APPENDIX H.12

LERF + ETF (CP-OP-11, CENTRAL PLATEAU)
EVALUATION UNIT SUMMARY TEMPLATE

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PART I. EXECUTIVE SUMMARY

EU LOCATION

200 East Area

RELATED EUS

CP-OP-10 (242-A Evaporator), CP-OP-12 (TEDF), CP-OP-13 (SALDS)[1], CP-OP-06 (ERDF)

PRIMARY CONTAMINANTS, CONTAMINATED MEDIA AND WASTES

To keep LERF below the Category 3 Nuclear Facility threshold (therefore the hazard category is determined to be a "Radiological Facility") with respect to radioactivity of various radionuclides, the radioactive inventory within the LERF basins at any one time must remain below the threshold planning quantities (TPQs)[2]. Three different liquids either present in a LERF basin or available for transfer to LERF are 242-A Evaporator process condensate ("PC"), onsite additions, and ETF recycle liquids[3]. The ETF contains the same primary contaminants as LERF since ETF is fed liquid waste from LERF. There are stored drums of treated dried powder produced by ETF's treatment processes and are orders of magnitude lower than the Category 3 Nuclear Facility thresholds and are considered LLW.

BRIEF NARRATIVE DESCRIPTION

The ETF, LERF, and TEDF are the three primary facilities for processing Hanford site liquid waste. The facilities were constructed to eliminate direct dangerous and hazardous waste discharge to Hanford soils and groundwater. Collectively, they store, treat, and dispose of large volumes of liquid waste containing high levels of chemical contamination, and low levels of radioactive contamination received from a variety of on-site projects and programs.[4]

The Liquid Effluent Retention Facility (LERF) was designed to store 242-A Evaporator process condensate and dilute liquid waste streams from other Hanford Sites as low-level liquid waste in the interim prior to treatment at the 200 East Area Effluent Treatment Facility (ETF). An additional transfer system to LERF is available for future use by the Hanford Site Waste Treatment Plant. LERF has been previously classified as a Category 3 Nonreactor Nuclear Facility. Category 3 Nuclear Facilities have the potential for significant localized (radiological) consequences. However, based on current facility design, operations, and radioactive constituent concentrations, the LERF does not have the potential for significant localized (radiological) consequences and is categorized as a "less than Category 3 Nuclear Facility" (often referred to as a "Radiological Facility") based on the final hazard categorization analysis documented in

1 Taken from the Datasheet posted on the CRESP Sharepoint site (https://spteams1.pnnl.gov/sites/HSWRR/Final%20Report/Data%20Sheets/CP-OP-16_ETF_LERF.pdf)

2 HNF-SD-WM-SAD-040, Rev 2, pg. 1-1

3 HNF-SD-WM-SAD-040, Rev 2, pg. 4-23 and 4-33

4 RPP-RPT-5827, Rev 0, pg. E-1

the *Liquid Effluent Retention Facility Final Hazard Category Determination* (HNF-SD-WM-SAD-040, Rev 2). [3,11,5]

The Effluent Treatment Facility (ETF) was constructed in the early 1990's and went into operation in 1995[6]. ETF receives liquids from the LERF. The ETF is also categorized as a "Less than Category 3 Nuclear Facility", or "Radiological Facility" according to the ETF Final Hazard Category Determination (WHC-SD-C018H-HC-002, Rev1).[7] A number of treatment processes at ETF remove radioactive and hazardous contaminants from waste water. Once the waste water has been treated through ETF, it is stored until tests confirm that various radioactive and hazardous contaminants have been removed or lowered to levels that make them acceptable for discharge to a state-approved disposal site in Hanford's 200 Area. Solids generated by ETF processes are drummed and disposed at the Environmental Restoration and Disposal Facility (ERDF). ETF is a state RCRA-permitted facility. It treats up to 28 million gallons of waste water each year[8] but the stated maximum capacity is a 56-million-gallon per year design capacity.[6] ETF and LERF have been restarted in May 2016 after being shutdown because of the secondary treatment train heat exchanger failure. Summary Tables of Risks and Potential Impacts to Receptors

SUMMARY TABLES OF RISKS AND POTENTIAL IMPACTS TO RECEPTORS

Table H.12-1 provides a summary of the LERF & ETF EU nuclear and industrial safety related risks to humans and impacts to important physical Hanford site resources. Due to the exclusion of calculated unmitigated doses to human receptors within ETF's ASA, the risk ratings for the combined ETF & LERF EU are based on the provided doses within the LERF's ASA and Final Hazard Categorization. Both facilities are low-hazard and are categorized as Radiological Facilities.

Human Health

A Facility Worker is deemed to be an individual located anywhere within the physical boundaries or immediate areas around the outside the facility; a Co-located Person is an individual located 100 meters from the facility boundary; and Public is an individual located at the closest point on the Hanford Site boundary not subject to DOE access control. The nuclear related risks to humans are based on unmitigated (unprotected or controlled conditions) dose exposures expressed in a range of from "low" to "high" according to the consequence levels. The estimated mitigated exposure that takes engineered and administrative controls and protections into consideration, when this information is available, is shown in parentheses within Table H.12-1, "IS" denotes insufficient information is available to provide a rating.

Due to LERF being a Radiological Facility, the potential receptor types that are identified in DOE-STD-3009-2014 are not applicable to the safety documentation developed for the LERF within the Auditable Safety Analysis (ASA). The LERF ASA was completed in compliance to DOE standards DOE-STD-1027-92 and DOE-EM-STD-5502-94 in 2001[9] . Two distances (30m and 100m) are used as hypothetical locations

[5] HNF-SD-WM-SAD-040, Rev 2, pgs. iii-iv

[6] RPP-RPT-58275, Rev 0, pg. 3

[7] HNF-SD-ETF-ASA-001, Rev 4, pg. xi (pg. 16 of 146 of the PDF) and WHC-SD-C018H-HC-002, Rev1, pg. 8

[8] Hanford.Gov. (2015, Last Revised December 1, 2015). "Effluent Treatment Facility." Accessed January 21, 2016, from http://www.hanford.gov/page.cfm/ETF.

[9] The DOE Standard DOE-EM-STD-5502-94 (Hazard Baseline Documentation) was canceled effective October 2001 due to FY 2001 Sunset Review (http://energy.gov/ehss/downloads/doe-em-std-5502-94)

in which a human receptor would be exposed to the released material from a spray release or basin (pool) leakage from the LERF basins. The unmitigated doses to the hypothetical receptor at 30m east of the release was taken to be the "facility worker" receptor type to consistent with other evaluation unit (EU) assessments. It should be noted that LERF is unstaffed during normal or routine operations. With the exception of periodic sampling, surveillance, and maintenance activities, there are no operations personnel located at LERF.[15]

The radiological related risks to humans are based on unmitigated (unprotected or controlled conditions) dose exposures expressed in a range of from "low" to "high" according to the consequence level bins considered by the CRESP team. The estimated mitigated exposure that takes engineered and administrative controls and protections into consideration is shown in parentheses.

Due to the exclusion of calculated unmitigated doses to human receptors within ETF's ASA, the risk ratings for the combined ETF & LERF EU are based on the provided doses within the LERF's ASA and Final Hazard Categorization. Both facilities are low-hazard and are categorized as Radiological Facilities.

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[10]

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[10]

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

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

Table H.12-1. Risk Rating Summary (for Human Health, unmitigated nuclear safety basis indicated, mitigated basis indicated in parentheses (e.g., "High" (Low)).

Population or Resource		Evaluation Time Period: Active Cleanup (to 2064)	
		Current Condition: Stabilization & Deactivation	**From Cleanup Actions:** Final D&D[(c)]
Human Health	Facility Worker	***S&D***: Low (IS)	***Proposed method***: IS
	Co-located Person	***S&D***: Low (IS)	***Proposed method***: IS
	Public	***S&D***: IS (IS)	***Proposed method***: IS
Environmental	Groundwater[(a)]	Not Discernible (ND)	ND
	Columbia River[(a)]	ND	ND
	Ecological Resources[(b)]	ND to Low	No cleanup decisions have been made for this EU. Estimated to be Low to High
Social	Cultural Resources[(b)]	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown Indirect: None **Manhattan/Cold War:** Direct: None Indirect: Known	**Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown Indirect: None **Manhattan/Cold War:** Direct: None Indirect: Known

a. Threat to groundwater or the Columbia River from Group A or B primary contaminants (PCs) (Table 6-1, CRESP 2015) remaining in the vadose zone. There are also no Group C or D PCs in the vadose zone associated with this EU. In fact, there are no vadose zone inventories reported for this EU (i.e., operating facilities and basins isolated from the vadose zone during the evaluation period), and thus no threat to the vadose zone, groundwater, or the Columbia River.

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. (IS = Insufficient Information.)

c. Proposed method: Dependent on D&D Methods yet to be determined. (Unknown)

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

Current

An uncontrolled release at LERF of radioactive material could adversely affect human receptors located 30m and 100m away from the release of low-hazard material via either a pipe failure spray release or

basin leakage. The human receptor located 30m away was taken as the facility worker and could receive unmitigated doses of 4.16 rem and 3.95 rem, respectively. The human health rating is considered "Low" for facility worker if the unmitigated dose calculated is less than 5 rem. The unmitigated doses to the potential human receptor located 100m away was taken to be the co-located person receptor at LERF for the two accident scenarios are 1.85 rem and 1.77 rem, respectively and both resultant doses are considered "Low" is less than 5 rem. No unmitigated dose to the offsite member of the public is calculated.

Due to the exclusion of calculated unmitigated doses to human receptors within ETF's ASA, the risk ratings for the combined ETF & LERF EU are based on the provided doses within the LERF's ASA and Final Hazard Categorization. Both facilities are low-hazard and are categorized as Radiological Facilities.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Risks of potential cleanup approaches at LERF and ETF are dependent on D&D methods yet to be determined.

Groundwater, Vadose Zone, and Columbia River

There are no reported vadose zone inventories (i.e., reported inventories are in operating facilities and basins that are isolated from the environment during the evaluation period) and thus no significant threats to the vadose zone, groundwater, or the Columbia River for the purposes of this Review.

Ecological Resources

Current

2% of EU and 54% of the buffer area are level 3 or greater resources. Current risk is related to vehicle traffic and herbicide use that can impact the buffer. Black-tailed jack rabbit observed in the buffer and along edges of the EU.

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

Uncertainties in the remediation activities make it difficult to predict the extent and magnitude of impacts to the EU. Deposition of waste at the facility and future cleanup actions will increase truck traffic to the region. Increased traffic and herbicide application will impact level 3 resources in the buffer. Potential for subsurface contamination is high and thus require more excavation and backfill/revegetation. High impacts are likely if excavation is required because of heavy equipment and potential to introduce exotic species.

Cultural Resources

Current

The EU has been extensively disturbed. The entire EU has been inventoried for cultural resources. Geomorphology indicates a low potential to contain intact archaeological resources on the surface and/or subsurface. Traditional cultural places are visible from EU. One archaeological resource is located within 500 meters of the EU.

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

Risks and Potential Impacts from Selected or Potential Cleanup Approaches

No cleanup decisions have been made for the deep vadose zone, and archaeological investigations and monitoring may need to occur prior to remediation. The geomorphology indicates a high potential for intact archaeological resources.

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

Considerations for Timing of the Cleanup Actions

Unknown.

Near-Term, Post-Cleanup Risks and Potential Impacts

Near-term and post-cleanup risks are dependent on D&D methods yet to be determined.

PART II. ADMINISTRATIVE INFORMATION

OU AND/OR TSDF DESIGNATION(S)

Not Applicable

COMMON NAME(S) FOR EU

LERF: Liquid Effluent Retention Facility

ETF: Effluent Treatment Facility

KEY WORDS

LERF, ETF, Radiological Facility

REGULATORY STATUS: (RCRA, CERCLA, ROD IN DISPOSITION TABLE FOR MANY)

Regulatory basis

LERF: DOE Order 5481.1B[11]; DOE Order 5700.6C[12]; Washington Administrative Code (WAC) 246-247-030(21)[13], WAC 173-303[25], RCRA[12], and various Code of Federal Regulations (CFRs) including 10CFR830, Section 120[12] and 40CFR465[25].

