APPENDIX H.8

ENVIRONMENTAL RESTORATION DISPOSAL FACILITY (ERDF)
(CP-OP-6, CENTRAL PLATEAU)
EVALUATION UNIT SUMMARY TEMPLATE

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PART I. EXECUTIVE SUMMARY

EU LOCATION

Environmental Restoration Disposal Facility, ERDF, between 200 East and 200 West Areas

RELATED EUS:

Other D&D Projects Providing Debris for Disposal

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA, AND WASTES:

The Environmental Restoration Disposal Facility (ERDF) accepts waste from Hanford Site environmental restoration activities as defined in the ERDF ROD. All waste received at ERDF is tracked using the Waste Management Information System (WMIS). Quantitative estimates of specific radionuclide inventories have been compiled based on an ERDF WMIS summary in August 2010, which provides bounding estimates of the inventory (larger than likely exists). The current and final inventory is described in Table H.8-1 (data from WCH 520).

Table H.8-1. Current and anticipated final inventory of major radionuclides in ERDF (WCH 520).

Constituent	2014	Final
Am-241	0.55 kCi	
C-14	1.9 kCi	<45 kCi
Cl-36	0	0.3 kCi
Co-60	5.5 kCi	<30 kCi
Cs-137	14.6 kCi	<2000 kCi
Eu-152	4.8 kCi	
Eu-154	1.4 kCi	
H-3	7.8 kCi	<160 kCi
I-129	1.9 E-5 kCi	< .01 kCi
Ni-59	0.19 kCi	
Ni-63	14.5 kCi	<110 kCi
Pu-Rad	5.5 kCi	
Sr-90	11.4 kCi	< 1200 kCi
Tc-99	0.021 kCi	<0.86 kCi
U-Total	202 Mg	<870 Mg

BRIEF NARRATIVE DESCRIPTION:

ERDF is Subtitle C style landfill that was constructed to permanently dispose of wastes generated by remediation at the Hanford site. Disposal of contaminated material at ERDF is the preferred remedy for

much of the waste excavated from numerous Hanford waste sites. As of July 2013, approximately 13.6 million metric tons of waste has been disposed at ERDF since the facility started operations in July 1996 (an average of 800,000 metric tons/yr).

ERDF employs a modular design consisting of a series of disposal cells with separate sumps. The first eight disposal cells were built in two-cell pairs (four pairs total). The most recent cells combine the past two-cell pairs into one larger "supercell," approximately the same size as each cell pair. Cells 1 through 4 have been filled; cells 5 through 8 are nearly filled; and supercells 9 and 10 are receiving waste. Each cell is lined with a RCRA Subtitle C double liner with a lower composite liner, leak detection between liners, and leachate collection. The entire disposal facility will be capped with a final cover combined of a water-balance cover underlain by a composite barrier (geomembrane over compacted soil barrier).

Waste disposal at ERDF consists primarily of high-volume slightly contaminated soils and debris that are delivered by truck from remediation sites. The soils are dumped, spread in a cell, and compacted to minimize void space and limit future waste volume subsidence. A limited volume of building debris and other non-soil wastes are also placed in ERDF. These wastes are grouted when necessary to fill void space.

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table H.8-2 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 ERDF; a co-located Person (CP) is an individual located 100 meters from the perimeter of the ERDF operation; and 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 west bank of the Columbia River approximately 305 m (1,000 ft) east 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: No risk ratings are provided for Cultural Resources. Table H.8-2 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 H.8-2. Risk Rating Summary (for Human Health, unmitigated nuclear safety basis indicated, mitigated basis indicated in parentheses (e.g., "Very High" (Low)).

Population or Resource		Evaluation Time Period	
		Active Cleanup (to 2064)	
		Current Condition: Operating as Waste Site	**From Cleanup Actions:** Final Closure
Human Health	Facility Worker	Medium (Low)	Medium (Low)
	Co-located Person	Low (Not Discernible (ND) to Low)	Low (ND to Low)
	Public	ND to Low (ND to Low)	ND to Low (ND to Low)
Environ-mental	Groundwater (A&B) from vadose zone[(a)]	ND	ND
	Columbia River from vadose zone[(a)]	ND	ND
	Ecological Resources[(b)]	Low to Medium	Low to High
Social	Cultural Resources[(b)]	Native American: Direct: Unknown Indirect: Known Historic Pre-Hanford: Direct: Known Indirect: Unknown Manhattan/Cold War: Direct: Known Indirect: Known	Native American: Direct: Unknown Indirect: Known Historic Pre-Hanford: Direct: Known Indirect: Unknown 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.

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.

