830 pCi/L (CY 3985) for the No Action Alternative versus 259 pCi/L (CY 3296) for the Landfill Scenarios where the threshold value is 900 pCi/L.
- I-129 peak concentration is 19.6 pCi/L (CY 4118) for the No Action Alternative versus 0.3 pCi/L (CY 3593) for the Landfill Scenarios where the threshold value is 1 pCi/L.
- Chromium peak concentration is 208 µg/L (CY 4027) for the No Action Alternative versus 6 µg/L (CY 2050) for the Landfill Scenarios where the threshold value is 100 µg/L for total chromium and 48 µg/L for hexavalent chromium.
- Nitrate and uranium peak concentrations were all lower than the standard for both the No Action and Landfill Scenarios.
- No values are reported at the U Barrier for Sr-90 and various other contaminants for either scenario, which indicates that the appropriate sources were not considered in the analysis, or peak fluxes that were less than 1×10^{-8} Ci/yr for radioactive contaminants, or 1×10^{-8} g/yr for chemical contaminants (Appendix O, DOE/EIS-0391 2012, p. O-2).

The predicted peak concentrations for all the contaminant at the U Barrier for the Landfill Scenarios would remain below threshold values during the TC&WM EIS evaluation period (10,000 years) and thus saturated zone ratings for those contaminants without current plumes for the Active and Near-term Post-Cleanup periods would be *Not Discernible* (*ND*) or *Low*, respectively (where the *Low* rating was maintained to account for uncertainty)[27]. Those contaminants with current plumes that are currently undergoing treatment would have a *Low* rating at the end of the Active Cleanup period to address uncertainties in the evaluation.

For waste sites near the southern part of CP-LS-5, the TC&WM EIS screening groundwater transport analysis indicates that there is also an impact of emplacing the engineered surface barrier on the predicted peak groundwater concentrations at the S Barrier[28]; however, the impact does not result in

---

[26] The barrier represents the edge of the infiltration barrier to be constructed over disposal areas that are within 100 meters [110 yards] of facility fence lines (DOE/EIS-0391 2012). The U Barrier is the closest to the northern part of CP-LS-5. Despite including sources other than those for CP-LS-5, the analysis in the TC&WM EIS was considered a reasonable source of information to assess the impact of the engineered surface barrier emplacement.

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

[28] The S Barrier is the closest to the southern part of the CP-LS-5 EU. Despite including sources other than those for CP-LS-5, the analysis in the TC&WM EIS was considered a reasonable source of information to assess the potential impact of the engineered surface barrier emplacement.

peak concentrations below thresholds. This result is likely due to the significant amounts of contaminants already in the groundwater and not due to an ineffective surface barrier. To summarize, the results for all Central Plateau sources (Appendix O, DOE/EIS-0391 2012) include:

- Tc-99 peak concentration is 22,800 pCi/L (CY 3072) for the No Action Alternative versus 1,510 pCi/L (CY 2051) for the Landfill Scenarios where the threshold value is 900 pCi/L.
- I-129 peak concentration is 29.1 pCi/L (CY 3136) for the No Action Alternative versus 2.8 pCi/L (CY 2050) for the Landfill Scenarios versus a threshold value of 1 pCi/L.
- Chromium peak concentration is 541 µg/L (CY 3242) for the No Action Alternative versus 156 µg/L (CY 2050) for the Landfill Scenarios versus a threshold value of 100 µg/L (total) or 48 µg/L (hexavalent).
- 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 30 µg/L.
- 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, or peak fluxes that were less than 1×10^{-8} Ci/yr for radioactive contaminants, or 1×10^{-8} g/yr for chemical contaminants (Appendix O, DOE/EIS-0391 2012, p. O-2).

Despite the large impacts on the predicted peak concentrations, these peak values for many contaminants at the S Barrier would still exceed threshold values within 50 years, which would suggest that saturated and vadose ratings for waste sites near the S Barrier would not be altered based on the surface emplacement even though predicted impacts due to barrier emplacement may be large. However, those contaminants with current plumes that are currently undergoing treatment (e.g., CCl_4, chromium, and uranium) would have a *Low* rating at the end of the Active Cleanup period.

To summarize for the CP-LS-5 EU in 200 West Area, the emplacement of a surface barrier would have a significant impact on contaminant movement for the waste sites in the northern part of the EU and would dramatically reduce most concentrations at the U Barrier during the evaluation period. Despite large changes in concentrations in the southern portion of CP-LS-5 due to emplacement of a surface barrier, the resulting concentrations do not fall below thresholds for most contaminants. Thus ratings are not changed based on emplacement of a surface barrier.

For Sr-90 from the CP-LS-5 EU remaining in the vadose zone that currently would translate to a *Medium* rating, it would require approximately 50 years to reach a *Low* rating. Because there is not current Sr-90 plume associated with CP-LS-5, the ratings *after* the Active Cleanup would be changed to *Low* to account for decay and uncertainties in the evaluation.

For the 200 East Area that includes CP-LS-11, the TC&WM EIS screening groundwater transport analysis indicates that there is some impact of emplacing an engineered surface barrier on the predicted peak groundwater concentrations (relative to thresholds) at the B Barrier[29]; however, the impact is too small to result in concentrations that fall below thresholds at the B Barrier. This result is not ascribed to an ineffective barrier, but instead to large amounts of contaminants already present in the subsurface and

[29] The B Barrier is the closest to the CP-LS-11 EU. Despite including sources other than those for CP-LS-11, the analysis in the TC&WM EIS was considered the best and most consistent information to assess the impact of the engineered surface barrier emplacement.

possible influence from sources outside CP-LS-11. To summarize, the screening groundwater results including sources in addition to those for CP-LS-11 (Appendix O, DOE/EIS-0391 2012) include:

- Tc-99 peak concentration is 26,500 pCi/L (CY 3957) for the No Action Alternative versus 3,570 pCi/L (CY 2056) for Landfill Closure where the threshold value is 900 pCi/L.
- I-129 peak concentration is 58.8 pCi/L (CY 3577) for the No Action Alternative versus 4.5 pCi/L (CY 2056) for Landfill Closure where the threshold value is 1 pCi/L.
- Chromium peak concentration is 864 µg/L (CY 3882) for the No Action Alternative versus 215 µg/L (CY 2050) for Landfill Closure where the threshold value is 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 4 µg/L (CY 11,778) for Landfill Closure where the threshold value is 30 µg/L.
- No values are reported at the B Barrier for Sr-90 for either scenario, which indicates that peak fluxes (related to the sources considered) were less than 1×10^{-8} Ci/yr (Appendix O, DOE/EIS-0391 2012, p. O-2).

Despite impacts on the predicted peak concentrations, the peak values for Tc-99, I-129, and chromium exceed thresholds at the B Barrier within 150-200 years and longer for either scenario, and thus ratings for these primary contaminants would not be altered based on recharge rate scenarios.

Uranium is already in the groundwater with sources not linked to CP-LS-11 (DOE/RL-2016-09, Rev. 0). However, a plausible case was made above that uranium could reach the groundwater in the Gable Mountain Pond (216-A-25) where the vadose zone is relatively thin and Sr-90 has already reached the saturated zone. Furthermore, no treatment activities are underway to 200-BP to reduce uranium in groundwater (although there is a treatability study extracting uranium from the perched water zone underneath the B Complex, which is unrelated to CP-LS-11). Thus as described above, it is assumed that uranium could contaminate groundwater in sufficient quantity to exceed the standard during the period considered; however, the contaminated area would be subsumed by that already contaminated by Sr-90; therefore, the Active Cleanup and Near-term Post-Cleanup ratings for total uranium would not be changed.

For Sr-90, the times required for the remaining vadose zone inventory to decay to values that would result in *Medium* and *Low* ratings are approximately 37 and 133 years, respectively. Thus assuming that additional sources do not contribute to the current Sr-90 plume during the evaluation period as indicated above, the rating after the Active Cleanup would be changed to *Low* to account for decay and uncertainties in the evaluation.

Columbia River

Threats to the Columbia River similar to those presented by the CP-LS-5 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) and by the CP-LS-11 EU in Section 7.5 of Appendix E.7 for CP-TF-6 (B-BX-BY Single-shell Tank and Waste Farm in 200 East) where all risks and potential impacts were rated *Not Discernible* (*ND*).

