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15-ECD-0054

Ms. Jane A. Hedges, Program Manager
Nuclear Waste Program
Washington State
Department of Ecology
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Ms. Hedges:

UPDATED EVALUATION OF WASTE TREATMENT AND IMMOBILIZATION PLANT SECONDARY DANGEROUS WASTE TREATMENT AND DISPOSAL FOR 2015 DANGEROUS WASTE PERMIT SUBMITTAL

References:

1. BNI letter from M.G. McCullough to K.W. Smith, ORP, "Submittal of Updated Evaluation of WTP Secondary Dangerous Waste Treatment and Disposal for 2015 DWP Submittal," CCN: 277133, dated September 23, 2015.

2. WA7890008967, "Dangerous Waste Portion of the Hanford Facility Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste, Part III, Operating Unit 10, 'Waste Treatment and Immobilization Plant.'"

3. ORP/BNI letter from D.A. Brockman, ORP, and F.M. Russo, BNI, to J.A. Hedges, Ecology, "Submittal of 'Evaluation of WTP Secondary Mixed Wastes for Dangerous Waste Treatment and Disposal,' 24590-WTP-RPT-ENS-10-003, Revision 1," 10-ESQ-203/CCN: 216656 (REISSUE), dated August 16, 2010.

This letter submits the Updated Evaluation of Waste Treatment and Immobilization Plant (WTP) Secondary Dangerous Waste Treatment and Disposal for 2015 Dangerous Waste Permit.

The WTP Dangerous Waste Permit (Reference 2) requires submittal of waste stream treatment approaches in accordance with the following permit condition:

> III.10.C.2.n.v.: By December 31, 2015, or 12 months prior to cold commissioning of the facility producing the waste, whichever is earlier, the Permittees will, for the mixed waste streams identified in item (iii) immediately above, select appropriate treatment approaches that mitigate their environmental impacts.

A waste stream treatment approach report, WTP Secondary Mixed Wastes for Dangerous Waste Treatment and Disposal, 24590-WTP-RPT-ENS-10-003, Rev. 1, was submitted to Washington State Department of Ecology in 2010 (Reference 3) pursuant to permit condition:

> III.10.C.2.n.iii.: By June 30, 2010, the Permittees will identify which mixed waste streams that, from a qualitative risk perspective, reasonably may cause or may significantly contribute to an exceedance of applicable environmental standards at a disposal facility.

The 2010 report did not identify waste streams that, from a qualitative risk perspective, might challenge disposal requirements. The attached 2015 report verifies that no streams meeting this criteria have been identified.

If you have any questions, please contact me, or your staff may contact Gae M. Neath, Environmental Compliance Division, (509) 376-7828.

Kevin W. Smith
Manager

ECD:GMN

Attachment

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Attachment
15-ECD-0054
(22 Pages)

Updated Evaluation of WTP Secondary Dangerous Waste Treatment and Disposal for 2015 DWP Submittal

24590-WTP-RPT-ENV-14-006, Rev. 0

Issued by
RPP-WTP PDC

Updated Evaluation of WTP Secondary Dangerous Waste Treatment and Disposal for 2015 DWP Submittal

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Notice

Please note that source, special nuclear, and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the US Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

History Sheet

Rev	Reason for revision	Revised by
0	Initial release	B. D. Christie

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Acronyms

CH	contact handled
ESRSWG	*WTP Estimate of Secondary Radioactive Solid Waste Generation,* (24590-WTP-PT-ENS-10-010)
ETF	Effluent Treatment Facility
HDPE	high density polyethylene
HEPA	high efficiency particulate air (filter)
HIC	high-integrity container
HLVIT	*Vitrification of High Level Mixed Radioactive Waste Treatment Standard,* 40 CFR 268.42
HOP	HLW melter offgas treatment process system
HSSWAC	*Hanford Site Solid Waste Acceptance Criteria*, HNF-EP-0063
IDF	Integrated Disposal Facility
IHLW	immobilized high-level waste
ILAW	immobilized low-activity waste
IX	ion exchange
Lab	Analytical Laboratory
LAW	low-activity waste
LDR	Land Disposal Restrictions
LERF	Liquid Effluent Retention Facility
LLW	low-level waste
LVP	LAW Facility secondary offgas/vessel vent process system
MLLW	mixed low-level waste
MTBF	mean time between failure
MTBM	mean time between maintenance
NNSS	Nevada National Security Site
PTF	Pretreatment Facility
RAM	reliability, availability, and maintainability
RCRA	Resource Conservation and Recovery Act of 1976
RH	remote handled
RLD	radioactive liquid waste disposal system

