INTEGRATED DISPOSAL FACILITY
APPENDIX BB
WASTE STREAM DESCRIPTIONS

CHANGE CONTROL LOG

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have its own change control log with a modification history table. The "**Modification Number**" represents Ecology's method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Modification History Table

Modification Date	Modification Number

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BB.1 INTRODUCTION

This appendix details the waste streams planned for treatment, storage, or disposal at the Integrated Disposal Facility (IDF) dangerous waste management units (DWMUs) that comprise Operating Unit Group (OUG) 11 of WA7890008967, Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit. Each waste stream is subject to the requirements and processes described in the Addendum B, "Waste Analysis Plan" (WAP) prior to acceptance at IDF for treatment, storage, or disposal.

The purpose of this appendix is to provide information on the regulatory background that defines the waste streams planned for disposal at IDF, corresponding waste stream descriptions, and compliance with applicable state and federal land disposal restrictions (LDRs) of Washington Administrative Code (WAC) 173-303-140, *Land disposal restrictions*, which includes by reference, 40 Code of Federal Regulations (CFR) 268, *Land Disposal Restrictions*.

The waste stream descriptions documented in this appendix do not replace or supersede generator-provided information evaluated during the IDF waste acceptance process. These descriptions serve to supplement the IDF portion of the Hanford Facility RCRA Permit and clarify the disposal mission of the IDF.

BB.1.1 Historical Background/Summary of Regulatory Decisions

The IDF was constructed in 2006 to provide a disposal location for waste generated by the Hanford Site Waste Treatment and Immobilization Plant (WTP). In 2012, U.S. Department of Energy (DOE) completed the DOE/EIS-0391, *Final Tank Closure and Waste Management Environmental Impact Statement* (TC&WM EIS) *for the Hanford Site, Richland, Washington*, which analyzed three key areas of Hanford environmental remediation. The three areas included waste retrieval, disposal, and closure of 177 underground tanks; the final end state of the Fast Flux Test Facility (FFTF) nuclear test reactor; and a Hanford Site disposal location for low-level waste (LLW) and mixed low-level waste (MLLW). The EIS analyzed various cleanup alternatives for each area of closure and waste management. DOE ultimately published their Record of Decision (ROD) (78 Federal Register [FR] 75913) in 2013. DOE selected a waste management alternative that identified IDF as a Subtitle C disposal facility for LLW and MLLW from WTP and Effluent Treatment Facility (ETF) operations, on-site non-*Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) sources, FFTF decommissioning waste and on-site waste management waste.

Following the selection of IDF to provide this instrumental role in the Hanford cleanup mission, a series of assessments were conducted to evaluate disposal of the proposed wastes while minimizing risk to human health and the environment. The RPP-RPT-59958, Rev. 1A, *Performance Assessment for the Integrated Disposal Facility, Hanford Site, Washington* provided an evaluation of the long-term performance of the disposal facility to contain LLW and MLLW in a near-surface disposal facility on the Hanford Site. Through computer modeling analysis, the *Performance Assessment* simulated impacts from radiological and hazardous constituents according to a defined set of exposure pathways (i.e., atmospheric, water, inadvertent intrusion). The RPP-CALC-63176, *Integrated Disposal Facility Risk Budget Tool Analysis* provided a similar evaluation specific to groundwater impacts and protection standards for the Washington State Department of Ecology (Ecology). These assessments consisted of modeling conducted for a series of waste streams planned for final disposal at IDF, as consistently referenced throughout the assessments and other documents discussed in this section.

BB.2 DESCRIPTION OF WASTE STREAMS

The IDF plans to receive MLLW and LLW generated by the WTP as a result of the vitrification process. Additional waste streams that are not a result of the WTP process are also planned for disposal at the IDF. Table BB-1 establishes the waste stream terminology that will be used throughout this appendix, consistent with the documents described in Section BB.1.1. A narrative description of each waste stream and the corresponding LDR treatment standards is provided in the subsequent sections.

