APPENDIX G.3

K AREA WASTE SITES (RC-LS-2, RIVER CORRIDOR)
EVALUATION UNIT SUMMARY TEMPLATE

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

This page intentionally left blank.

PART I. EXECUTIVE SUMMARY

EU LOCATION

100 K-Reactor Area

RELATED EUS

RC-DD-2; operable unit cross walk is 100-KR-1 and 100-KR-2

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES

The K Area Waste Sites consists of a variety of sites within the fence at the 100-K area associated with the original plant facilities constructed to support K Reactor operation. Included within the EU are 4 burial grounds, (includes pits, dumping areas, burial grounds), 33 cribs (subsurface liquid disposal, includes French drains, cribs, sumps), 2 infrastructure buildings, 10 pipelines and associated valves, 1 pond/ditch, 6 process buildings, 10 septic systems, 19 storage pads, 11 underground storage tanks, and 9 unplanned release sites.

BRIEF NARRATIVE DESCRIPTION

This EU contains a variety of sites within the fence at the 100-K area associated with the original plant facilities constructed to support K Reactor operation. RC-LS-2 includes diverse sites, many with no contamination, but that need to be removed as part of remediation efforts. The waste site remediation needs to be coordinated with Sludge treatment project and reactor cocooning. The known/likely presence of tribal cultural resources complicates remediation efforts.

Many of the waste sites identified with this evaluation unit will be remediated through the process of 'confirmatory sampling, no action' also known as CNSA. Others will be remediated through the process of remove-treat-dispose (RTD). For these sites, excavation, coupled with removal of underground structures such as piping will take place, samples will confirm that cleanup criteria are met, and the site will be backfilled with clean and compacted soil. The contaminated soil will be disposed of at ERDF or elsewhere if it contains hazardous materials.

SUMMARY TABLE OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table G.3-1 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 K Area Waste sites; a Co-located Person (CP) is an individual located 100 meters from the boundary; and the Public is an individual located at the closest point on the Hanford Site boundary not subject to DOE access control, which in this instance is the south bank of the Columbia River approximately 150 m (500 ft) north of the facility. The nuclear related risks to humans are based on unmitigated (unprotected or controlled conditions) dose exposures expressed in a range of from Not Discernible (ND) to High. The estimated mitigated exposure that takes engineered and administrative controls and protections into consideration is shown in parentheses.

Groundwater and Columbia River

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

Ecological Resources

The risk ratings are based on the degree of physical disruption (and potential additional exposure to contaminants) in the current status and as a potential result of remediation options.

Cultural Resources

A rating for cultural resources is not being made because cultural resources will be evaluated under Section 106 of the National Historic Preservation Act (16 USC 470, et. seq.) during the planning for remedial action. The resulting Section 106 process will engage all stakeholders, including Native American Tribes, concerning the Native American, Historic Pre-Hanford, and Manhattan Project/Cold War landscapes. This process will identify all cultural resources and evaluate their eligibility for the National Register of Historic Places, any direct and indirect effects from remediation, as well as the need for any mitigation actions. CRESP has consulted with the Native American Tribes having historical ties to Hanford and they consider the entire Hanford Site to be culturally and historically important.

Table G.3-1. Risk Rating Summary (for Human Health, unmitigated nuclear safety basis indicated, mitigated basis indicated in parentheses (e.g., "Very High" (Low)).

Population or Resource		Evaluation Time Periods: Active Cleanup (to 2064)	
		Current Condition/ Operations: D4	**From Cleanup Actions:** Same activities as Current
Human Health	Facility Worker	Low (Low)	Low (Low)
	Co-located Person	Low (Not Discernible (ND) to Low)	Low (ND to Low)
	Public	Low (ND to Low)	Low (ND to Low)
Environmental	Groundwater (A&B) from vadose zone[a]	*High* (C-14) *Low* (Sr-90) *Not rated* (Cr-VI, TCE)[c]	*High* (C-14) *Low* (Sr-90) *Not rated* (Cr-VI, TCE)[c]
	Columbia River from vadose zone[a]	ND[c]	ND[c]
	Ecological Resources[b]	ND to Low	ND to Medium
Social	Cultural Resources[b]	**Native American**: Direct: Known Indirect: Known **Historic Pre-Hanford**: Direct: Known Indirect: Known **Manhattan/Cold War**: Direct: Known Indirect: Known	**Native American**: Direct: Known Indirect: Known **Historic Pre-Hanford**: Direct: Known Indirect: Known **Manhattan/Cold War**: Direct: Known Indirect: Known

a. Threat to groundwater or the Columbia River from Group A and B primary contaminants (PCs) (Table 6-1, CRESP 2015) remaining in the vadose zone. There is a current tritium plume (Group C) linked to this EU with an area that would translate to a Medium rating; however, the plume has been generally decreasing over time and the threat to groundwater is dominated by C-14. Threats from plumes associated with the K Area Waste Sites EU are described in **Part V** with additional information provided in Appendix D.4.

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

c. There are potential K Area Waste Sites EU sources for the hexavalent chromium (Cr-VI) and trichloroethene (TCE) (DOE/RL-2016-09, Rev. 0) but reported inventories are unavailable making it impossible to rate these PCs, which represent data gaps in the evaluation. The 100-K plumes associated with these PCs (including the hexavalent chromium plume currently in contact with the Columbia River) are evaluated in Appendix D.4.

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH TIME PERIOD

Human Health

Current and from Selected or Potential Cleanup Approaches

As the 100-K Area deactivation, decommissioning, decontamination, and demolition organization completes work, sites will be remediated either by the process of 'confirmatory sampling, no action' also known as CNSA or by the process of remove-treat-dispose (RTD). For these sites, excavation, coupled

with removal of underground structures such as piping will take place, samples will confirm that cleanup criteria are met, and the site will be backfilled with clean and compacted soil. The contaminated soil will be disposed of at ERDF or elsewhere if it contains hazardous materials. About half of the identified sites will undergo remediation. Trenching and potholing will be performed as required to support sampling at depths up to 20 ft below the ground surface. Following confirmation of sampling results, excavations will be backfilled to grade with clean soil and compacted if needed.

Many of the sites, such as underground pipelines, were never used with radioactive materials and so remediation is not likely to expose radioactive contamination. Other sites are considered to have minimal contamination. A Hazard and accident analysis for these sites found only low unmitigated risk:

> From SGW-40938, Rev 0, page 3-4*: "The hazard analysis identified 18 potential scenarios... The postulated unmitigated hazardous conditions result in "low" consequences to the onsite and offsite receptors and no significant impact to the facility worker. Several scenarios were identified as presenting a standard industrial hazard to the facility worker, which is consistent with the nature of the activities. All scenarios are in Risk Bin III, which require Safety Management Programs"*

Three scenarios were identified as requiring further evaluation. These included: 1) a dropped ERDF canister with spill; 2) collapse of the KE basin excavation pit with subsequent resuspension of contaminated soils; and 3) a spill from an ERDF container as a result of two trucks colliding. These scenarios were considered bounding of other accidents. In all cases the low radiological consequences and unlikely probability put these as a risk class III, which is defined as "... generally provided with adequate mitigation and prevention by the existing safety management programs."

Groundwater

There are current plumes for primary contaminants (PCs) including C-14, Sr-90, nitrate (NO_3), tritium (H-3) are linked to the K Area Waste Sites EU, and the hexavalent chromium (Cr-VI) and trichloroethene (TCE) plumes may also have sources in this EU (DOE/RL-2016-09, Rev. 0). The C-14 remaining in the vadose zone translates to a *High* rating. The current tritium (Group C) plume that has been linked to the K Area Waste Sites EU has an area that translates to a *Medium* rating; however, the plume has generally been decreasing over time (likely from dispersion and decay) and the risk to groundwater is riven by C-14. As described in **Part V**, vadose zone ratings cannot be made for hexavalent chromium (Cr-VI) or trichloroethene (TCE) that may be linked to K Area Waste Sites sources; these plumes are evaluated in Appendix D.4. However, treatment, decay, and dispersion of contaminants has caused plume areas to generally decrease over the past decade (DOE/RL-2016-09, Rev. 0), which is expected to continue into the future. A final Record of Decision was expected in 2016. Because final remedial decision (that might involve vadose zone activities) have not been made, the vadose zone ratings do not change for the remainder of the Active Cleanup period.

Columbia River

The only primary contaminant that may be linked to K Area Waste Sites sources that currently impacts the Columbia River is hexavalent chromium (DOE/RL-2016-09, Rev. 0). As described in **Part V**, there are no documented releases of hexavalent chromium related to the K Area Waste Sites EU; however, there is evidence of residual chromium in the soil beneath the tank and piping system from many years of unloading and handling of the sodium dichromate (WHC-SD-EN-TI-239, Rev. 0). The threat posed by

hexavalent chromium cannot be evaluated for the K Area Waste Sites EU (representing a data gap[1]) although the risk to the Columbia River from hexavalent chromium in 100-K is evaluated in Appendix D.4. Furthermore, there are three Pump and Treat (P&T) systems actively treating hexavalent chromium in the 100-K groundwater. Given the transport (generally decreasing plumes) and decay properties of C-14, Sr-90, nitrate (NO_3), tritium (H-3), no plumes are expected to reach the Columbia River in the next 150 years for these PCs. This leads to a *Not Discernible* (*ND*) rating during the Active Cleanup period.

Ecological Resources

Current

Most of the EU is non-vegetated, but risk is Low (rather than ND) because part of the EU falls in area of Eagle roosting, which is a species of concern, and 8% is level 4 resources.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

ND to Low in EU because of eagle roosting, but Low to Medium in buffer because of high percent of level 3 and 4 resources (78 % is level 3 and 4 resources), and it is close to the riparian habitat (all of which is level 5 habitat). Removal of dirt will result in disturbance and disruption.

Cultural Resources

Current

Manhattan Project/Cold War significant resources have already been mitigated. Area within the EU is heavily disturbed, but the entire area is extremely culturally sensitive based on prehistoric, ethno-historic, and historic land use in the area. Traditional cultural places are known to be located in the vicinity as well as National Register eligible archaeological sites associated with all 3 landscapes.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Due to high cultural sensitivity of area, consultation may need to occur. Archaeological investigations or monitoring may also need to occur. Direct and indirect effects are likely to archaeological sites and traditional cultural places.

Considerations for timing of the cleanup actions

There is no risk to the Facility Worker, CP or Public if cleanup of the soils or building is delayed. There is no known physical deterioration of these facilities. There are potential benefits to delaying cleanup due to radioactive decay (ca. 90 years) or allowing natural attenuation to achieve long-term environmental safety.

Near-Term, Post-Cleanup Risks and Potential Impacts

The cleanup actions will remove contaminated soils and overlying structures and stabilize soils. Re-vegetation in EU will result in additional level 3 resources, and potentially creation of level 4 resources potentially at risk because of disturbance, especially from invasive species. Similar effects are possible in the buffer zone. Permanent direct and indirect effects to cultural resources are possible due to high sensitivity of area.

[1] The link between the trichloroethene (TCE) plume and the K Area Waste Sites EU sites has also not been definitively established representing an additional data gap.

PART II. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S)

100-KR-1 and 100-KR-2

COMMON NAME(S) FOR EU

K Area Waste Sites

KEY WORDS

D4, soils

REGULATORY STATUS

Regulatory basis

The OUs are currently in various stages of the CERCLA process (DOE/RL-96-17 page 1-1). 100-KR-1 and 100-KR-2 are source OUs.

Applicable regulatory documentation

- Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington (hereinafter referred to as the Interim Action Record of Decision [ROD]) (EPA 1995)
- Amendment to the Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units (hereinafter referred to as the ROD Amendment) (EPA 1997a)
- *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR -2 , 100-HR-1, 100-HR-2 , 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (hereinafter referred to as the Remaining Sites ROD) (EPA 1999)
- *Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, and 100-KR-2 Operable Units, Hanford Site (100 Area Burial Grounds), Benton County Washington* (hereinafter referred to as the 100 Area Burial Grounds ROD) (EPA 2000b).