RSW	radioactive solid waste
TCLP	Toxicity Characteristic Leaching Procedure (SW-846 Method 1311)
TOC	Tank Operations Contractor
TRU	transuranic waste
TRUM	transuranic mixed waste
TSD	treatment, storage, and disposal
WIPP	Waste Isolation Pilot Plant
WTP	Hanford Tank Waste Treatment and Immobilization Plant

Executive Summary

This report has been prepared for inclusion into the Hanford Tank Waste Treatment (WTP) and Immobilization Plant Dangerous Waste Permit (DWP) Administrative Record as required by permit condition III.10.C.2.n.v. of the DWP. Permit condition III.10.C.2.n.v. requires:

III.10.C.2.n.v. By December 31, 2015 or 12 months prior to cold commissioning of the facility producing the waste, whichever is earlier, the Permittees will, for the mixed waste streams identified in item (iii) immediately above, select appropriate treatment approaches that mitigate their environmental impacts.

The DWP condition III.10.C.2.n.iii. requires:

III.10.C.2.n.iii. By June 30, 2010, the Permittees will identify which mixed waste streams that, from a qualitative risk perspective, reasonably may cause or may significantly contribute to an exceedance of applicable environmental standards at a disposal facility;

This document fulfills the DWP requirement to submit additional secondary mixed waste treatment information by December 2015 for the mixed waste streams that were identified as meeting the III.10.C.2.n.iii criteria in the report submitted in June 2010.

In June 2010, the WTP report 24590-WTP-RPT-ENS-10-003, *Evaluation of WTP Secondary Mixed Wastes for Dangerous Waste Treatment and Disposal*, was submitted to Washington Department of Ecology (CCN 216656), as required by the DWP conditions III.10.C.2.n.i. through III.10.C.2.n.iv. The 2010 report provided an estimate of the type and volume of WTP secondary waste streams, their required Land Disposal Restrictions (LDR) treatment standards, and the proposed treatment methods to meet those standards. The report also provided a qualitative discussion of potential ecological risks associated with LDR compliance.

Per the conclusion in the 2010 report, the LDR treated waste streams from a qualitative risk perspective, do not cause or significantly contribute to an exceedance of applicable environmental standards at a disposal facility. As such, no waste streams require submittal of appropriate treatment selection by December 2015, as required in the DWP condition III.10.C.2.n.v.

There have been no changes in WTP waste estimates since the 2010 report and the selected treatment approaches remain principally the same. Treatment capabilities of offsite vendors have been evaluated and support the 2010 report conclusions. Multiple vendors are able to provide treatment or treatment and disposal services for these waste streams.

The treatments for chemical and radiological hazards have been identified and confirmed with the vendors for all WTP dangerous and mixed wastes. These treatments mitigate any potential environmental impacts from WTP waste. This report, along with the 2010 report, fulfills the requirements and intent of DWP condition III.10.C.2.n.v.

1 Introduction

This report has been prepared for incorporation into the Hanford Tank Waste Treatment and Immobilization Plant (WTP) Dangerous Waste Permit (DWP) Administrative Record as required by permit condition III.10.C.2.n.v. of the DWP. Permit condition III.10.C.2.n.v. requires:

III.10.C.2.n.v. By December 31, 2015 or 12 months prior to cold commissioning of the facility producing the waste, whichever is earlier, the Permittees will, for the mixed waste streams identified in item (iii) immediately above, select appropriate treatment approaches that mitigate their environmental impacts.

The DWP condition III.10.C.2.n.iii. requires:

III.10.C.2.n.iii. By June 30, 2010, the Permittees will identify which mixed waste streams that, from a qualitative risk perspective, reasonably may cause or may significantly contribute to an exceedance of applicable environmental standards at a disposal facility;

In June 2010, the WTP report 24590-WTP-RPT-ENS-10-003, *Evaluation of WTP Secondary Mixed Wastes for Dangerous Waste Treatment and Disposal*, was submitted to Washington Department of Ecology (CCN 216656), as required by the DWP conditions III.10.C.2.n.i. through III.10.C.2.n.iv. The 2010 report provided an estimate of the types and volume of WTP secondary waste streams, their associated Land Disposal Restrictions (LDR) treatment standards, and the proposed treatment methods to meet the standards. The report also provided a qualitative discussion of potential ecological risks associated with LDR compliance.