SUPPORT FOR RISK AND IMPACT RATINGS FOR EACH POPULATION OR RESOURCE

Human Health

Current

The risks at ERDF are associated with (i) radiation exposure by facility workers unloading trucks and placing waste within the disposal cell, (ii) physical accidents associated with trucks and machinery within or entering/exiting the ERDF area, and (iii) ground water contamination. The two scenarios that exist are:

- *C*ontact with waste of much higher activity than expected, resulting in up to high risk even with health and safety plans being followed; and

- Equipment accident that could cause severe injury or loss of life, but has low risk given implementation of the health and safety plan.

For the public, the engineered barrier systems provide a high level of containment, with ND to low risk associated with use of groundwater that might be contaminated from ERDF, as described in the ERDF Performance Assessment (WCH 520).

Unmitigated Risk: Facility Worker – Medium; Co-located person – Low; Public – ND to Low

Mitigation: All personnel at ERDF are required to follow the health and safety plans for waste disposal and equipment operations.

Mitigated Risk: Facility Worker – Low; CP – ND to Low; Public – ND to Low

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Clean up actions involve closure of ERDF with a final cover. The closure activities are the same as those associated with the current operational condition, except radionuclide exposure is eliminated.

Unmitigated Risk: Facility Worker – Medium; Co-located person – Low; Public – ND to Low

Mitigation: The facility worker retains medium risk because of the potential for an equipment accident, but has low risk given implementation of the health and safety plan. For the public, the engineered barrier systems provide a high level of containment, with ND to low risk associated with use of groundwater that might be contaminated from ERDF, as described in the ERDF Performance Assessment (WCH 520).

Mitigated Risk: Facility Worker – Low; CP – ND to Low; Public – ND to Low

Groundwater

It is assumed that the waste in ERDF is contained within a RCRA Subtitle C landfill. Any waste outside of the ERDF facility is assumed negligible. This leads to a ND rating.

Columbia River

The Columbia River will not be impacted by ERDF due to the distance between the facility and the river. It is assumed that the waste in ERDF is contained within a RCRA Subtitle C landfill. Any waste outside of the ERDF facility is assumed negligible. This leads to a ND rating.

Ecological Resources

Current

Levels of frequent disturbance can result in increases in invasive species, particularly to high quality habitat in buffer (80% is level 3-5 resources). ERDF is one of only 2 EUs in the interim report with level 5 resources (about 9% of buffer is level 5 resources, 0 in EU).

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Because of high quality of resources in buffer area (7% level 3 resources in EU, 80% levels 3-5 in buffer), the potential for disturbance is medium, which could disrupt native communities in buffer, and result in increases in exotic species. Continued dust suppression changes available water levels, which could affect native species diversity and abundance.

Cultural Resources

Current

A few National Register ineligible archaeological sites and isolated finds were recorded before construction of ERDF within this EU. None are likely present due to construction of ERDF and were

addressed under the National Historic Preservation Act, Section 106 Review completed prior to ERDF construction. A Manhattan Project/Cold War eligible site is recorded within 500 meters of ERDF as well as several other archaeological sites associated with various landscapes. Traditional cultural places are visible from this EU.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

The entire EU has been inventoried for archaeological resources on the surface. Because there are pockets of land where no disturbance has occurred, the potential for subsurface archaeological material to be present in these areas is moderate. Indirect effects to the Manhattan Project/Cold War eligible archaeological site are possible.

Considerations for timing of the cleanup actions

ERDF is an operating facility and will continue to operate until remediation activities at Hanford are complete. Final cover will be placed once use of the disposal facility ceases. Thus, timing is not an issue for ERDF.

Near-Term, Post-Cleanup Risks and Potential Impacts

The near-term and post-clean up risks and impacts are the same as those from current (near term) and clean up cited above, as ERDF is an operating facility.

Because of low level of monitoring expected in the near-term post-cleanup period, the effect on ecological resources is expected to be ND. However, the risk will depend on the level of disturbance, which may adversely affect the 80% level 3-5 resources in buffer area.

Permanent indirect effects to cultural resources may be caused by alterations in the view shed due to placement of the final cover. The presence of permanent contamination from disposal of waste will have a low level impact on cultural resources.

PART II. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S)

CP-OP-6

COMMON NAME(S) FOR EU

Environmental Restoration and Disposal Facility (ERDF)

KEY WORDS

landfill, demolition debris

REGULATORY STATUS

Regulatory basis: ERDF is a mixed waste disposal facility operating under regulations stipulated in RCRA Subtitle C and DOE O 435.1. The disposal cells are designed, constructed, and operated to meet the technical requirements stipulated in 40 CFR 264, Subpart N.