Applicable Consent Decree or TPA milestones

M-016-00C: Complete all response actions for the 100 Area by 12/30/2020

RISK REVIEW EVALUATION INFORMATION

Completed

Revised January 30, 2015; groundwater updated March 15, 2017

Evaluated by

K.A. Higley and Kevin Brown

Reviewed by

H. Mayer and Kevin Brown

PART III. SUMMARY DESCRIPTION

CURRENT LAND USE

DOE Hanford industrial site area

DESIGNATED FUTURE LAND USE

"To the extent practicable, return soil concentrations to levels that allow for unlimited future use and exposure. Where it is not practicable to remediate to levels that will allow for unrestricted use in all areas, institutional controls and long-term monitoring will be required" (EPA 1995, page 26). [2]

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

This EU contains a variety of sites within the fence at the 100-K area. In general, the area contains waste units associated with the original plant facilities constructed to support K Reactor operation. Included within the EU are 4 burial grounds, (includes pits, dumping areas, burial grounds), 33 cribs (subsurface liquid disposal, includes French drains, cribs, sumps), 2 infrastructure buildings, 10 pipelines and associated valves, 1 pond/ditch, 6 process buildings, 10 septic systems, 19 storage pads, 11 underground storage tanks, and 9 unplanned release sites. RC-LS-2 includes diverse sites, many with no contamination, but that need to be removed as part of remediation efforts. The waste site remediation needs to be coordinated with Sludge treatment project and reactor cocooning. The known/likely presence of tribal cultural resources complicates remediation efforts.

Many of the waste sites identified with this evaluation unit will be remediated through the process of 'confirmatory sampling, no action' also known as CNSA. Others will be remediated through the process of remove-treat-dispose (RTD). For these sites, excavation, coupled with removal of underground structures such as piping will take place, samples will confirm that cleanup criteria are met, and the site will be backfilled with clean and compacted soil. The contaminated soil will be disposed of at ERDF or elsewhere if it contains hazardous materials.

"To the extent practicable, return soil concentrations to levels that allow for unlimited future use and exposure. Where it is not practicable to remediate to levels that will allow for unrestricted use in all areas, institutional controls and long-term monitoring will be required" (EPA 1995, page 26). [3]

High-Level Waste Tanks and Ancillary Equipment

Not Applicable

Groundwater Plumes

There are current plumes for primary contaminants (PCs) including C-14, Sr-90, nitrate (NO_3), tritium (H-3) are linked to the K Area Waste Sites EU, and the hexavalent chromium (Cr-VI) and trichloroethene

---

[2] EPA, 1995, *Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington,* September 1995, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

[3] EPA, 1995, *Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington,* September 1995, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

(TCE) plumes may also have sources in this EU (DOE/RL-2016-09, Rev. 0) that represent data gaps in the evaluation. See **Part I** for more information.

Operating Facilities

Not Applicable

D&D of Inactive Facilities

Not Applicable

LOCATION AND LAYOUT MAPS

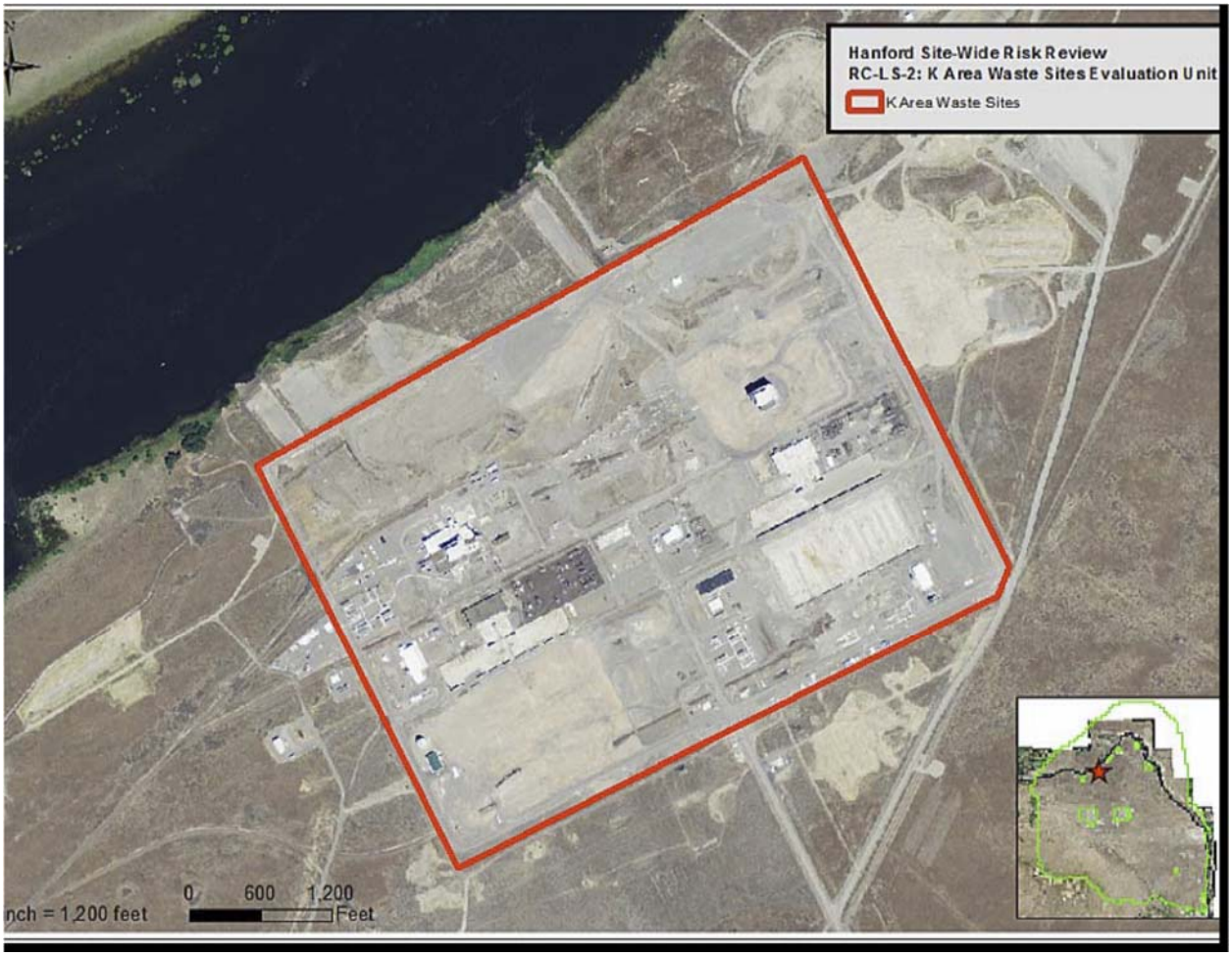

Figure G.3-1. EU Boundary Map.

Figure G.3-2. K-Area Waste Sites.

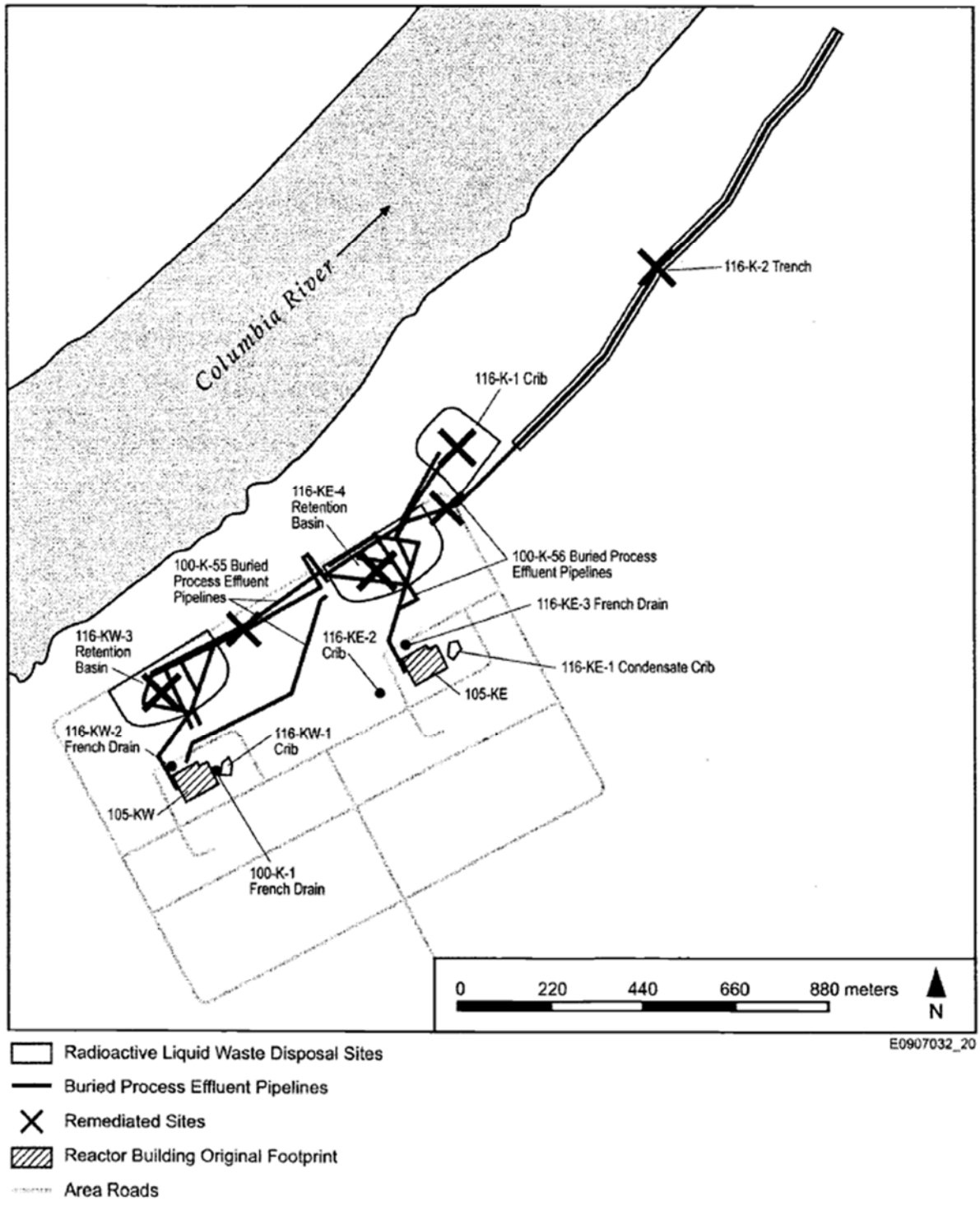

Figure G.3-3. 100-K Area Radioactive Liquid Effluent Waste Sites (DOE/RL-96-17 page 1-9).

.

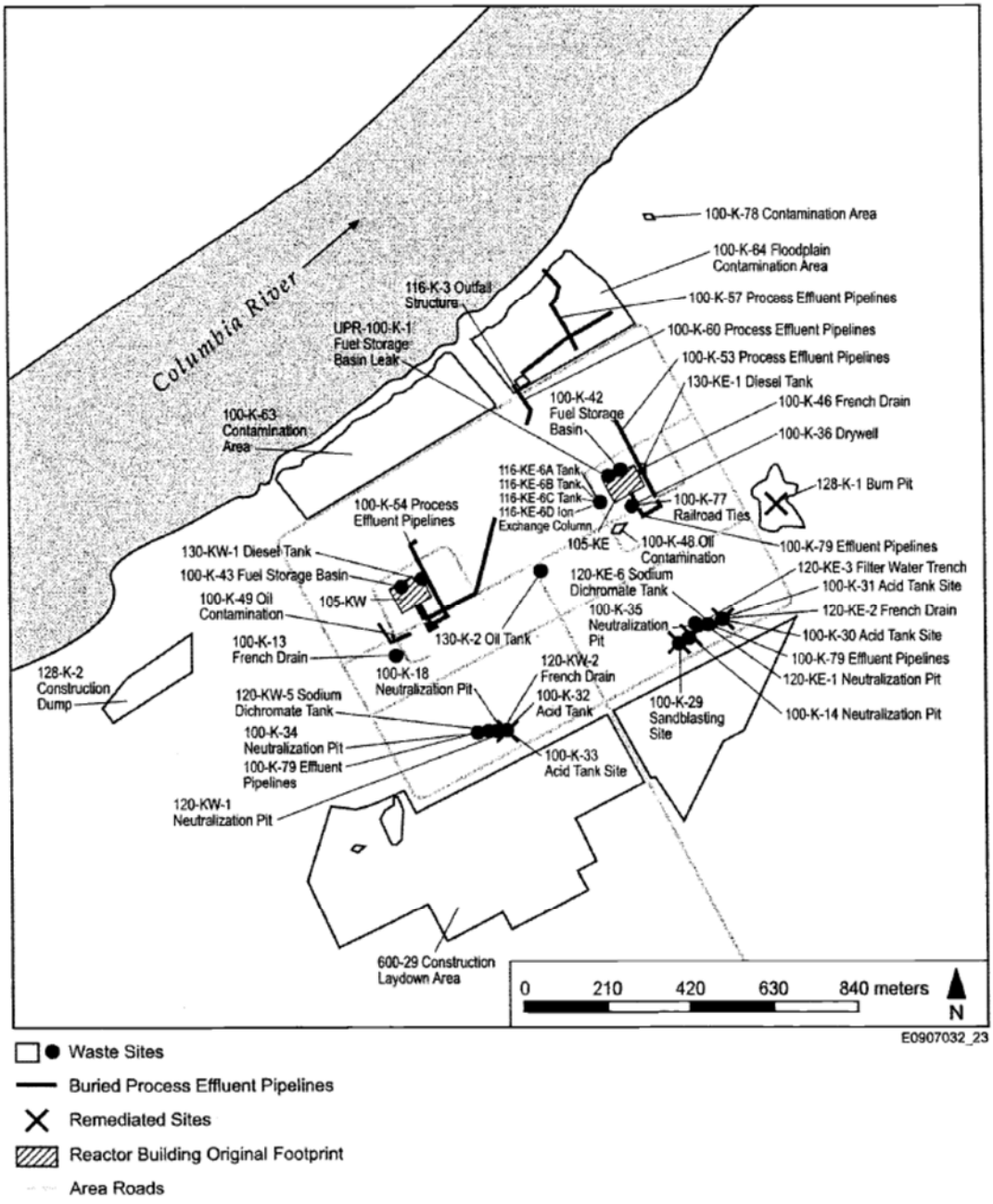

Figure G.3-4. 100-K Area Remaining Sites (DOE/RL-96-17 page 1-14).