Table G.6-2. 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)]			230	140	NR	6.5	8,100	0.014	1.2	21,000	0.23
216-S-10P	Pond	2001	SIM	53	2.5	NR	1.1	38	0.00012	0.0078	1	1.80E-05
216-S-16P	Pond	2001	SIM	0.0067	0.00085	NR	0.0041	71	0.00023	0.015	2.6	3.50E-05
216-S-17	Pond	2001	SIM	0.0081	0.0016	NR	0.0026	84	0.00033	0.022	0.73	4.70E-05
216-U-10	Pond	2001	SIM	160	0.2	NR	5.1	74	0.00022	0.063	250	0.21
216-S-5	Cribs	2001	SIM	0.01	0.0011	NR	0.0018	56	0.00022	0.015	3.3	3.20E-05
216-S-6	Cribs	2001	SIM	0.055	9.20E-05	NR	0.00083	11	0.0001	0.012	3.5	0.0028
216-S-10D	Other	1998	EIS-S	0.019	NR	NR	NR	1	NR	NR	NR	NR
216-S-16D	Other		EIS-S	NR	NR	NR	NR	NR	NR	NR	NR	NR
216-S-14	Trenches	2001	SIM	NR	NR	NR	NR	NR	NR	NR	NR	NR
216-B-3	Pond	2001	SIM	12	99	NR	0.052	430	0.0017	0.13	20,000	0.0032
216-A-25	Pond	2001	SIM	2.8	35	NR	0.25	7300	0.011	0.91	870	0.014
216-A-29	Other		EIS-S	NR	NR	NR	NR	NR	NR	NR	NR	NR
216-B-63	Other	2001	SIM	0.044	0.034	NR	5.30E-05	0.093	7.70E-07	5.70E-05	130	5.90E-08

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.6-3. 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)]			0.02	1.8	2300	360	2.2	16
216-S-10P	Pond	2001	SIM	0.00033	0.032	130	0.83	0.012	0.43
216-S-16P	Pond	2001	SIM	0.00065	0.062	0.013	1.4	0.029	0.45
216-S-17	Pond	2001	SIM	0.00028	0.026	0.014	7.1	0.03	0.0024
216-U-10	Pond	2001	SIM	0.0008	0.076	1,800	2	0.021	1.5
216-S-5	Cribs	2001	SIM	0.00029	0.026	0.027	31	0.026	0.75
216-S-6	Cribs	2001	SIM	7.00E-05	0.0067	0.57	5.8	0.016	0.58
216-S-10D	Other	1998	EIS-S	NR	NR	0.0082	0.87	NR	6.90E-11
216-S-16D	Other		EIS-S	NR	NR	NR	NR	NR	NR
216-S-14	Trenches	2001	SIM	NR	NR	NR	NR	NR	5.00E-05
216-B-3	Pond	2001	SIM	0.0032	0.3	170	130	0.32	2.3
216-A-25	Pond	2001	SIM	0.014	1.3	200	180	1.7	9.5
216-A-29	Other		EIS-S	NR	NR	NR	NR	NR	NR
216-B-63	Other	2001	SIM	4.90E-07	4.70E-05	0.047	0.69	0.017	0.12

a. NR = Not reported for indicated EU
b. EIS-S = DOE/EIS-0391 2012
c. SIM = RPP-26744, Rev. 0 (Corbin, et al. 2015)
d. Radionuclides are summed without decay correction since the uncertainties in inventories are large

Table G.6-4. Inventory of Primary Contaminants (cont)[(a)]

WIDS	Description	Ref[(b, c)]	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
All	Sum		46,000	NR	13,000	NR	490	6,900,000	18,000	140,000	NR	20,000
216-S-10P	Pond	SIM	NR	NR	3,000	NR	120	45,000	3,000	NR	NR	510
216-S-16P	Pond	SIM	NR	NR	1.5	NR	40	2,300,000	0.012	NR	NR	660
216-S-17	Pond	SIM	NR	NR	3.3	NR	5.3	310,000	0.031	NR	NR	3.5
216-U-10	Pond	SIM	39,000	NR	9,000	NR	35	3,300,000	9,300	140,000	NR	2,200
216-S-5	Cribs	SIM	NR	NR	3.6	NR	4	230,000	0.0012	NR	NR	1,100
216-S-6	Cribs	SIM	NR	NR	0.18	NR	4.3	250,000	0.0013	NR	NR	850
216-S-10D	Other	EIS-S	NR	NR	NR	NR	NR	NR	NR	NR	NR	3.20E-08
216-S-16D	Other	EIS-S	NR	NR	NR	NR	NR	10	NR	NR	NR	NR
216-S-14	Trenches	SIM	NR	NR	0.29	NR	NR	130	NR	NR	NR	0.074
216-B-3	Pond	SIM	4,700	NR	1,400	NR	280	290,000	5,900	NR	NR	2,800
216-A-25	Pond	SIM	2,200	NR	4.6	NR	0.88	160,000	94	NR	NR	12,000
216-A-29	Other	EIS-S	NR	NR	NR	NR	NR	320	NR	NR	NR	NR
216-B-63	Other	SIM	NR	NR	14	NR	0.78	3,100	1.1	NR	NR	180

a. NR = Not reported for indicated EU
b. EIS-S = DOE/EIS-0391 2012
c. SIM = RPP-26744, Rev. 0 (Corbin, et al. 2015)

Table G.6-5. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Saturated Zone (SZ) and Remaining Vadose Zone (VZ) Contamination associated with the CP-LS-5 (U and S Pond) 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	2.75E+00 Ci	---	---	2.75E+00 Ci	1.38E+00	*Low*
I-129	A	1 pCi/L	0.23	0.2	1.84	2.17E-01 Ci	---	---	2.17E-01 Ci	8.33E+01	*Medium*
Sr-90	B	8 pCi/L	0.23	22	1.84	4.94E+01 Ci	---	---	4.94E+01 Ci	3.49E+01	*ND*[(e)]
Tc-99	A	900 pCi/L	0.23	0	1.84	1.33E-01 Ci	---	---	1.33E-01 Ci	1.48E-01	*Low*
CCl_4	A	5 µg/L	0.23	0	1.84	3.91E+04 kg	2.38E+03 kg	5.17E+03 kg	3.15E+04 kg	6.30E+03	*Very High*
Cr	B	100 µg/L	0.23	0	1.84	1.20E+04 kg	3.21E+00 kg	2.02E-01 kg	1.20E+04 kg	1.20E+02	*High*
Cr-VI	A	48 µg/L[(b)]	0.23	0	1.84	1.20E+04 kg	1.90E+01 kg	2.02E-01 kg	1.20E+04 kg	2.50E+02	*High*
TCE	B	5 µg/L	0.23	2	1.84	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.23	0.8	1.84	5.28E+03 kg	5.10E+00 kg	2.22E+01 kg	5.25E+03 kg	2.37E+01	*Medium*

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

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

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

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

e. As discussed in **Part V**, no appreciable Sr-90 plume would be expected in the next 150 years due to transport and decay considerations. Thus the *Low* rating would apply to the period at the end of the Active Cleanup is complete to account for uncertainties.

Table G.6-6. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Saturated Zone (SZ) and Remaining Vadose Zone (VZ) Contamination associated with the CP-LS-11 (B Pond) Evaluation Unit

PC	Group	WQS	Porosity[(a)]	K_d (mL/g)[(a)]	ρ (kg/L)[(a)]	VZ Source M^{Source}	SZ Total M^{SZ}	Treated[(c)] M^{Treat}	VZ Remaining M^{Tot}	VZ GTM (Mm^3)	VZ Rating[(d)]
C-14	A	2000 pCi/L	0.25	0	1.82	1.34E+02 Ci	---	---	1.34E+02 Ci	6.70E+01	*Medium*
I-129	A	1 pCi/L	0.25	0.2	1.82	1.72E-02 Ci	1.80E-03 Ci	---	1.54E-02 Ci	6.29E+00	*Low*
Sr-90	B	8 pCi/L	0.25	22	1.82	3.18E+02 Ci	1.26E+00 Ci	---	3.17E+02 Ci	2.46E+02	*High*
Tc-99	A	900 pCi/L	0.25	0	1.82	2.04E+00 Ci	---	---	2.04E+00 Ci	2.27E+00	*Low*
CCl_4	A	5 µg/L	0.25	0	1.82	6.88E+03 kg	---	---	6.88E+03 kg	1.38E+03	*Very High*
Cr	B	100 µg/L	0.25	0	1.82	1.43E+03 kg	---	---	1.43E+03 kg	1.43E+01	*Medium*
Cr-VI	A	48 µg/L[(b)]	0.25	0	1.82	1.43E+03 kg	---	---	1.43E+03 kg	2.97E+01	*Medium*
TCE	B	5 µg/L	0.25	2	1.82	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.25	0.8	1.82	1.52E+04 kg	---	---	1.52E+04 kg	7.40E+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).

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

e. As discussed in **Part V**, no uranium plume would be expected in the next 150 years that would exceed the plume area associated with Sr-90 in the same period. Thus the *Low* rating would apply to the period at the end of the Active Cleanup is complete to account for uncertainties.

PART VI. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

Pathways and Barriers

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

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

Exposure to DOE facility workers through excavation of ditches and ponds. No or insufficient information on the response time.

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

Insufficient information available

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

Insufficient information available

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?

Current barriers are soil back-filling, stabilization and vegetation cover. No or insufficient information on barrier integrity and completed or would-be-completed pathways to receptors.

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

A barrier being breach by soil drilling, and increased water recharge and/or overland precipitation

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

External gamma radiation, incidental soil ingestion, and inhalation of dust particulates for the direct contact pathway

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

Insufficient information available

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

Insufficient information available

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker

Insufficient information available

Co-Located Person (CP)

Insufficient information available

Public

Insufficient information available

Groundwater

Table G.6-5 represents the risks and associated ratings for groundwater from remaining vadose zone contamination associated with the CP-LS-5 waste sites. Sites within the CP-LS-5 EU have contaminated both the vadose zone and are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-16, Rev. 0). The current risk and potential impact ratings for the CP-LS-5 EU are *Very High* (carbon tetrachloride), *High* (total and hexavalent chromium), *Medium* (total uranium and I-129), *ND* (Sr-90), and *Low* (other Group A and B PCs) (Table G.6-5). Monitoring and treatment of groundwater is being conducted within the 200-UP GWIA (using the WMA S-SX groundwater extraction system, the U Plant area P&T system, and the I-129 plume hydraulic control system) and 200-ZP GWIA (using the 200 West P&T facility), 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-5 EU waste sites (although the carbon tetrachloride plume is managed as part of the 200-ZP GWIA).