ETF: RCRA containment and leak detection criteria are found in 40 CFR 264 (EPA 1980) and WAC 173-303, and criteria to process low-level waste streams below the requirements of secondary containment found in DOE Order 5820.2A. Design criteria are based on DOE Orders 6430. 1A and 5400.1. [14] Other appropriate codes, standards, regulations, guidelines, and orders pertinent to ETF are the following[14]:

11 HNF-SD-LEF-ASA-002, Rev. 2, Summary page of the report (page 8 of the PDF report)

12 HNF-SD-WM-SAD-040, Rev2, pg. 2-1

13 ECF-200E-13-0024, Rev. 0, pg. 1

14 HNF-SD-ETF-ASA-001, Rev4A, pg. 2-3

- DOE Order 5400.2A, *Environmental Compliance Issue Coordination*
- DOE Order 5400.5, *Radiation Protection of the Public and the Environment*
- DOE Order 5480.5, *Safety of Nuclear Facilities*
- DOE Order 5440. l C, *National Environmental Policy Act (DOE J 985a)*
- DOE Order 5480.3, *Safety Requirements for the Packaging of Hazardous Materials, Hazardous Substances, and Hazardous Wastes*
- DOE Order 5700.6C, *Quality Assurance*
- DOE-RL Order 4700 1*, Project Management Systems*
- DOE-RL Order 5480 IA*, Environment Safety and Health Program for DOE-RL Operations*
- DOE-RL Order 5480 48, *Environmental Protection Safety and Health Protection*
- *Standards for DOE-RL Operations*
- DOE RL Order 6430 IC*, Hanford Plant Standards (HPS) Program*
- DOE-RL Order 5480 7 A, *Fire Protection*
- DOE-RL Order 5480 10A, *Industrial Hygiene Program*
- DOE-RL Order 5440 IA*, Implementation of the National Environmental Policy Act*
- *at the Richland Operations Office*
- DOE-RL Order 5480 I IA, *Requirements for Radiation Protection*
- DOE-RL Order 5481 I, *Safety Analysis and Review System*
- WAC 173-201, *Water Quality Standards for Waters of the State of Washington*
- WAC 173-216*, Waste Discharge Permit*

Applicable regulatory documentation

The LERF is classified as a "Radiological Facility" based on the final hazard categorization analysis documented in the “Liquid Effluent Retention Facility Final Hazard Category Determination” (HNF-SD-WM-SAD-040).[15,16]

As discussed in “Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports” (DOE-STD-1027-92), 'Radiological Facilities' do not require a DOE Order 5480.23-compliant facility safety analysis report; however, radiological facilities are not exempt from other safety requirements. The format and content of this ASA report are based on guidance provided in DOE 5481. IB, “Safety Analysis and Review System”, DOE-EM-STD-5502-94, “DOE Limited Standard: Hazard Baseline Documentation, and Occupational Safety and Health Standards”, Process Safety Management [29 Code of Federal Regulations (CFR) 1910.119].[15]

The ETF stores a quantity of chemicals on-site that have the potential to cause water pollution if accidentally released. The Washington State Department of Ecology (Ecology) can require a facility to develop best management plans to prevent this accidental release [Section 402(a)(1) of the Federal Water Pollution Control Act (FWPCA) and RCW 90.48.080]. USDOE developed a plan for preventing the accidental release of pollutants to state waters and for minimizing damages if such a spill occurs.[17]

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15 HNF-SD-WM-SAD-040, Rev2, pg. 2-1

16 HNF-SD-LEF-ASA-002, Rev. 2, pg. 1-1

17 Pg. 20 of Washington State Department of Ecology (2014). Fact Sheet for State Waste Discharge Permit ST0004500 - Effluent Treatment Facility and State Approved Land Disposal Site **(URL:** http://www.ecy.wa.gov/programs/nwp/permitting/HDWP/Rev/8c/Draft/9_8_14/ETF/fact.pdf): 33 pages

Applicable Consent Decree or TPA milestones

TPA Milestone M-026-07C "*Submit to Environmental Protection Agency and Ecology an evaluation of development status of tritium treatment technology that would be pertinent to the cleanup and management of Tritiated Waste Water (e.g., the 242-A Evaporator Process Condensate Liquid Effluent) and tritium contaminated groundwater at the Hanford site. (03/31/2014 And Every Five Years Thereafter)".* The milestone was completed for 2014. The process required interface and input from the CHPRC Soil and Groundwater organization. Additionally, annual commitment C-026-07 requires reviewing the M-026-07 report to determine if new technologies are available. The report review is transmitted to the regulator by letter and is due annually except in years when M-026-07 is due.[18]

The construction and operation of the ETF/SALDS was incorporated as a portion of Milestone 17 in the 1989 Hanford Federal Agreement and Consent Order (Tri-Party Agreement) between the Permittee, the U.S. Environmental Protection Agency, and Ecology. No major modifications have occurred at ETF/SALDS since operations began.[19]

RISK REVIEW EVALUATION INFORMATION

Completed

August 2, 2016

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Ratings/Impacts Reviewed by

Henry Mayer

PART III. SUMMARY DESCRIPTION

CURRENT LAND USE

The current land use is Industrial for the 200 East Area of the DOE Hanford Site. Both LERF and ETF are part of the 200 East Area.

DESIGNATED FUTURE LAND USE

The DOE preferred alternative is the Industrial Exclusive Use Category for the LERF and ETF areas within the 200 East area[20].

[18] RPP-RPT-58275, Rev 0, pg. 26

[19] Department of Ecology State of Washington (2014). Fact Sheet for State Waste Discharge Permit ST0004500 - Effluent Treatment Facility and State Approved Land Disposal Site **(URL:** http://www.ecy.wa.gov/programs/nwp/permitting/HDWP/Rev/8c/Draft/9_8_14/ETF/fact.pdf): 33 pages.

[20] DOE-EIS-0222 CLUP-EIS Summary document, Figure S-10 on page 45/131

PRIMARY EU SOURCE COMPONENTS

Groundwater Plumes

Not applicable

Operating Facilities

The ETF, LERF, and TEDF are the three primary facilities for processing Hanford site liquid waste. The facilities were constructed to eliminate direct dangerous and hazardous waste discharge to Hanford soils and groundwater. Collectively, they store, treat, and dispose of large volumes of liquid waste containing high levels of chemical contamination, and low levels of radioactive contamination received from a variety of on-site projects and programs.[21]

based on current facility design, operations, and radioactive constituent concentrations, the LERF does not have the potential for significant localized (radiological) consequences and is categorized as a "less than Category 3 Nuclear Facility" (often referred to as a "Radiological Facility") based on the final hazard categorization analysis documented in the *Liquid Effluent Retention Facility Final Hazard Category Determination* (HNF-SD-WM-SAD-040, Rev 2). [3,11,22]

To keep LERF below the Category 3 Nuclear Facility threshold (therefore the hazard category is determined to be a "Radiological Facility") with respect to radioactivity of various radionuclides, the radioactive inventory within the LERF basins at any one time must remain below the threshold planning quantities (TPQs)[23]. Three different liquids either present in a LERF basin or available for transfer to LERF are 242-A Evaporator process condensate ("PC"), onsite additions, and ETF recycle liquids[24]. The ETF contains the same primary contaminants as LERF since ETF is fed liquid waste from LERF. There are stored drums of treated dried powder produced by ETF's treatment processes and are orders of magnitude lower than the Category 3 Nuclear Facility thresholds and are considered LLW.

LOCATION AND LAYOUT MAPS

The LERF is located in the 200 East Area approximately 0.75 miles north of the 242-A Evaporator (242-A) and south of the 200 Area ETF. The LERF consists of three identical surface impoundments (basins) constructed with primary and secondary composite liners, a leachate detection, collection, and removal systems between the liners, and a floating cover.[25]

The ETF is located in the northeast corner of the 200 East area near LERF and approximately 1 mile north of the 242-A Evaporator. The selection of the ETF site was based on a downgradient location (see Figure H.12-2), the need to coordinate the operation of the ETF with interfacing facility operations to minimize the length of pipe required to transfer ETF feed streams, provide the use of common utilities and accommodate and future expansion of the ETF. [26]

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21 RPP-RPT-5827, Rev 0, pg. E-1