Applicable regulatory documentation

Hanford Site remedial action RODs and action memoranda identify ERDF as the location for disposal of waste. The ERDF ROD was signed by the EPA, Ecology, and DOE (the Tri-Parties) in January 1995. An ESD was issued in August 1996. Four amendments to the ERDF ROD have also been issued. The first amendment was signed on September 30, 1997; the second was signed on March 23, 1999; the third was signed on January 31, 2002; and the fourth was signed on May 24, 2007. ERDF is authorized to accept waste from Hanford Site environmental restoration activities consistent with the ERDF ROD, the Explanation of Significant Difference (ESD), and ROD amendments (EPA/ROD/R10-95/100, EPA/ESD/R10-96/145, EPA/AMD/R10-97/101, EPA/AMD/R10-99/038, EPA/AMD/R10-02/030,07-AMRC-0077, 09-AMRC-0179).

Applicable Consent Decree or TPA milestones

Not Applicable

Risk Review Evaluation Information

Completed: Revised January 19, 2015

Evaluated by: Craig Benson

Ratings/Impacts Reviewed by: D. Kosson, M. Gochfeld, J. Salisbury, A. Bunn, H. Mayer

PART III. SUMMARY DESCRIPTION

CURRENT LAND USE

DOE HANFORD INDUSTRIAL SITE AREA

DESIGNATED FUTURE LAND USE

INDUSTRIAL

PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

Not Applicable

High-Level Waste Tanks and Ancillary Equipment

Not Applicable

Groundwater Plumes

Not Applicable

Operating Facilities

Environmental Restoration and Disposal Facility

LOCATION AND LAYOUT MAPS

ERDF is located between the 200 East Area and 200 West Area as shown in Fig. 1.

Figure H.8-1. Location map of ERDF (yellow rectangle) at Hanford Site.

Figure H.8-2. EU Boundary Map

PART IV. UNIT DESCRIPTION AND HISTORY

EU Former/Current Use(s)

ERDF is a composite-lined waste disposal facility constructed to permanently dispose of all wastes generated by remediation of Hanford Site past-practice and CERCLA waste sites in an environmentally protective manner. As of July 2013, approximately 13.6 million metric tons of waste has been disposed at ERDF since the facility started operations in July 1996 (an average of 800,000 metric tons/yr). ERDF is on the Central Plateau portion of the Hanford Site between the 200 West and 200 East Areas and is constructed in a modular fashion so that additional disposal space can be built as needed. The first eight disposal cells were built in pairs located at the west end of ERDF. Waste disposal at ERDF predominantly consist of high-volume slightly contaminated soils and debris delivered by truck from remediation sites that are spreading in ERDF cells and compacted to minimize void space and limit future waste volume subsidence. However, other demolition wastes are also placed in ERDF, and when necessary, grouted to fill void space. Characteristics of ERDF that strongly affect contaminant release and transport through the vadose zone and into the unconfined aquifer are its location, engineered barriers, and the nature of the waste. The vadose zone (rock/soil zone above the water table) is approximately 80 to 100 m thick and provides the greatest possible distance to the water table compared to waste sites located elsewhere in the Hanford Site. In addition, because of its location in the middle of the Central Plateau it provides the largest contaminant migration distance possible to the Columbia River from the Hanford Site.

EU Designation: CP-OP-6 (ERDF)

LEGACY SOURCE SITES

Not Applicable

HIGH-LEVEL WASTE TANKS

Not Applicable

GROUNDWATER PLUMES

Not Applicable

D&D OF INACTIVE FACILITIES

Not Applicable

OPERATING FACILITIES

ERDF was constructed is constructed in a modular fashion consistent of disposal cells (see Figure H.8-3). The first eight disposal cells were built in pairs located at the west end of ERDF. Each cell is approximately 152 m by 152 m at the bottom, approximately 21 m deep, and has a 3:1 (horizontal to vertical ratio) side slope that extends 64 m horizontally from the base of the cells. The latest cell construction toward the east (Supercells 9 and 10) combines the cell pairings into larger cells, approximately the same size as each two-cell pair. Since the beginning of operations in July 1996, cells 1 through 4 have been filled; cells 5 through 8 are nearly filled; and Supercells 9 and 10 are receiving waste. Using the lined, deep, single-trench configuration, the disturbed area needed for additional construction of ERDF (including the trench, container handling, material stockpile, and support facilities) will not exceed the maximum of 4.1 km^2 identified in the ERDF ROD.

Figure H.8-3. Layout of conventional cells (1-8) and supercells (9, 10) in ERDF.