Table G.6-6 represents the risks and associated ratings for groundwater from remaining vadose zone contamination associated with the CP-LS-11 waste sites. Sites within the CP-LS-11 EU have contaminated both the vadose zone and are suspected of being able to contribute mobile contaminants to the saturated zone (DOE/RL-92-19, Rev. 0). The current risk and potential impact ratings for the CP-LS-11 EU are *Very High* (carbon tetrachloride), *High* (Sr-90), *Medium* (total and hexavalent chromium and C-14), *ND* (total uranium), and *Low* (other Group A and B PCs) (Table G.6-6). Monitoring of groundwater is being conducted within the 200-BP and 200-PO GWIAs, which is described as part of the CP-GW-1 EU (Appendix D.5).

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-5 waste sites) currently intersect the Columbia River, thus current ratings for all contaminants for the benthic, riparian, and free-flowing ecology are *ND*.

As described in Appendix D.5 (CP-GW-1 EU, **Part V**), although tritium (Group C) from the 200-PO GWIA currently intersects the Columbia River, current ratings for all contaminants for the benthic, riparian, and free-flowing ecology are *ND*. As indicated in Table G.6-2, a significant amount of tritium (H-3) is associated with the CP-LS-11 EU waste sites with reported inventories and B Pond (216-B-3) is a source for the 200-PO groundwater contamination (DOE/RL-2016-09, Rev. 0). However, the focus in these sections are on the Group A and B primary contaminants (CRESP 2015a).

Ecological Resources

CP-LS-5:

- More than 60% of the EU consists of level 3 or greater resources; of the remaining land area, ~36% is classified as level 0 or level 1.
- Areas reclassified as level 3 resources within the EU are contiguous with level 2 and level 4 habitats in the adjacent landscape buffer area
- Loggerhead shrikes, a Washington State Candidate species and Federal species of concern were observed within the EU

- Habitats inside and outside of the EU that surround the waste site and borrow area footprints are recovering from past wildfires and contain a diverse plant community with a variety of native grasses and forbs with scattered successional and climax shrubs.

CP-LS-11:

- 71% of the surface area within the B Pond EU has been stabilized or revegetated, and is classified as a level 1 biological resource.
- 80% of the EU is characterized as a resource level 2 or below.
- Within the combined EU and buffer area, 58% of habitat is characterized as level 2 or below.
- 75.4 acres within the EU and an additional 612.7 acres with the adjacent landscape buffer area are characterized as resource level 3. Loss of this habitat during cleanup actions will not significantly impact the connectivity of resources within the EU to those outside the 200-East Area.
- Signs of black-tailed jackrabbits were observed in the eastern portion of the combined EU and buffer area. This species is a Washington state candidate species.
- Level 3 and level 4 resources at the eastern end of the buffer area are contiguous with similar habitat covering much of the Hanford Site.
- Two relatively large populations of Piper's daisy, a state sensitive species, occur within the combined area, but are outside the EU boundary. Piper's daisy is relatively common in habitats outside of this EU, and remediation actions within the EU are unlikely to affect population viability.

Cultural Resources

CP-LS-5:

Cultural Resource Literature Reviews, Inventories and Potential for Cultural Resources

The CP-LS-5, U and S Pond EU is located in the 600 Area of the Hanford Site, just southwest of the 200 West area. Small portions of the EU have been inventoried for cultural resources under various survey efforts including, HCRC# 88-200-009 (Cadoret and Chatters 1989a), HCRC# 89-200-010 (Cadoret and Chatters 1989b), HCRC# 89-200-023 (Minthorn and Chatters 1990), HCRC# 93-200-023 (Crist and Wright 1993), HCRC# 93-200-0136 (Nickens 1996), HCRC# 93-600-014 (Last 1993), HCRC# 93-600-016 (Wright 1993), HCRC# 94-600-032 (Crist and Nickens 1994), HCRC# 95-200-013 (Stapp and Woodruff 1994), HCRC# 95-600-020 (Crist and Nickens 1995), HCRC# 2007-600-034 (McFarland et al. 2009), HCRC# 2011-600-015 (Hughes et al. 2011) and HCRC# 2013-600-012b (Hay et al. 2014). An NHPA Section 106 review has not been completed specifically for the remediation of the CP-LS-5, U and S Pond EU. Much of the EU remains relatively undisturbed, suggesting a high potential for intact surface and subsurface archaeological resources.

Archaeological sites, buildings and Traditional Cultural Properties (TCPs) located within the EU[30]

- Two archaeological isolates associated with the Pre-Hanford Early Settlers/Farming Landscape have been recorded within the CP-LS-5, U and S Pond EU. Neither of these isolates have been

[30] 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).

formally evaluated for listing in the National Register of Historic Places, however, it should be noted that isolates are typically considered not eligible.
- No buildings and/or Traditional Cultural Properties (TCPs) are currently known to exist within the EU.

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

- Nine archaeological sites/isolates have been recorded within 500 meters of the CP-LS-5, U and S Pond EU. Two of these resources are associated with the Native American Precontact and Ethnographic Landscape (1 isolate and 1 site) and 7 are associated with the Pre-Hanford Early Settlers/Farming landscape (6 isolates and 1 site). The one site associated with the Native American Precontact and Ethnographic Landscape is the only resource located within the EU that has been formally evaluated for listing in the National Register of Historic Places, and it has been determined not eligible. The remaining archaeological resources have not been formally evaluated, however, it should be noted that isolates are typically considered not eligible.
- A non-contributing segment of a National Register-eligible historic/ethnohistoric Trail/Road is located within 500 meters of the CP-LS-5, U and S Pond EU.
- Segments of the National Register-eligible Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required, are located within 500 meters of the EU. In accordance with the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56) (DOE-RL 1998), all documentation requirements have been completed for this property.
- There are 18 National Register-eligible Manhattan Project and Cold War Era buildings located within 500 meters of the EU (all 18 are contributing within the Manhattan Project and Cold War Era Historic District, 10 recommended for individual documentation and 8 with no additional documentation required). Mitigation for contributing buildings/structures has been completed in accordance with the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56) (DOE-RL 1998) and buildings demolition is ongoing.

Closest Recorded TCP

There are 2 recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from the CP-LS-5, U and S Pond EU.

CP-LS-11:

Cultural Resource Literature Reviews, Inventories and Potential for Cultural Resources

The CP-LS-11, B Pond EU is located partially within and adjacent to the 200-East Area of the Hanford Site, an area known to have low potential to contain Native American Precontact and Ethnographic archaeological resources and Pre-Hanford Early Settlers/Farming resources. Much of the 200 Areas were addressed in a cultural resources report entitled *Archaeological Survey of the 200 East and 200 West Areas, Hanford Site* (Chatters and Cadoret 1990). The focus of this archaeological survey was on inventorying all undisturbed portions of the 200-East and 200-West Areas. This report concluded that much of the 200-East and 200-West Areas can be considered areas of low archaeological potential with the exception of intact portions of an historic/ethnohistoric trail/road corridor which runs through the 200-West Area.

Portions of the EU have been inventoried for archaeological resources under ten cultural resource reviews: HCRC#87-200-046 (Chatters 1987), HCRC#88-200-009 (Cadoret 1988, Cadoret and Chatters 1989), HCRC#88-200-015 (Hoover 1988), HCRC#88-200-038 (Chatters and Cadoret 1990), HCRC#90-600-006 (Gard and Chatters 1990), HCRC#92-200-008 (Gard and Chatters 1992), HCRC#96-200-109 (Cadoret

1996), HCRC#98-200-022 (Hale and Stapp 1998), HCRC#2003-200-044 (Kennedy and Stapp 2003), and HCRC#2008-200-017 (Kennedy 2008). With the exception of HCRC#92-200-008, none of these cultural resource reviews resulted in the identification of any cultural resources within the CP-LS-11, B Pond EU. The isolated historic artifact identified as a result of HCRC#92-200-008 was collected by archaeologists during survey. It is unknown if an NHPA Section 106 review has been completed specifically for the remediation of CP-LS-11, B Pond EU. Extensive ground disturbance within most of the EU suggest a low potential for intact cultural resources at or below ground surface, except in a few isolated pockets where some intact deposits may be present.

Archaeological sites, buildings and Traditional Cultural Properties (TCPs) located within the EU[31]

- Two archaeological isolates associated with the Pre-Hanford Early Settlers/Farming Landscape have been documented within the EU. One of these isolates was collected during survey. These isolates have not been formally evaluated for listing in the National Register of Historic Places, however, isolates are typically considered not eligible.