22 HNF-SD-WM-SAD-040, Rev 2, pgs. iii-iv

23 HNF-SD-WM-SAD-040, Rev 2, pg. 1-1

24 HNF-SD-WM-SAD-040, Rev 2, pg. 4-23 and 4-33

25 HNF-SD-WM-SAD-040, Rev 2, pg. 2-2 through 2-14

26 HNF-SD-ETF-ASA-001, Rev 4, pg. 1-2

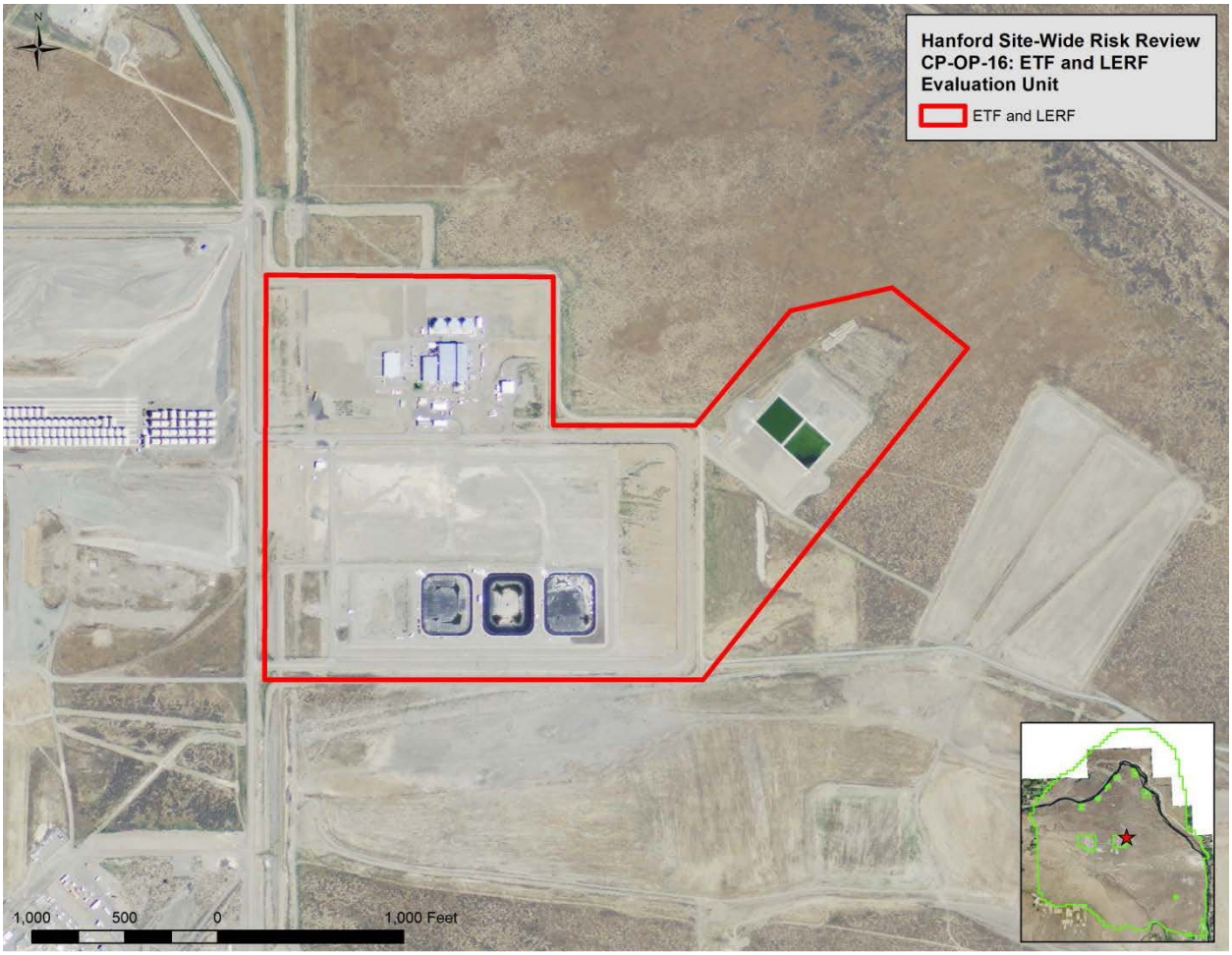

Figure H.12-1. CP-OP-16 (ETF and LERF) Site Location Map

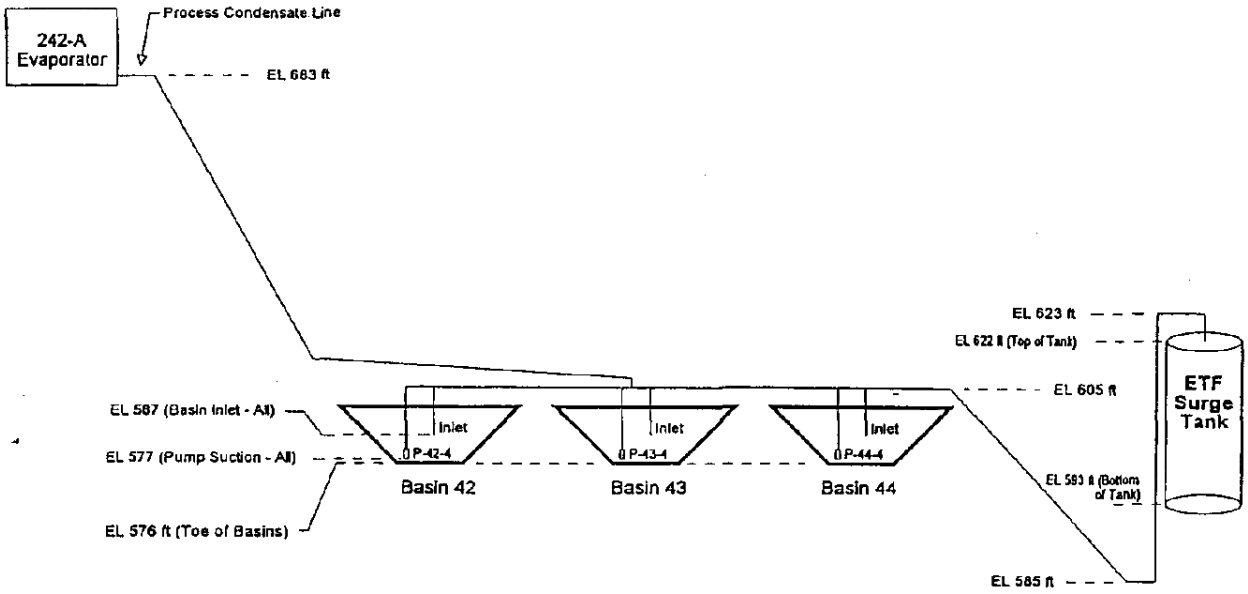

Figure H.12-2. LERF Hydraulic Elevations with Pipe Transfer Connections originating at the 242-A Evaporator and ending at the ETF Surge Tank[27]

[27] HNF-SD-WM-SAD-040, Rev 2, Figure 2, pg. 2-7

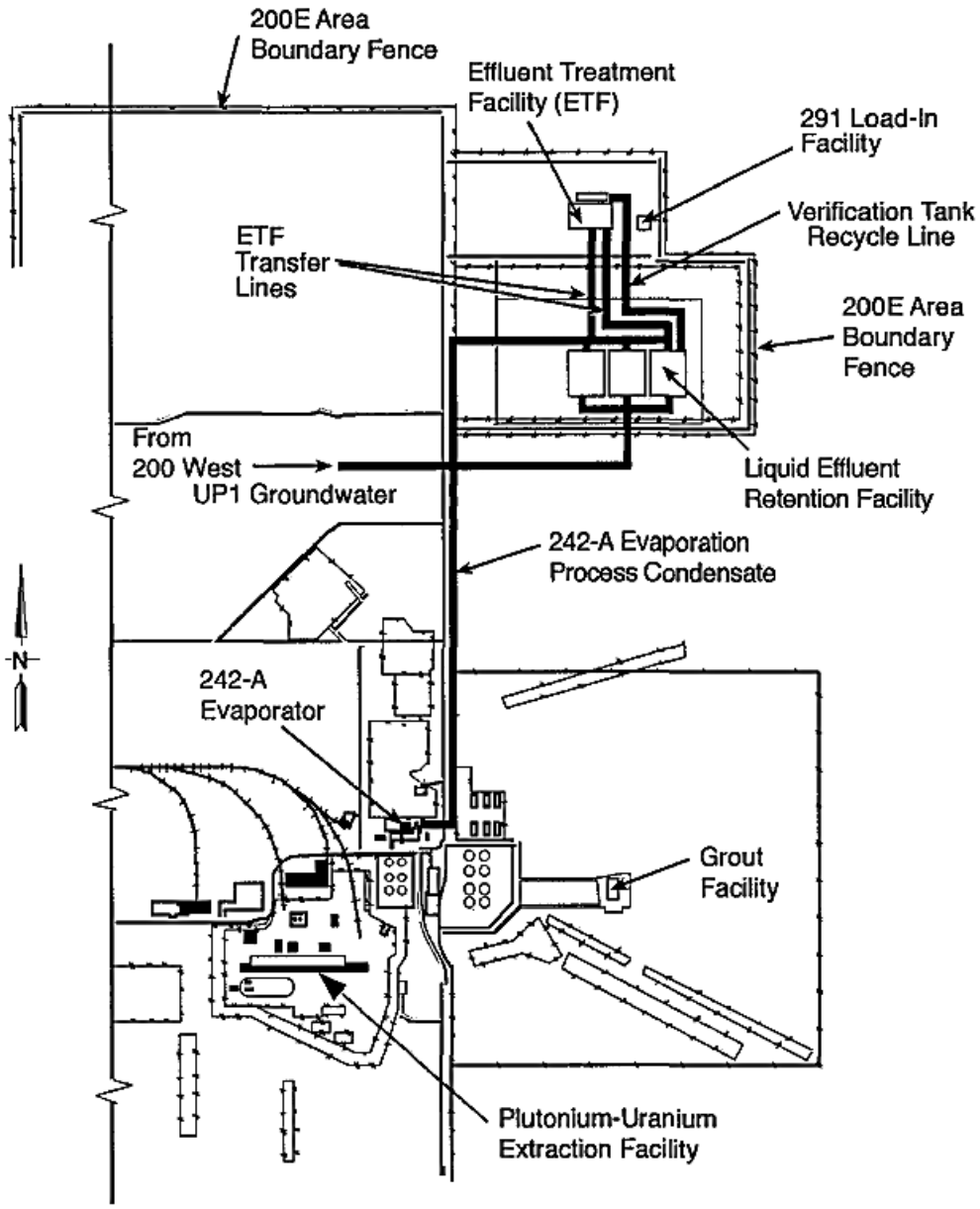

Figure H.12-3. LERF and Liquid Transfer Systems between 242-A Evaporator, ETF, and 200West UP1 Groundwater[28]

28 HNF-SD-LEF-ASA-002, Rev 2, Figure 2-1, pg. 2-4 (*Installed Waste Treatment Plant Piping routes are not shown since the routes are not active)

Shown below in Figure H.12-4 and Figure H.12-5 is the LERF Floating Cover system and the .Each basin has a multi-layer liner system and a High-Density Polyethylene floating cover. The cover is suspended by a cable system anchored to I-beam posts around the basin perimeter[29]

Figure H.12-4. LERF Floating Cover[30]

Figure H.12-5. LERF Floating Cover Support System[31]

[29] RPP-RPT-58275, Rev 0, pg. 15 and pg. 16

[30] RPP-RPT-58275, Rev 0, Figure 2-14, pg. 15

[31] RPP-RPT-58275, Rev 0, Figure 2-15, pg. 16

Figure H.12-6. ETF Building Image[32]

[32] Hanford.Gov. (2015, Last Revised December 1, 2015). "Effluent Treatment Facility." Accessed January 21, 2016, from http://www.hanford.gov/page.cfm/ETF.

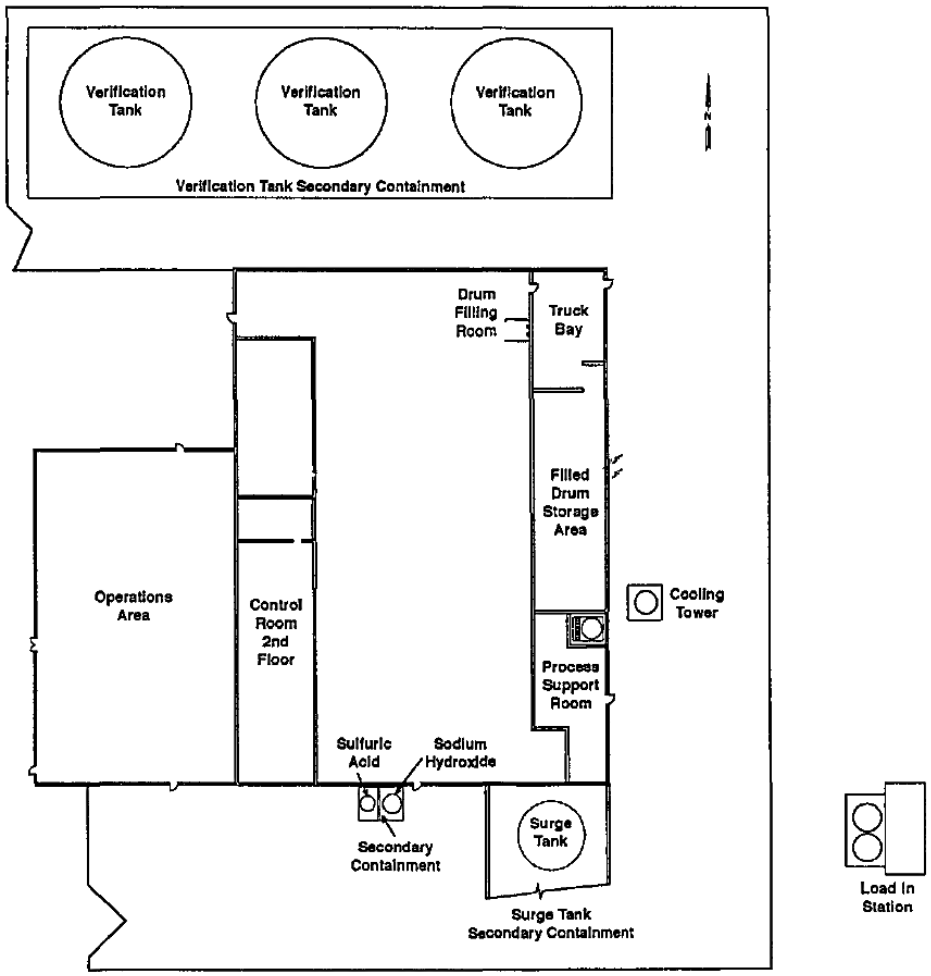

Figure H.12-7. ETF Building Layout[33]

PART IV. UNIT DESCRIPTION AND HISTORY

EU FORMER/CURRENT USE(S)

The Liquid Effluent Retention Facility (LERF) was designed to store 242-A Evaporator process condensate and dilute liquid waste streams from other Hanford Sites as low-level liquid waste in the interim prior to treatment at the 200 East Area Effluent Treatment Facility (ETF). An additional transfer system to LERF is available for future use by the Hanford Site Waste Treatment Plant. LERF began operating in April 1994 and is designed for a 20-year life. [34]

LERF has been previously classified as a Category 3 Nonreactor Nuclear Facility. Category 3 Nuclear Facilities have the potential for significant localized (radiological) consequences. However, based on current facility design, operations, and radioactive constituent concentrations, the LERF does not have

[33] HNF-SD-ETF-ASA-001, Rev 4, Figure 2-1, pg. F2-1

[34] RPP-RPT-58275, Rev 0, pg. 16

the potential for significant localized (radiological) consequences and is categorized as a "Radiological Facility" based on the final hazard categorization analysis documented in the *Liquid Effluent Retention Facility Final Hazard Category Determination* (HNF-SD-WM-SAD-040, Rev 2). [11,35]

The Effluent Treatment Facility (ETF) is designed to treat low activity radioactive process condensate to produce an effluent suitable for discharge to a State Approved Land Disposal Site (SALDS). ETF and SALDS began operations in 1995.[36] The process systems employed at ETF consist of two treatment trains and their supporting systems. In the primary treatment train, influent is filtered to remove solids and passed through an ultraviolet oxidation process to decompose any small quantities of organic contamination. The influent is further treated through a reverse osmosis system for further removal of dissolved solids material. In the secondary treatment train, the waste from the primary treatment train is processed through an evaporator system and thin film dryer to isolate and condense ammonia salts and other residual solids. The powder from the thin film dryer is packaged in SS-gal. (208-L) drums at a drum filling and handling station. A maximum of 720 filled drums may be stored at the ETF.[37]

OPERATING FACILITIES

1. Processes that produced the radioactive material and waste contained in the facility

No operational processes originating at LERF produced the radioactive material at LERF. Transferred low-level liquid wastes (process condensate) from the 242-A Evaporator process and other Hanford sites were the sources of radioactive material and waste contained in the facility.