Waste Disposal Criteria and Management. The waste disposal criteria for the ERDF are outlined in WCH-191, Environmental Restoration Disposal Facility Waste Acceptance Criteria. The ERDF is authorized to accept waste from Hanford Site environmental restoration activities consistent with the ERDF ROD, the Explanation of Significant Difference (ESD), and ROD amendments (EPA/ROD/R10-

95/100, EPA/ESD/R10-96/145, EPA/AMD/R10-97/101, EPA/AMD/R10-99/038, EPA/AMD/R10-02/030, 07-AMRC-0077, 09-AMRC-0179). Inactive treatment, storage, and disposal; RCRA past practice; and decontamination and decommissioning waste may be placed in the ERDF through a remedial action ROD or removal action memorandum issued in accordance with CERCLA and the "Oil and Hazardous Substances Pollution National Contingency Plan" (40 CFR 300). On a case-by-case basis, other documents may be used to provide regulatory authority for disposal of waste at the ERDF. Waste that has not been subjected to the waste acceptance process defined in Section 3.0 of WCH-191 shall not be accepted for disposal at ERDF.

All waste received at ERDF is tracked using the Waste Management Information System (WMIS). Before waste is accepted into ERDF, a waste profile and a waste designation is developed and approved for each waste source in accordance with WMT-1, Waste Management and Transportation. Waste that is within the established profile, meets the Supplemental Waste Acceptance Criteria for the Environmental Restoration Disposal Facility (0000X-DC-W001), has been authorized for disposal by a regulator-approved CERCLA or RCRA past-practice decision document, and is accompanied by the appropriate documentation is disposed in accordance with the ERDF operation process.

Engineered Barriers –Liner System. A schematic of the ERDF multi-layer liner system is shown below. The ERDF sideslope liner comprises six layers: (1) a 0.9-m silty sand operations layer, (2) a primary geocomposite drainage layer, (3) a primary 1.5-mm high-density polyethylene (HDPE) geomembrane, (4) a secondary geocomposite drainage layer, (5) a secondary 1.5 mm HDPE geomembrane liner, and (6) a 0.9-m-thick compacted soil barrier with a hydraulic conductivity no more than $1x10^{-7}$ cm/s. The secondary geomembrane and underlying compacted soil barrier comprise a secondary composite liner.

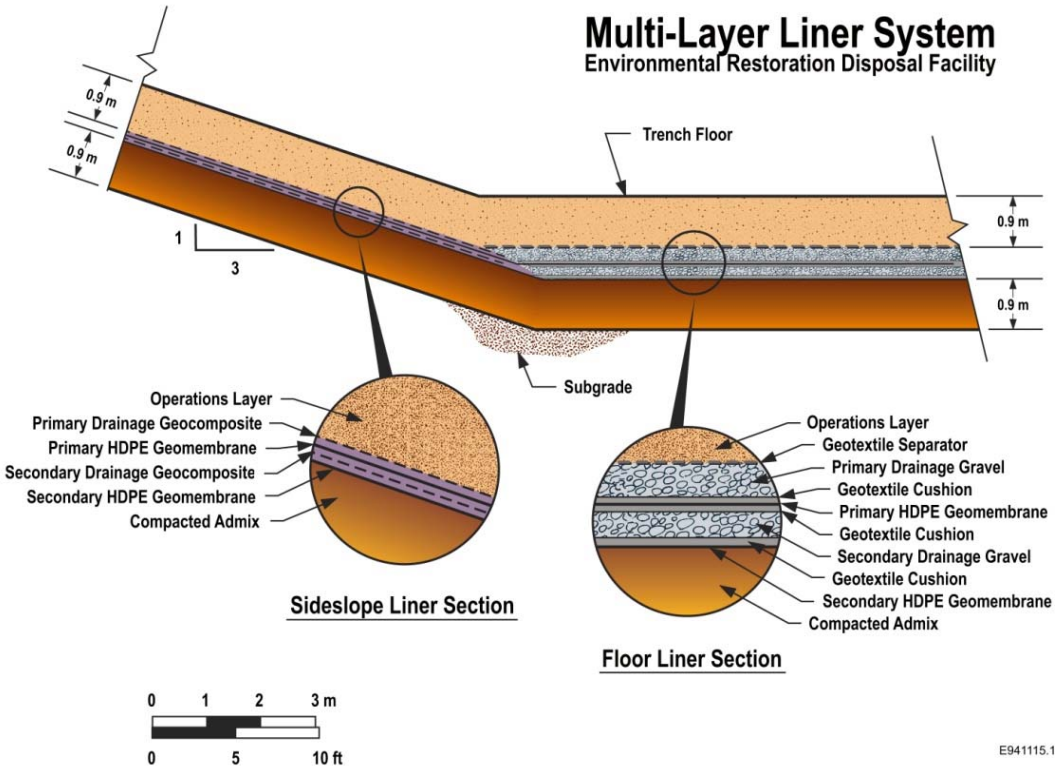

Figure H.8-4. Multilayer double liner system used at ERDF.