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

- One archaeological site associated with the Native American Precontact and Ethnographic Landscape has been recorded within 500 meters of the EU. This site has not been evaluated for listing in the National Register of Historic Places.
- Four additional archaeological isolates have been documented within 500 meters of the EU (2 associated with the Native American Precontact and Ethnographic Landscape and 2 associated with the Pre-Hanford Early Settlers/Farming Landscape. None of these isolates have been formally evaluated for listing in the National Register of Historic Places, however, isolates are typically considered not eligible.
- There are 4 National Register-eligible buildings that are contributing properties within the Manhattan Project and Cold War Era Historic District are located within 500-meters of the CP-LS-11, B Pond EU (all 4 are contributing properties within the Manhattan Project and Cold War Era Historic District, 1 with individual documentation required, and 3 with no additional documentation required). Mitigation of contributing buildings/structures has been completed in accordance with the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56) (DOE-RL 1998).

Closest Recorded TCP

There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from the CP-LS-11, B Pond EU.

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

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

Of the remediation alternatives evaluated in the 200-CS-1 OU FS Report[32], the preferred alternative as selected by the DOE, the EPA and the Washington State Department of Ecology (Ecology) is to mitigate the source of the contamination as follows:

- 216-A-29 Ditch- Removal, Treatment, and Disposal
- 216-B-63 Trench- No Action
- 216-S-10 Ditch- Removal, Treatment, and Disposal
- 216-S-10 Pond- No Action
- 216-S-11 Pond- No Action.

The 216-A-29 Ditch and 216-S-10 Ditch contain contaminants that are greater than human health cleanup and ecological screening levels at depths of 0-8.5 feet below ground surface. Peak exposure for a Facility (industrial) Worker in a hypothetical excavation scenario at the 216-A-29 Ditch would be approximately 5.9×10^{-4} at time zero with the primary contributor to risk being Cs-137. The peak exposure for a Facility Worker at the 216-S-10 Ditch would be 4.9×10^{-5} at time zero. There are no risk drivers present at the 216-B-63 Trench and the 216-S-10 and 216-S-11 Ponds, and thus these sites do not represent a human health or ecological risk.

A CERCLA risk evaluation of an industrial worker estimated an unmitigated risk of 5.9×10^{-4} excess lifetime cancer risk (ELCR) (DOE/RL-2005-63, Revision 0), which exceeds the CERCLA “action limit” of 1×10^{-4}. The levels of contamination at the 216-A-29 and 216-S-10 Ditches are not expected to pose a substantial health risk to remediation workers when typical mitigation practices are followed in accordance with a site specific health and safety plan. Typical practices include enclosed excavation equipment and water-based dust suppression. These practices limit worker risk, with minimal impact on schedule and cost, because excavation with dust suppression and health and safety controls have been proven effective in excavating soil sites. There would not be any short-term risks to the public from existing DOE site-access measures. Thus a Medium Unmitigated rating and Low Mitigated rating were assigned for the Facility Worker.

No information is available regarding remediation strategies for other sites within the two EUs, however action memoranda (DOE/RL-2009-37, DOE/RL-2009-86) are in place to remove contaminated soil, structures, and debris from 200 West and 200 East Inner Area soil sites (200-EA-1, 200-CW-1, 200-OA-1 and 200-IS-1 OUs), with disposal at ERDF. Future cleanup decisions for remaining waste sites will be included in decision documents (e.g., action memoranda, RODs).[33]

<u>Range of Plausible Alternatives</u>

- RTD approximately half of waste sites and cap remainder.
- RTD all waste sites; backfill and revegetate.
- Cap and maintain under LTS with monitoring and appropriate institutional controls.
- If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

---

[32] *Feasibility Study for the 200-CS-1 Chemical Sewer Group Operable Unit*, DOE/RL-2005-63, Revision 0, p 7-6, US Department of Energy, September 2008.
[33] DOE/RL-2014-11 Table B-3 CP-16

In addition, an interim ROD, ESD, and action memoranda are in place to remediate remaining outer area contaminated soil sites (200-OA-1, 200-CW-1, and 200-CW-3 OUs) with disposal at ERDF.[34]

> EPA/ROD/R10-99/039,
> EPA, 2009a, *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision,*
> DOE/RL-2009-37; DOE/RL-2009-48; DOE/RL-2009-86

Future cleanup decisions for remaining soil sites will be included in decision documents (e.g., action memoranda, RODs).

<u>Range of Plausible Alternatives</u>

- RTD contaminated soil sites to achieve RAOs comparable to 100 Areas; backfill, contour, and revegetate excavations.
- RTD all sites except ponds; allow monitored natural attenuation for large pond sites with presence of existing vegetated soil covers.
- Allow monitored natural attenuation to proceed for all sites with appropriate institutional controls.

If residual contamination remains after cleanup actions are completed, cleanup work will transition to LTS, including institutional controls and 5-year reviews of remedy effectiveness.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

There are no risk drivers present at the 216-B-63 Trench and the 216-S-10 and 216-S-11 Ponds and thus do not represent a human health or ecological risk.

Excavation of the 216-A-29 and 216-S-10 Ditches would continue until the contaminated soil in each that is greater than the remediation action objective (RAO) is removed. The first two CERCLA criteria are overall protection of human health and the environment and compliance with ARARs. The waste site will then be backfilled with clean material. The surface would be recontoured and revegetated to be compatible with surrounding natural areas or other features.

No information is available regarding remediation strategies for other sites within the two EUs not described above.

Risks and Potential Impacts Associated with Cleanup

The levels of contamination at the 216-A-29 and 216-S-10 Ditches are not expected to pose a health risk to remediation workers when typical practices are followed from a health and safety plan. Typical practices should include enclosed excavation equipment and water-based dust suppression. These practices limit the worker risk, with minimal impact on schedule and cost because excavation with dust suppression and health and safety controls have been proven effective in excavating soil sites. There would not be any short-term risks to the public from existing DOE site-access measures.

No information is available regarding remediation strategies for other sites within the two EUs not described above.

[34] DOE/RL-2014-11 Table B-3 CP-2

Populations and Resources at Risk or Potentially Impacted During or as a Consequence of Cleanup Actions

Facility Worker

See above

Co-located Person

See above

Public

See above

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 CP-LS-5 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). Because the current plumes associated with CP-LS-5 sources are best represented by the S Barrier analysis (see previous section), the vadose zone (VZ) GTM values for the Group A and B primary contaminants for CP-LS-5 (during the Active Cleanup period) translate to ratings of *Not Discernible* to *Very High* (because of large amounts of contaminants in the vadose zone to be treated). As indicated in **Part V**, Sr-90 is unlikely to impact the groundwater in sufficient quantities to exceed the drinking water standard by the end of the Active Cleanup period (from radioactive decay) and would thus be rated *Low* afterwards. The groundwater in the area is being treated using several methods, which does not impact the threats or ratings associated with the vadose zone contaminant sources. However, measures are being taken to limit the spread of the I-129 plume; thus it is assumed that the current rating of *Medium* would apply during and after the Active Cleanup period. These ratings correspond to an overall rating of *Very High* for both the Active and Near-term, Post-Cleanup periods to account for uncertainties. These ratings would be subject to change when final remedial decisions are made to control vadose zone sources. 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 and the 200 West Area P&T system in the 200-ZP GWIA are assumed to be operational during this evaluation period, which will be treating groundwater contamination in the 200 West area.

As described in **Part V**, there will be a continuing impact during this period to groundwater from mobile primary contaminants from CP-LS-11 currently with plumes. These impacts are described in more detail in Appendix G.5 for the CP-GW-1 EU. Furthermore, there are contaminant sources (legacy source sites) in the vadose zone that pose continuing risk to groundwater. Because the current plumes associated with CP-LS-11 sources are best represented by the B Barrier analysis (see previous section), the vadose zone (VZ) GTM values for the Group A and B primary contaminants for CP-LS-11 (during the Active Cleanup period) translate to ratings of *Not Discernible* to *Very High* (because of large amounts of contaminants in the vadose zone to be treated and the fact that final cleanup decisions have not been made for the 200 East Area). As indicated in **Part V**, uranium is unlikely to impact the groundwater in sufficient quantities to exceed the current and future corresponding Sr-90 plume area and thus is rated *Low* during the Active and Near-term, Post-Cleanup periods. The groundwater in the area is being monitored but not treated and thus no changes are made to ratings during the Active and Near-term, post-Cleanup periods for the Group A and B primary contaminants. The exception is Sr-90 where radioactive decay to the remaining vadose zone inventory would result in *Low* ratings after the Active period. These ratings correspond to an overall rating of *Very High* for both the Active and Near-term, Post-Cleanup periods (because treatment is pending).

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 from both CP-LS-5 and Cp-LS-11 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 apart from those associated with these EUs are described in Appendix G.5 and Appendix G.6.