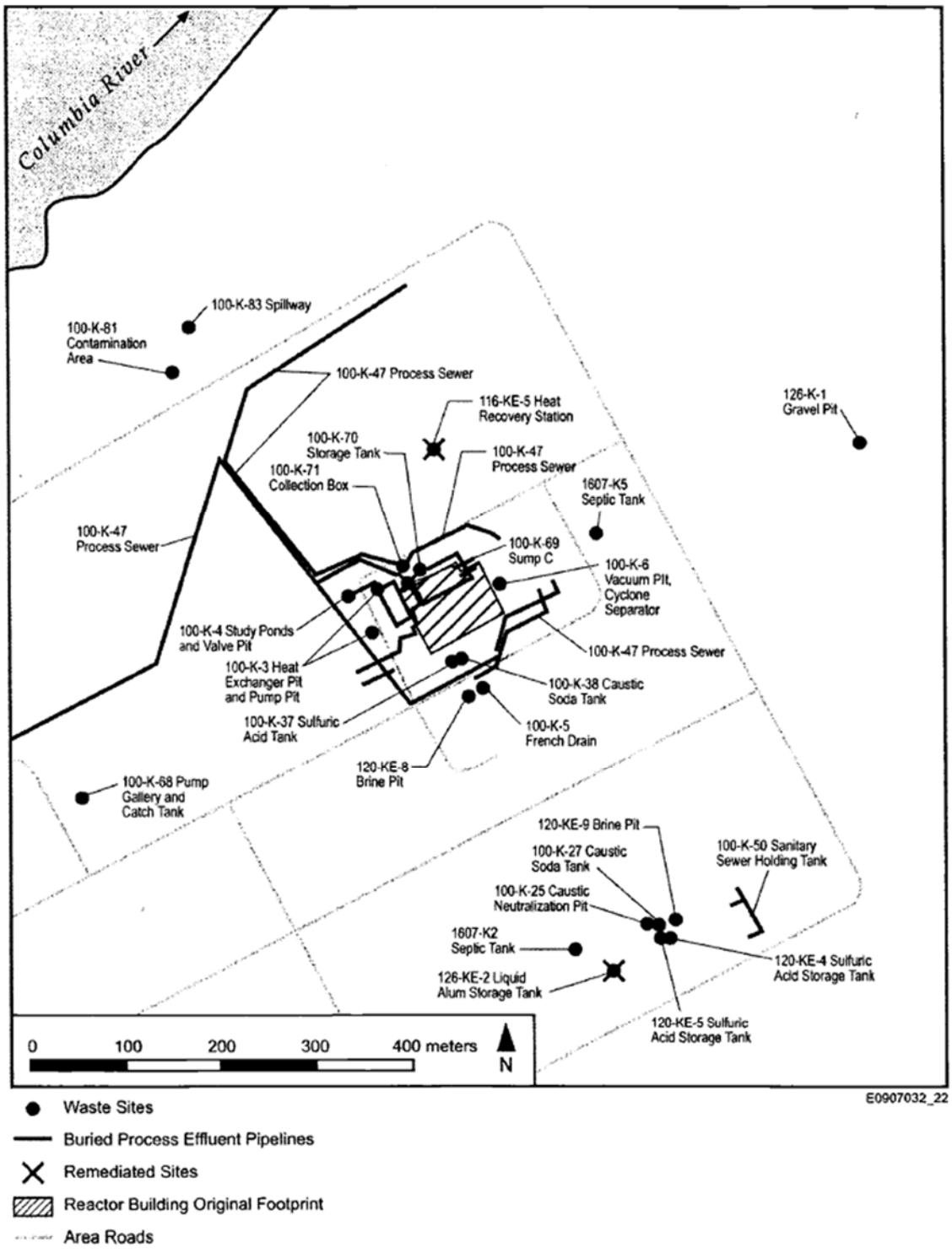

Figure G.3-5. Waste Sites in the 100-K East Area Added to the Remaining Sites ROD (DOE/RL-96-17 page 1-20).

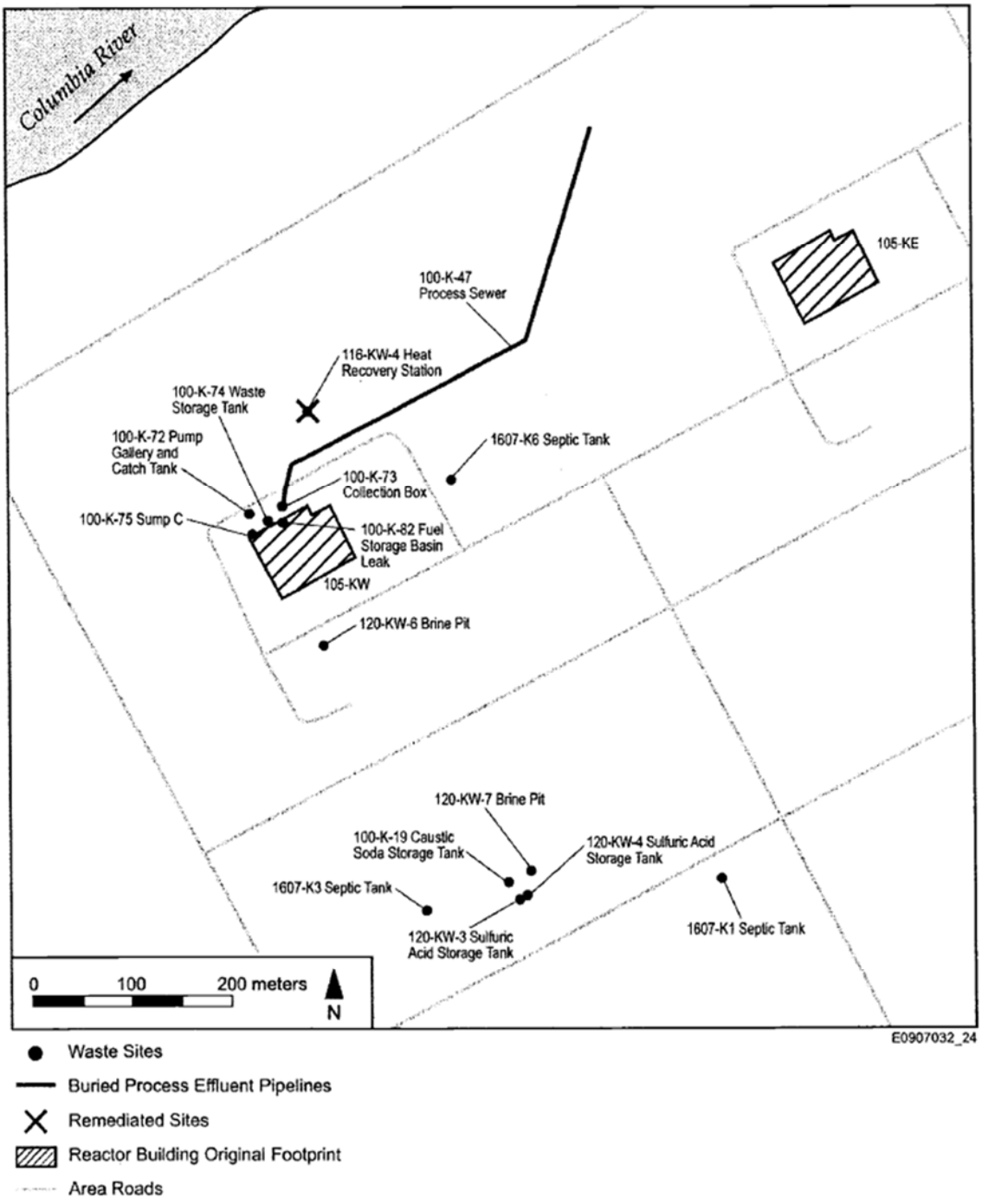

Figure G.3-6. Waste Sites in the 100-K West Area Added to the Remaining Sites ROD (DOE/RL-96-17 page 1-21).

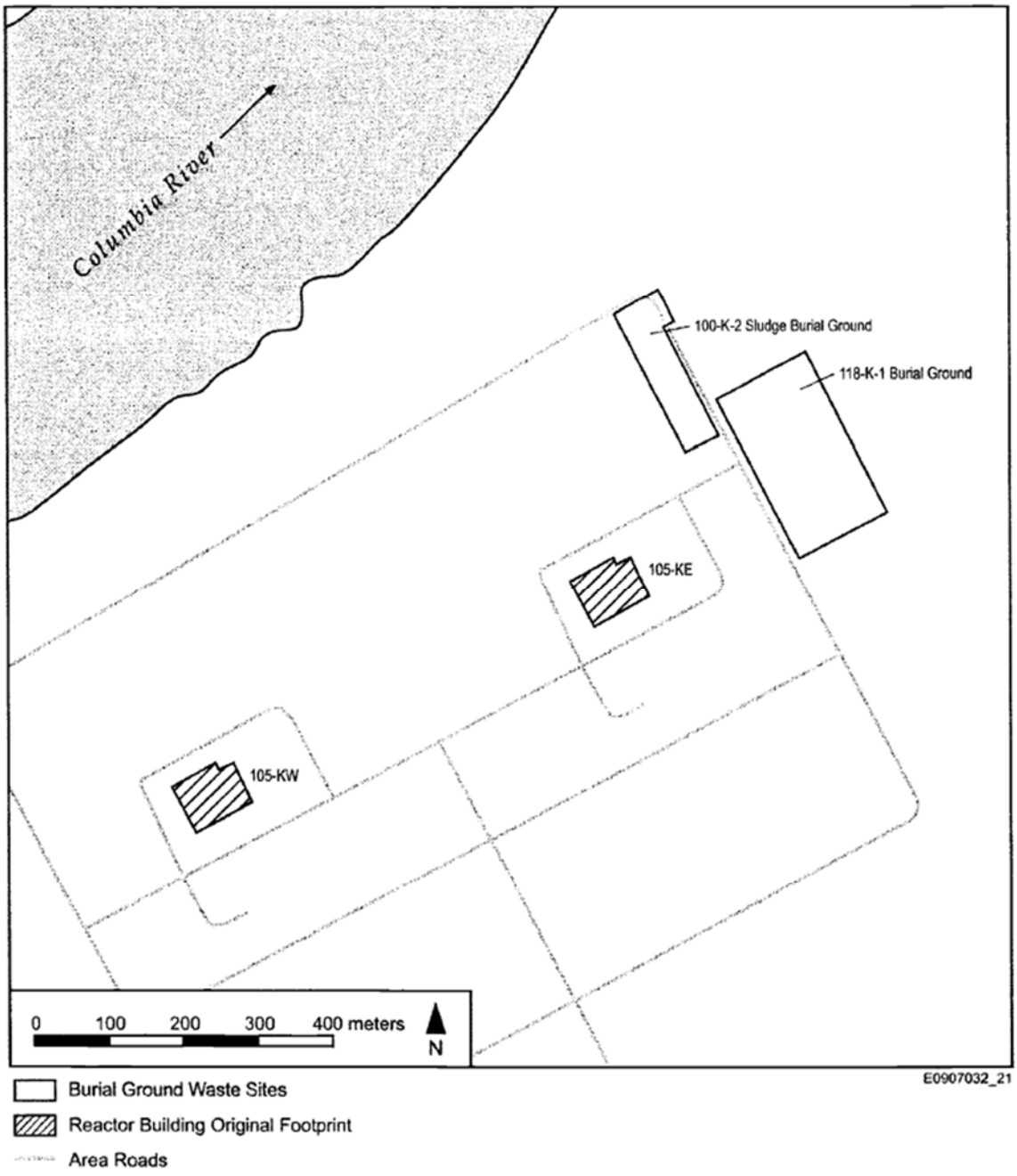

Figure G.3-7. Burial Grounds at the 100-K Area (DOE/RL-96-17 Page 1-25).