The ERDF floor liner has 10 layers: (1) a 0.9-m operations layer, (2) a geotextile separator, (3) a primary gravel drainage layer, (4) a geotextile cushion, (5) a primary 1.5-mm HDPE geomembrane liner, (6) a geotextile cushion, (7) a secondary gravel drainage layer, (8) a geotextile cushion, (9) a secondary 1.5-mm HDPE geomembrane liner, and (10) a 0.9-m-thick compacted soil barrier with a hydraulic conductivity no more than $1x10^{-7}$ cm/s. The secondary geomembrane and underlying compacted soil barrier comprise a secondary composite liner. Field data from similar systems reported by Bonaparte et al. (2002) indicates that the leakage rate is less than 0.1 mm/yr.

Engineered Barriers – Cover System. A schematic of the multi-layer cover system currently proposed for ERDF is shown below. The cover consists of a water balance design at the surface underlain by a composite barrier as described by the ERDF ROD (EPA/ROD/R10-95/100). The upper 50 cm (20 in.) of the soil cover system is composed of an admixture of silt and gravels that provides long-term resistance to erosion, which is underlain by 4.6 m of soil, geomembrane, clay, and sand and gravel. Prior to cover construction, closure cover designs will be evaluated and the most appropriate closure cover design will be selected for construction. The design will, at a minimum, comply with applicable RCRA requirements (WCH-520, 2013). Field monitoring of a similar cover system at the Monticello Uranium Mill Tailings Disposal facility, a more humid climate, has shown near zero percolation in the waste (Apiwantragoon et al. 2014). Even lower percolation rates should be expected at ERDF.

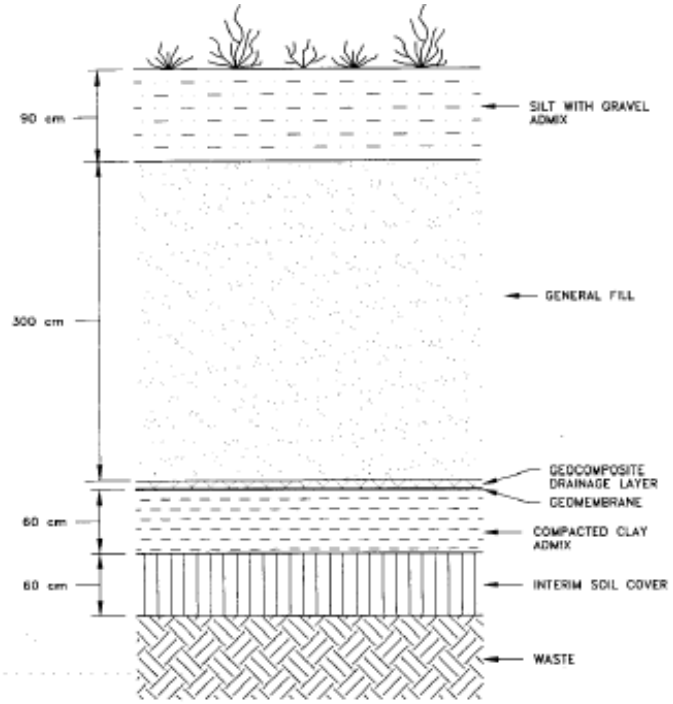

Figure H.8-5. Multilayer final cover proposed for ERDF.

A commercial low-level waste disposal facility (US Ecology) also operates within the perimeter of the Hanford boundary and in close proximity to ERDF. This facility is not part of this EU, CP-OP-6 (ERDF). The facility is located directly east of ERDF and just to the southwest of the 200 East Area on federal land leased to the State of Washington. The facility is operated by US Ecology Inc. under contract to the State of Washington. The inventory of major radionuclides for the commercial low-level waste disposal facility is summarized in Table H.8-3 (WDOH 2004).

Table H.8-3. Inventory at closure for the US Ecology commercial low-level waste disposal facility. This inventory is not part of this EU, CP-OP-6 (ERDF).

Constituent	Inventory at Closure
C-14	18.4 Ci
Cs (ag)	137 kCi
H-3	1004 kCi
Ni (ag)	883 kCi
Sr-90	65.7 kCi
Tc-99	<0.07 kCi
U (ag)	1.8 Ci
Fe-55	278 kCi
Pu (ag)	14.5 kCi
Sb-125	4.2 kCi

ag = aggregated total of isotopes.

In contrast to the multi-layer double liner system employed at ERDF, the commercial LLW facility wastes in un-lined trenches. When the commercial facility ceases accepting wastes, a final cover will be installed that is similar to the cover proposed for ERDF, except the earthen layers above the composite barrier will be approximately one-half the thickness used for the final cover at ERDF.