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

CP-LS-5: Personnel, car and pickup truck traffic through the non-target and target (remediation) area, truck and heavy equipment traffic on roads through the non-target and target area, soil removal and contamination in the soil, dust suppression, vegetation control, and Irrigation (for revegetation) will cause the following disturbance from remediation activities: Carry seeds or propagules (pieces of vegetation or other biological parts that can grow and/or reproduce) on person (boots, clothes, equipment), from tires of vehicles or blowing from heavy equipment; injure or kill vegetation or small invertebrates or small animals; vehicle traffic can make paths, compact soil, scare or displace animals, can impact animal behavior or reproductive success; affect animal dispersion and habitat use (e.g., some birds avoid nesting near roads because of song masking); displacement of animals from near roads due to increased noise or other disturbances; and heavy equipment may permanently destroy areas of the site with intense activity. Soil removal causes complete destruction of existing ecosystem, but these effects are potentially more severe because of blowing soil (and seeds); and potential for exposure of dormant seeds. In the revegetation stage, there is the potential for invasion of exotic species, changing the species diversity of native communities. During remediation, radionuclides or other contaminants could be released or spilled on the surface, and depending upon the type and quantity, could have adverse effects on the plants and animals onsite. Additional water from dust suppression could lead to more diverse and abundant vegetation in areas that receive water, which could encourage invasion of exotic species; the latter could displace native plant communities; excessive dust suppression activities could lead to compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Use of nonspecific herbicides for vegetation control results in some mortality of native vegetation (especially native forbes), and allows exotic species to move in; it may change species composition of native communities, but it also could make it easier for native species to move in; improved methods could yield positive results. Irrigation requires a system of pumps and water, resulting in physical disturbance; repeated irrigation from the same locations could result in some soil compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. These effects will be higher in the EU itself.

CP-LS-11: Remove, Treat and Dispose of waste involves personnel through the target (remediation) area, car and pickup truck traffic through the non-target and target (remediation) area, truck, heavy equipment (including drill rigs) traffic on roads through the non-target and target area, caps (and other containment), soil removal and contamination in the soil, vegetation control, and irrigation (for revegetation) will cause the following disturbance from remediation activities: Carry seeds or propagules (pieces of vegetation or other biological parts that can grow and/or reproduce) on tires of vehicles or blowing from heavy equipment; injure or kill vegetation or small invertebrates or small animals; vehicle traffic can make paths, compact soil, scare or displace animals, can impact animal behavior or reproductive success; affect animal dispersion and habitat use (e.g., some birds avoid nesting near roads because of song masking); displacement of animals from near roads due to increased noise or other disturbances; and heavy equipment may permanently destroy areas of the site with intense activity. soil removal can cause more severe effects because of blowing soil (and seeds) During remediation, radionuclides or other contaminants could be released or spilled on the surface, and depending upon the type and quantity, could have adverse effects on the plants and animals on-site. Use of non-specific herbicides for vegetation control results in some mortality of native vegetation (especially native forbes), and allows exotic species to move in; it may change species composition of native communities, but it also could make it easier for native species to move in; improved methods could yield positive results. Irrigation requires a system of pumps and water, resulting in physical disturbance; repeated irrigation from the same locations could result in some soil compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Alternatively, barriers could be the remediation option and involves personnel car and pickup truck traffic through the non-target and target (remediation) area, truck and heavy equipment traffic on roads through the non-target and target area, dust suppression, and irrigation (for revegetation) will cause the following disturbance from remediation activities: Carry seeds or propagules (pieces of vegetation or other biological parts that can grow and/or reproduce) on person (boots, clothes, equipment) or tires of vehicles or blowing from heavy equipment; injure vegetation or small invertebrates or small animals (e.g., insects, snakes); make paths or compact soil; scare or displace animals. Caps and other containment can cause compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Destruction of soil invertebrates at depths of pits. Potential bringing up of dormant seeds from soil layers; disruption of ground-living small mammals and hibernation sites of snakes and other animals on-site of containment; often disrupts local aquatic environment and drainage; often non-native plants used on caps (which can become exotic/alien adjacent to the containment site). Additional water from dust suppression could lead to more diverse and abundant vegetation in areas that receive water, which could encourage invasion of exotic species; the latter could displace native plant communities; excessive dust suppression activities could lead to compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Irrigation requires a system of pumps and water, resulting in physical disturbance; repeated irrigation from the same locations could result in some soil compaction, which can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. These effects will be higher in the EU itself.

Cultural Resources

CP-LS-5:

Native American & Historic-PreHanford: Archaeological investigations and monitoring may need to occur prior to remediation. The area remains relatively undisturbed, suggesting a high potential for intact archaeological resources. Remediation disturbance may result in impacts to archaeological resources if they are present in the subsurface.

Manhattan/Cold War: Manhattan Project/Cold War Era significant resources have been mitigated. No Manhattan Project/Cold War Era buildings located within the EU.

CP-LS-11:

Native American & Historic-PreHanford: Archaeological investigations and monitoring may need to occur prior to remediation. The geomorphology indicates a moderate potential for intact archaeological resources. Remediation disturbance may result in impacts to archaeological resources if they are present in the subsurface. Permanent indirect effects to viewshed are possible from capping. Temporary indirect effects to viewshed are possible during remediation.

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

Additional Risks and Potential Impacts if Cleanup is Delayed

Insufficient information available to assess risks and impacts to human health.

Sites within the CP-LS-5 and CP-LS-11 EUs have contaminated the vadose zone and are linked as sources to groundwater plumes (DOE/RL-2016-09, Rev. 0). Vadose zone contamination is likely to continue, especially in 200 East where remedial actions have not been started. Vadose zone and groundwater monitoring should continue to evaluate contaminant release and migration.

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

Excavation of the 216-A-29 and 216-S-10 Ditches would continue until the contaminated soil in each that is greater than the remediation action objective (RAO) is removed. The first two CERCLA criteria are overall protection of human health and the environment and compliance with ARARs. The waste site will then be backfilled with clean material. The surface would be recontoured and revegetated to be compatible with surrounding natural areas or other features.

No information is available regarding remediation strategies for other sites within the two EUs not described above.

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

Table G.6-7. 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)[(a)]	
	Co-located Person	ND	
	Public	ND	
Environmental	Groundwater (A&B) from vadose zone[(a)]	*CP-LS-5:* *Very High* – CCl_4 *High* – Cr-tot & Cr-VI *Medium* – I-129 & U(tot) *Low* – other PCs **Overall**: *Very High* *CP-LS-11:* *Very High* -- CCl_4 *Medium* -- Cr(tot), Cr-VI, C-14 *Low* – other PCs **Overall**: *Very High*	*Current* GTM values for Group A&B primary contaminants (Table G.6-5 and Table G.6-6): where *Very High* (current) ratings both from CCl_4. Groundwater treatment in 200 West (CP-LS-5) would not impact vadose zone threats or ratings although final remedial decisions (to be made) could impact ratings if vadose zone sources are managed. Treatment decisions not made for 200 East (CP-LS-11). Sr-90 and U(tot) may impact groundwater depending on area (**Part V**).
	Columbia River from vadose zone[(b)]	CP-LS-5 and CP-LS-11: 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[(c)]	CP-LS-5: Low to Medium CP-LS-11: ND to Medium	See following section below
Social	Cultural Resources[(c)] *Same ratings for CP-LS-5 and CP-LS-11*	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Known **Manhattan/Cold War:** Direct: None Indirect: None	See following section below

a. Ratings are for the 216-A-29 and 216-S-10 Ditches only. No information is available regarding remediation strategies for other sites within the two EUs.

b. Threat to groundwater or Columbia River for Group A and B contaminants remaining in the vadose zone. No existing plumes are associated with the CP-LS-7 EU as described in Part V. More detailed information on all threats to groundwater as a protected resource are described in Appendix G.5 and Appendix G.6.

c. 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

CP-LS-5:

Ecological - Post-cleanup monitoring might pose a risk to level 3 and above resources in the buffer area. Possible disruption of migratory birds and loggerhead shrike. Past revegetation efforts with introduced species will likely not be replaced by native species over time.

Cultural (Direct) – Potential direct effects from the use of caps and/or other containment options are possible during the near-term post-cleanup period. Permanent effects are possible in the area of the cap site if resources were exposed during installation, thereby creating a possibility that other resources around the cap may be exposed (depending on traffic and current activities). Periodic monitoring of the cap will involve effects due to personnel, car and truck traffic including: landscape alterations from traffic (e.g. ruts, changes in vegetation), the creation of permanent paths in vegetation, introduction of invasive species, changes in plants used for food, medicines or cultural purposes. Potential direct effects are possible (and potentially permanent) if contamination remains and/or resources are contaminated. Resources may be destroyed and/or have to be removed. Plants having cultural importance to Tribes may not recolonize or thrive. If contamination remains, access to and/or use of resources may be prohibited.

Cultural (Indirect) – Potential indirect effects are possible from the use of caps and/or other containment options due to periodic monitoring of the cap and continued traffic through the area. Indirect effects due to personnel, car and truck traffic may decrease viewshed values and/or impact viewshed through the introduction of increased dust, the creation of trails, changes in vegetation and other potential alterations to the landscape. Potential indirect effects are possible (and potentially permanent) if contamination remains and/or resources are contaminated. If contamination remains, access to and/or use of resources may be prohibited.

CP-LS-11:

Ecological - Monitoring activities for post-closure conditions are expected to occur. Medium impacts are likely if exotic species are introduced to EU and buffer area with level 3 resources.