PART IV. UNIT DESCRIPTION AND HISTORY

EU FORMER/CURRENT USE(S)

This EU contains a variety of sites within the fence at the 100-K area. In general, the area contains waste units associated with the original plant facilities constructed to support K Reactor operation. Included within the EU are 4 burial grounds, (includes pits, dumping areas, burial grounds), 33 cribs (subsurface liquid disposal, includes French drains, cribs, sumps), 2 infrastructure buildings, 10 pipelines and associated valves, 1 pond/ditch, 6 process buildings, 10 septic systems, 19 storage pads, 11 underground storage tanks, and 9 unplanned release sites. RC-LS-2 includes diverse sites, many with no contamination, but that need to be removed as part of remediation efforts. The waste site remediation needs to be coordinated with Sludge treatment project and reactor cocooning. The known/likely presence of tribal cultural resources complicates remediation efforts.

Legacy Source Sites

The RC-LS-2 EU contains a variety of sites within the fence at the 100-K area. Included within the EU are 4 burial grounds, (including pits, dumping areas, and burial grounds), 33 subsurface liquid disposal sites (including French drains, cribs, and sumps), 2 infrastructure buildings, 10 pipelines and associated valves, 1 pond/ditch, 6 process buildings, 10 septic systems, 19 storage pads, 11 underground storage tanks, and 9 unplanned release sites (UPRs).

From SGW-54741 Rev 0 page 4: The 116-KE-3 waste site is an engineered structure that received contaminated cooling water from the 105-KE fuel storage basin (FSB) during KE Reactor operation from 1955 through 1971. The waste site was originally constructed to dispose of water from the FSB that accumulated in the sub-basin drainage area. It was later modified to serve as an overflow for drainage from the 105-KE FSB. This site is located approximately 75 ft north of the KE Reactor building. The waste site was composed of a drain field with a reverse well in the center of the drain field that extended to below the water table. Contaminated cooling water was discharged directly to the unconfined aquifer via the reverse well.

The UPR-100-K-1 waste site is the result of an unplanned release of cooling water leaking from a failed construction joint between the 105-KE Reactor and the 105-KE FSB at the discharge chute. The leak contaminated the vadose zone beneath a portion of the 105-KE FSB and the foundation of the KE Reactor. The leak was first discovered in the early 1970s and continued until at least May 1980. The leak rate was observed to vary over the years and the actual volume of contaminated water released to the vadose zone has not been quantified.

The reported inventory information for the K Area Waste Sites EU sites is provided in Table G.3-3 through Table G.3-5.

From Morgans et al., 2012: “The operational area within the perimeter fence has been disturbed and graded extensively by human activity since reactor construction began in the 1950s through present-day waste site remedial activities.”

From Morgans et al., 2012: “Contaminated wastes released from reactor support facilities, cooling water processing facilities, underground piping, liquid waste disposal sites, solid waste disposal sites, and surface spills were primary sources of contamination in 100-K during operations and secondary sources may have developed in vadose zone and aquifer materials. The potential for transport of contaminants within the vadose zone and aquifer at 100-K is affected by historical high volume liquid waste disposal during operations on vadose zone moisture and the water table, the development of

secondary sources of contamination in the vadose zone material, groundwater/surface water interactions, and the effect of Columbia River stage fluctuations on contaminant transport."

Is information available indicating the partition coefficients and other important transport parameters for the primary contaminants with the type of soil (if yes, provide table)?

Partition coefficients (K_d's) can be found within the Hanford Contaminant Distribution Coefficient Database and Users Guide (PNNL-13895). In addition, PNNL-14072, Rev. 1 lists K_d estimates for key radionuclides. The CRESP team reviewed the available partition coefficient information and provided a set for use in the Review (CRESP 2015); these values are used to estimate groundwater threats as described below in Table G.3-6.

Compared to other sites, the inventory vadose zone remaining is relatively modest. There is substantial experience with remediating other sites along the river, and consequently the assessment of potential risk is likely to be fairly accurate. The biggest challenge is likely to be modeling the subsurface transport of contaminants through an area that has been heavily remodeled and is also strongly influenced by the influence of the Columbia River on the ground water in the vicinity.

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification

Approximately 89% of the area within EU is classified as level 0 or level 1 biological resources. A small hillslope north of the reactors is classified as level 2 resources. The level 4 resources within the EU reflect a restricted use buffer area for the bald eagle (*Haliaeetus leucocephalus*) roosting site to the northwest of the 100-K Area along the river and do not consist of any habitat resources.

The amount and proximity of biological resources to the 100-K Waste Sites EU was examined within the adjacent landscape buffer area radiating 1,396 m from the geometric center of the EU (equivalent to 1,286 acres). Note that within the landscape buffer area, obvious areas where vegetation was cleared or removed were reclassified as level 0 resources. Numerous areas within the adjacent landscape buffer had been revegetated with varying degrees of success; these areas were not reclassified, but retain the original biological resource level assigned in DOE/RL-96-32 2013. The adjacent landscape buffer area extends across the Columbia River shoreline and into the riverine habitat. Level 4 resource patches along the river shoreline and in the river reflect the riparian habitat along the shoreline and a small patch of level 5 habitat in the river reflects a known spawning location for Fall Chinook salmon (*Oncorhynchus tshawytscha).*

Field Survey

Field evaluation of the 100-K Area Waste Sites EU revealed that most of the EU consists of built infrastructure, roads, parking lots, buildings, with small fragments of habitat to the north of the two reactors. Much of the surrounding area has been re-vegetated after cleanup of waste areas and trenches outside the 100-K fence lines. Installation of numerous pump and treat wells, well pads, buildings and transfer pipes has occurred both within and outside the EU.

No observations of wildlife were made during the October survey of the EU. However, a PNNL ECAP review of the 100-K Area and buildings done in 2010 noted numerous birds in association with the buildings and structures that existed within the EU at that point in time. Since then, clean up and decommissioning activities may have removed much of the infrastructure that previously was used as nesting and perching habitat.

CULTURAL RESOURCES SETTING

Cultural resources documented within the K Area Waste Sites EU include 2 historic era linear resources (1 representing the Pre-Hanford Early Settlers/Farming Landscape and 1 representing the Manhattan Project and Cold War era), 23 contributing resources to the NRHP Eligible Manhattan Project and Cold War era historic district (9 with individual documentation required, 12 with no individual documentation required), and no precontact archaeological resources. No TCPs are known within the EU. In accordance with the 1998 *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (*DOE/RL-97-56), all documentation requirements have been completed for properties contributing to the Manhattan Project and Cold War era historic district.

Portions of the EU have been inventoried for cultural resources by several surveys in the past. Remediation of waste sites within the K Area Waste Sites Evaluation Unit has been addressed by two NHPA Section 106 reviews. There are 14 archaeological sites within 500 meters of the EU; 7 archaeological sites (3 eligible and 4 unevaluated) and 2 isolates (2 not eligible) represent the Native American Precontact and Ethnographic landscape, 3 archaeological sites (1 not eligible and 2 unevaluated) and 2 isolates (2 not eligible) represent the Manhattan Project/Cold War landscape.

The geomorphologic composition of the EU and historic map data suggest some subsurface potential for cultural resources presence within the north 1/3 of the EU. However, the large earthworks disturbances shown in modern aerial imagery within the entire EU indicate that discovery of surface or near-surface cultural resources are not likely within the EU. Consultation with Hanford Tribes (Confederated Bands of the Yakama Nation, Wanapum, Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce) and other groups who may have an interest in the areas (e.g. East Benton Historical Society, Prosser Cemetery Association, Franklin County Historical Society, the Reach, and the B-Reactor Museum Association) may need to occur. Consultation with Hanford Tribes may also be necessary to provide input on indirect effects to both recorded and potential unrecorded TCPs in the area and other cultural resource issues of concern.

PART V. WASTE AND CONTAMINATION INVENTORY

There are several discrete sites within the RC-LS-2 EU (Table G.3-2). Many contain residual contamination in soils stemming from liquid waste disposal within the 100-K areas. Other sites are not contaminated, but will need to be removed as part of the demolition and remediation process. The reported inventory is provided in Table G.3-3 through Table G.3-5. Most of the contamination resides in the soil sorbed onto sediments and soils.

Table G.3-2. List of Waste Sites Considered.

Site Code	Name	Site Status	Site Type	Site Type Category	Operable Unit
100-K-1	100-K-1; 100-K-45; 119-KW Exhaust Air Sample Building French Drain; 119-KW French Drain	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-100	100-K-100; 116-KW-3 Remaining Contaminated Soil and Items; Radioactive Material Area Remaining After 107-KW Basin Removal	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	100-KR-1
100-K-101	100-K-101; French Drains and Mercury Stained Soils near the 183KE Sedimentation Basin	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-102	100-K-102; French Drains and Mercury Stained Soils near the 183KW Sedimentation Basin	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-103	100-K-103; 1704-K and 1717-K Septic Systems; Additional Components of 1607-K4	Unknown	Settling Tank	Septic System	100-KR-2
100-K-104	100-K-104; 166-KE French Drain	Unknown	French Drain	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-105	100-K-105; Pit at Southeast Corner of 100K	Inactive	Depression/Pit (nonspecific)	Burial Ground	100-KR-2
100-K-106	100-K-106; 182-K Fuel Oil Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-107	100-K-107; 1706-KER Abandoned Drain Field	Inactive	Drain/Tile Field	Septic System	100-KR-2
100-K-108	100-K-108; 1706-KER Septic System; 1706-KER Septic Tank; Crib and Sewer Line	Unknown	Septic Tank	Septic System	100-KR-2
100-K-109	100-K-109; Unplanned Chemical Release near 183.1KW Head House; Yellow Stained Soil adjacent to 183.1KW Head House	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	100-KR-2
100-K-110	100-K-110; Soil beneath 183.2-KW Flocculation and Sedimentation Basins; the 183.3- KW Sand Filter Basins	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	TBD
100-K-112	100-K-112; Surface Contamination from Waste Storage Operations	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	TBD
100-K-13	100-K-13; French Drain West of the 166-KW Oil Storage Tank Facility	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-14	100-K-14; 183-KE Acid Neutralization Pit and Overflow French Drain	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-18	100-K-18; 183-KW Caustic Neutralization Pit	Inactive	Sump	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-19	100-K-19; 183-KW Caustic Soda Storage Tank Site	Inactive	Foundation	Storage Pad	100-KR-2
100-K-2	100-K-2; 118-K-2; 118-K-2 Sludge Burial Ground; Burial Area	Inactive	Burial Ground	Burial Ground	Not Applic
100-K-25	100-K-25; 183-KE Caustic Neutralization Pit	Inactive	Sump	Crib - Subsurface Liquid Disposal Site	100-KR-2