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification

The amount of each category of biological resources at and near the ERDF EU was examined within a circular area radiating 2,123 m from the geometric center of the unit (equivalent to 3,499 acres). The majority of the area within the 424.2 acres of the EU is classified as level 0 (365.4 ac), with only 31.4 acres classified as level 3 or higher biological resources, whereas the adjacent landscape buffer contains substantial level 3 and higher resources (2,468 ac out of 3,075.1 ac). Overall, approximately 71.5 percent of the total combined area currently consists of level 3 or higher biological resources.

Field Survey

The EU associated with the ERDF facilities was surveyed in October 2014 by pedestrian and vehicle reconnaissance of disturbed areas and field measurement or visual survey of natural habitat areas. The majority of the EU consists of disturbed landfill cells, roads/ramps, buildings, parking lots, and associated facilities. Small areas of natural habitat remain along the EU perimeter. Based on visual surveys the natural habitat along the northern boundary (survey areas 4-01a and 4-01b) was classified as a composite of levels 1-3 and the natural habitat along the eastern boundary (survey area 3-09a) was classified as primarily level 2 to reflect current vegetation conditions. Two sanitation tile/drain fields are located within the EU: 1) part of the level 1 habitat resource in the northwest corner which was visually surveyed and 2) an area along the central southern boundary which could not be accessed during the field survey. Field measurements conducted in the natural habitat area located at the southwest corner (survey area 3-09b) of the EU confirmed the habitat to be resource level 3 with mature big sagebrush (*Artemisia tridentata*) in the overstory.

Wildlife observations included a side-blotched lizard (*Uta stansburiana*) and harvester ants in habitats near the northern boundary, signs of small mammals in habitats near the northern boundary and in the southwest corner, and a white-crowned sparrow (*Zonotrichia leucophrys*) in habitats near the eastern boundary.

CULTURAL RESOURCES SETTING

The entire ERDF EU has been inventoried for archaeological resources with limited findings. Specifically, there are two Native American Pre-contact and Ethnographic landscape associated archaeological sites/isolates and four pre-Hanford Early Settler/Farming sites/isolates. None of these resources are National Register-Eligible. No TCPs or Manhattan Project/Cold War Era Landscape resources are known within the ERDF EU.

Three archaeological isolates, one archaeological site representing the Native American Pre-contact and Ethnographic, and the Manhattan Project/Cold War landscapes are located within 500 meters of the ERDF EU. The Manhattan Project/Cold War Era Atmospheric Dispersion Grid archaeological site has been determined to be National Register-eligible. Additionally the 201W Instrument Building is a contributing property within the Manhattan Project/Cold War Landscapes.

While the geomorphologic composition suggest a potential for buried archaeological materials the great distance from a permanent water source as well as the extensive earthworks, evidence of ground disturbances, and inferences based on historic map data suggest that the potential for intact

archaeological resources associated with all three landscapes to be present within the EU is low. 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, Prosser Cemetery Association, Franklin County Historical Society, the Reach, and the B-Reactor Museum Association) may need to occur. Indirect effects are always possible when TCPs are located in the general vicinity. Consultation with Hanford Tribes will 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

The inventory in ERDF is well characterized through the WMIS. The final disposition is expected to have the inventory summarized in Table H.8-3. (WCH 520).

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Legacy Source Sites

Not Applicable

Vadose Zone Contamination

None from ERDF

Groundwater Plumes

None from ERDF

Facilities for D&D

Not applicable

Operating Facilities

See previous discussion in Part IV.

Detailed inventories are provided in Table H.8-4, Table H.8-5, and Table H.8-6. All values are to 2 significant figures. The source document should be consulted for greater precision data. The sum for each primary contaminant is shown in the first row. Table H.8-7 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.

Table H.8-4. Inventory of Primary Contaminants[a]

WIDS	Description	Decay Date	Ref	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			550	1,900	0.0	5,500	15,000	4,800	1,400	7,800	0.019
600-148	Burial Ground	2011	WCH 520 Rev 1	550	1,900	0.0	5,500	15,000	4,800	1,400	7,800	0.019

a. NR = Not reported

Table H.8-5. Inventory of Primary Contaminants (cont)[a]

WIDS	Description	Decay Date	Ref	Ni-59 (Ci)	Ni-63 (Ci)	Pu (total) (Ci)	Sr-90 (Ci)	Tc-99 (Ci)	U (total) (Ci)
All	Sum			190	14,000	5,500	11,000	21	100
600-148	Burial Ground	2011	WCH 520 Rev 1	190	14,000	5,500	11,000	21	100

a. NR = Not reported

Table H.8-6. Inventory of Primary Contaminants (cont)[a]

WIDS	Descrip-tion	Ref	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	NR	NR	NR	NR	NR	NR	200000
600-148	Burial Ground	WCH 520 Rev 1	NR	NR	NR	NR	NR	NR	NR	NR	NR	200000

a. NR = Not reported

Table H.8-7. Summary of the Evaluation of Threats to Groundwater as a Protected Resource from Saturated Zone (SZ) and Remaining Vadose Zone (VZ) Contamination associated with the Evaluation Unit