Cultural (Direct) - Potential direct effects from the use of caps and/or other containment options are possible during the near-term post-cleanup period. Permanent effects are possible in the area of the cap site if resources were exposed during installation, thereby creating a possibility that other resources around the cap may be exposed (depending on traffic and current activities). Periodic monitoring of the cap will involve effects due to personnel, car and truck traffic including: landscape alterations from traffic (e.g. ruts, changes in vegetation), the creation of permanent paths in vegetation, introduction of invasive species, changes in plants used for food, medicines or cultural purposes. Potential direct effects are possible (and potentially permanent) if contamination remains and/or resources are contaminated. Resources may be destroyed and/or have to be removed. Plants having cultural importance to Tribes may not recolonize or thrive. If contamination remains, access to and/or use of resources may be prohibited.

Cultural (Indirect) - Potential indirect effects are possible from the use of caps and/or other containment options due to periodic monitoring of the cap and continued traffic through the area. Indirect effects due to personnel, car and truck traffic may decrease viewshed values and/or impact viewshed through the introduction of increased dust, the creation of trails, changes in vegetation and other potential alterations to the landscape. Potential indirect effects are possible (and potentially permanent) if contamination remains and/or resources are contaminated. If contamination remains, access to and/or use of resources may be prohibited. Supplemental Information and Considerations

PART VII. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

Table G.6-8. Hanford Site-Wide Risk Review CP-LS-11 (B Pond) 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	Comments
200-E-118	200-E-118; 216A271 Shack;	Waste Site	Inactive	Accepted	None	Control Structure	Process Building	TBD		
200-E-289-PL	200-E-289-PL; Lines 637, SN-700	Waste Site	Inactive	Accepted	None	Direct Buried	Pipeline and associated valves, etc.	TBD		
216-A-29	216-A-29; 216-A-29 Ditch; A-29	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface Liquid Disposal Site	200-EA-1		
216-B-2-1	216-B-2-1; 216-B-2W; B Ditch; B	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface Liquid Disposal Site	200-EA-1		
216-B-2-2	216-B-2-2; 216-B-2-2W; 216-B-1	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface Liquid Disposal Site	200-EA-1		
216-B-2-3	216-B-2-3; 216-B-2-3W; B Pond	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface Liquid Disposal Site	200-EA-1		
216-B-3-1	216-B-3-1; B Swamp Ditch;	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface Liquid Disposal Site	200-OA-1		
216-B-3-2	216-B-3-2; B Swamp Ditch;	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface Liquid Disposal Site	200-OA-1		
216-B-3-3	216-B-3-3; 216-B-3-3 Ditch; B	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface Liquid Disposal Site	200-OA-1		
216-B-63	216-B-63; 216-B-63 Ditch; 216-B-63	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface Liquid Disposal Site	200-EA-1		
216-B-3	216-B-3; 216-B-3 Main	Waste Site	Inactive	Accepted	None	Pond	Pond/Ditch – Surface Liquid Disposal Site	200-CW-1		
216-B-3A RAD	216-B-3A RAD; West	Waste Site	Inactive	Accepted	None	Pond	Pond/Ditch – Surface Liquid Disposal Site	200-CW-1		
216-B-3B RAD	216-B-3B RAD; East	Waste Site	Inactive	Accepted	None	Pond	Pond/Ditch – Surface Liquid Disposal Site	200-CW-1		
216-B-3C RAD	216-B-3C RAD; 216-B-3C	Waste Site	Active	Accepted	None	Pond	Pond/Ditch – Surface Liquid Disposal Site	200-CW-1		
200-E-237-PL	200-E-237-PL; 2904-E-	Waste Site	Active	Accepted (Proposed)	None	Process Sewer	Pipeline and associated valves, etc.	TBD		
600-291-PL	600-291-PL; LERF Line; TEDF Line;	Waste Site	Active	Accepted	None	Process Sewer	Pipeline and associated valves, etc.	Not Applicable		

200-E-114-PL	200-E-114-PL; 216-BC-2805; 2805-E1, 2805-E2, 2805-E3 and 2805-	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	200-IS-1		
200-E-126-PL-	200-E-126-PL-A; Segments of 200-	Waste Site	Inactive	Accepted	None	Radioactive Process	Pipeline and associated valves, etc.	200-OA-1		
200-E-126-PL-	200-E-126-PL-B; Segments of 200-	Waste Site	Inactive	Accepted	None	Radioactive Process	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-127-PL-	200-E-127-PL-B; Segments of Gable	Waste Site	Inactive	Accepted	None	Radioactive Process	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-188-PL	200-E-188-PL; 2904-E-2; B Plant	Waste Site	Inactive	Accepted	None	Radioactive Process	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-191-PL	200-E-191-PL; 216-B-63 Pipeline;	Waste Site	Inactive	Accepted	None	Radioactive Process	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-203-PL	200-E-203-PL; Line 9712; Pipeline	Waste Site	Inactive	Accepted	None	Radioactive Process	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-204-PL	200-E-204-PL; Pipeline to 216-B-	Waste Site	Inactive	Accepted	None	Radioactive Process	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-205-PL	200-E-205-PL; 216-B-2-3 Ditch	Waste Site	Inactive	Accepted	None	Radioactive Process	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-E-265-PL	200-E-265-PL; 241-BY and 241-	Waste Site	Inactive	Accepted	None	Radioactive Process	Pipeline and associated valves, etc.	TBD_200-IS-1		
207-B	207-B; 207-B Retention Basin; B	Waste Site	Inactive	Accepted	None	Retention Basin	Crib - Subsurface Liquid Disposal Site	200-EA-1		
UPR-200-E-	UPR-200-E-138; UPR-200-W-66;	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release -	Not Applicable		
UPR-200-E-	UPR-200-E-14; 216-B-3 Pond Dike	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release -	Not Applicable		
UPR-200-E-	UPR-200-E-32; Coil Leak from	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release -	Not Applicable		
UPR-200-E-	UPR-200-E-34; Liquid Release to	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release -	Not Applicable		
UPR-200-E-	UPR-200-E-51; Liquid Release	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release -	Not Applicable		
UPR-200-E-	UPR-200-E-92; 216-E-20;	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release -	Not Applicable		

EU Designation: Combined CP-LS-5 and CP-LS-11

UPR-200-E-	UPR-200-E-93; UN-216-E-21	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release - Surface/Near	Not Applicable		
218-E-12A	218-E-12A; 200 East Dry Waste No. 12A	Waste Site	Inactive	Accepted	None	Burial Ground	Burial Ground	200-SW-2	X	Included in 200-East Burial

EU Designation: Combined CP-LS-5 and CP-LS-11

Site Code	Name, Aliases, Description	Feature Type	Site Status	ERS Classification	ERS Reclassification	Site Type	Site Type Category	Operable Unit	Exclude from Evaluation	Comments
GTFL	GTFL; PSW Vault; 218-E-16; Grout	Waste Site	Inactive	Accepted	None	Burial Ground	Burial Ground	Not Applicable	X	Included in Grout Vaults
200-E-19	200-E-19; 216-B-3 Borrow Pit; B Pond Borrow Area	Waste Site	Inactive	Not Accepted	None	Depression/ Pit (nonspecific)	Burial Ground	Not Applicable	X	Not Accepted
200-E-286	200-E-286; A Swamp; A-Swamp and	Waste Site	Inactive	Accepted	Rejected	Pond	Pond/Ditch – Surface Liquid Disposal Site	Not Applicable	X	Rejected
216-B-3A	216-B-3A; B Pond First	Waste Site	Inactive	Accepted	Closed Out	Pond	Pond/Ditch – Surface Liquid	Not Applicabl	X	Closed Out
216-B-3B	216-B-3B; B Pond Lobe B; B	Waste Site	Inactive	Accepted	Closed Out	Pond	Pond/Ditch – Surface Liquid	Not Applicabl	X	Closed Out
216-B-3C	216-B-3C; B Pond Lobe C; B	Waste Site	Inactive	Accepted	Closed Out	Pond	Pond/Ditch – Surface Liquid	Not Applicabl	X	Closed Out
200-E-126-PL	200-E-126-PL; Underground	Waste Site	Inactive	Accepted	Rejected	Radioactive Process Sewer	Pipeline and associated valves,	Not Applicabl	X	Rejected
200-E-288-PL	200-E-288-PL; PC-5000; Pipeline	Waste Site	Active	Accepted	None	Radioactive Process Sewer	Pipeline and associated valves, etc.	TBD	X	Included in A-AX Tank
UPR-200-E-94	UPR-200-E-94; Vehicle Decontamination Area; UN-200-E-94; UN-216-E-22	Waste Site	Inactive	Accepted	Rejected	Unplanned Release	Unplanned Release - Surface/Near Surface	Not Applicable	X	Rejected
216A27	VALVE	Facility	INACTIV			BUILDING	Process Building			
MO248	MOBILE OFFICE SOUTH OF 12B BURIAL	Facility	ACTIVE			BUILDING	Infrastructure Building		X	Mobile Office