Site Code	Name	Site Status	Site Type	Site Type Category	Operable Unit
100-K-27	100-K-27; 183-KE Caustic Soda Storage Tank Site	Inactive	Foundation	Storage Pad	100-KR-2
100-K-29	100-K-29; 183-KE Sandblasting Site	Inactive	Dumping Area	Burial Ground	100-KR-2
100-K-3	100-K-3; 1706-KE Fish Pond Heat Exchanger Pit and Pump Pit; Water Studies Semi- Works	Inactive	Valve Pit	Pipeline and associated valves, etc.	100-KR-2
100-K-30	100-K-30; 183-KE Sulfuric Acid Tank Bases (West Tank)	Inactive	Storage Tank	Storage Pad	100-KR-2
100-K-31	100-K-31; 183-KE Sulfuric Acid Tank Bases (East Tank)	Inactive	Storage Tank	Storage Pad	100-KR-2
100-K-32	100-K-32; 183-KW Sulfuric Acid Tank Bases (East Tank)	Inactive	Storage Tank	Storage Pad	100-KR-2
100-K-33	100-K-33; 183-KW Sulfuric Acid Tank Bases (West Tank)	Inactive	Storage Tank	Storage Pad	100-KR-2
100-K-34	100-K-34; 183-KW Acid Neutralization Pit	Inactive	Sump	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-35	100-K-35; 183-KE Acid Neutralization Pit	Inactive	Sump	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-36	100-K-36; 1706-KE Chemical Storage Facility Dry Well	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-37	100-K-37; 1706-KE Sulfuric Acid Tank	Inactive	Storage Tank	Storage Pad	100-KR-2
100-K-38	100-K-38; 1706-KE Caustic Soda Tank	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	100-KR-2
100-K-4	100-K-4; 1706-KE Wet Fish Studies Ponds and Valve Pit	Inactive	Pond	Pond/Ditch – Surface Liquid Disposal Site	100-KR-2
100-K-46	100-K-46; 119-KE French Drain; Drywell	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-47	100-K-47; 1904-K Process Sewer	Active	Process Sewer	Pipeline and associated valves, etc.	100-KR-2
100-K-48	100-K-48; 100-KE Oil Contamination Areas	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	100-KR-2
100-K-49	100-K-49; 100-KW Oil Contamination Areas	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	100-KR-2
100-K-5	100-K-5; 1705-KE French Drain	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-50	100-K-50; 1725-K & 1726-K Sanitary Sewer System Holding Tank	Active	Storage Tank	Septic System	100-KR-2
100-K-51	100-K-51; 105-KE 90-Day Waste Accumulation Area; 100K 90-Day Waste Storage Facility	Active	Storage Pad (<90 day)	Storage Pad	Not Applic
100-K-53	100-K-53; 100-KE Glycol Heat Recovery Underground Pipelines	Inactive	Product Piping	Pipeline and associated valves, etc.	100-KR-2
100-K-54	100-K-54; 100-KW Glycol Heat Recovery Underground Pipelines	Inactive	Product Piping	Pipeline and associated valves, etc.	100-KR-2
100-K-55	100-K-55; 100-KW Reactor Cooling Water Effluent Underground Pipelines	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	100-KR-2

EU Designation: K Area Waste Sites

Site Code	Name	Site Status	Site Type	Site Type Category	Operable Unit
100-K-56	100-K-56; 100-KE Reactor Cooling Water Effluent Underground Pipelines	Inactive	Radioactive Process Sewer	Pipeline and associated valves, etc.	100-KR-2
100-K-6	100-K-6; 105-KE Vacuum Pit; Cyclone Separator; Vacuum Pit	Inactive	Process Unit/Plant	Process Building	100-KR-2
100-K-60	100-K-60; 1904-K Process Sewer (165-KW)	Inactive	Process Sewer	Pipeline and associated valves, etc.	100-KR-2
100-K-61	100-K-61; 117-KW Filter Building	Inactive	Process Unit/Plant	Process Building	100-KR-2
100-K-62	100-K-62; 117-KE Filter Building	Inactive	Process Unit/Plant	Process Building	100-KR-2
100-K-66	100-K-66; 165-KW Power Control Building	Inactive	Control Structure	Infrastructure Building	100-KR-2
100-K-67	100-K-67; 165-KE Power Control Building	Active	Control Structure	Infrastructure Building	100-KR-2
100-K-68	100-K-68; 105-KE Pump Gallery and Catch Tank; D Sump	Inactive	Catch Tank	Underground Storage Tank	100-KR-2
100-K-69	100-K-69; 105-KE Sump C	Inactive	Sump	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-70	100-K-70; 105-KE Waste Storage Tank; Holding Tank	Inactive	Storage Tank	Storage Pad	100-KR-2
100-K-71	100-K-71; 105-KE Collection Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	100-KR-2
100-K-72	100-K-72; 105-KW Pump Gallery and Catch Tank; D Sump	Active	Catch Tank	Underground Storage Tank	100-KR-2
100-K-73	100-K-73; 105-KW Collection Box	Inactive	Diversion Box	Pipeline and associated valves, etc.	100-KR-2
100-K-74	100-K-74; 105-KW Waste Storage Tank; Holding Tank	Inactive	Storage Tank	Storage Pad	100-KR-2
100-K-75	100-K-75; 105-KW Sump C	Inactive	Sump	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-77	100-K-77; Underground Railroad Ties Southeast of 1706KE	Inactive	Dumping Area	Burial Ground	100-KR-2
100-K-79	100-K-79; Sodium Dichromate and Sulfuric Acid Product Pipelines at 100-K	Inactive	Product Piping	Pipeline and associated valves, etc.	100-KR-2
100-K-97	100-K-97; 183-KW French Drain and Rail Spur Unplanned Release	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-98	100-K-98; 183-KE French Drain and Rail Spur Unplanned Release	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	100-KR-2
100-K-99	100-K-99; 116-KE-4 Contaminated Soil and Items; Radioactive Material Area Remaining After 107-KE Basin Removal	Inactive	Unplanned Release	Unplanned Release - Surface/Near Surface	100-KR-1
116-KE-1	116-KE-1; 115-KE Condensate Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	100-KR-2
116-KE-2	116-KE-2; 1706-KER Waste Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	100-KR-2
116-KE-3	116-KE-3; 105-KE Fuel Storage Basin Sub-Basin Drainage Disposal System Crib; 105- KE Storage Basin French Drain	Inactive	Injection/Reverse Well	Crib - Subsurface Liquid Disposal Site	100-KR-2
116-KE-4	116-KE-4; 107-KE; 107-KE Retention Basins	Inactive	Retention Basin	Crib - Subsurface Liquid Disposal Site	100-KR-1
116-KE-5	116-KE-5; 150-KE Heat Recovery Station	Inactive	Process Unit/Plant	Process Building	100-KR-2

Site Code	Name	Site Status	Site Type	Site Type Category	Operable Unit
116-KE-6A	116-KE-6A; 1706-KE Condensate Collection Tank; 1706-KE Waste Treatment System	Inactive	Storage Tank	Underground Storage Tank	100-KR-2
116-KE-6B	116-KE-6B; 1706-KE Evaporation Tank; 1706-KE Waste Treatment System	Inactive	Storage Tank	Underground Storage Tank	100-KR-2
116-KE-6C	116-KE-6C; 1706-KE Waste Accumulation Tank; 1706-KE Waste Treatment System	Inactive	Storage Tank	Underground Storage Tank	100-KR-2
116-KE-6D	116-KE-6D; 1706-KE Ion Exchange Column; 1706-KE Waste Treatment System	Inactive	Process Unit/Plant	Process Building	100-KR-2
116-KW-1	116-KW-1; 115-KW Condensate Crib	Inactive	Crib	Crib - Subsurface Liquid Disposal Site	100-KR-2
116-KW-2	116-KW-2; 105-KW Basin Reverse Well; 105-KW Fuel Storage Basin Sub-Basin Drainage Disposal System Crib; 105-KW Storage Basin French Drain	Inactive	Injection/Reverse Well	Crib - Subsurface Liquid Disposal Site	100-KR-2
116-KW-3	116-KW-3; 107-KW; 107-KW Retention Basin	Inactive	Retention Basin	Crib - Subsurface Liquid Disposal Site	100-KR-1
116-KW-4	116-KW-4; 150-KW Heat Recovery Station	Inactive	Process Unit/Plant	Process Building	100-KR-2
118-KE-2	118-KE-2; Rod Cave; 105-KE Horizontal Control Rod Storage Cave	Inactive	Storage	Storage Pad	100-KR-2
118-KW-2	118-KW-2; 105-KW Horizontal Control Rod Storage Cave	Inactive	Storage	Storage Pad	100-KR-2
120-KE-1	120-KE-1; 183-KE Acid Neutralization Pit; 183-KE Filter Waste Facility Dry Well; 183-KE Filter Water Facility; 100-K-26; 100-KE-1	Inactive	Sump	Crib - Subsurface Liquid Disposal Site	100-KR-2
120-KE-2	120-KE-2; 183 KE Filter Water Facility; 183-KE Filter Waste Facility French Drain; 100-KE-2	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	100-KR-2
120-KE-3	120-KE-3; 183-KE Filter Water Facility Trench; 100-KE-3	Inactive	Trench	Crib - Subsurface Liquid Disposal Site	100-KR-2
120-KE-4	120-KE-4; 183-KE1 Sulfuric Acid Storage Tank	Inactive	Storage Tank	Storage Pad	100-KR-2
120-KE-5	120-KE-5; 183-KE2 Sulfuric Acid Storage Tank	Inactive	Storage Tank	Storage Pad	100-KR-2
120-KE-6	120-KE-6; 183-KE Sodium Dichromate Tank	Inactive	Foundation	Underground Storage Tank	100-KR-2
120-KE-8	120-KE-8; 165-KE Brine Mixing Tank; 165-KE Brine Pit	Inactive	Sump	Crib - Subsurface Liquid Disposal Site	100-KR-2
120-KE-9	120-KE-9; 183-KE Brine Pit; 183-KE Salt Dissolving Pits and Brine Pump Pit	Inactive	Sump	Crib - Subsurface Liquid Disposal Site	100-KR-2
120-KW-1	120-KW-1; 183-KW Acid Neutralization Pit; 183-KW Filter Water Facility Dry Well; 100-K-17; 100-KW-1	Inactive	Sump	Crib - Subsurface Liquid Disposal Site	100-KR-2
120-KW-2	120-KW-2; 183-KW Filter Water Facility French Drain; 100-KW-2	Inactive	French Drain	Crib - Subsurface Liquid Disposal Site	100-KR-2
120-KW-3	120-KW-3; 183-KW1 Sulfuric Acid Storage Tank	Inactive	Storage Tank	Storage Pad	100-KR-2
120-KW-4	120-KW-4; 183-KW2 Sulfuric Acid Storage Tank	Inactive	Storage Tank	Storage Pad	100-KR-2

Site Code	Name	Site Status	Site Type	Site Type Category	Operable Unit
120-KW-5	120-KW-5; 183-KW Sodium Dichromate Storage Tank	Inactive	Foundation	Storage Pad	100-KR-2
120-KW-6	120-KW-6; 165-KW Brine Mixing Tank; 165-KW Brine Pit	Inactive	Sump	Underground Storage Tank	100-KR-2
120-KW-7	120-KW-7; 183-KW Brine Pit; 183-KW Salt Dissolving Pits and Brine Pump Pit	Inactive	Sump	Crib - Subsurface Liquid Disposal Site	100-KR-2
126-KE-2	126-KE-2; 183-KE Liquid Alum Storage Tank #2	Inactive	Storage Tank	Storage Pad	100-KR-2
130-K-2	130-K-2; 1717-K Waste Oil Storage Tank	Inactive	Storage Tank	Storage Pad	100-KR-2
130-KE-1	130-KE-1; 105-KE Emergency Diesel Fuel Tank; 105-KE Emergency Diesel Oil Storage Tank	Inactive	Storage Tank	Underground Storage Tank	100-KR-2
130-KE-2	130-KE-2; 166-KE Oil Storage Tank; Oil Bunker	Inactive	Storage Tank	Underground Storage Tank	100-KR-2
130-KW-1	130-KW-1; 130-KW-1A/130-KW-1B Tanks; 105-KW Emergency Diesel Fuel Tank; 105-KW Emergency Diesel Oil Storage Tank	Inactive	Storage Tank	Underground Storage Tank	100-KR-2
130-KW-2	130-KW-2; 166-KW Oil Storage Tank	Inactive	Storage Tank	Underground Storage Tank	100-KR-2
1607-K1	1607-K1; 1607-K1 Sanitary Sewer System; 1607-K1 Septic Tank; 1607-K1 Septic Tank and Associated Drain Field; 124-K-1	Active	Septic Tank	Septic System	100-KR-2
1607-K2	1607-K2; 1607-K2 Sanitary Sewer System; 1607-K2 Septic Tank; 1607-K2 Septic Tank and Associated Drain Field; 124-KE-1	Active	Septic Tank	Septic System	100-KR-2
1607-K3	1607-K3; 1607-K3 Sanitary Sewer System; 1607-K3 Septic Tank; 1607-K3 Septic Tank and Associated Drain Field; 124-KW-2	Inactive	Septic Tank	Septic System	100-KR-2
1607-K4	1607-K4; 1607-K4 Sanitary Sewer System; 1607-K4 Septic Tank; 1607-K4 Septic Tank and Associated Drain Field; 124-K-2	Inactive	Septic Tank	Septic System	Not Applic
1607-K5	1607-K5; 1607-K5 Sanitary Sewer System; 1607-K5 Septic Tank; 1607-K5 Septic Tank and Associated Drain Field; 124-KE-2	Active	Septic Tank	Septic System	100-KR-2
1607-K6	1607-K6; 1607-K6 Sanitary Sewer System; 1607-K6 Septic Tank; 1607-K6 Septic Tank and Associated Drain Field; 124-KW-1	Active	Septic Tank	Septic System	100-KR-2
UPR-100-K-1	UPR-100-K-1; 105-KE Fuel Storage Basin Leak; UN-100-K-1; UN-116-KE-2	Inactive	Unplanned Release	Unplanned Release - Subsurface	100-KR-2

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

Reported inventories are provided in Table G.3-3 through Table G.3-5. All values are to 2 significant figures. The source document should be consulted for greater precision data. The sum (which is not decay corrected for radionuclides) for each primary contaminant is shown in the first row. Table G.3-6 provides a summary of the evaluation of threats to groundwater as a protected resource from saturated zone and remaining vadose zone contamination associated with the evaluation unit.