PC	Group	WQS	Porosity[a]	K_d (mL/g)[a]	ρ (kg/L)[a]	VZ Source M^{Source}	SZ Total M^{SZ}	Treated[c] M^{Treat}	VZ Remaining M^{Tot}	VZ GTM (Mm^3)	VZ Rating[d]
C-14	A	2000 pCi/L	0.23	0	1.84	---	---	---	---	---	ND
I-129	A	1 pCi/L	0.23	0.2	1.84	---	---	---	---	---	ND
Sr-90	B	8 pCi/L	0.23	22	1.84	---	---	---	---	---	ND
Tc-99	A	900 pCi/L	0.23	0	1.84	---	---	---	---	---	ND
CCl4	A	5 µg/L	0.23	0	1.84	---	---	---	---	---	ND
Cr	B	100 µg/L	0.23	0	1.84	---	---	---	---	---	ND
Cr-VI	A	48 µg/L[b]	0.23	0	1.84	---	---	---	---	---	ND
TCE	B	5 µg/L	0.23	2	1.84	---	---	---	---	---	ND
U(tot)	B	30 µg/L	0.23	0.8	1.84	---	---	---	---	---	ND

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

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 2015).

PART VI. POTENTIAL RISK/IMPACT PATHWAYS AND EVENTS

CURRENT CONCEPTUAL MODEL

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)

The final cover and the composite liner are the primary barriers to contaminant migration from ERDF. The thick vadose zone beneath ERDF is a secondary barrier to contaminant migration. Leakage from ERDF is expected to be less than 0.5 mm/yr, and most likely will be much lower.

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

Soils placed over and around disposed debris provide active and passive shielding during operations. The final cover provides active and passive shielding after closure.

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

Soils placed over and around disposed debris provide active and passive shielding during operations. The final cover provides active and passive shielding after closure.

3. *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 final cover and the composite liner are the primary barriers to contaminant migration from ERDF. The thick vadose zone beneath ERDF is a secondary barrier to contaminant migration. Leakage from ERDF is expected to be less than 0.5 mm/yr, and most likely will be much lower.

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

The liner system will degrade over time as antioxidants are depleted from the geomembrane, ultimately leading to stress cracking and potentially higher leakage rates. The geomembrane in the cover will also degrade due to antioxidant depletion, ultimately leading to higher percolation rates. The cover may also be degraded by catastrophic erosion events. Recent studies on geomembranes, however, indicate that degradation is unlikely to begin for at least 1000 yr after installation.

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

Contaminant migration to groundwater is the primary pathway for populations or resources at risk from ERDF.

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

Hundreds of years, if not longer.

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

Not at this time

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker

Workers involved in unloading, distribution, compaction, and grouting are at risk during operations due to contact with the waste or physical accidents associated with operation of machinery.

Co-Located Person (CP)

CPs are not directly exposed to the disposal operations because they are located 100 meters away from the periphery of ERDF, thereby precluding contact with the waste being disposed.

Public

There is no direct risk to the public beyond those associated with impacts to groundwater that might ultimately be **used by the public.**

Groundwater

It is assumed that the waste in ERDF is contained within a RCRA Subtitle C landfill. Any waste outside of the ERDF facility is assumed negligible. This leads to a ND rating.

Columbia River

The Columbia River will not be impacted by EDRF due to the distance between the facility and the river. It is assumed that the waste in ERDF is contained within a RCRA Subtitle C landfill. Any waste outside of the ERDF facility is assumed negligible. This leads to a ND rating.

Ecological Resources:

- The majority of the area within the 424.2 acres of the ERDF EU is classified as level 0 (365.4 ac), with only 31.4 acres classified as level 3 or higher biological resources.
- Remediation actions undertaken within the ERDF EU boundary would result in no more than an approximate 1% (31.4 ac) reduction of level 3 or higher biological resources within a 2.1 km radius.
- Areas of habitat within the ERDF EU are located near its perimeter and are contiguous with surrounding habitats located in the adjacent landscape buffer; the removal of the small amount of habitat within the EU would not be expected to significantly affect habitat connectivity.
- Future plans to expand ERDF by adding new landfill cells have the potential to significantly affect those level 3 or higher biological resources immediately adjacent to the EU.

Cultural Resources:

- There are no known TCPs within the EU.
- Six cultural resources have been documented in the EU. These resources include archaeological sites and isolates representing the pre-contact, ethnographic, and historic era landscapes. Specifically, there are two Native American Pre-contact and Ethnographic landscape associated archaeological sites and four pre-Hanford Early Settler/Farming sites. Each of these six sites has been determined to be not eligible for listing on the NRHP.