The report concluded that:

- WTP secondary mixed waste streams require some form of treatment to meet LDR prior to disposal in a Resource Conservation and Recovery Act (RCRA) permitted landfill.
- Appropriate LDR treatment standards and potential treatment methods have been identified for WTP secondary waste streams, including seven potentially difficult to treat waste streams.
- Existing Hanford Site and commercial treatment and disposal facilities offer capability to achieve compliance with the LDR standards for the WTP secondary wastes. Some uncertainties exist regarding transportation of WTP waste to and from a facility and the capacity of these facilities.
- The majority of challenges associated with the difficult to treat mixed waste secondary wastes are programmatic in nature.
- The qualitative risk associated with treatment and disposal of those waste streams is projected to be low.

The 2010 report did not identify any WTP secondary waste streams that from a qualitative risk perspective may cause or significantly contribute to an exceedance of applicable environmental standards at a disposal site. There have been no changes in WTP waste estimates since the 2010 report, and the selected treatment approaches remain principally the same. Offsite treatment vendor capabilities were evaluated and support the conclusions above from the 2010 report. This report documents compliance with DWP condition III.10.C.2.n.v.

An updated summary of the waste categories and the processes generating WTP secondary waste is provided in Sections 2 and 3. Section 3 also provides a summary of offsite treatment vendor capabilities to provide the LDR compliant treatment methods identified in the 2010 report. Section 4 presents the conclusions of this update.

2 Background

Secondary solid mixed waste is generated from the WTP waste processing and maintenance activities. These wastes include fouled or worn ultrafilter media, spent ion exchange (IX) resins, contaminated consumable components of the melters and process offgas systems, the melters, and a number of maintenance wastes such as failed equipment and degreasing or decontamination materials. These wastes are placed into drums or boxes or specially designed containers. Some items will need to be size reduced in order to fit into disposal containers.

Secondary solid wastes are packaged for transportation or disposal at WTP. The waste is then transferred to the Tank Farm Operating Contractor (TOC) who coordinates volume reduction or treatment to meet disposal requirements. The TOC transports treated WTP wastes to a permitted disposal facility such as the Hanford Site Integrated Disposal Facility (IDF) or other approved disposal site such as the Low-Level Radioactive Waste Burial Grounds. Transuranic (TRU) and TRU-mixed (TRUM) waste containers are transferred to the Plateau Remediation Contractor for storage while awaiting shipment to Waste Isolation Pilot Plant (WIPP).

Non-radioactive dangerous wastes are also generated by operations, laboratory, and maintenance activities. These wastes are packaged at the WTP for transfer to a permitted treatment, storage, and disposal (TSD) facility. Transportation and disposal of WTP secondary wastes are in the TOC and plateau remediation contractor scopes.

The radioactive liquid waste disposal system (RLD) collects secondary liquid wastes generated by most WTP facilities. The RLD receives effluent wastes from a wide variety of processes and drains including but not limited to laboratory analytical processes, high efficiency mist eliminator drains, process condensates from evaporators, caustic waste from the Low-Activity Waste (LAW) Facility caustic scrubber, spent reagents from the resin addition process, vessel washes, floor drains and sumps, and vessel vent header drains. All of these sources are expected to have low levels of radioactive contamination and ultimately discharge to the Liquid Effluent Retention Facility (LERF) and the Effluent Treatment Facility (ETF) for treatment.

2.1 Description of Projected Secondary Waste Streams

2.1.1 Radioactive Solid Wastes

Radioactive solid wastes (RSW) including mixed wastes, that are derived from WTP operations include a wide variety of wastes that can be categorized as waste derived from routine maintenance activities, non-routine maintenance activities, and day-to-day operating activities.

2.1.1.1 Chemical, Physical, and Radiological Properties

Radioactive waste that contains dangerous waste constituents is designated as mixed waste. Many WTP secondary wastes would not designate as mixed wastes based on constituent concentrations but are mixed wastes because they have contacted listed tank wastes. These wastes are designated with F001-F005 listed waste codes.