Table BB-1 Integrated Disposal Facility Waste Stream Terminology

WTP-Generated Waste Streams	Non-WTP-Generated Waste Streams
Immobilized Low-Activity Waste glass	Secondary Waste Management LLW and MLLW
Low-Activity Waste melters	Fast Flux Test Facility decommissioning waste
Solid secondary waste	On-site non-CERCLA non-tank LLW and MLLW
Effluent Treatment Facility-generated solid secondary waste	

Reference: RPP-RPT-59958, Rev. 01A, *Performance Assessment for the Integrated Disposal Facility, Hanford Site, Washington*

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*

LLW = Low-level waste

MLLW = Mixed low-level waste

WTP = Waste Treatment and Immobilization Plant

BB.2.1 Waste Treatement and Immobilization Plant-Generated Waste Streams

The WTP was constructed to treat and immobilize waste currently stored underground in the Hanford Tank Farms. As a result of related waste treatment, processing, and operating activities, the WTP generates a series of solid and liquid wastes.

BB.2.1.1 Immobilized Low-Activity Waste Glass

Immobilized low-activity waste (ILAW) glass is generated by treating low-activity waste (LAW) from the Hanford Tank Farms. This process is initiated by transferring treated LAW from the Hanford Tank Farms to the WTP LAW Vitrification Facility via an underground waste transfer line. The tank waste is combined with glass-forming chemicals and melted into a solid glass form in a process known as vitrification. This treatment process is designed to immobilize the waste constituents into a glass matrix. Following vitrification treatment in the melters, ILAW glass is poured into stainless steel cylinders, cooled, and shipped to IDF for disposal. Each ILAW glass package consists of a stainless steel cylinder with outside container dimensions of approximately 7.5 ft (2.3 m) in height and 4.0 ft (1.22 m) in diameter. It is estimated that each ILAW glass package contains 5.51 metric tons of glass. At disposal, the final waste form is anticipated to be the vitrified LAW tank waste. The vitrified tank waste represents more than 90% of the planned waste disposal volume at IDF.

BB.2.1.2 Low-Activity Waste Melters

The LAW melters are designed to safely manage molten glass within a rectangular shell, lined with refractory material. During use, the melter refractory package is designed to serve as a mechanical, thermal, and electrical barrier between the molten glass residing in the melter and the melter shell. An outer steel casing encloses each melter, providing local shielding and containment for the molten glass. Active cooling on the outside of the refractory package is provided by water jackets. Penetrations in the melter system are sealed using appropriate gaskets and flanges. Each LAW melter has external

dimensions of approximately 31 x 21 x 16 ft high, and weighs approximately 295 metric tons empty and 318 metric tons with glass. The operating temperature of the melter is between 1050° C and 1200° C.

Due to the conditions of the vitrification process, LAW melters require periodic replacement throughout the operational lifespan of the WTP. The LAW melters requiring replacement are cooled, allowing residual molten glass to vitrify prior to disconnection and removal from the WTP LAW Vitrification Facility. The used LAW melters are expected to be MLLW and are managed as miscellaneous units prior to disposal at IDF. The actual number of used LAW melters to be disposed of at IDF will be determined by WTP operations, but it is estimated that approximately 18 used LAW melters might be disposed of at IDF (TC&WM EIS). At disposal, the final waste form is anticipated to be the used LAW melter. Grout or similar material may be added to the used LAW melters to ensure stability of the disposed waste, minimizing risk of subsidence.

BB.2.1.3 Secondary Solid Waste

Secondary solid waste (SSW) is generated as a result of WTP operations, such as waste derived from routine maintenance activities, nonroutine maintenance activities, and daily operating activities. It includes LLW and MLLW debris and non-debris waste such as melter consumables, failed process components, analytical laboratory waste, spent resins, spent carbon adsorbent, high-efficiency particulate air (HEPA) filters, and other process-related waste. Specific types of SSW described in this section are known wastes generated by the WTP. Additional types of SSW could also be generated.