ETF: The ETF processes and reduces the concentration of contaminants including ammonia, residual organics and dissolved radionuclides to levels allowing for direct disposal of the treated liquid effluent to the State Approved Land Disposal Site (SALDS) in the 600 Area north of 200W. Liquid waste streams managed through the ETF Load-In Facility include: Mixed Waste Burial Trench leachate, AZ-301 condensate, Perched Water, and miscellaneous liquid waste that meet acceptance criteria[38].

2. Primary radioactive and non-radioactive constituents that are considered risk drivers

LERF & ETF: Transferred low-level liquid wastes (process condensate) from the 242-A Evaporator process and other Hanford sites were the sources of radioactive material and waste contained in the facility.

3. Containers or storage measures are used for radioactive materials at the facility

LERF: The LERF consists of three identical surface impoundments (basins) constructed with primary and secondary composite liners, a leachate detection, collection, and removal system between the liners, a floating cover, piping and pumps, change trailer, electrical power substation, security fencing, and an instrument building. The LERF consists of three 29.5-million liter (7.8-million gallon) basins located on a 16-hectare (39-acre) site east of the 200 East Area. The process condensate from the 242-A Evaporator, and other low-level liquid waste streams for further treatment at the ETF are stored in one or more of

[35] HNF-SD-WM-SAD-040, Rev 2, pgs. iii-iv

[36] Pg. 7 of the report: Department of Ecology State of Washington (2014). Fact Sheet for State Waste Discharge Permit ST0004500 - Effluent Treatment Facility and State Approved Land Disposal Site **(URL:** http://www.ecy.wa.gov/programs/nwp/permitting/HDWP/Rev/8c/Draft/9_8_14/ETF/fact.pdf): 33 pages.

[37] WHC-SD-C018H-HC-002, Rev 1, pg. 2

[38] RPP-RPT-58275, Rev 0, pg. 3

the basins. The LERF can store up to 88.5 million liters (23.4 million gallons) of waste. The low radiological activity and low concentrations of toxicological materials present at the LERF preclude the need for shielding or special toxicological design features [12].

ETF: Liquids incoming from the LERF are transported through established pipelines. Once the process condensate is treated (originating from the double shell tanks and 242-A Evaporator), a maximum of 720 filled drums may be stored at the ETF that hold the condensed ammonia salts and other residual solids from the evaporator (primary treatment train).[39]

4. Classification of radioactive material and waste contained or stored within the facility

ETF & LERF: low-activity radioactive liquid waste and low-level mixed wastes (RCRA waste). The dried powder waste is considered LLW.[40]

5. Average and maximum occupational radiation doses incurred at the facility

No specific information was available regarding ETF and LERF operations. Site-wide dose rate levels are provided in the Hanford Sitewide Environmental Report for Calendar Year 2014 [DOE/RL-2014-52]. Dose rate levels measured during 2014 in the 200 East and 200 West Areas were generally unchanged compared to 2013 [41] and were approximately 100 mrem per individual in the year 2014.

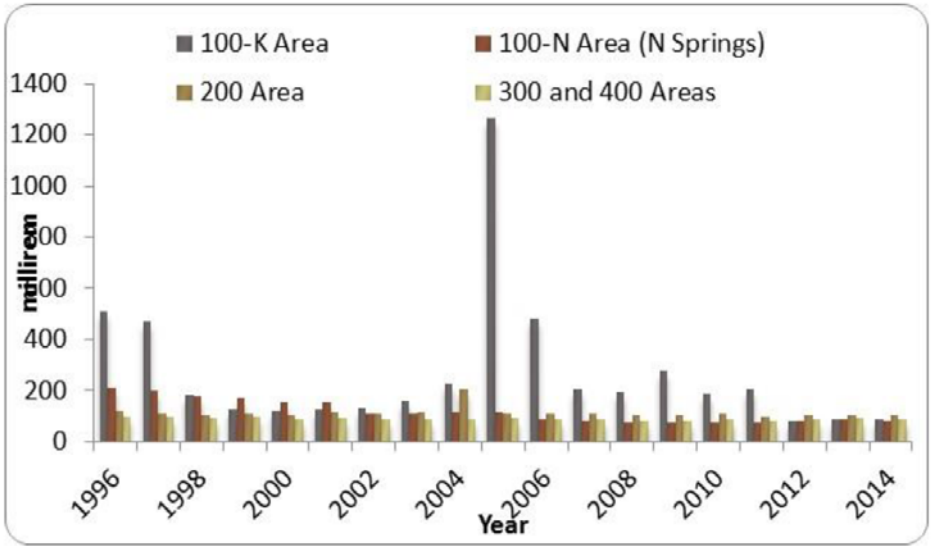

Figure H.12-8. Average Thermoluminescent Dosimeter Results from year 1996 to 2014[42]

6. Processes and operations conducted within the facility

[39] WHC-SD-C018H-HC-002, Rev 1, pg. 2. Ammonia concentrations (originating in the double shell tanks and subsequently 242-A Evaporator operations) were determined to be a dangerous waste stream and must be treated before discharge to SALDS [HNF-SD-ETF-ASA-001, Rev 4, pg. 1-1]

[40] HNF-SD-ETF-ASA-001, Rev 4, pg. 1-3 through pg. 1-4

[41] DOE/RL-2014-52, pg. 4.3

[42] DOE/RL-2014-52, Figure 4.1., pg. 4.3

LERF: Interim storage of transferred low-level liquid wastes (process condensate) from the 242-A Evaporator process and other Hanford sites were the sources of radioactive material and waste contained in the facility before being treated at the ETF.

ETF: The ETF process is designed to treat low activity radioactive process condensate to produce an effluent suitable for discharge to a State Approved and Disposal Site (SALDS). The process systems consist of two treatment trains and their supporting systems. In the primary treatment train, influent is filtered to remove solids and passed through an ultraviolet oxidation process to decompose any small quantities of organic contamination. The influent is further treated through a reverse osmosis system for further removal of dissolved solids material. In the secondary treatment train, the waste from the primary treatment train is processed through an evaporator system and thin film dryer to isolate and condensed ammonia salts and other residual solids. The powder from the thin film dryer is packaged in SS-gal. (208-L) drums at a drum filling and handling station. A maximum of 720 filled drums may be stored at the ETF.[43] Remaining liquids from the ETF secondary treatment train accumulate in any of the three 650,000-gallon verification tanks. If verification tank contents are shown via sampling and analysis to be out of compliance of the State Discharge Permit issued by the State of Washington, then the contents of that tank are re-routed through the ETF for further treatment. [44]

[43] WHC-SD-C018H-HC-002, Rev 1, pg. 2

[44] Pg. 8 of Department of Ecology State of Washington (2014). Fact Sheet for State Waste Discharge Permit ST0004500 - Effluent Treatment Facility and State Approved Land Disposal Site **(URL:** http://www.ecy.wa.gov/programs/nwp/permitting/HDWP/Rev/8c/Draft/9_8_14/ETF/fact.pdf): 33 pages

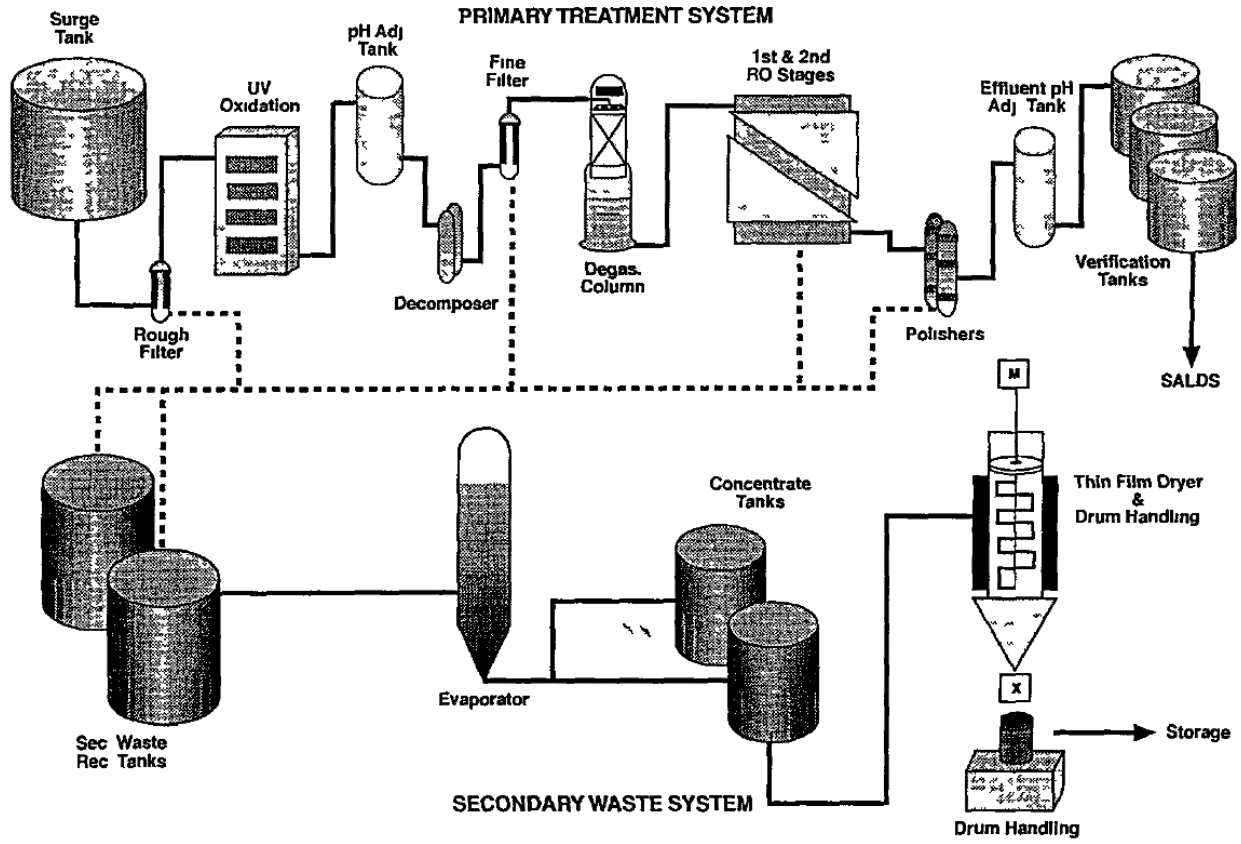

Figure H.12-9. ETF Process System Flow Diagram[45]

An ETF process engineer maintains a spread sheet that shows historical ETF processing volumes and rates, ETF projected processing rates, and projected waste stream volumes to be received into each LERF basin. The historical ETF processing rates for the last three years are summarized in the following table (Table H.12-2). [46] The facility was designed for a 150gpm flow rate and to support a total operating efficiency of 72 % during the initial two years of treatment system operation. The functional design criteria document WHC-SD-C018-FDC-001 "Project C-018H, 242-A Evaporator/Purex Plant Condensate Treatment Facility" states these criteria. Due to the thin film dryer operation inefficiency, the need for frequent filter changes, back flushing, preventative maintenance, calibrations, and corrective maintenance the process engineer conservatively assumes the following processing rates (Table H.12-3)

[45] HNF-SD-ETF-ASA-001, Rev 4, Figure 2-4, pg. F2-4

[46] RPP-RPT-58275, Rev 0, pg. 26

Table H.12-2. ETF Historical Processing Rates (2011 – 2013)[47]

Basin No.	Low Rate, gpd	High Rate, gpd
42	46,008	84,859
43	41,818	129,605
44	41,040	51,710

Table H.12-3. Estimated ETF Processing Rates[48]

Basin No.	Waste Stream	Rate, gpm	Rate, gpd
42	242-A & AZ Condensate	42.6	61,344
43	ERDF Leachate	28.5	41,040
44	ERDF Leachate	28.5	41,040

7. Process flow of material into and out of the facility

The upstream LERF boundary includes the transfer line from the 242-A Evaporator. The LERF downstream envelope is bounded by isolation valves 60M-4A, 60M-4B, and 60N-Ol located in the three transfer lines leading to/from the ETF. The LERF boundary does not include the transfer line from the UPI Groundwater transfer facility. The LERF boundary for the groundwater is a set of sample risers, SR-42-5, SR-43-5, and SR-44-5 (See Figure H.12-2 and Figure H.12-3 in Part II).