RSW chemical properties are related to the main material of construction (for example, silver mordenite) and the radioactive and dangerous contaminants on the material. This section defines the properties of the contaminants, since the bulk material properties can be determined by process knowledge. These materials have varying amounts and compositions of contaminants (chemical and radioactive). The kinds of the RSW vary widely, but generally include the following:

- Debris wastes such as valves and pumps, spent bubblers, thermowells, pipe jumpers, and spent melters, plastic, rubber, wood, paper, cloth.
- Non-Debris organic solids such as spent cesium (Cs) IX resin, spent catalyst, silver mordenite, and activated carbon bed media.
- Glass fragments that spall from the glass canister during decontamination, or drips from the melter discharge component, or spall from melter components such as bubblers and thermowells.
- Organic sludges such as lubricating grease.
- Organic liquids such as spent laboratory chemicals and reagents, lubricating oils, hydraulic fluids, and organic analytical wastes that cannot be recycled back into the pretreatment process.

The radionuclide and chemical composition and the radiation dose rate of the waste are required to determine specific waste acceptance criteria that apply to each waste stream. Waste is contact handled (CH) if the external dose rate on the container surface is less than 200 mrem/hr; otherwise, the waste is considered remote handled (RH). Waste containing more than 100 nCi/g of alpha-emitting transuranic elements with half-lives greater than 20 years is classified as TRU; otherwise, the waste is classified as low-level waste (LLW).

LLW is subdivided into Category 1, Category 3, and greater than Category 3 waste as defined in Appendix A of the Hanford Site Solid Waste Acceptance Criteria (HSSWAC). These categories are based on the waste's radionuclide content and radiation dose rate. Radioactive solid wastes

complying with the HSSWAC that are likely to be generated at WTP can be grouped into the following main categories:

- CH-LLW-1 (contact-handled Category 1 low-level waste)
- CH-LLW-3 (contact-handled Category 3 low-level waste)
- CH-MLLW-1 (contact-handled Category 1 mixed low-level waste)
- CH-MLLW-3 (contact-handled Category 3 mixed low-level waste)
- RH-MLLW-3 (remote-handled Category 3 mixed low-level waste)
- CH-TRUM (contact-handled mixed TRU waste)
- RH-TRUM (remote-handled mixed TRU waste)

WTP is currently not predicting any secondary waste to be considered HLW. However, this determination is made by the regulatory authority. WTP is prepared to alter plans to accommodate any waste stream that remains classified as HLW. The projected WTP waste streams described in Secondary Waste Compliance Plan (24590-WTP-PL-RT-03-003) with respect to these general waste categories are provided below.

2.1.1.2 Low-Level Waste

The Low-Level secondary waste streams (CH-LLW-1 and CH-LLW-3) consists of items that are radioactive, but do not contain dangerous waste constituents at regulated levels. If WTP LLW comes in direct contact with tank waste it is re-classified as mixed waste due to contact with listed waste constituents. WTP LLW is predominantly debris waste generated during maintenance and operations (such as personal protective equipment, tools, failed equipment, and other contaminated debris that has not been in direct contact with tank waste and is not subject to regulation as mixed waste, TRU, or both). Some operational consumables such as selected offgas treatment media (for example, heating, ventilation, and air-conditioning (high efficiency particulate air [HEPA] filters) are also included in this category.

Certain LLW may be packaged at the generating facility for transport and disposal at the Hanford Site in accordance with the Integrated Disposal Facility Waste Acceptance Criteria (IDFWAC) or HSSWAC. The LLW that cannot be packaged for disposal at the WTP is transported to a Hanford Site or commercial treatment facility for processing to meet Hanford Site disposal criteria (i.e., volume reduction, 90% full, 50 psi compaction criteria, and radiological stabilization). A significant number of LLW waste streams are expected to be Category 3 wastes. These wastes may require additional processing or special packaging (for example, a high-integrity container [HIC]) to control radiological contaminants.

2.1.1.3 Contact-Handled Mixed Low-Level Waste

Contact-handled MLLW (CH-MLLW-1 and CH-MLLW-3) is generated at several areas in the WTP. The largest contributors are expected to be LAW melter consumables (for example, bubblers, thermowells); debris generated by the Analytical Laboratory (Lab); and failed process components such as jumpers and pumps that have been in contact with the waste feed.