LAW melters are fitted with various ancillary equipment (e.g., bubbler assemblies and thermocouples) that requires periodic replacement. Ancillary equipment (e.g., pumps, valves, piping, motors, and electrical equipment) no longer fit for use is removed from service and designated as waste. Equipment that has been in contact with the tank farms waste feed is packaged for transportation and will be treated, if needed, to meet LDR requirements (Section BB.3) prior to disposal at IDF.

HEPA filters, high-efficiency mist eliminators, spent carbon, and catalyst material are components of the offgas treatment system incorporated to remove contaminants from the offgas streams prior to discharge of the molten glass. These components are replaced periodically to maintain treatment efficiency. They are removed from their respective equipment, packaged for transportation, and will be treated, if needed, to meet LDR requirements (Section BB.3) prior to disposal at IDF.

Non-wastewater laboratory waste derived from the tank farms waste feed is designated, packaged, and shipped to IDF. Other non-wastewater laboratory waste (e.g., off-specification laboratory chemicals and spent or unused simulant) is designated and managed accordingly, which may include treatment to meet LDR requirements (Section BB.3) prior to disposal at IDF.

Personal protective equipment (PPE) is worn by WTP personnel performing certain tasks such as facility maintenance, treatment process operations, and waste packaging activities. Used PPE that cannot be recycled and has had contact with the tank farms waste feed or other sources of contamination is designated, packaged for transportation, and will be treated, if needed, to meet LDR requirements (Section BB.3) prior to disposal at IDF.

WTP also generates maintenance wastes such as paints, lubricants, cleaning solvents, adhesives, and off-specification chemicals. Maintenance waste that comes in direct contact with the tank farms waste feed is designated, packaged for transportation, and will be treated, if needed, to meet LDR requirements (Section BB.3) prior to disposal at IDF.

At disposal, the final waste form for SSW is anticipated to be stabilized non-debris and grout-encapsulated SSW debris.

BB.2.1.4 Effluent Treatment Facility-Generated Secondary Solid Waste

The dangerous and mixed liquid waste streams generated at the WTP that cannot be incorporated back into the treatment process are sent to the Liquid Effluent Retention Facility/Effluent Treatment Facility (LERF/ETF) as hazardous aqueous waste, pending compliance with the LERF/ETF acceptance criteria. ETF-generated SSW results from WTP operations, which are categorized according to aqueous waste from processes, plant wastewater, and Effluent Management Facility effluents. This includes LLW and MLLW liquid effluent from the melter primary off-gas treatment system, the LAW vitrification secondary off-gas/vessel vent treatment system, process vessel washes, floor drains, sumps, and vessel vent header drains. In addition, liquid waste from WTP Pre-Treatment Facility sources such as the radioactive liquid vessels and tanks including process condensates from evaporators, caustic waste from the LAW caustic scrubber, and spent reagents from the resin addition process are routed to the LERF/ETF for treatment.

After treatment at the ETF, the liquid portion of the treated waste stream is disposed of at the State-Approved Land Disposal Site while the byproduct waste generated from the ETF solidification process is designated, packaged for transportation, and will be treated, if needed, to meet LDR requirements (Section BB.3) prior to disposal at IDF. At disposal, the final waste form is anticipated to be solidified ETF-generated SSW in a cementious waste form.

BB.2.2 Non-WTP-Generated Waste Streams

In addition to the disposal of WTP-generated waste streams, IDF provides further disposal capacity for non-WTP-generated waste streams to support Hanford Site cleanup.

BB.2.2.1 Secondary Waste Management Low-Level Waste and Mixed Low-Level Waste

Secondary waste includes workers' PPE, tools, and other contaminated materials from tank farms operations, as well as:

- Secondary LLW and MLLW from operation of the Low-Level Burial Grounds 200-W-254, mixed waste Trenches 31 and 34.
- Secondary LLW and MLLW from operation of the Waste Receiving and Processing Facility.
- Secondary LLW and MLLW from operation of the T Plant Complex.