Vadose Zone Contamination

Reported inventories for the K Area Waste Sites are provided in Table G.3-3 through Table G.3-5. The sites (with the exceptions of the wells and tank that have no reported inventories) are considered contributing to vadose zone contamination. These sites are also considered representative of the vadose zone contamination except for hexavalent chromium and possibly trichloroethene that may be linked to the K Area Waste Sites but have no reported inventories, representing data gaps in the evaluation.

Groundwater Plumes

There are current plumes for primary contaminants (PCs) including C-14, Sr-90, nitrate (NO_3), tritium (H-3) that have been linked to the K Area Waste Sites EU (DOE/RL-2016-09, Rev. 0). The hexavalent chromium (Cr-VI) and trichloroethene (TCE) plumes may also have sources in this EU, which represents data gaps in the evaluation (Table G.3-5). Estimates of the saturated zone inventories are provided in Table G.3-6. See **Part I** for more information.

Facilities for D&D

Not Applicable

Table G.3-3. Inventory of Primary Contaminants[a]

WIDS	Description	Decay Date	Ref[b]	Am-241 (Ci)	C-14 (Ci)	Cl-36 (Ci)	Co-60 (Ci)	Cs-137 (Ci)	Eu-152 (Ci)	Eu-154 (Ci)	H-3 (Ci)	I-129 (Ci)
All	Sum[f]			NR	220	NR	12	3.7	2.0	0.91	140	NR
116-KE-1	Cribs	1986	Stenner	NR	110	NR	0	0	0	0	56.5	0
116-KE-2	Cribs	1986	Stenner	NR	0.12	NR	11.1	0.662	0.00263	0.17	0.428	NR
116-KE-3[c]	Reverse well	1986	Stenner	NR	NR	NR	NR	NR	NR	NR	NR	NR
116-KE-4	Basins	1998	EIS-S	NR	NR	NR	NR	0.997	NR	NR	0.0361	NR
116-KE-4[e]	UPRs	Unknown	Carpenter	NR	NR	NR	1.1	1.7	2	0.74	1.3E-04	NR
120-KE-1	Dry well	Unknown	Carpenter	NR	NR	NR	NR	NR	NR	NR	NR	NR
116-KW-1	Cribs	1986	Stenner	NR	110	NR	0.001	0.00364	0	0.00008	81.9	0
116-KW-2[c]	Cribs	1986	Stenner	NR	NR	NR	NR	NR	NR	NR	NR	NR
116-KW-3	Basins	1998	EIS-S	NR	NR	NR	NR	0.302	NR	NR	0.138	NR
120-KW-1	Dry well	Unknown	Carpenter	NR	NR	NR	NR	NR	NR	NR	NR	NR
120-KW-5	Tank	Unknown	Carpenter	NR	NR	NR	NR	NR	NR	NR	NR	NR
UPR-100-K-1[d]	UPRs	1986	Stenner	NR	NR	NR	NR	NR	NR	NR	NR	NR

a. NR = Not reported for indicated EU

b. Stenner = (Stenner, et al. 1988); EIS-S = TC&WM EIS Appendix S (DOE/EIS-0391 2012); Carpenter = WHC-SD-EN-TI-239, Rev. 0

c. Although used for radioactive waste disposal, no inventory is available (Stenner, et al. 1988).

d. The release was completely below ground and caused no surface contamination where soil beneath the basin estimated to have 2530 Ci total activity including 1.3 Ci Pu-239/240 (Stenner, et al. 1988).

e. Contaminated soil column adjacent to waste site assumed to represent corresponding UPRs that do not have reported inventories.

f. Radionuclides are summed without decay correction since the uncertainties in inventories are large (CRESP 2015).

Table G.3-4. Inventory of Primary Contaminants (cont)[a]

WIDS	Description	Decay Date	Ref[b]	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)
All	Sum[f]			NR	NR	1.3	2.4	NR	0.0022
116-KE-1	Cribs	1986	Stenner	0	0	0	0	0	0
116-KE-2	Cribs	1986	Stenner	NR	NR	0.0189	2.13	NR	0.0021
116-KE-3[c]	Reverse well	1986	Stenner	NR	NR	NR	NR	NR	NR
116-KE-4	Basins	1998	EIS-S	NR	NR	0.000538	0.094	NR	1.26E-09
116-KE-4[e]	UPRs	Unknown	Carpenter	NR	NR	3E-04	0.16	NR	NR
120-KE-1	Dray well	Unknown	Carpenter	NR	NR	NR	NR	NR	NR
116-KW-1	Cribs	1986	Stenner	NR	0	0	0.00622	0	0.00011
116-KW-2[c]	Cribs	1986	Stenner	NR	NR	NR	NR	NR	NR
116-KW-3	Basins	1998	EIS-S	NR	NR	5.38E-04	0.0456	NR	1.26E-09
120-KW-1	Dry well	Unknown	Carpenter	NR	NR	NR	NR	NR	NR
120-KW-5	Tank	Unknown	Carpenter	NR	NR	NR	NR	NR	NR
UPR-100-K-1[d]	UPRs	1986	Stenner	NR	NR	1.3	NR	NR	NR

a. NR = Not reported for indicated EU

b. Stenner = (Stenner, et al. 1988); EIS-S = TC&WM EIS Appendix S (DOE/EIS-0391 2012); Carpenter = WHC-SD-EN-TI-239, Rev. 0

c. Although used for radioactive waste disposal, no inventory is available (Stenner, et al. 1988).

d. The release was completely below ground and caused no surface contamination where soil beneath the basin estimated to have 2530 Ci total activity including 1.3 Ci Pu-239/240 (Stenner, et al. 1988).

e. Contaminated soil column adjacent to waste site assumed to represent corresponding UPRs that do not have reported inventories.

f. Radionuclides are summed without decay correction since the uncertainties in inventories are large (CRESP 2015).

Table G.3-5. Inventory of Primary Contaminants (cont)[a]

WIDS	Description	Ref[b]	CCl4 (kg)	CN (kg)	Cr (kg)	Cr-VI (kg)	Hg (kg)	NO3 (kg)	Pb (kg)	TBP (kg)	TCE (kg)	U (total) (kg)
All	Sum		NR	NR	NR[g]	NR[g]	220[f]	NR	NR	NR	NR	NR[c,d]
116-KE-1	Cribs	Stenner	NR	NR	0	0	NR	NR	NR	NR	NR	0
116-KE-2	Cribs	Stenner	NR	NR	0	0	NR	NR	NR	NR	NR	NR[c]
116-KE-3[c]	Reverse well	Stenner	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
116-KE-4	Basins	EIS-S	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
116-KE-4[e]	UPRs	Carpenter	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
120-KE-1	Dry well	Carpenter	NR	NR	NR	NR	220	NR	NR	NR	NR	NR
116-KW-1	Cribs	Stenner	NR	NR	0	0	NR	NR	NR	NR	NR	NR[d]
116-KW-2[c]	Cribs	Stenner	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR[d]
116-KW-3	Basins	EIS-S	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
120-KW-1	Dry well	Carpenter	NR	NR	NR	NR	NR[f]	NR	NR	NR	NR	NR
120-KW-5	Tank	Carpenter	NR	NR	NR[g]	NR[g]	NR	NR	NR	NR	NR	NR
UPR-100-K-1	UPRs	Stenner	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

a. NR = Not reported for indicated EU

b. Stenner = (Stenner, et al. 1988); EIS-S = TC&WM EIS Appendix S (DOE/EIS-0391 2012); Carpenter = WHC-SD-EN-TI-239, Rev. 0

c. Although used for radioactive waste disposal, no inventory is available (Stenner, et al. 1988).

d. The release was completely below ground and caused no surface contamination where soil beneath the basin estimated to have 2530 ci total activity including 1.3 Ci Pu-239/240 (Stenner, et al. 1988).

e. Contaminated soil column adjacent to waste site assumed to represent corresponding UPRs without inventories.

f. Sampling of the sludge indicated mercury contamination in quantities high enough to designate it as dangerous waste (WHC-SD-EN-TI-239, Rev. 0).

g. Although there are no documented releases, there is evidence of residual chromium in the soil beneath the tank and piping system from many years of unloading and handling of the sodium dichromate (WHC-SD-EN-TI-239, Rev. 0).

Table G.3-6. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Remaining Vadose Zone (VZ) Contamination associated with the Evaluation Unit

PC	Group	WQS	Porosity[a]	K_d (mL/g)[a]	ρ (kg/L)[a]	VZ Source M^{Source}	SZ Total M^{SZ}	Treated[c] M^{Treat}	VZ Remaining M^{Tot}	VZ GTM (Mm^3)	VZ Rating[d]
C-14	A	2000 pCi/L	0.18	0	1.84	2.20E+02 Ci[e]	1.07E+00 Ci[e]	---	2.19E+02 Ci[e]	1.09E+02[e]	*High*
I-129	A	1 pCi/L	0.18	0.2	1.84	---	---	---	---	---	*ND*
Sr-90	B	8 pCi/L	0.18	22	1.84	2.43E+00 Ci[f]	4.42E-03 Ci[f]	---	2.43E+00 Ci[f]	1.35E+00[f]	*Low*
Tc-99	A	900 pCi/L	0.18	0	1.84	---	---	---	---	---	*ND*
CCl4	A	5 µg/L	0.18	0	1.84	---	---	---	---	---	*ND*
Cr	B	100 µg/L	0.18	0	1.84	---[g]	---	---	---	---	*ND*
Cr-VI	A	10 µg/L[b]	0.18	0	1.84	---[g]	1.53E+02 kg[g]	8.36E+02 kg[g]	---[g]	---[g]	---[g]
TCE	B	5 µg/L	0.18	2	1.84	---[h]	4.33E-01 kg[h]	---	---[h]	---[h]	---[h]
U(tot)	B	30 µg/L	0.18	0.8	1.84	---	---	---	---	---	---

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

b. Criteria for chronic exposure in fresh water, WAC 173-201A-240. "Water Quality Standards for Surface Waters of the State of Washington," "Toxic Substances," Table 240(3).

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

d. Groundwater Threat Metric rating based on Table 6-3, Methodology Report (CRESP 2015). Since 1997, the 100-KR-4 P&T systems have removed 836 kg of hexavalent chromium from the aquifer (DOE/RL-2016-09, Rev. 0).

e. The primary sources of C-14 in the 100-K groundwater are historical discharges of reactor gas dryer regeneration condensate to the 116-KE-1 and 116-KW-1 cribs (DOE/RL-2016-09, Rev. 0) that are part of the K Area Waste Sites EU. Thus the saturated zone total is subtracted from the vadose zone total to estimate the remaining vadose zone estimate and the groundwater threat metric (GTM).

f. There is a small current Sr-90 plume that has multiple sources, including 116-KW-2 and 116-KE-3 and direct leakage from the basins (e.g., UPR-100-K-1) (DOE/RL-2016-09, Rev. 0). However, the contribution from the K Area Waste Sites EU to the saturated zone estimate (M^{SZ}) cannot be determined and thus this value is not subtracted from the vadose zone total to estimate the remaining vadose zone estimate and the groundwater threat metric (GTM).

g. The 100-K hexavalent chromium plumes have multiple sources – the primary sources appear to be outside of the K Area Waste Sites EU (DOE/RL-2016-09, Rev. 0). There are no documented releases related to the K Area Waste Sites EU although there is evidence of residual chromium in the soil beneath the 120-KW-5 tank and piping system from many years of unloading and handling of the sodium dichromate (WHC-SD-EN-TI-239, Rev. 0). Therefore, no GTM estimates can be made and this represents a data gap. The threat related to the 100-K hexavalent chromium plume is evaluated in Appendix D.4.

h. The sources of TCE at 100-KR are from the use of solvents during equipment maintenance activities; however, specific TCE release points have not been identified (DOE/RL-2016-09, Rev. 0). Therefore, no GTM estimates can be made and this represents a data gap. The threat related to the 100-K trichloroethene (TCE) plume is evaluated in Appendix D.4.