Additional sources are expected to be offgas treatment absorbent media, and LAW caustic scrubber packing. Contact handled mixed wastes also includes wastes that would not designate as mixed wastes based on characteristic waste constituent concentrations, but are mixed wastes because they have contacted listed tank wastes. These wastes are designated and manifested with the F001-F005 listed waste codes. Except for the LAW melters, CH-MLLW is packaged for transport to an offsite TSD for treatment, such as macroencapulation for debris and stabilization or thermal treatment for non-debris. MLLW treatment residues containing Category 3 radionuclides may require further processing for radiological stabilization, unless the RCRA treatment (e.g., macroencapsulation or stabilization) satisfies the radiological stabilization requirement.

2.1.1.4 Remote-Handled Mixed Low-Level Waste

MLLW packages that exceed 200 mrem/hr on contact require remote handling and/or additional shielding during packaging, transport, treatment, and disposal operations (RH-MLLW-3). This waste stream includes spent cesium IX resin generated at the Pretreatment Facility (PTF), spent PTF and HLW HEPA filters, HLW melter consumables (including immobilized high-level waste [IHLW] glass shards), and failed HLW components such as pumps and jumpers. RH-MLLW is packaged for transport to an offsite TSD for treatment, such as macroencapulation for debris and stabilization or thermal treatment for non-debris. MLLW treatment residues containing Category 3 radionuclides may require further processing for radiological stabilization, unless the RCRA treatment (e.g., macroencapsulation or stabilization) satisfies the radiological stabilization requirement. Management of RH-MLLW also requires consideration for special packaging (overpacks, casks, shielding) and remote operations.

2.1.1.5 Transuranic Mixed Waste

Wastes with a TRU constituent content exceeding 100 nCi/g are packaged in accordance with HSSWAC and shipped to the Central Waste Complex or another approved storage area pending preparation for disposal at the WIPP in accordance with the WIPP waste acceptance criteria.

The only RH-TRUM waste currently identified is HLW melter discharge chamber thermowells. Although no single transuranic radionuclide causes an exceedance of the HSSWAC TRU limit (100 nCi/g), the cumulative quantity of transuranic radionuclide on the discharge chamber thermowells is estimated to be 120 nCi/g. Spent melter discharge chamber thermowells are size reduced and packaged in 55 gallon drums.

Currently the only potential CH-TRUM wastes identified at the WTP are the HLW melters. The HLW melters are contact handled waste because they are placed in 8 inch thick steel disposal overpacks before they are removed from the HLW melter vitrification cave.

2.1.1.6 High Level Waste (HLW)

While no RSW at WTP is projected to be high level waste (HLW) following completion of the waste incidental to reprocessing evaluation, there is a risk some of the above items could be classified as HLW by the governing regulatory agency. There are no HLW disposal sites in the country. Any HLW may be packaged and stored along with the IHLW canisters at the Interim Hanford Storage area, or stored at the Canister Storage Building and Interim Storage Area in the 200 East area.

2.1.2 Radioactive Solid Waste Packaging

Radioactive solid waste is packaged in containers appropriate for the physical, chemical, and radiological properties of the waste stream. A number of standard pre-approved packages are in use at the Hanford Site. When practical, waste is packaged in these standard packages. Waste streams such as cesium IX resin and the HLW melters present unique circumstances that dictate a nonstandard package.

The following types of waste packages are expected to be used by the WTP project:

- Labpacks
- 16 gallon drums
- 30 gallon drums
- 55 gallon drums
- 85 gallon drums
- 2x2x6 Type A box
- 4x4x8 Type A box
- 5x5x9 Type A box
- 8x8x20 IP1 conex or sea-land type box
- HLW melter overpack (welded 8 inch carbon steel encapsulation overpack)
- HIC for spent IX resin

2.1.3 Radioactive, Dangerous Liquid Effluents

The RLD system is the primary source of radioactive, dangerous liquid effluents at the WTP. This secondary mixed waste stream consists of dilute process waste liquid effluents that contain both radioactive and dangerous waste components. The RLD effluent is derived from plant wash, acidic and alkaline effluent, evaporation processes, treatment of melter offgas streams, Lab liquid waste, and equipment decontamination. To the extent practical, RLD effluents are recycled back into the WTP treatment process, however, excess evaporator condensates and other effluents are transferred to the Liquid Effluent Retention Facility/Effluent Treatment Facility (LERF/ETF). Dilute radioactive and dangerous process waste liquid effluents discharged from the PTF RLD system meet acceptance criteria for discharge to the LERF/ETF.