Waste water may be off-loaded from tank trucks or other containers directly to the ETF or LERF via the ETF Load-in Station. Off-loaded waste water may also be transferred to storage tanks before it is transferred via a pipe-in-pipe system to LERF for storage or the ETF for treatment. Waste may also be transferred between containers and tank trucks prior to transfer to storage tanks, ETF or LERF[49].

The ETF has multiple outflow streams that are then transferred to other facilities for disposal. Resultant municipal waste water (non-dangerous non-RCRA, and non-radioactive) is transferred to the TEDF (Treated Effluent Disposal Facility). Low-activity liquid mixed wastes are transferred via piping to SALDS for disposal through the soil column. Dried solids resulting from the ETF treatment trains will be packaged in 55-gallon drums and temporarily stored within the ETF (see Question 6, above). To keep the inventory below the required thresholds, two methods will be used: (1) Poor to any batch of wastewater being accepted at the ETF, radionuclide concentrations will be determined and failed samples will require originating producing facilities to adjust effluent to concentrations allowed at ETF, (2) accumulated inventory at ETF will be controlled by shipping 55-gallon drums of powdered waste[50] to the Central Waste Complex (CWC)[51] (or to the Environmental Restoration Disposal Facility [ERDF]).[52]

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[47] RPP-RPT-58275, Rev 0, Table 3-2, pg. 26

[48] RPP-RPT-58275, Rev 0, Table 3-3, pg. 26

[49] HNF-SD-LEF-ASA-001, Rev 4A, pg. 2-12 and HNF-SD-ETF-ASA-001, Rev 4, pg.1-2 and 1-3.

[50] It was evaluated if criticality control measures were required at the ETF for the plutonium and/or uranium content in dried solids (powder) stored in 55-gallon drums. It was calculated and found that the expected content within the drums being lower than the thresholds for requiring criticality control measures. The expected radioactivity of individual radionuclides per drum was estimated and listed in . The sections describing Pu and U

8. Potential effects of potential delays on the processes, operations, and radioactive materials in the facility

Any delays in accepting low-level liquid wastes at LERF would delay operations upstream and downstream including 242-A Evaporator/treatment of material sourced from the double-shell tanks and at ETF, respectively. ETF and LERF have been restarted in May 2016 after being shutdown because of the secondary treatment train heat exchanger failure.

9. Other facilities or processes that are involved in the flow of radioactive material into and out of the facility

LERF & ETF: The 242-A Evaporator is used to reduce the volume of waste stored in double-shell storage tanks through a process of evaporative concentration This process creates two primary waste streams a concentrated stream (which is routed back to double-shell tanks for storage) and a process condensate (PC) stream. To support the restart of the 242 A Evaporator, LERF has been constructed to provide *Resource Conservation and Recovery Act* permittable interim storage of the PC from the 242-A Evaporator LERF will be used m the future for staging PC, recycle of ETF dischargeable effluents to accomplish flushing both at LERF and the ETF, and storage of other waste streams prior to treatment at the ETF.[53]

10. Shipping of material

LERF: See Questions 7 and 9, above.

ETF: See Questions 6 and 7, above.

11. Infrastructure considered a part of the facility

LERF: See Question 3, above.

ETF: The ETF is a 4,100-m^2 (44,000-ft^2) facility divided into the following three distinct areas[37]:

- Process Area- primary treatment train, secondary treatment train, and drum handling/storage area.
- Operations Area- control room, heating, ventilating, and air conditioning room, and support offices.
- External Areas- with support systems (cooling tower, truck off-loading station, etc.).

The main ETF building also contains a chemical makeup and storage area, secondary waste treatment and storage systems, and off gas and ventilation systems. There also are various support systems including fire protection communications, sanitary and raw water, and electrical systems[54].

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limits requiring criticality control measures are found within the ETF ASA (HNF-SD-ETF-ASA-001, Rev 4, Section 4, pg. 4-2 through pg. 4-3.)

51 HNF-SD-ETF-ASA-001, Rev 4, pg. 4-1

52 Pg. 8 of Department of Ecology State of Washington (2014). Fact Sheet for State Waste Discharge Permit ST0004500 - Effluent Treatment Facility and State Approved Land Disposal Site (URL: http://www.ecy.wa.gov/programs/nwp/permitting/HDWP/Rev/8c/Draft/9_8_14/ETF/fact.pdf): 33 pages

53 HNF-SD-LEF-ASA-001, Rev 4, pg. viii (pg. 13 of 146 of the PDF)

54 HNF-SD-ETF-ASA-001, Rev 3, pg. 1-2

LEGACY SOURCE SITES

Not Applicable

GROUNDWATER PLUMES

Not Applicable

D&D OF INACTIVE FACILITIES

Not Applicable

ECOLOGICAL RESOURCES SETTING

Landscape Evaluation and Resource Classification

More than 82% of the habitat within the EU is covered by ponds, buildings and bare ground, which are classified as level 0 biological resources (Appendix J, Figure J.119 and Table J.105). An additional 8% of the habitat is classified as level 1 resource, where cheatgrass and Russian thistle dominate. The remaining 7% consists of successional vegetation and somewhat degraded climax vegetation (levels 2 and 3, respectively).

The amount and proximity of biological resources surrounding the ETF EU were examined within the adjacent landscape buffer area, which extends 4185 ft (1276 m) from the geometric center of the EU (Appendix J, Figure 2). Habitats to the west, east and south of the EU are a patchwork of level 0 (20%), level 1 and 2 resources (more than 31%), and isolated patches of level 3 shrub-steppe habitat (approximately 14%). North of the EU, the habitat within the adjacent landscape buffer is relatively undisturbed and is classified as a level 4 resource, with a mosaic of climax shrub-steppe with big sagebrush (*Artemisia tridentata*) and spiny hopsage (*Grayia spinosa*) and native steppe.

Field Survey

The ETF EU is primarily bare ground surrounding buildings and effluent treatment ponds except on the east side of the EU where remnants of higher quality habitat fall within the boundary. Along the eastern edge is a narrow strip of habitat containing mature sagebrush and spiny hopsage (Appendix J, Table J.104, Patch ID 3-1). The understory in this strip has only the introduced forb Russian thistle (*Salsola tragus*) in the southern portion, but along this edge to the northeast the understory contains decreasing Russian thistle and increasing cheatgrass (*Bromus tectorum*) and native forbs and grasses.

A patch of successional native vegetation (level 2 resource) containing 25% gray rabbitbrush (*Ericameria nauseosa*) and 15% Sandberg's bluegrass (*Poa secunda*) occurs at the northeast end of the EU (Appendix J, Figure J.119). This area is identified as habitat for the black-tailed jackrabbit (*Lepus californicus*), a Washington state candidate. Rabbit scat was observed in the area but could not be identified to genus. Species lists from the June 2015 survey are provided in the EU discussion in Appendix K.

CULTURAL RESOURCES SETTING

The entire CP-OP-16, ETF/LERF EU has been inventoried for archaeological resources as part of two cultural resource survey efforts. In addition, an NHPA Section 106 review was completed for the installation of the ETF and documented in the *Cultural Resources Review of the Effluent Retention and Treatment Complex (ERTC), HCRC#89-200-023* (Minthorn 1990). No cultural resources were identified as part of these survey efforts. No documented cultural resources are present within the EU. It is highly

unlikely that intact archaeological material is present in the EU, which has been extensively disturbed by Hanford Site activities.

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 have been recorded within 500 meters of the CP-OP-16, ETF/LERF EU. All National-Register-eligible Manhattan Project and Cold War Era properties have been documented as described in the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (DOE/RL-97-56). In addition, one archaeological isolate associated with the Native American Precontact and Ethnographic Landscape has been recorded within 500 meters of the EU. While this isolate has not been formally evaluated for listing in the National Register of Historic Places, it should be noted that isolates are typically considered not eligible.

Historic maps and aerial imagery suggest a low potential for archaeological resources associated with the Pre-Hanford Early Settlers/Farming Landscape to be present within the CP-OP-16, ETF/LERF EU. Geomorphology suggests a moderate potential for the presence of archaeological resources associated with the Native American Precontact and Ethnographic Landscape to be present within the CP-OP-16, ETF/LERF EU. However, extensive ground disturbance within the EU may negate this potential, suggesting a low potential for intact cultural resources at or below ground surface. Resources, if present, would likely be limited to areas of intact or undisturbed soils.

Because of the potential for intact archaeological resources, it may be appropriate to conduct surface and subsurface archaeological investigations prior to the initiation of any remediation activities. Indirect effects are always possible when TCPs are known to be located in the general vicinity. Consultation with Hanford Tribes (Confederated Bands of the Yakama Nation, Wanapum, Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce) and other groups associated with these landscapes (e.g. East Benton Historical Society, the Franklin County Historical Society and the Prosser Cemetery Association, the Reach, and the B-Reactor Museum Association) may be necessary to provide input on indirect effects to both recorded and potential unrecorded TCPs in the area and other cultural resource issues of concern.

PART V. WASTE AND CONTAMINATION INVENTORY

CONTAMINATION WITHIN PRIMARY EU SOURCE COMPONENTS

Vadose Zone Contamination

The reported inventories for CP-OP-8 (Table H.12-8 through Table H.12-10) are contained in facilities and basins that are both in operation and isolated from the environment for the period of evaluation. Thus there is no reported vadose zone inventory to be evaluated.