Archaeological sites and TCPs located within 500 meters of the EU

- There are no known TCPs within 500 meters of the EU.
- Five additional cultural resources have been documented within 500-meters of the EU. These resources include archaeological sites and isolates representing the Native American Pre-contact and Ethnographic, and the Manhattan Project/Cold War landscapes.

- One contributing properties to the Manhattan Project and Cold War Era Landscape, the 201W Instrument Building (with no documentation required) is located within 500-meters of the ERDF Evaluation Unit:
- The Hanford Atmospheric Dispersion Test Facility is a National Register-eligible archaeological site, that is associated with the Manhattan Project and Cold War Era Landscape

Closest Recorded TCP

- There are 2 recorded TCPs that are known to be visible from the ERDF EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

ERDF is intended for permanent disposal and isolation of wastes. No clean up approaches are needed after the facility is filled and the final cover is installed. The only "clean up" activity is installation of the final cover.

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

The inventory summarized in Table H.8-1 will remain when ERDF is closed and the final cover is installed.

Risks and Potential Impacts Associated with Cleanup

The risks during operations are the same as those currently existing at ERDF, which is an operating facility.

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

Workers (directly involved)

The worker risks are similar to those during operations, except radionuclide exposure is eliminated because of shielding provided by interim cover soil over waste.

Co-located (CW)

Same as worker. CW risk would be due to accident with machinery operating around ERDF.

Public

Same at risk as in existing condition (operating facility).

Groundwater

Same at risk as in existing condition (operating facility). It is assumed that the waste in ERDF is contained within a RCRA Subtitle C landfill. Any waste outside of the ERDF facility is assumed negligible. This leads to a ND rating.

Columbia River

Same at risk as in existing condition (operating facility). The Columbia River will not be impacted by ERDF due to the distance between the facility and the river. It is assumed that the waste in ERDF is contained within a RCRA Subtitle C landfill. Any waste outside of the ERDF facility is assumed negligible. This leads to a ND rating

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. 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 for re-vegetation requires a system of pumps and water, resulting in physical disturbance. Use of non-specific herbicides 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 result in positive results. Irrigation for re-vegetation requires a system of pumps and water, resulting in physical disturbance. This is used to re-establish native plant species. 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. 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. Construction of staging areas, caps and other containment systems, and/or soil removal activities are assumed to have been cleared for cultural resources and any adverse effects would be resolved and/or mitigated. If staging areas have not been reviewed for cultural resources this could result in compaction and disturbance to the soil surface and throughout the subsurface leading to permanent adverse effects to the surface and subsurface integrity of an archaeological site by destroying the stratigraphic relationships of the soil, archaeological artifacts and features as well as all proximal information associated with archaeological artifacts and features. Construction of staging areas can have direct effects to TCPs including destroying physical attributes of TCP, destruction of culturally important plants, alteration of the setting and introduction of noise and vibrations also altering the setting. These actions may interfere with traditional uses of TCP. Otherwise, capping could result in compaction and

compression of artifacts by destroying the stratigraphic relationships of the soil, archaeological artifacts and features as well as all proximal information associated with archaeological artifacts and features. Direct effects to TCPs include permanent alteration of physical setting and design of TCP, permanent viewshed impacts and possibly permanent interference with traditional use of TCP. 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. During construction, indirect effects could result in temporary auditory, visual and vibrational effects. 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

None

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

ERDF is an operating facility that will operate until remediation is completed at Hanford. The near-term risks are the same as existing risks.

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

Facility Worker

None

Co-Located Person (CP)

None

Public

There is no direct risk to the public beyond those associated with impacts to groundwater that might ultimately be used by the public.

Groundwater

It is assumed that the waste in ERDF is contained within a RCRA Subtitle C landfill. Any waste outside of the ERDF facility is assumed negligible. This leads to a ND rating.

Columbia River

The Columbia River will not be impacted by ERDF due to the distance between the facility and the river. It is assumed that the waste in this EU is contained within a RCRA Subtitle C landfill. Any waste outside of the ERDF facility is assumed negligible. This leads to a ND rating.

EU Designation: CP-OP-6 (ERDF)

Ecological Resources

Personnel, car, and pick-up truck traffic through non-target and remediated areas will likely no longer cause an effect on the ecological resources, unless heavy traffic caused ruts. If alien/exotic species became established during remediation, their presence could continue to affect the ecological resources.

Cultural Resources

Personnel, car and truck traffic on paved roads will likely have no direct effects on the cultural resources assuming the resources were not disturbed during remediation.

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

All waste disposed in ERDF will remain in place in perpetuity. The long-term risk is the same as the post-closure risk.

PART VII. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

None

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