PART VI. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

Narrative description of pathways and barriers to receptors and conditions/events that can lead to completed pathways

Pathways and Barriers

1. description of institutional, natural and engineered barriers (including material characteristics) that currently mitigate or prevent risk or impacts, 2. Time scale from loss of each barrier to realization of risk or impacts)

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?*

Most potential accidents were deemed to be low risk. Three accident scenarios were identified as requiring further evaluation. These included: 1) a dropped ERDF canister with spill; 2) collapse of the KE basin excavation pit with subsequent resuspension of contaminated soils; and 3) a spill from an ERDF container as a result of two trucks colliding. These scenarios were considered bounding of other accidents. In all cases the low radiological consequences and unlikely probability put these as a risk class III, which is defined as "... generally provided with adequate mitigation and prevention by the existing safety management programs." (from SGW-40938 REV 0 2009)

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

From SGW-40938 Rev 0 2009 the required or applicable Safety Management Programs (SMPs) are:

- Fire Protection Program. The 100OK Area Fire Protection Program is used.
- Radiation Protection Program. The SGRP Radiological Control Program is used.
- Occupational Safety Program. The SGRP Site-Specific Health and Safety Plan is used.
- Training Program. The CHPRC Safety Program Specifications for Contractors is used. This ensures that the remediation contractor performs work in accordance with applicable Hanford Site safety requirements (e.g., the Hoisting and Rigging Program).
- Work Management Program. The CHPRC Work Management Program is used. All work will be coordinated with the 1 05-KW Shift Office.
- Hazardous Material Protection Program. The CHPRC Hazardous Material Protection Program is used.

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

Not Applicable

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

The current barriers to release are soil and or structures covering the site. The site also has limited contamination for most areas.

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

Dropped canister, collapse of 105 KE Basis excavation pit, or vehicle accident resulting in spill.

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

Facility worker and collocated persons

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

Seconds.

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

Minimal

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Workers

Workers may be exposed to residual radioactive and chemical contaminants, but are protected by special equipment.

Workers (co-located)

CPs are not directly exposed to the contaminated soils unless through an accidental release (dropped canister, vehicle accident or pit collapse.

Public

The contamination remains underground until remediation. Dispersion from accidents is localized and so there is not a dispersion pathway for the material to reach the atmosphere and travel outside the site boundary.

Groundwater

Migration of the contaminants through the soil into groundwater requires a driving force (source of water to mobilize the contamination). Infiltrating water and fluctuating river stage impacts may mobilize and/or disperse contaminants near the river over time. There are current plumes for primary contaminants (PCs) including C-14, Sr-90, nitrate (NO_3), tritium (H-3) are linked to the K Area Waste Sites EU, and the hexavalent chromium (Cr-VI) and trichloroethene (TCE) plumes may also have sources in this EU (DOE/RL-2016-09, Rev. 0). The C-14 remaining in the vadose zone translates to a *High* rating and the Sr-90 to a *Low* rating (Table G.3-6). The current tritium (Group C) plume that has been linked to the K Area Waste Sites EU has an area that translates to a *Medium* rating; however, the plume has generally been decreasing over time (likely from dispersion and decay) and the risk to groundwater is riven by C-14. Vadose zone ratings cannot be made for hexavalent chromium (Cr-VI) or trichloroethene (TCE) that may be linked to K Area Waste Sites sources; these plumes are evaluated in Appendix D.4. However, treatment, decay, and dispersion of contaminants has caused plume areas to generally decrease over the past decade (DOE/RL-2016-09, Rev. 0), which is expected to continue into the future. A final Record of Decision was expected in 2016. Because final remedial decision (that might involve vadose zone activities) have not been made, the vadose zone ratings do not change for the remainder of the Active

Cleanup period. The overall rating for the K Area Waste Sites EU is thus *High* (C-14) for the Active Cleanup period.

Columbia River

Migration of the contaminants through the soil into groundwater requires a driving force (source of water to mobilize the contamination). Infiltrating water and fluctuating river stage impacts may mobilize and/or disperse contaminants near the river over time. The only primary contaminant that may be linked to K Area Waste Sites sources that currently impacts the Columbia River is hexavalent chromium (DOE/RL-2016-09, Rev. 0). There are no documented releases of hexavalent chromium related to the K Area Waste Sites EU; however, there is evidence of residual chromium in the soil beneath the tank and piping system from many years of unloading and handling of the sodium dichromate (WHC-SD-EN-TI-239, Rev. 0). The threat posed by hexavalent chromium cannot be evaluated for the K Area Waste Sites EU (representing a data gap[4]). The risk to the Columbia River from hexavalent chromium in 100-K is evaluated in Appendix D.4. Furthermore, there are three Pump and Treat (P&T) systems actively treating hexavalent chromium in the 100-K groundwater. Given the transport (generally decreasing plumes) and decay properties of C-14, Sr-90, nitrate (NO_3), tritium (H-3), no plumes are expected to reach the Columbia River in the next 150 years for these PCs. This leads to a *Not Discernible* (*ND*) rating during the Active Cleanup period.

Ecological Resources

Summary of Ecological Review

- Most of the K Waste Sites EU (nearly 90% of the area) has been disturbed or consists of buildings, roadways, parking areas, and infrastructure that are classified as level 0 or level 1 habitat.
- Level 4 resources within the EU reflect the bald eagle roost site buffer area (~400 m diameter) that extends into the EU. Noise and construction activities associated with clean-up activities within 400 m of the roost site could potentially influence eagle use of the roost, during the seasonal use period when eagles are present along the river.
- Because most of the EU is disturbed, and remaining habitat within the unit is not contiguous with the adjacent landscape, the loss of habitat resources within the K Waste Sites evaluation unit would not be expected to negatively impact habitat connectivity at the landscape level.

Cultural Resources

- There are no known TCPs within the EU.
- A National Register-eligible irrigation canal associated with the Pre-Hanford Early Settlers/Farming Landscape is located within this EU. This large linear historic resource has been extensively documented and contains miles of main canal and dozens of miles of laterals. It is eligible for the NRHP. However, within the EU, visible evidence of the canal is minimal; within the EU the canal has been destroyed by 100-K Area Hanford construction and remediation activities.

[4] The link between the trichloroethene (TCE) plume and the K Area Waste Sites EU sites has also not been definitively established representing an additional data gap.

- 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 the EU. In accordance with the 1998 *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56), all documentation requirements have been completed for this property.
- In addition to the Hanford Site Railroad, there are 23 Manhattan Project and Cold War Era buildings located within the Evaluation Unit (9 with individual documentation required, 12 with no individual documentation required). Mitigation for contributing buildings/structures have been completed as per the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56) and building demolition is ongoing.

Table G.3-7. Buildings Located in K Area Evaluation Unit.

Name	Description
115-KE	Gas Recirculation Building
115-KW	Gas Recirculation Building
116-KE	Reactor Exhaust Stack
117-KE	Exhaust Air Filter Building
117-KW	Exhaust Air Filter Building
165-KE	Power Control Building
165-KW	Power Control Building
167-K	Cross-tie Tunnel Building
1706-KE	Rad Con Count Lab Facility
1706-KER	Water studies Recirculation Building
1713-KER	Shop Building
1717-K	Maintenance Transportation
1720-K	Administration Office Building
1724-K	Maintenance Shop
181-KE	River Pump House
181-KW	River Pump House
182-K	Emergency Water Reservoir Pump House
183-KE	Complex
183-KW	Complex
1908-K	Outfall Structure
1908-KE	Outfall Structure
190-KE	Main Pump House
190-KW	Main Pump House

Archaeological sites and TCPs located within 500 meters of the EU

- There are no documented TCPs located within 500 meters of the EU.
- Fourteen additional archaeological sites have been documented within 500-meters of the EU.
- Seven archaeological sites (3 eligible and 4 unevaluated) and two isolates (2 not eligible) represent the Native American Precontact and Ethnographic landscape.

- 3 archaeological sites (1 not eligible and 2 unevaluated) and 2 isolates (2 not eligible) represent the Manhattan Project and Cold War era landscape.

Closest Recorded TCP

- There are known TCPs exist in the vicinity of the EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

From SGW-40938, Rev. 0

"Remediation activities will be performed using SGRP sampling rigs, typical construction vehicles (e.g., trucks, trackhoes, and cranes) and may involve refueling vehicles. Contaminated soil and debris will be transferred to the Environmental Remediation Disposal Facility (ERDF), which is managed by the River Corridor Contractor (RCC). A queue area for ERDF roll-off containers will be located at the site of the demolished 107-KE retention basins. ERDF containers are large (approximately 15) truck-mounted, reusable steel containers that typically are equipped with plastic liners. ERDF containers will be used to transport demolition debris and contaminated soil to ERDF. SGRP personnel will fill the ERDF containers and transport them to the queue area. Excavated material will be sorted as necessary in the queue area and all shipments will be verified to meet the ERDF Waste Acceptance Criteria (WAC). RCC drivers will transport the containers to ERDF. The queue area will accommodate 78 empty ERDF containers and 78 full containers, but it is estimated that a nominal 60 ERDF containers will be present in the queue area at one time, and that the traffic increase will be a maximum of 45 trucks per day.

Work activities may be controlled by the 100-K Area Safety Basis (e.g., 105-KW Basin Final Safety Analysis Report [FSAR] and Technical Safety Requirement [TSR], Cold Vacuum Drying Facility FSAR and TSR), and will be subjected to the Unreviewed Safety Question process as appropriate."

From DOE-RL 96-17 In conducting the remedial action, various waste steams will be encountered. Each waste stream will require specific processing and disposal. Similar types of OU-specific waste will be managed uniformly. Assignment of waste to the appropriate waste stream depends on knowing the designation of the waste and appropriate disposal facility. Projected waste streams include, but are not limited to, the following:

- Nonhazardous, nondangerous miscellaneous solid waste
    - Filter paper, wipes, personal protective equipment, cloth, plastic, equipment, tools, pumps, wire, metal and plastic piping, and materials from cleanup of unplanned releases
    - "Demolition waste," which means solid waste, largely inert waste, resulting from the demolition or razing of buildings, roads, or other man-made structures
- Low-level radioactive waste, including soil and associated miscellaneous solid waste. Decommissioning debris includes such materials as concrete, wood, rebar, metal/plastic pipe and screens, wire, liners, equipment, pumps, and tanks
- Mixed waste (i.e., waste that is both low-level radioactive waste and hazardous waste)
- Liquids including, but not limited to, the following:
    - Water from unplanned releases (i.e., spills)
    - Decontamination/cleaning fluids

  - Unknown (i.e., liquid in pipes)
- Used oil/hydraulic fluids
- Returned sample waste associated with these waste sites
- Nonradioactive waste (e.g., asbestos, PCBs, TPH)
- Hazardous or dangerous waste
- Spent nuclear fuel

From SGW-40938, Rev. 0

As the 100-K Area D4 organization completes work on the sites listed in Table 1, SGRP will remediate the sites by one of two methods. For sites designated as Confirmatory Sampling –No Action (CSNA), SGRP will sample the soil to confirm that the site meets DOE/RL-96-17 cleanup criteria. For sites designated as Remove-Treat-Dispose (RTD), SGRP will excavate the site, remove any underground structures (e.g., piping) and verify that the site meets DOE/RL-96-17 cleanup criteria. For all sites, SGRP will backfill the excavated area with clean soil, compacted as necessary.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

The proposed cleanup actions will remove contaminated soils and stabilize the filled sites. Where contamination must be left in place due to the need to maintain structural integrity, soils will be remediated to 15 feet below ground surface. To the extent practical the soils will be cleaned such that unlimited future use is allowed. Where not practical, institutional controls and long term monitoring will be required.

Risks and Potential Impacts Associated with Cleanup

Cleanup activities have the potential to put workers at risk from standard industrial hazards (slips, trips, falls, and fires). However, risks were assessed and determined manageable through a safety management program.