Groundwater Plumes and Columbia River

Not applicable

Operating Facilities

The LERF receives waste from 242-A and other onsite generating units. Chemical constituents potentially contained in wastewater stored at LERF are identified and presented in Table H.12-4. The quantity of the potential chemicals stored within the LERF basins and pipework are not available but do not set any bounding conditions or quantities.[55]

Table H.12-4. LERF Chemical Constituents[55]

Constituent[a]	
Inorganic chemicals (analytes)	Potential inorganic chemical compound[b]
Aluminum	AlOH, $AlP0_4$, NaAlOH, Al_2CO_3
Ammonia[c,f,g]	NH_3
Ammonium	NH_3, NH_4, NH_4OH
Barium	BaOH, $BaCO_3$, $BaNO_3$
Boron	Na_3BO_3
Cadmium	CdOH
Calcium	$CaSO_4$, $CaCO_3$, CaOH
CO_2/CO_3 as CO_3	Na_2CO_3, $NaHCO_3$
Chloride	NaCl
Chromium	Na_2CrO_4
Copper	CuOH
Cyanide	NaCN
Fluoride	NaF
Iron	Fe, FeO, FeOH, Fe_2CO_3, FeS
Lead	PbOH
Manganese	MnO
Magnesium	MgOH, $MgCO_3$
Mercury	Hg, HgOH
Molybdenum	Mo_2O_3+H_2O, Na_2MoO_4
Nitrite	$NaNO_2$
Phosphate	Na_3PO_4
Potassium	KNO_3
Silicon	SiO_2, Na_4SiO_4
Sodium	NaOH, $NaNO_2$, Na_3PO_4
Sulfate	$NaSO_4$, $CaSO_4$
Tungsten	Na_2WO_4
Zinc	ZnOH
Organic compounds	
Acetone[d]	Diethyl phthalate[e]
Acetophenone[e]	Dimethyl phthalate[e]
Benzyl alcohol[e]	Chloroform[c,d]
Bis(2-ethylhexyl)phthalate[e]	Di-n-octyl phthalate[e]
1-Butanol (butyl alcohol)[d]	Methylene chloride[c]
2-Butanone[e]	2-Pentanone[e]
Constituent[a]	
Organic compounds	
2-Butoxyethanol[e]	Tetrahydrofuran[e]
Carbon tetrachloride[c]	Tributyl phosphate[e]

[a] Taken from Table 3-3, HNF-SD-WM-SAD-040, Rev 2 with the understanding that the following footnotes describe the presence of the chemical constituents but do not set a bounding condition.
Inorganic analytes and organic compounds taken from the following:
WHC-SD-WM-SAR-023; BHI-00647; Waste Sampling and Characterization Facility waste water sample number W96W001501, date January 13, 1997; Environmental Restoration Disposal Facility waste water sample numbers 96-104, 96-106, 96-107, 97-119, 97-121, 97-200, 97-210, 97-211, and 97-250; and UP-1 well groundwater sample W97C000028.
[b] Potential compounds (WHC-SD-WM-SARR-011).
[c] Chemical concentration less than or equal to 10 percent of the threshold quantity.
[d] Chemical concentration less than or equal to 1,000 parts per billion.
[e] Chemical concentration at or near detection limits, i.e., 10 parts per billion.
[f] Chemical listed in 29 CFR 1910.119, Appendix A.
[g] Chemical listed in 40 CFR 355, Appendix A.

[55] HNF-SD-LEF-ASA-002, Rev 2, Table 3-1, pgs. 3-2 and 3-3

The LERF radiological inventory varies greatly dependent on the operations at any upstream and downstream facilities. The bounding conservative estimate of the LERF radiological inventory at any given time identified and presented in Table H.12-5, is directly taken from the Final Hazard Category Determination report [HNF-SD-WM-SAD-040, Rev 2 from 2001] and is repeated within the Auditable Safety Analysis [HNF-SD-LEF-002, Rev 2 from 2011]. It should be noted that the tritium, strontium-90, iodine-129, cesium-137, cerium-144, europium-154, europium-155, plutonium-239/240, and curium-244 exceeded the Category 3 threshold quantities or maximum quantities allowable for a radiological facility. Even though some of the radionuclides could hypothetically exist at higher radioactivities allowed to be considered above a "Radiological Facility", inventory control procedures are in place such that before any batch of wastewater is accepted at LERF, radionuclide concentrations are analyzed to assess if the wastewater falls within the maximum liquid concentration consequence based limits identified in HNF-SD-WM-SAD-040. If the radionuclide concentrations exceed the maximum, the wastewater may still be accepted into LERF provided that the overall dose consequences of the wastewater do not exceed the limits in HNF-SD-WM-SAD-040. Inventory is controlled procedurally to ensure that the calculated dose consequences in HNF-SD-WM-SAD-040 are not exceeded to maintain LERF as a radiological facility. [56]

[56] HNF-SD-LEF-ASA-002, Rev 2, pg. 4-1

Table H.12-5. LERF Radiological Inventory[57]

Radionuclide	Total curies assuming 8.85E+07 L
H-3	2.10E+04
C-14	1.40E+02
Co-60	2.10E+02
Se-79	1.30E+01
Sr-90	3.70E+03
Nb-94	2.30E+01
Tc-99	1.60E+03
Ru-106	5.80E+01
I-129	1.60E+02
Cs-134	3.60E+01
Cs-137	8.90E+02
Ce-144	1.80E+03
Eu-154	8.70E+02
Eu-155	5.60E+03
Ra-226	5.70E+00
U gross as U-234	1.90E-02
Np-237	1.90E-01
Pu-238	2.40E-01
Pu-239/240	1.50E+00
Pu-241	2.30E+00
Am-241	1.20E-01
Cm-244	2.20E+00
TOTAL	3.60E+04

[57] HNF-SD-WM-SAD-040, Rev 2, Table A-1, Appendix A

The ETF radiological and chemical inventories were compared to threshold quantities identified in DOE Standard 1027 (DOE-STD-1027-92) and DOE Standard 5502 (DOE-EM-STD-5502-94). The quantities of radioisotopes identified in the ETF inventory fall below the Category 3 thresholds identified in Standard 1027. The ETF radiological and chemical inventories were then compared to threshold/reportable quantities identified in Standard 5502. The radiological quantity for Sr-90 and Ru-106 exceed the reportable quantities identified in 40 CFR 302, "Designation, Reportable, Quantities, and Notification". The chemical inventory for hydrogen peroxide exceeds the threshold quantity identified in 29 CFR 1910.119, "Process Safety Management", and the chemical inventories for both Sulfuric acid and Hydrogen Peroxide exceed the reportable quantities in 40 CFR 355, "Emergency Planning and Notification'. As a result, the ETF is categorized as a Radiological Facility with Non-Nuclear Facility documentation. According to the requirements for safety analysis documentation as described in Standard 5502, the ETF must develop a safety analysis and prepare an Auditable Safety Analysis document. The safety documentation must meet the requirements of DOE Order 5481.18, *Safety Analysis and Review System.* The ETF is also required to meet the requirements of 29 CFR 1920.120(a), "Hazardous Waste Operation and Emergency Response", by developing a health and safety plan and must meet the principles and requirements of 29 CFR 1910.119. The expected radiological inventory for the ETF (presented in Table H.12-6) is compared to Category 3 threshold limits from Standard 1027. Table 1 shows the ratio of each isotope in the facility inventory to the threshold quantities identified in Standard 1027. The sum of the resulting fractions for each isotope falls below 1. Therefore the ETF is not categorized as a nuclear facility. Furthermore, the ETF category is determined by comparison of the radiological and chemical inventories to quantities specified in Standard 5502.[58]

A complete inventory of radioactive materials is presented in Table H.12-6, below, and contains radioactive concentrations throughout the facility The information contained in both of these tables is developed from the WHC-SD-C018G-HC-002, Rev 1, Hazard Categorization Report for the 200 Area Effluent Treatment Facility. The inventory was based upon expected maximum radionuclide concentrations ID the 242-A Process Condensate stream and the design basis capabilities of the ETF The inventory to be managed will be bounded at LERF by valves 60M-4A 60M-4B and 60N-01 as shown on drawings H-2-88766, sheets 3 and 4, and will include all process and support areas within the ETF including the load-m station and transfer piping It is planned to operate the ETF facility, at radioactive inventory levels below DOE STD 1027-92 Category 3 limits Chapter 4 of the auditable safety analysis (ASA) contains the methodology for managing the radioactive inventory at the ETF and maintaining that inventory below the stated levels Identification of potential hazards, mitigating features and operating hazards for the load-m station were developed using the information prepared for other similar equipment and applications within the ETF.[59] The radioactivity content contained within individual 55-gallon drums is also provided within the supplemental information (Part VII) but it is noted that the radioactivity inventory values are already counted within the inventory values provided in Table H.12-6, below.

[58] WHC-SD-C018H-HC-002, Rev 1, pg. 1 through 8

[59] HNF-SD-ETF-ASA-001, Rev 4, pg. 3-2

Table H.12-6. ETF Radiological Inventory[60]

Radionuclide	ETF Inventory [Ci]	ETF Curies / STD-1027 TQ
H-3	9.38E+01	9.38E-02
C-14	4.93E-03	1.17E-05
Se-79	4.68E-04	1.30E-06
Sr-90	1.34E+00	8.38E-02
Y-90	1.34E+00	9.57E-04
Tc-99	3.75E-04	2.00E-07
Ru-103	3.17E+00	2.11E-03
Rh-103m	3.17E+00	7.30E-06
Ru-106	1.94E+00	1.94E-02
Rh-106	1.94E+00	no TQ
Sn-113	1.36E-01	1.05E-04
In-113m	1.36E-01	4.50E-06
I-129	1.09E-04	1.82E-03
Cs-134	2.90E-04	6.90E-06
Cs-137	9.51E-01	1.59E-02
Ba-137m	9.51E-01	no TQ
Ce-144	3.01E-03	3.01E-05
Pm-147	2.82E-01	2.82E-04
Eu-154	1.09E-03	5.90E-06
Eu-155	9.51E+04	1.00E-06
U (gross)	5.87E-03	1.40E-03
Np-237	5.87E-03	1.40E-02
Pu-238	5.87E-03	9.47E-03
Pu-239/240	5.87E-03	1.13E-02
Pu-241	5.87E-03	1.83E-04
Am-241	5.87E-03	1.13E-02
Cm-244	5.87E-03	5.87E-03
TOTAL	9.52E+04	2.72E-01

[60] WHC-SD-C018H-HC-002, Rev 1, Table 1, pg. 3 and 4 and repeated within HNF-SD-ETF-ASA-001, Rev 4, Table 3-3 on pg. T3-3.

The chemicals added as part of the treatment process are 92 wt% and 4 wt% sulfuric acid, 50 wt% and 4 wt% sodium hydroxide, 50 wt% hydrogen peroxide, reverse osmosis (RO) membrane maintenance additives (e.g., Zenotreat 150, MC1, MC4, MP4) and cooling water treatment chemicals (e.g., Spectrus NX1106 and Continuum AEC3113). Specific chemical product names are provided as typical examples only and may be substituted as needed to meet process requirements without revision to this document. Use of other cleaning, corrosion control and fouling control chemical products will be in accordance with the requirements of 29CFR1910.1200 "Hazard Communication". Table H.12-7 shows the maximum expected inventory of chemicals used within the ETF. The chemical quantities and concentrations that are used during normal operations are shown in Table 3-1 and Table 3-2 of HNF-SD-ETF-ASA-001, Rev 4.

Table H.12-7. ETF Chemical Inventory[61]

Chemical	Max Inventory [gallons]	Max Inventory [pounds]
Sulfuric Acid (H2SO4) 92 wt%	7500	106000
Sodium Hydroxide (NaOH) 50 wt%	5000	32000
Sulfuric Acid (H2SO4) 4 wt%	600	200
Sodium Hydroxide (NaOH) 4 wt%	600	200
Hydrogen Peroxide (H2O2) 50 wt%	2500	12300
Cooling Water Treatment (Dearcide 702)	55	462
Cooling Water Treatment (Dearborn 878)	350	3270
RO Membrane Maintenance (Zenotreat 150)	350	3400
RO Membrane Maintenance (MC1)	350	1000
RO Membrane Maintenance (MC4)	--	200
RO Membrane Maintenance (MP4)	--	300

[61] WHC-SD-C018H-HC-002, Rev 1, Table 3, pg. 7 and 8

Table H.12-8. 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			0.13	140	NR	210	890	NR	870	21000	160
200-E-17 LERF	Process Building		HNF-SD-WM-SAD-040, Rev 2, Table A-1, Appendix A	0.12	140	NR	210	890	NR	870	21000	160
200 ETF	Process Building		WHC-SD-C018H-HC-002, Rev 1, Table 1, pg. 3 and 4	0.0059	0.0049	NR	NR	0.95	NR	0.0011	94	0.00011

a. NR = Not reported

Table H.12-9. 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			NR	NR	4.1	3700	1600	0.025
200-E-17 LERF	Process Building		HNF-SD-WM-SAD-040, Rev 2, Table A-1, Appendix A	NR	NR	4	3700	1600	0.019
200 ETF ETF	Process Building		WHC-SD-C018H-HC-002, Rev 1, Table 1, pg. 3 and 4	NR	NR	0.018	1.3	0.00038	0.0059

a. NR = Not reported

Table H.12-10. 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	NR
200-E-17 LERF	Process Building		NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
200 ETF ETF	Process Building		NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

a. NR = Not reported

Table H.12-11. Summary of the Evaluation of Current Threats to Groundwater as a Protected Resource from Saturated Zone (SZ) and Remaining Vadose Zone (VZ) Contamination associated with the Evaluation Unit

PC	Group	WQS	Porosity[a]	K_d (mL/g)[a]	ρ (kg/L)[a]	VZ Source M^{Source}	SZ Total M^{SZ}	Treated[c] M^{Treat}	VZ Remaining M^{Tot}	VZ GTM (Mm^3)	VZ Rating[d]
C-14	A	2000 pCi/L	0.25	0	1.82	---	---	---	---	---	*ND*
I-129	A	1 pCi/L	0.25	0.2	1.82	---	---	---	---	---	*ND*
Sr-90	B	8 pCi/L	0.25	22	1.82	---	---	---	---	---	*ND*
Tc-99	A	900 pCi/L	0.25	0	1.82	---	---	---	---	---	*ND*
CCl4	A	5 µg/L	0.25	0	1.82	---	---	---	---	---	*ND*
Cr	B	100 µg/L	0.25	0	1.82	---	---	---	---	---	*ND*
Cr-VI	A	10 µg/L[b]	0.25	0	1.82	---	---	---	---	---	*ND*
TCE	B	5 µg/L	0.25	2	1.82	---	---	---	---	---	*ND*
U(tot)	B	30 µg/L	0.25	0.8	1.82	---	---	---	---	---	*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. What nuclear and non-nuclear safety accident scenarios dominate risk at the facility? What are the response times associated with each postulated scenario?