Table G.6-9. Table G.6-9. Hanford Site-Wide Risk Review CP-LS-5 (U and S Ponds) 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	Comments
200-W-	200-W-240; Contaminated	Waste Site	Not Specified	Accepted	None	Contamination Migration	Unplanned Release -	TBD		
216-S-172	216-S-172; 216-S-172	Waste Site	Inactive	Accepted	None	Control Structure	Pipeline and associated	200-IS-1		
2904-S-160	2904-S-160; 2904-S-160 Control	Waste Site	Inactive	Accepted	None	Control Structure	Pipeline and associated	200-IS-1		
2904-S-171	2904-S-171; 2904-S-171 Control	Waste Site	Inactive	Accepted	None	Control Structure	Pipeline and associated	200-IS-1		
216-S-5	216-S-5; 216-S-5 Cavern #1; 216-S-6	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface	200-WA-1		
216-S-6	216-S-6; 216-S-6 Cavern #2; 216-S-13	Waste Site	Inactive	Accepted	None	Crib	Crib - Subsurface	200-WA-1		
216-S-10D	216-S-10D; 216-S-10D Ditch;	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface Liquid	200-OA-1		
216-S-16D	216-S-16D; 216-S-24 Ditch; REDOX Pond #2; 202-S Swamp	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface	200-OA-1		
216-U-11	216-U-11; 216-U-11 (New Ditch); 216-U-11 (Old Ditch); 216-	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface	200-CW-1		
216-U-14	216-U-14; 216-U-14 Ditch; Laundry	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface	200-WA-1		
216-U-9	216-U-9; U Swamp-S Swamp Ditch;	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface	200-CW-1		
216-Z-11	216-Z-11; 216-Z-11 Ditch; Z Plant Ditch	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface	200-CW-5		
216-Z-19	216-Z-19; 216-Z-19 Ditch; Z Plant Ditch;	Waste Site	Inactive	Accepted	None	Ditch	Pond/Ditch – Surface	200-CW-5		
200-W-11	200-W-11; Concrete Foundation South	Waste Site	Inactive	Accepted	None	Dumping Area	Burial Ground	200-WA-1		

200-W-	200-W-242; Area of Debris and	Waste Site	Inactive	Accepted	None	Dumping Area	Burial Ground	TBD		
216-S-10P	216-S-10P; 216-S-10P Pond; Chemical Sewer	Waste Site	Inactive	Accepted	None	Pond	Pond/Ditch – Surface	200-OA-1		
216-S-11	216-S-11; 216-S-11 Swamp; Chemical	Waste Site	Inactive	Accepted	None	Pond	Pond/Ditch – Surface	200-OA-1		
216-S-16P	216-S-16P; REDOX Pond #2; 202-S	Waste Site	Inactive	Accepted	None	Pond	Pond/Ditch – Surface	200-CW-1		
216-S-17	216-S-17; REDOX Swamp; 202-S REDOX Swamp;	Waste Site	Inactive	Accepted	None	Pond	Pond/Ditch – Surface	200-CW-1		
216-U-10	216-U-10; 216-U-10 Pond; 231 Swamp;	Waste Site	Inactive	Accepted	None	Pond	Pond/Ditch – Surface	200-CW-1		
200-W-157-	200-W-157-PL; Pipeline	Waste Site	Inactive	Accepted	None	Process Sewer	Pipeline and associated valves, etc.	TBD_200-IS-1		
200-W-	200-W-147-PL-B; Portion of Pipeline	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated	TBD_200-IS-1		
200-W-	200-W-152-PL; Pipeline from 202-S to 2904-S-	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated	TBD_200-IS-1		
200-W-	200-W-153-PL; Steel Pipeline from 240-S-151	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated	TBD_200-IS-1		
200-W-	200-W-154-PL; Pipeline from 200-	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated	TBD_200-IS-1		
200-W-	200-W-155-PL-A; Portion of 200-W-	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated	TBD		
200-W-	200-W-155-PL-B; Portion	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated	TBD_200-IS-1		
200-W-	200-W-156-PL; 216-S-6 Crib Pipeline; Pipeline from 200-	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated	TBD_200-IS-1		
200-W-	200-W-159-PL; Cooling Water Lines from 241-	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated	TBD_200-IS-1		
200-W-	200-W-161-PL; Line 557; Pipeline from	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated	TBD_200-IS-1		

200-W-	200-W-169-PL; Pipeline Between	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated	TBD		
200-W-	200-W-218-PL; Pipeline from 216-	Waste Site	Inactive	Accepted	None	Radioactive Process Sewer	Pipeline and associated	TBD		
216-S-14	216-S-14; 216-S-4 Burial Contaminated	Waste Site	Inactive	Accepted	None	Trench	Crib - Subsurface	200-WA-1		
UPR-200-	UPR-200-W-104; 216-U-10 Pond	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release -	Not Applicable		

Site Code	Name, Aliases, Description	Feature Type	Site Status	ERS Classification	ERS Reclassification	Site Type	Site Type Category	Operable Unit	Exclude from	Comments
UPR-200-W-105	UPR-200-W-105; 216-U-10 Pond Leach Trench; UN-216-W-15	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release -	Not Applicable		
UPR-200-W-106	UPR-200-W-106; 216-U-10 Pond Leach Trench; UN-216-W-16	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release -	Not Applicable		
UPR-200-W-107	UPR-200-W-107; 216-U-10 Pond Flood Plain; UN-216-W-17	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release -	Not Applicable		
UPR-200-W-124	UPR-200-W-124; Dike Break at the REDOX Pond; UN-200-W-124	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release -	200-CW-1		
UPR-200-W-34	UPR-200-W-34; Overflow of the 216-S-10 Ditch; UN-200-W-34	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release -	Not Applicable		
UPR-200-W-47	UPR-200-W-47; 216-S-16P Dike Release; UN-200-W-47	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release -	Not Applicable		
UPR-200-W-59	UPR-200-W-59; Contaminated Liquid Released to 216-S-16P	Waste Site	Inactive	Accepted	Consolidated	Unplanned Release	Unplanned Release -	Not Applicable		
UPR-200-W-71	UPR-200-W-71; Contamination Spread from 16th Street to	Waste Site	Inactive	Accepted	None	Unplanned Release	Unplanned Release -	200-WA-1		
218-W-4C	218-W-4C ANNEX; Unused Portion of 218-W-4C Burial Ground	Waste Site	Inactive	Not Accepted	None	Burial Ground	Burial Ground	Not Applicable	X	Not Accepted
200-W-24	200-W-24; 216-S-10 Borrow Pit; S-10 Pond Borrow Area	Waste Site	Inactive	Not Accepted	None	Depression/Pit (nonspecific)	Burial Ground	Not Applicable	X	Not Accepted
200-W-25	200-W-25; 216-S-16 Borrow Pit	Waste Site	Inactive	Not Accepted	None	Depression/Pit (nonspecific)	Burial Ground	Not Applicable	X	Not Accepted
200-W-26	200-W-26; 216-S-17 Borrow Pit	Waste Site	Inactive	Not Accepted	None	Depression/Pit (nonspecific)	Burial Ground	Not Applicable	X	Not Accepted
200-W-27	200-W-27; 216-S-19 Borrow Pit	Waste Site	Inactive	Not Accepted	None	Depression/Pit (nonspecific)	Burial Ground	Not Applicable	X	Not Accepted
200-W-28	200-W-28; 216-U-10 Borrow Pit; U Pond Borrow Area	Waste Site	Inactive	Not Accepted	None	Depression/Pit (nonspecific)	Burial Ground	Not Applicable	X	Not Accepted
200-W-29	200-W-29; 216-U-11 Borrow Pit	Waste Site	Inactive	Not Accepted	None	Depression/Pit (nonspecific)	Burial Ground	Not Applicable	X	Not Accepted

216-S-19	216-S-19; 216-S-19 Pond; 216-SL-1; 222-S Lab Swamp; REDOX Lab	Waste Site	Inactive	Accepted	Interim Closed Out	Pond	Pond/Ditch – Surface Liquid	200-OA-1	X	Closed Out
2607-W6	2607-W6	Waste Site	Active	Accepted	None	Septic Tank	Septic System	200-WA-1	X	Septic System
UPR-200-W-68	UPR-200-W-68; Road Contamination; UN-200-W-68	Waste Site	Inactive	Accepted	Rejected	Unplanned Release	Unplanned Release -	Not Applicable	X	Rejected
2508W11	SIREN BETWEEN DAYTON AND	Facility	ACTIVE			STRUCTURE	Infrastructure			
2508W9	SIREN SOUTH OF S PLANT COMPLEX	Facility	ACTIVE			STRUCTURE	Infrastructure			

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

BIBLIOGRAPHY

CRESP 2015. *Methodology for the Hanford Site-Wide Risk Review Project*, Consortium for Risk Evaluation with Stakeholder Participation (CRESP), Nashville, Tennessee. Available at: http://www.cresp.org/hanford/.

Pacific Northwest National Laboratory (2002). *Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch*, PNNL-14070.

DOE/RL-2016-09, Rev. 0, *Hanford Site Groundwater Monitoring Report for 2015, Rev 0*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.' Available at: http://higrv.hanford.gov/Hanford_Reports_2015/Hanford_GW_Report/

US DOE, (2000). *200-CS-1 Operable Unit RI/FS Work Plan and RCRA TSD Unit Sampling Plan* (DOE/RL-99-44, Rev. 0).

US DOE, (2001). *200-CW-1 Operable Unit Remedial Investigation Report (DOE/RL-2000-35 Rev 0).*

US DOE (2004). *Remedial Investigation Report for the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2- S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units*, DOE/RL-2003-11, Revision 0.