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

Facility Worker

From SGW-40938, Rev. 0

All sites …. are below Hazard Category-3 (KBC-36585, 100-K Area Project Facility Hazard Categorization, and SGW-42 107, Initial Hazard Categorization for S&GRP Waste Sites Near 100-K Area). Some sites, such as the underground pipelines and the 183-KW sites listed in Section 2.2.2.3, were never used with radioactive materials; therefore, debris from these sites is not expected to have any radioactive contamination. Other sites have only minor residual contamination.

The hazard analysis identified 18 potential scenarios (Appendix C of SGW-40938). The postulated unmitigated hazardous conditions result in "low" consequences to the onsite and offsite receptors and no significant impact to the facility worker. Several scenarios were identified as presenting a standard industrial hazard to the facility worker, which is consistent with the nature of the activities. All scenarios are in Risk Bin III, which require Safety Management Programs (SMP).

Co-located Person

The postulated unmitigated hazardous conditions result in "low" consequences to the onsite receptors.

Public

The postulated unmitigated hazardous conditions result in "low" consequences to the offsite receptors.

Groundwater

There are current plumes for primary contaminants (PCs) including C-14, Sr-90, nitrate (NO_3), tritium (H-3) are linked to the K Area Waste Sites EU, and the hexavalent chromium (Cr-VI) and trichloroethene (TCE) plumes may also have sources in this EU (DOE/RL-2016-09, Rev. 0). Of the Group A and B primary contaminants (PCs) with reported inventories, the C-14 and Sr-90 remaining in the vadose zone translate to a *High* and *Low* rating, respectively (Table G.3-6). The current tritium (Group C) plume that has been linked to the K Area Waste Sites EU has an area that translates to a *Medium* rating; however, the plume has generally been decreasing over time (likely from dispersion and decay) and the risk to groundwater is riven by C-14. Vadose zone ratings cannot be made for hexavalent chromium (Cr-VI) or trichloroethene (TCE) that may be linked to K Area Waste Sites sources; these plumes are evaluated in Appendix D.4. However, treatment, decay, and dispersion of contaminants has caused plume areas to generally decrease over the past decade (DOE/RL-2016-09, Rev. 0), which is expected to continue into the future. A final Record of Decision was expected in 2016. Because final remedial decision (that might involve vadose zone activities) have not been made, the vadose zone ratings do not change after the Active Cleanup period (because the remaining Sr-90 inventory would still translate to a *Low* rating). The overall rating for the K Area Waste Sites EU is thus *High* (C-14) for the Near-term, Post-Cleanup period. This rating would be lower if remedial actions are subsequently taken in the vadose zone to treat sources.

Columbia River

Migration of the contaminants through the soil into groundwater requires a driving force (source of water to mobilize the contamination). Infiltrating water and fluctuating river stage impacts may mobilize and/or disperse contaminants near the river over time. The only primary contaminant that may be linked to K Area Waste Sites sources that currently impacts the Columbia River is hexavalent chromium (DOE/RL-2016-09, Rev. 0). There are no documented releases of hexavalent chromium related to the K Area Waste Sites EU; however, there is evidence of residual chromium in the soil beneath the tank and piping system from many years of unloading and handling of the sodium dichromate (WHC-SD-EN-TI-239, Rev. 0). The threat posed by hexavalent chromium cannot be evaluated for the K Area Waste Sites EU (representing a data gap[5]). The risk to the Columbia River from hexavalent chromium in 100-K is evaluated in Appendix D.4. Furthermore, there are three Pump and Treat (P&T) systems actively treating hexavalent chromium in the 100-K groundwater. Given the transport (generally decreasing plumes) and decay properties of C-14, Sr-90, nitrate (NO_3), tritium (H-3), no plumes are expected to reach the Columbia River in the next 150 years for these PCs. However, because C-14 is long-lived and there is considerable uncertainty in the evaluation, a rating of *Low* is given after the Active Cleanup period to address these uncertainties.

[5] The link between the trichloroethene (TCE) plume and the K Area Waste Sites EU sites has also not been definitively established representing an additional data gap.

Ecological Resources

Trucks, heavy equipment and drill rigs on roads through non-target areas or remediation site carry seeds or propagules on tires, injure or kill vegetation or animals, make paths, cause greater compaction of soil, displace animals and disrupt behavior/reproductive success. Also seeds and propagules can be dispersed from soil from truck or blowing from heavy equipment. Often permanent or long-term compaction can result in the destruction of soil invertebrates. Compaction can decrease plant growth in those areas, decrease abundance and diversity of soil invertebrates, and prevent fossorial snakes or mammals from using the area. Compaction of soils may permanently destroy areas of the site with intense activity. Drilling can cause destruction of soil invertebrates at greater depths, and has the potential to bring up dormant seeds from deeper soil layers. Drilling can cause disruption of ground-living small mammals and hibernation sites of snakes and other animals. Construction of new buildings can cause permanent destruction of plants and animals, and of the on-site ecosystem larger than the footprint of the building. Effects will radiate from the building, and post-remediation effects depend on the degree of use (e.g., personnel and truck traffic, type of truck traffic and heavy equipment activity). 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. Soil removal can cause complete destruction of existing ecosystem, all of the above effects on adjacent sites, but these effects are potentially more severe because of blowing soil (and seeds) and the potential for exposure of dormant seeds. In the re-vegetation 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 on site.

Cultural Resources

Personnel, car, and truck traffic on paved roads as well as use of heavy equipment will not have any direct impact on archaeological resources because there is no disturbance to soil/ground or alteration to the landscape. Assuming heavy equipment locations and staging areas have been cleared for cultural resources, then it is assumed adverse effects would have been resolved and/or mitigated. If heavy equipment locations and staging areas have not been cleared, this could result in artifact breakage and scattering, compaction and disturbance to the soil surface and immediate subsurface, thereby compromising stratigraphic integrity of an archaeological site. TCPs may be directly affected if personnel are on roads located on TCP and if personnel are unaware of cultural resource sensitivity, appropriate behaviors and protocols. For traffic on paved roads located on TCP, direct effects include visual, auditory and vibrational alterations to landscape/setting. Heavy equipment may cause direct effects to TCPs including destruction of culturally important plants, physical attributes of the TCP and introduction of noise and vibrations also altering the setting. These actions may interfere with traditional uses of TCP. Revegetation activities may cause direct effects to TCPs include physical alteration to or restoration of TCP depending on how the area is recontoured and what plants are selected for revegetation. Contamination remaining in situ may have direct effects including permanent physical alteration of TCP, and lead to permanent intrusion in long-term use and access to TCP.

Indirect effects from personnel, car, and truck traffic on paved roads as well as use of heavy equipment may lead to the introduction of invasive plant species or removal of culturally important plants that alters the landscape/setting for roads located within the viewshed and noise-scape of TCP. Existing road

causes no alteration to viewshed or noise-scape. Presence of vehicles may result in visual, auditory and vibrational alterations to landscape/setting. Remediation actions may lead to visual alteration of landscape/setting. Introduction of noise alters landscape/setting. Introduction of equipment and buildings may interfere with traditional uses of TCP. Revegetation could lead to indirect effects from visual alterations to setting depending on how the area is recontoured and what plants are selected for revegetation. Remaining contamination could lead to indirect effects from permanent intrusion, which could limit the use and access to TCP.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

There is no risk to workers if cleanup of the soils or building is delayed**. There may be some potential for groundwater impact. (From SGW 54741 Rev 0, Page 6 (SGW 54741 2014):** *Near the Columbia River, the unconfined aquifer is strongly influenced by fluctuations in river stage, which affect the pattern of movement and the rate at which groundwater discharges to the river. During periods of prolonged high river conditions, the elevated water table may contact and mobilize contaminants held in the normally unsaturated lower vadose zone (DOE/RL-2010-11, Hanford Site Groundwater Monitoring and Performance Report for 2009***).**

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

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

Table G.3-8. Populations and Resource at Risk.

Population or Resource		Risk/Impact Rating	Comments
Human	Facility Worker	Not Discernible (ND)-Low	Other than periodic inspections, no workers will be present.
	Co-located Person	ND	None
	Public	ND	Public access will be prevented by physical barriers and institutional controls
Environmental	Groundwater (A&B) from vadose zone[(a)]	*High* (C-14) *Low* (Sr-90) *Not rated* (Cr-VI, TCE)	There are current small plumes for C-14 and Sr-90. Current vadose ratings for Group A and B primary contaminants with reported inventories (Table G.3-6) are *High* for C-14 and *Low* for Sr-90. No ratings can be made for hexavalanet chromium (Cr-VI) and trichloroethene (TCE) as described in **Part V**. Final remedial decisions concerning vadose zone actions have not been made but would change ratings.
	Columbia River from vadose zone[(a)]	*Low* (C-14) *Not rated* (Cr-VI)	The C-14 plume is not currently intersecting the Columbia River; however, due to uncertainties associated with the transport of C-14, which does not decay quickly, a *Low* rating is given. The hexavalent chromium plume (currently intersecting the river) may be linked to EU sources; this plume is evaluated in Appendix D.4.
	Ecological Resources[(b)]	Low - Medium	Re-vegetation in EU will result in additional level 3 resources, and potentially creation of level 4 resources potentially at risk because of disturbance, especially from invasive species. Similar effects in buffer zone.
Social	Cultural Resources[(b)]	**Native American:** Direct: Known Indirect: Known **Historic Pre-Hanford:** Direct: Known Indirect: Known **Manhattan/Cold War**:	Permanent direct and indirect effects are possible due to high sensitivity of area.

Population or Resource		Risk/Impact Rating	Comments
		Direct: None Indirect: None	

a. Threat to groundwater or Columbia River for Group A and B contaminants remaining in the vadose zone. Threats from existing plumes associated with the K Area Waste Sites EU are described in **Part I** and **Part V** with more detailed evaluation in Appendix D.4.

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

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

Cleanup will be dictated by the extent of the contamination and the ability to remediate the site. The point of compliance for human exposure via direct contact will be 15 feet below ground surface (from the Washington Administrative Code (WAC) 173-340 (1996)). From EPA 1995: To the extent practicable, return soil concentrations to levels that allow for unlimited future use and exposure. Where it is not practicable to remediate to levels that will allow for unrestricted use in all areas, institutional controls and long-term monitoring will be required.

PART VII. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

Not Applicable

REFERENCES

DOE/RL-96-17, Rev. 6, Remedial Design Report/ Remedial Action Work Plan for the 100 Area, US Department of Energy, Sept 2009. Richland WA 99352

DOE/EIS-0391 2012, *Tank Farm Closure & Waste Management (TC&WM) Environmental Impact Statement*. U.S. Department of Energy, Richland, WA. Available at: http://www.hanford.gov/page.cfm/FinalTCWMEIS.

PNNL-13895. Hanford Contaminant Distribution Coefficient Database and Users Guide, K. J. Cantrell R. J. Serne G. V. Last May 2002

Donna Morgans, John Lowe, Chris McCarthy, and Alaa Aly, *"*A Conceptual Site Model for Nature and Extent of Contamination in a Riparian-Near Shore Area -12410*"* WM2012 Conference, February 26 – March 1, 2012, Phoenix, AZ.

EPA, 1995, *Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington,* September 1995, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

CARPENTER, R. W., COTE, S.L. 1994. 100-K Area Technical Baseline Report. Richland: Westinghouse Hanford Company.

CRESP 2015. Methodology for the Hanford Site-Wide Risk Review Project. Nashville, TN: Consortium for Risk Evaluation with Stakeholder Participation (CRESP).

DOE/RL-2016-09, Rev. 0. Hanford Site Groundwater Monitoring Report for 2015. Richland, WA: U.S. Department of Energy, Richland Operations Office.

Stenner, R.D., KH Cramer, KA Higley, SJ Jette, DA Lamar, TJ McLaughlin, DR Sherwood, and NC Van Houten. October 1988, Hazard Ranking System Evaluation of CERCLA Inactive Waste Sites at Hanford Volume 1, 2, 3. PNL-6456, Pacific Northwest Laboratory, Richland, Washington.

SGW-40938 REV 0 2009, Williams, JC, *Hazard analysis in support of final hazard categorization for 10OK Area waste site remediation*, SGW-40938, Rev. 0, CH2MHill Plateau Remediation Company, Richland, Wash.

SGW 54741 2014, Whitley, KM, *Description of work for performing characterization drilling and well installation at the UPR-100-K-1 and 116-KE-3 waste sites*, SGW-54741, Rev. 0, CH2MHill Plateau Remediation Company, Richland, Wash.