Three events were identified for analysis for the LERF: a pool evaporation and entrainment release (airborne) caused by a loss of pool cover, and two spray releases (airborne) caused by a failure of a valve, pipe seal, or transfer pipe.[62] Response times analyzed were 12-hour and 24-hour timeframes[35] .

LERF Pool Evaporation and Entrainment Release. This accident assumed that the surface area of one-equivalent basin is exposed to the environment. The suspension of radionuclides (i.e., particulates) caused by evaporation was not considered credible; therefore, the airborne release from this event was caused by entrainment of surface liquids (droplets) in the wind blowing over the basin liquids. Although the LERF can accept liquids from various facilities (e.g., 242-A Evaporator, N Basin) and based on the discussion provided in Appendix A within HNF-SD-WM-SAD-040, Rev 2, only one feed stream was identified. This feed stream is made up of the maximum concentration for each radionuclide and was used to develop the total curies stored in the LERF.

LERF Spray Release. The spray release scenario assumed that a spray release occurred at a pipe flange or valve seal; however, the spray release also could have been caused by a small split in the fiberglass pipe. For the spray release, it was assumed, for conservatism, that the maximum head pressure of the pump, either the 242-A Evaporator PC or the ETF load in/load out, is 7.03 kilograms per square centimeter (100 pounds per square inch gauge).

ETF: Hazards Analysis (What-If Analysis) resulted with only one accident scenario with a Severity Category II rating (Plane crash or helicopter crash into the ETF building).[63]

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

LERF: There are no engineered safety features or programs identified for LERF that are required to mitigate or prevent an unacceptable release. Safe operation of the facility is ensured by maintaining the radiological inventory of the facility below the maximum liquid concentrations, and the facility operating parameters for the two credible accidents identified in HNF-SD-WM-SAD-040, to maintain LERF as a radiological facility. The implementation of a methodology for maintaining radiological inventory below Category 3 levels is identified in Section 4.0 of HNF-SD-LEF-ASA-002, Rev 2. Therefore, there are no commitments with respect to inventory control Identified. [64] The LERF inventory control practice entails determining radionuclide concentrations of the batches of wastewater at upstream facilities before the wastewater is accepted at LERF. [56]

ETF: A hazards analysis was employed to identify and qualitatively assess hazards associated with the ETF. No release of hazardous/radioactive material is expected. It is concluded from the hazards analysis

[62] HNF-SD-WM-SAD-040-002, Rev 2, pg. 4-27

[63] HNF-SD-ETF-ASA-001, Rev 4, Table 3-6, pg. T3-7

[64] HNF-SD-LEF-ASA-002, Rev 2, pg. 3-1

that the facility has adequate mitigation features established, either administrative or engineered, to control the hazards present during normal operations. No additional mitigative features are required and no Safety Class or Safety Significant equipment exists at the ETF.[65]

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

LERF: See response to Question 2, above.

ETF: See response to Question 2, above.

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 LERF basins were designed to comply with containment and leak detection criteria found in 40 CFR 265, WAC 173-303, and U.S Environmental Protection Agency (EPA) guidelines. Each basin is constructed with primary and secondary liners, consisting of a synthetic membrane and an essentially impermeable soil composite, and has a floating cover keeping unwanted material entering into the basins and minimizes evaporation. Transfer pipes are double lined and are outfitted with electronic leak protection systems at 1,000-ft intervals.

The basin covers have reached or exceeded their 20-year design life. The basins liners appear to maintain their integrity; however additional inspection is required. The liner is exposed to a less harsh environment than the covers. The support systems (piping, etc.) were designed for a thirty-year life[66]. The basin liners have required some limited repairs and can be utilized into the near term.[67] Startup and initial facility operation is not impacted by either the liners or the covers. [68]

The three basins are referred to as Basins 42, 43 or 44. Ongoing activities for Basins 42 and 43 include cover cleanup and temporary repairs on Basin 42. Twelve Basin 42 cover tears and two liner tears identified prior to the site walk-down were repaired before this report was completed. One tear in the Basin 43 cover was identified and repaired. Washington State Department of Ecology (Ecology) authorized the liner repair without emptying the basin because the tear is above waste the line. Basin 44 continues to receive small volumes of waste. The supporting systems including transfer pumps, piping and power and controls were designed for thirty-year life. Regular preventive maintenance is necessary to extend the life and avoid operational interruptions. Basin 44 cover will need to be replaced because of the repair complexity and potential for personnel exposure. The basin contents must be emptied before the cover replacement and repairs to the cover should only be considered if the replacement funds are not available. The startup of ETF should be expedited if LERF is nearing full storage capacities.[69]

The most critical issue impacting long term operation is LERF covers and liners. LERF covers and liners have exceeded their design life. LERF is governed by the Resource Conservation and Recovery Act Permit and long term facility operation will require replacing the liners and covers. [70] Transfer integrity

[65] HNF-SD-ETF-ASA-001, Rev 4, pg. xi (pg. 16/146 of the PDF)

[66] RPP-RPT-58275, Rev 0, pg. 57

[67] RPP-RPT-58275, Rev 0, pg. 38

[68] RPP-RPT-58275, Rev 0, pg. E-3 through E-4

[69] RPP-RPT-58275, Rev 0, pg. 57

[70] RPP-RPT-58275, Rev 0, pg. E-3 through E-4

assessments are required per the RCRA permit. The lines have not been inspected (internally), nor tested since operations began in 1994. [67]

Until LERF covers are repaired/replaced WRPS will need to assign resources to manage the water and biota accumulation on the covers. Pumps originally used to remove accumulated water have failed over time and were not replaced. Mechanical means used to clean the basin covers resulted in tears. Until basin covers are replaced, the need to provide resources and expend budget to prevent water and biota accumulation on the covers will continue.

ETF: Building structure, pipes and treatment train process equipment, and drums holding dried solids.

The ETF has been shut down since February 2014. If facility startup holds to its current schedule it will have been down almost two years before resuming operations. Preventive maintenance activities have not been maintained; corrective maintenance activities have been minimal.[70]

ETF maintenance records indicate transfer line air vacuum relief valves to and from TEDF, Environmental Restoration Disposal Facility, and State Approved Land Disposal Site needs repair. Piping systems have not been inspected; Nondestructive examination inspection such as Ultrasonic test or radiography should be performed over the next several years to document piping integrity.

ETF is currently shut down and not processing stored liquid waste from the LERF because of the secondary treatment train heat exchanger failure. The current CHPRC schedule projects heat exchanger repair completion and facility re-start in December 2015 (see Question 8, Part IV)

The ETF overall building interior housekeeping was satisfactory but there are numerous catch basins posted as “contamination areas” because of leaking valves, flanges, etc. in the ETF process area. Operations and maintenance personnel indicated some of these catch basin Contamination Areas designations are because of existing leaks, but many Contamination Areas designations remain in place after repairs are complete. Operations have left the Contamination Areas designation in place against the potential for a new leak. A large number of pump rebuilds must occur as well within the ETF. [71]

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

Barrier failures for LERF accident scenarios include basin cover and/or liner failures (punctures, tears, etc.) and pipe and/or pipe connection failures.

External event: (helicopter or plane crash)[72] compromising building structure integrity.

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

LERF: Estimated unmitigated doses to facility workers (within 30m of the event), co-located persons (at a distance of 100m from the event) includes exposure pathways of external exposure and inhalation (lung dose plus additional doses caused by exposed organs and radiological materials expelled from the pulmonary region and ingested)[73].

ETF: No information provided within the ETF ASA or Final Hazard Categorization documents.

[71] RPP-RPT-5827, Rev 0, pg. 22

[72] HNF-SD-ETF-ASA-001, Rev 4, Table 3-6, pg. T3-7

[73] HNF-SD-WM-SAD-040, Rev 2, footnotes to Table 4-14 and Table 4-15 on pg. 4-32 and 4-33

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

LERF analyzed timeframe of the two credible accident scenarios were for a 12-hour duration.[35]

ETF: No information provided within the ETF ASA or Final Hazard Categorization documents.

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

There are no on-going releases to the environment or receptors at LERF.

POPULATIONS AND RESOURCES CURRENTLY AT RISK OR POTENTIALLY IMPACTED

Facility Worker

Because LERF is a "less than Category 3 Nuclear Facility (often referred to as a "Radiological Facility"), the Auditable Safety Analysis is not required to meet the standards and use the nomenclature as outlined within DOE-STD-3009-2014. The unmitigated doses to hypothesized persons on site at predetermined distances are included in the ASA and are based on 30m and 100m distances east of LERF. It is assumed that the 30m east of the LERF hypothetical receptor analyzed in the ASA is the facility worker and the 100m east receptor is analogous to the co-located person.

LERF: The unmitigated dose to the facility worker (within 30m east of the event) estimated within the Final Hazard Category Determination [HNF-SD-WM-SAD-040, Rev 2] for the pool release accident scenario from three basins (including evaporation and entrainment of the liquid wastes) is 3.95 rem (See Table H.12-12, below).[74] The human health rating is considered "Low" for a facility worker if the unmitigated dose calculated is less than 5 rem.

LERF: The unmitigated dose to the facility worker (within 30m east of the event) estimated for the spray release with a release rate of 6.25 liters per minute for 12 hours [4,500 liters released total] is 4.16 rem. [74] The human health rating is considered "Low" for a facility worker if the unmitigated dose calculated is less than 5 rem.