US DOE, (2005). *Central Plateau Ecological Evaluation (DOE/RL-2001-54 Rev 0).*

US DOE (2008). *Hanford Facility Dangerous Waste Closure/Postclosure Plan for the 216-A-29 Ditch* (DOE/RL-2008-53 Rev. 0)

US DOE, (2008). *Feasibility Study for the 200-CS-1 Chemical Sewer Group Operable Unit (DOE/RL-2005-63 Rev 0)*.

US DOE, (2008). *Proposed Plan for the 200-CS-1 Chemical Sewers Group Operable Unit (DOE/RL-2005-64 Rev 0)*.

US DOE, (2008). *Sampling and Analysis Plan for Supplemental Remedial Investigation Activities at Model Group 5, Large-Area Ponds, Waste Sites Located Within the 200-CW-1 Operable Unit (DOE/RL-2006-57 Rev 0)*

US DOE, (2010). *Interim Status Groundwater Monitoring Plan for the 216-B-3 pond (DOE/RL-2008-59 Rev 0)*.

US DOE (2013). *216-B-3 Main Pond Closure Plan*, DOE/RL-2013-24, Draft A.

US DOE, (2013). *216-S-10 Pond and Ditch Closure Plan*, DOE/RL-2006-12, Draft B.

US DOE, (2016). *Interim Status Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch (DOE/RL-2008-61 Draft Rev 1)*.

Washington State, Department of Ecology (2012). *Draft-Hanford Facility Dangerous Waste Permit (Site-Wide Permit), Revision 9-WA7890008967, Part V-Closure Units.*

CP-LS-5: U and S Pond Cultural Resources[35]

Cadoret, N and J Chatters. 1989a. Cultural Resources Reviews for Four Projects in the Vicinity of the 200 Areas on the Hanford Site, Washington: HCRC# HCRC# 88-200-009, HCRC# 88-200-044, HCRC# 88-200-047, HCRC# 88-200-056. Pacific Northwest Laboratories, Richland, Washington.

Cadoret, N and J Chatters. 1989b. Cultural Resources Review of the Interim Stabilization of the 216-S-5 and 216-S-6 Cribs (HCRC#89-200-010). Pacific Northwest Laboratories, Richland, Washington.

Crist, ME and MK Wright. 1993. Cultural Resources Review of the 12-Wide Modular Facility, 200E Core Area Project L-199, HCRC# 93-200-023. Pacific Northwest National Laboratory, Richland, Washington.

Crist, ME and PR Nickens. 1994. Cultural Resources Review of the Topographic Survey for Area South of 200W Project, HCRC# 94-600-032. Pacific Northwest National Laboratory, Richland, Washington.

Crist, ME and PR Nickens. 1995. Cultural Resources Review of the 94-EWW-370, 2607-W6 Drainfield Replacement Project, HCRC# 95-600-020. Pacific Northwest National Laboratory, 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.

DOE-RL (Department of Energy, Richland Operations Office). 1998. Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (DOE/RL-97-56). Richland, Washington.

Hay, HS, D Sheldon, S Sexton, K Mendez and K Clark. 2014. Cultural Resources Review for Removal of 8 Meteorological Towers and Associated Infrastructure in Benton, Franklin, and Grant Counties (HCRC# 2013-600-012b). Pacific Northwest National Laboratory, Richland, Washington.

Hughes, SS, E White, D McFarland and JL Gutzeit. 2011. Supplemental Surface Sample RI/FS Study in Zone 3 and 4, 600 Area, Hanford Site, Benton County, Washington (HCRC# 2011-600-015)--NHP Review. Pacific Northwest National Laboratory, Richland, Washington.

Last, GV. 1993. S.R. 240 Access Road to 200 West Area – A Cultural Resources Survey Report (HCRC# 93-600-014). Pacific Northwest National Laboratory, Richland, Washington.

McFarland, DP, C Dage, EP Kennedy, J Tomlinson, JL Downs, GV Last and BN Bjornstad. 2009. Emergency Cultural Resources Review and Inventory for the 2007 Wautoma Fire Reseeding Effort, 600 Area, Hanford Site, Washington State (HCRC# 2007-600-034. Pacific Northwest National Laboratory, Richland, Washington.

Minthorn, PE & JC Chatters. 1990. Cultural Resources Review of the Effluent Retention and Treatment Complex (ERTC), HCRC# 89-200-023. Pacific Northwest National Laboratory, Richland, Washington.**

[35] Many references accessible only to qualified individuals at the Washington State Department of Archaeology and Historic Preservation.

Nickens, PR. 1996. Survey Narrative for the L-116, 200 Area Sanitary Sewer System (HCRC# 93-200-0136). Pacific Northwest National Laboratory, Richland, Washington.

Parker, P. and T. King. 1998. National Register Bulletin: Guidelines for Evaluating and Documenting Traditional Cultural Properties. U.S. Department of the Interior, National Park Service. Washington, D. C.

Stapp, DC and JK Woodruff. 1994. Cultural Resources Review of the 200-UP-1 Characterization Drilling, HCRC# 95-200-013. CH2MHill, Richland, Washington.

USGS (United States Geological Survey). 1916. Coyote Rapids Quadrangle, 1:62,500 Topographic Map. Reston, VA.

U.S. War Department. 1943. Real Estate Engineer Works 1943 (maps). Washington D.C.

Wright, MK. 1993. Cultural Resources Review of the Hanford Well and Borehole Survey (HCRC# 93-600-016). Pacific Northwest National Laboratory, Richland, Washington.

CP-LS-11 B Pond Cultural Resources[36]

Chatters, JC. 1987. Report of Cultural Resources Survey of the Proposed Decontamination Laundry Facility HCRC #87-200-046, Pacific Northwest National Laboratory, Richland, Washington.

Cadoret, NA. 1988. Letter to F.G. Dement Regarding Cultural Resources Review of the 216-U-11 Topsoil Borrow Pit Extension, Revision 1, HCRC#88-200-009, Pacific Northwest National Laboratory, Richland, Washington.

Cadoret, NA. 1996. notes September 1996, Survey of the "TWRS Privatization Phase I Site" Development Project, HCRC#96-200-109, Cultural and Historic Resources Program Library and Archives, Operated by Mission Support Alliance, Richland, Washington.

Cadoret, NA and JC Chatters. 1989. Letter Report Regarding Cultural Resources Reviews for Four Project in the Vicinity of the 200 Areas of the Hanford Site, Washington: HCRC#88-200-009, HCRC#88-200-044, HCRC#88-200-047, HCRC#88-200-056, Pacific Northwest National Laboratory, Richland, Washington.

Chatters JC and NA Cadoret. 1990. Archaeological Survey of the 200 East and 200 West Areas, Hanford Site. Pacific Northwest Laboratory, Richland, Washington.

DOE-RL (Department of Energy, Richland Operations Office). 1998. Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (DOE/RL-97-56). Richland, Washington.

DOE/RL-92-19, Rev. 0, 200 East Groundwater Aggregate Area Management Study Report, U.S. Department of Energy, Richlands Operations Office, Richland, Washington.

[36] Many references accessible only to qualified individuals at the Washington State Department of Archaeology and Historic Preservation.

Gard, HA and JC Chatters. 1990. Cultural Resources Review of the Effluent Retention and Treatment Facility, Disposal Surface Site Evaluation, HCRC#90-600-006, Pacific Northwest Laboratories, Richland, Washington.

Gard, HA and JC Chatters. 1992. Cultural Resources Review of the B Pond Interim Stabilization, HCRC#92-200-008, Pacific Northwest Laboratories, Richland, Washington.

Hale, LL and DC Stapp. 1998. Cultural Resources Review of the TWRS Mitigation Planning Support – Phase One Project, HCRC#98-200-022, Pacific Northwest Laboratories, Richland, Washington.

Hoover, KA. 1988. Letter to D.B. Erb Regarding Cultural Resources Review of the Proposed 216-A-8 Crib Topsoil Borrow Pit, HCRC#88-200-015, Pacific Northwest National Laboratory, Richland, Washington.

Kennedy, EP. 2008. Cultural Resources Review and Inventory for Interim Pretreatment System Facility to Support Treatment of Hanford Tank Waste and the Waste Treatment Plant, 200 East Area, Hanford Site (HCRC#2008-200-017), Pacific Northwest National Laboratory, Richland, Washington.

Kennedy, EP and DC Stapp. 2003. Cultural Resources Review of Retrieval, Treatment and Disposal of Tank Waste and Closure of Single Shell Tanks (Tank Closure) Environmental Impact Statement (EIS) (HCRC#2003-200-044), Pacific Northwest National Laboratory, Richland, Washington.

Parker, P and T King. 1998. National Register Bulletin: Guidelines for Evaluating and Documenting Traditional Cultural Properties. U.S. Department of the Interior, National Park Service. Washington, D. C.

USGS (United States Geological Survey). 1916. Coyote Rapids Quadrangle, 1:62,500 Topographic Map. Reston, VA.

USGS (United States Geological Survey). 1924. Hanford Quadrangle, 1:62,500 Topographic Map. Reston, VA.

U.S. War Department, 1943, Real Estate Engineer Works 1943 (maps). Washington D.C.