In addition, mixed waste is generated by IDF operations including waste resulting from treatment at IDF and waste generated from operations and maintenance activities. The waste described in this section will be treated, if needed, to meet LDR requirements (Section BB.3) prior to disposal at IDF. At disposal, the final waste form is anticipated to be grout-encapsulated SSW.

BB.2.2.2 Fast Flux Test Facility Decommissioning Waste

In accordance with the ROD (78 FR 75913) that published DOE's selected tank closure and waste management alternatives, entombment was selected as the final end-state for the FFTF. This includes removal of all above-grade structures and treatment of certain remaining wastes, including the remote-handled special components and bulk-sodium inventories. Sodium residuals from FFTF components (e.g., the reactor and miscellaneous traps), are planned for disposal at IDF. In addition to sodium residuals, other FFTF waste resulting from decomissioning activities is planned for disposal at IDF. The FFTF secondary waste under the Entombment Alternative includes:

- Demolition waste from the main Reactor Containment Building and Buildings 491E and 491W that cannot be consolidated in below-grade spaces.
- Radioactive and hazardous materials from other ancillary buildings.
- The reactor vessel, piping systems, and tanks that would not fit in below-grade spaces.
- Solid waste resulting from waste processing.

Additional types of SSW could also be generated. This waste will be treated, if needed, to meet LDR requirements (Section BB.3) prior to disposal at IDF. At disposal, the final waste form is anticipated to be grout-encapsulated SSW.

BB.2.2.3 On-site Non-CERCLA Non-Tank Low-Level Waste and Mixed Low-Level Waste

On-site non-CERCLA, non-tank LLW and MLLW is Hanford-generated waste from sources other than the tank treatment operations. Hanford activities, such as surveillance and maintenance, environmental research and development, sample analyses, liquid effluent waste treatment, infrastructure support, and environmental monitoring programs all support Hanford's cleanup mission and generate waste. These wastes have been and will continue to be generated in support of historical and existing Hanford cleanup operations. Wastes contaminated with radiological and hazardous constituents pose a risk to human health and the environment until they are appropriately treated and safely disposed. Prior to disposal at IDF, all waste is subject to the acceptance process and criteria described in Addendum B. LLW and LDR-compliant MLLW may be disposed of at IDF.

On-site non-CERCLA, non-tank LLW and MLLW includes RCRA solid wastes (i.e., debris, non-debris wastes) contaminated with radiological and hazardous constituents, such as F-, P-, and U-listed RCRA constituents, characteristics, and Washington State Only wastes. A description of typical on-site non-CERCLA, non-tank LLW and MLLW is provided for each of the on-site generator examples below:

- **Central Waste Complex (CWC)** - The CWC is comprised of a series of storage buildings and other structures that provide segregated areas for storage of dangerous and mixed waste. Wastes at CWC include contaminated materials from routine maintenance, repair, operations, and spill cleanup. This includes contaminated soils, hazardous debris, PPE, and other materials that designate as dangerous or mixed waste when discarded.
- **Plutonium Finishing Plant (PFP)** - The PFP Complex was used to conduct plutonium processing and storage supporting the production of nuclear weapons and reactor fuel. Project activities at PFP are specified by CERCLA documentation. Waste management within the PFP Complex includes waste generation from ongoing removal actions, including surveillance, maintenance, deactivation, decommission, decontamination, and demolition (D4) activities. Wastes generated at PFP include contaminated materials from routine facility operations and D4 activities. Most of the waste will be LLW, but a small amount of dangerous or MLLW could also be generated.
- **T Plant Complex** - Waste management within the T Plant Complex includes storage and treatment of dangerous and mixed waste. Wastes at T Plant include contaminated materials from routine maintenance, repair, operations, and spill cleanup. This includes contaminated soils, step-off pad waste (e.g., PPE), organic and inorganic debris from cleanout activities such as the 221-T Canyon (e.g., plastic, rubber, wood, paper, cloth, metals, etc.), and other materials that designate as dangerous or mixed waste when discarded.
- **Waste Encapsulation and Storage Facility (WESF)** - Waste management within WESF includes storage of 1,936 capsules containing cesium and strontium radioactive mixed waste currently being stored in the Pool Cells DWMU. The capsules will be transferred to a dry storage configuration at the Capsule Interim Storage Facility. Wastes are generated from routine operations and maintenance activities, including debris, discarded PPE, and maintenance waste that designate as dangerous or mixed waste when discarded.