It should be noted that LERF is unstaffed during normal or routine operations and no facility worker impacts were calculated within the Final Hazard Category Determination [HNF-SD-WM-SAD-040, Rev 2]. With the exception of periodic sampling, surveillance, and maintenance activities, there are no operations personnel located at LERF.[15]

[74] HNF-SD-WM-SAD-040, Rev 2, Table B-2, pg. B-5

Table H.12-12. LERF Final Hazard Categorization Estimated Dose Consequences

Table B-2. Final Hazard Category Estimated Dose Consequences:
Receptor Located 30 Meters (98 Feet) to the East from the Point of Release[a]

Initial calculated and estimated consequences (100 meters)			Estimated consequences for final hazard category (30 meters)		
Event	Inventory of concern	Consequences (rem)[b]	Event	Inventory of concern	Estimated consequences (rem)
Pool release from one-basin equivalent, evaporation and entrainment, release rate equal to 4 E-06 per hour, for 12 hours	Total curies in one basin, without tritium	0.59	Pool release from one basin equivalent, evaporation and entrainment, release rate equal to 4 E-06 per hour, for 12 hours	Total curies in one basin, without tritium	1.32
	Total curies in one basin, tritium only	3.30 E-04		Total curies in one basin, tritium only	7.43 E-04
Pool release from three basins, evaporation and entrainment, release rate equal to 4 E-06 per hour, for 12 hours	Total curies in three basins, without tritium	1.77	Pool release from three basins, evaporation and entrainment, release rate equal to 4 E-06 per hour, for 12 hours	Total curies in three basins, without tritium	3.95
	Total curies in three basins, tritium only	9.90 E-04		Total curies in three basins, tritium only	2.23 E-03
Spray release, total release at 6.25 liters per minute (1.65 gallons per minute), for 12 hours	Maximum bounding without tritium	1.85	Spray release, total release at 6.25 liters per minute (1.65 gallons per minute), for 12 hours	Maximum bounding without tritium	4.16
	Maximum bounding tritium only	1.10 E-03		Maximum bounding tritium only	2.48 E-03
Spray release, respirable release at 5.26 liters per minute (1.39 gallons per minute), for 12 hours	Maximum bounding without tritium	1.56	Spray release, respirable release at 5.26 liters per minute (1.39 gallons per minute), for 12 hours	Maximum bounding without tritium	3.50
	Maximum bounding tritium only	9.27 E-04		Maximum bounding tritium only	2.09 E-03

a Radiological inventories used as bases for analysis are shown in Appendix A, Table A-1. Individual is located 30 meters (98 feet) to the east from the point of release and X/Q=7.2 E-02 sec/m³.
b Taken from Table B-1
c Estimated dose is 2.25 times calculated and estimated consequences shown in column 3 or 7.2 E-02 sec/m³/3.2 E-02 sec/m³.

B-5

HNF-SD-WM-SAD-040, Rev. 2

ETF: ETF is also categorized as a Radiological Facility but the calculated dose consequences are not provided. Qualitative consequence severity ratings are provided from a Hazards Analysis with only one accident scenario resulting with an Accident Severity Level II (Table H.12-13).

Due to the exclusion of calculated unmitigated doses to human receptors within ETF's ASA, the risk ratings for the combined ETF & LERF EU are based on the provided doses within the LERF's ASA and Final Hazard Categorization. Both facilities are low-hazard and are categorized as Radiological Facilities. The qualitative consequence severity ratings that are provided from a Hazards Analysis within the ETF ASA briefly describes only one accident scenario resulting with an Accident Severity Level II (Table H.12-13).

Table H.12-13: ETF Hazard Analysis Results with Severity Category II[75]

C	HELICOPTER OR PLANE CRASH	The 200 Area Effluent Treatment Facility could be demolished	Radiological/ toxicological release would occur locally onsite and offsite		Hanford Site no longer has helicopters aircraft flights over the 200 Area are infrequent	Extremely unlikely	II

Co-Located Person (CP)

LERF: The unmitigated dose to a co-located person (at 100m east of the event) estimated for the pool release accident scenario from three basins (including evaporation and entrainment of the liquid wastes) is 1.77 rem.[76] The human health rating is considered "Low" for a co-located person if the unmitigated dose calculated is less than 5 rem.

LERF: The unmitigated dose to the co-located Person (at 100m east of the event) estimated for the spray release with a release rate of 6.25 liters per minute for 12 hours [4,500 liters released total] is 1.85

[75] HNF-SD-ETF-ASA-001, Rev 4, Table 3-6, pg. T3-7

[76] HNF-SD-WM-SAD-040, Rev 2, Table B-2, pg. B-5

rem.[74] The human health rating is considered "Low" for a co-located person if the unmitigated dose calculated is less than 5 rem.

Due to the exclusion of calculated unmitigated doses to human receptors within ETF's ASA, the risk ratings for the combined ETF & LERF EU are based on the provided doses within the LERF's ASA and Final Hazard Categorization. Both facilities are low-hazard and are categorized as Radiological Facilities. The qualitative consequence severity ratings that are provided from a Hazards Analysis within the ETF ASA briefly describes only one accident scenario resulting with an Accident Severity Level II (Table H.12-13).

Public

No doses (mitigated or unmitigated) were calculated for a member of the public due to potential accident scenarios at LERF. Impacts to the public are not required for LERF as it is a less than Category 3 Nuclear Facility.[35]

Due to the exclusion of calculated unmitigated doses to human receptors within ETF's ASA, the risk ratings for the combined ETF & LERF EU are based on the provided doses within the LERF's ASA and Final Hazard Categorization. Both facilities are low-hazard and are categorized as Radiological Facilities. The qualitative consequence severity ratings that are provided from a Hazards Analysis within the ETF ASA briefly describes only one accident scenario resulting with an Accident Severity Level II (Table H.12-13).

Groundwater and Columbia River

Not applicable

Ecological Resources

Summary of Ecological Review:

- Over 82% of the EU is classified as level 0 resource. Loss of the remaining 18% of primarily level 2 and 3 resources within the EU during remediation activities would not be expected to cause significant impacts to wildlife populations.
- The eastern part of the EU falls within an area identified as black-tailed jackrabbit habitat by DOE's Public Safety and Resource Protection program[77]. Black-tailed jackrabbits are a Washington state candidate for listing as threatened or endangered.
- Level 2 and level 3 habitats within the combined EU and adjacent landscape buffer area are fragmented and are not contiguous with similar habitat outside the 200-East Area.

Cultural Resources

The CP-OP-16, ETF/LERF EU is located within the 200-East Area of the Hanford Site, an area known to have low potential to contain Native American Precontact and Ethnographic archaeological resources and Pre-Hanford Early Settlers/Farming resources. Much of the 200 Areas were addressed in a cultural resources report entitled Archaeological Survey of the 200 East and 200 West Areas, Hanford Site (Chatters and Cadoret 1990). The focus of this archaeological survey was on inventorying all undisturbed portions of the 200-East and 200-West Areas. This report concluded that much of the 200-East and 200-West Areas can be considered areas of low archaeological potential with the exception of intact portions of an historic/ethnohistoric trail/road corridor which runs through the 200-West Area.

[77] Map and database information about Hanford Biological Resources were supplied by Mission Support Alliance, which operates the Public Safety and Resource Protection program for DOE-RL.

The entire CP-OP-16, ETF/LERF EU has been inventoried for archaeological resources under two cultural resource reviews, including HCRC# 89-200-023 (Minthorn 1990) and HCRC#2014-600-002 (Dage, Mendez and Clark 2014). These cultural resource reviews did not result in the identification of any cultural resources within the CP-OP-16, ETF/LERF EU. An NHPA Section 106 review was completed for the installation of the ETF/LERF and documented in the Cultural Resources Review of the Effluent Retention and Treatment Complex (ERTC), HCRC#89-200-023 (Minthorn 1990). It is very unlikely that intact archaeological material is present in the areas that have not been inventoried for archaeological resources (both on the surface and in the subsurface), because soils in the entire EU appear to have been extensively disturbed by Hanford Site activities.

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

- No cultural resources are known within the CP-OP-16, ETF/LERF EU.

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

- Segments of the National Register-eligible Hanford Site Plant Railroad, a contributing property within the Manhattan Project and Cold War Era Historic District, with documentation required, are located within 500-meters of the CP-OP-16, ETF/LERF EU. In accordance with the Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan (DOE/RL-97-56) (DOE-RL 1998), all documentation requirements have been completed for this property.
- One archaeological isolate associated with the Native American Precontact and Ethnographic Landscape has been documented within 500 meters of the EU. While this isolate has not been formally evaluated for listing in the National Register, it should be noted that isolates are typically considered not eligible.

Closest Recorded TCP

There are two recorded TCPs associated with the Native American Precontact and Ethnographic Landscape that are visible from the CP-OP-16, ETF/LERF EU.

CLEANUP APPROACHES AND END-STATE CONCEPTUAL MODEL

Selected or Potential Cleanup Approaches

No cleanup decisions have been made for the Remaining Waste Treatment, Storage and Disposal Facilities (* Includes LERF/ETF, WESF, WRAP, 222-S Lab, IDF, and Inert Waste Landfill/Pit 9). Range of Plausible Alternatives: Closure of facilities will be according to approved operating plans and closure plans (e.g., RCRA Closure Plans); consequently, cleanup actions will be determined and accomplished in accordance with applicable regulatory and permit/license requirements. No other alternatives are being considered.[78]

Contaminant Inventory Remaining at the Conclusion of Planned Active Cleanup Period

Unknown.

Risks and Potential Impacts Associated with Cleanup

Unknown.

[78] Working internal document to CRESP with document file name, "02_EU_disposition_All_8x11-revised.docx" from an email with subject line "Hanford Team Meeting: Revised remediation options table and Assignments for Final report" from January 27, 2016.

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

Facility Worker

Unknown.

Co-located Person

Unknown.

Public

Unknown.

Groundwater

Groundwater and Columbia River

Not applicable

Ecological Resources

No cleanup decisions have been made for this EU. As a result, the potential effects of cleanup on ecological resources cannot be made for the active cleanup evaluation period.

Cultural Resources

No cleanup decision for the remaining waste treatment, storage and disposition facilities.

ADDITIONAL RISKS AND POTENTIAL IMPACTS IF CLEANUP IS DELAYED

Unknown.

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

Unknown.

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

Table H.12-14. Summary of Populations and Resources at Risk or Potentially Impacted after Cleanup.

Population or Resource		Risk/Impact Rating	Comments
Human	Facility Worker	Insufficient Information (IS)	
	Co-located Person	IS	
	Public	IS	
Environmental	Groundwater	*Not Discernible* (*ND*)	Reported inventories are in operating facilities and basins isolated from the environment.
	Columbia River	*ND*	
	Ecological Resources[(a)]	No cleanup decisions have been made for this EU. Estimated to be ND to Medium	Monitoring activities for post-closure conditions are expected to occur. Medium impacts are likely if exotic species are introduced to buffer area with level 3 resources.
Social	Cultural Resources[(a)]	No cleanup decisions have been made for this EU. Estimated to be: **Native American:** Direct: Unknown Indirect: Known **Historic Pre-Hanford:** Direct: Unknown Indirect: None **Manhattan/Cold War:** Direct: None Indirect: None	Permanent direct effects are possible if residual contamination remains after remediation and from capping. The National Register eligible Manhattan Project/Cold War Era significant resource located within 500 meters of the EU will be demolished, but they have already been mitigated.

a. 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. (IS = Insufficient Information)

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

Unknown

PART VII. SUPPLEMENTAL INFORMATION AND CONSIDERATIONS

The radioactivity content contained within individual 55-gallon drums is also provided within the Table H.12-15, below. It is noted that the radioactivity inventory values are already counted within the inventory values provided in Table H.12-6 described in Part V. A maximum of 720 filled drums may be stored at the ETF.[79]

Table H.12-15. ETF maximum inventory of powder drums stored within ETF[80]

Radionuclide	Powder Drum [Ci/drum]	720 Powder Drums [Ci]
H-3	--	
C-14	3.57E-06	2.57E-03
Se-79	3.39E-07	2.44E-04
Sr-90	9.69E-04	6.98E-01
Tc-99	2.72E-07	1.96E-04
Ru-103	2.29E-03	1.65E+00
Ru-106	1.40E-03	1.01E+00
I-129	7.92E-08	5.70E-05
Cs-134	2.10E-07	1.51E-04
Cs-137	6.88E-04	4.95E-01
Ce-144	2.18E-06	1.57E-03
Eu-154	8.64E-07	6.22E-04
Eu-155	6.89E-07	4.96E-04
U (gross)	4.25E-06	3.06E-03
Np-237	4.25E-06	3.06E-03
Pu-238	4.25E-06	3.06E-03
Pu-239/240	4.25E-06	3.06E-03
Pu-241	4.25E-06	3.06E-03
Am-241	4.25E-06	3.06E-03
Cm-244	4.25E-06	3.06E-03

[79] WHC-SD-C018H-HC-002, Rev 1, pg. 2
[80] HNF-SD-ETF-ASA-001, Rev 4, Table 3-4, pg. T3-4

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