- **Waste Receiving and Processing Facility (WRAP)** - Waste management activities at WRAP include storage and treatment of dangerous and mixed waste. Wastes at WRAP include contaminated materials from routine maintenance, repair, operations, and spill cleanup. This includes contaminated soils, hazardous debris, PPE, and other materials that designate as dangerous or mixed waste when discarded.
- **Groundwater sampling activities** - Groundwater monitoring is conducted across the Hanford Site. Groundwater samples are analyzed to identify and evaluate contaminants in the groundwater, including concentration levels and migration behaviors. Typical wastes generated from groundwater sampling activities include contaminated sampling media, PPE, and tools or other equipment used for well drilling, sampling, or maintenance activities that designate as dangerous or mixed waste when discarded.
- **Pacific Northwest National Laboratory (PNNL)** - Waste management within PNNL includes storage and treatment of dangerous and mixed waste. Wastes generated at PNNL include contaminated waste from routine operations, including from research laboratory analysis, support activities, or as a byproduct of waste handling and treatment activities. Typically, these wastes include PPE, rags, and other spent materials that designate as dangerous or mixed waste when discarded.
- **Cold Vacuum Drying Facility (CVDF)** - The primary mission of the CVDF, or 142K Building, was drying and dewatering fuel in multi-canister overpacks shipped from the K-Basins. Project activities at the CVDF are specified by CERCLA documentation. Waste management within the CVDF includes waste generation from ongoing removal actions, surveillance, maintenance, and D4 activities (e.g., rubber, glass, paper, PPE, cloth, equipment). Wastes generated at the CVDF are mostly LLW, but a small amount of dangerous or MLLW could also be generated.
- **Canister Storage Building (CSB)** - The CSB contains equipment to support the staging and temporary storage of multi-canister overpacks containing spent nuclear fuel. CSB generates mostly LLW from periodic surveillance and maintenance and may generate mixed waste (e.g., rags or similar spent materials that designate as dangerous or mixed waste when discarded).
- **Liquid Waste Processing Facilities (LERF, ETF, State-Approved Land Disposal Site [SALDS], and Treated Effluent Disposal Facility)** - The Liquid Waste Processing Facilities work together to process liquid waste containing chemical and radioactive contamination. The LERF is comprised of a series of retention basins designed to store liquid waste until it can be processed at the ETF. The ETF processes the liquid waste to treat chemical and radioactive contaminants. Treated effluent from the ETF is discharged to a SALDS. The Treated Effluent Disposal Facility (TEDF) collects nonhazardous treated waste effluents for disposal. Wastes generated at the 200 Area ETF include spent materials from routine operations and maintenance activities (e.g., spent media and process filters, equipment, rags, glass, etc.), waste resulting from spills, and discarded chemical products that designate as dangerous or mixed waste.

This waste will be treated, if needed, to meet LDR requirements (Section BB.3) prior to disposal at IDF.

BB.3 LAND DISPOSAL RESTRICTIONS COMPLIANCE

LDR requirements ensure the treatment of dangerous and/or mixed waste prior to disposal in RCRA Subtitle C land disposal units; thereby, reducing dangerous waste toxicity and the potential for leaching of dangerous waste constituents into the environment. Dangerous and/or mixed waste must comply with the LDR requirements of WAC 173-303-140, which includes by reference 40 CFR 268, prior to disposal. IDF performs limited waste treatment using the immobilization technologies according to the alternative standards for hazardous debris (Table 1, 40 CFR 268.45, *Treatment standards for hazardous debris*), as further described in Section C.3 of Addendum C. Waste requiring treatment beyond IDF's capabilities is sent to an alternate on-site facility or off-site commercial vendor to meet LDR requirements prior to disposal at IDF.

BB.3.1 Land Disposal Restrictions Treatment Standards

Waste that does not meet LDR treatment standards at the point of generation must be treated to comply with the applicable concentration-based and/or technology-based treatment standards, prior to land disposal. Treatment standard(s) are determined according to the designated waste codes, subcategory (if any), and wastewater or nonwastewater category assigned to the waste.

When the concentration-based standards apply, the constituent concentration for the waste must be at or below those specified in 40 CFR 268.40, *Applicability of treatment standards,* and/or 268.48, *Universal treatment standards*, for underlying hazardous constituents. If the concentrations exceed these specified limits, treatment is required prior to land disposal. When the technology-based standards are used, the appropriate treatment technology must be performed in accordance with 40 CFR 268.40 and 268.42, *Treatment standards expressed as specific technologies,* Table 1, "Technology Codes and Description of Technology-Based Standards." For waste treated to the alternative treatment standards of 40 CFR 268.45, treatment technologies are performed in accordance with the technology description, performance and/or design and operating standard specified in Table 1, "Alternative Treatment Standards for Hazardous Debris." For contaminated soil, the alternative treatment standards of 40 CFR 268.49, *Alternative LDR treatment standards for contaminated soil,* apply. If a waste is designated with multiple waste codes, both concentration-based and technology-based standards could apply and such waste would be subject to more than one LDR treatment standard.

In order to confirm that a treatment was effective, the appropriate qualitative or quantitative standard must be met. During the acceptance process, IDF reviews generator documentation to evaluate compliance with these treatment standards according to the following methodologies:

- Concentration-based treatment standard shall be confirmed via analysis of the treated waste.
- Technology-based treatment standard shall be demonstrated to conform to the specified technology performance standard.

For hazardous debris treated at IDF, effectiveness of treatment is a qualitative confirmation methodology performed according to the frequency specified in Table B-1 of the IDF WAP, in accordance with 40 CFR 268.45. For waste that meets the treatment standard(s) or approved variance (Section BB.3.2) at the point of generation, a one-time notice certifying that the waste complies with 40 CFR 268 must be provided to IDF by the generator. This notice must include the required information specified in 40 CFR 268.7, *Testing, tracking, and recordkeeping requirements for generators, treators, and disposal facilities,* and be replaced with a new notice if the waste changes.

LDR notification and certification statements are reviewed during the pre-shipment review to confirm the LDR-status of incoming waste to IDF, and to prepare for any additional treatment needs prior to disposal. Compliance with LDR requirements is tracked per dangerous waste container and is maintained in accordance with Section B.6 of the IDF WAP.

BB.3.2 Land Disposal Restrictions Evaluation for Immobilized Waste

In 2017, an LDR treatability variance for Hanford tank waste was submitted to Ecology for review and approval (17-ECD-0050). The proposed action was a site-specific variance under 40 CFR 268.44, *Variance from a treatment standard*, Section (h) that specified high-level waste vitrification (HLVIT) as the method of treatment for Hanford tank waste processed through the WTP, for all applicable waste codes. The basis for the variance was the dose associated with repeated sampling and analysis that would otherwise be required to demonstrate compliance with concentration-based LDR treatment standards. The variance was approved by Ecology in 2019 (19-NWP-165), thereby determining HLVIT as the LDR treatment standard for the Hanford tank waste treated at WTP.

Compliance with the approved treatment variance must be identified on the LDR notification and certification statement.

BB.4 REFERENCES

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