Process effluents contributing to the composition of RLD effluent include:

- Plant wash from vessels, cells, and bulges
- Decontamination effluent from equipment and IHLW canisters
- Condensate and drains from various processes
- Cleaning effluent from ultrafilters, cesium IX columns and caustic scrubber
- Miscellaneous waste water from floor drains

2.1.4 Other Radioactive Liquid Wastes

In addition to RLD effluent, other liquid waste streams including agitator gear oils, lubricating oils, hydraulic fluid and spent chemical reagents require treatment and disposal when they cannot be recycled. In certain cases, these materials may be radioactively contaminated by the environment in which the associated equipment operates. These wastes are packaged in labpacks and transported to a TSD for treatment.

2.2 Estimating Secondary Waste Quantities and Composition

Estimates of secondary waste have not changed since 2010 and are not recounted here. See 24590-WTP-RPT-ENS-10-003, *Evaluation of WTP Secondary Mixed Waste for Dangerous Waste Treatment and Disposal Estimate*, for details on the modeling and results.

3 Secondary Waste Streams

24590-WTP-RPT-ENS-10-003 did not identify any WTP secondary waste streams that from a qualitative risk perspective may cause or may significantly contribute to an exceedance of applicable environmental standards at a disposal facility that would require submittal of information by December 2015, as required in the DWP condition III.10.C.2.n.v. The majority of secondary waste streams (LLW and MLLW) have readily available offsite treatment capabilities that meet Hanford Site disposal requirements in accordance with the IDF-WAC or HSSWAC and are not discussed further in this report. The report did identify the following seven difficult to treat waste streams.

- Cesium IX resin
- ILAW glass detritus
- LAW facility secondary off-gas/vessel vent process system (LVP) HEPA filters
- LVP carbon bed adsorber media
- HLW melter off-gas process system (HOP) carbon bed adsorber media
- HOP silver mordenite media
- RLD effluent discharged to LERF/ETF

In addition, spent and failed melters present a unique waste stream with outstanding programmatic waste management issues that are being actively addressed. The HLW melters are placed in 8-inch thick steel overpacks. The LAW melters have sufficient shielding in the walls of the melters so an overpack is not needed. These melters are large and heavy, making transportation and treatment difficult.

These waste streams and their LDR and radionuclide treatment are discussed below. A summary of Sections 3.1 through 3.8, including waste constituents of concern and projected constituent concentrations, is also provided in Table ES-1-1 in 24590-WTP-RPT-ENS-10-003.

3.1 Cesium IX Resin

The *WTP Estimate of Secondary Radioactive Solid Waste Generation,* 24590-WTP-PT-ENS-10-010 (ESRSWG) indicates that cesium IX resin is a mixed RH Category 3 waste (RH-MLLW-3). This non-debris waste could designate as dangerous waste for chromium. However, actual Toxicity Characteristic Leaching Procedure (SW-846 Method 1311, EPA 2008) (TCLP) testing with a bounding surrogate waste indicates that although the resin accumulated significant levels of chromium, the waste does not leach chromium above the dangerous waste TCLP concentrations (WSRC-STI-2007-00213) after the normal elution process.

This waste requires treatment for F-listed dangerous waste constituents and mobile radionuclides. High surface dose rates require that the treatment facility have RH waste treatment/stabilization capability. Additionally, the treatment facility is required to provide the appropriate waste handling equipment to remotely remove the large HIC from the shielded

overpack, remove and treat the IX resin, and repackage the treated waste in an appropriate disposal container. For conservatism, until actual characterization data are available, this waste is assumed to require sampling to verify F-listed and Toxicity Characteristic constituents meet their concentration-based LDR treatment standards.

3.2 ILAW Glass Detritus

LAW glass detritus is generated from the ILAW canister bagging station. Glass detritus spalls from LAW melter consumables during the remote removal and bagging of these wastes. The glass detritus is collected in a HEPA vacuum and containerized for disposal. The LAW glass detritus is predicted to be a CH-MLLW-3 waste.

The glass itself has already been treated to the *Vitrification of High Level Mixed Radioactive Waste Standard* (HLVIT) LDR treatment standard. This waste still contains F-listed constituents and mobile radionuclides above the mobile radionuclide reporting limit. The potential treatment for this waste stream is volume reduction and Category 3 radiological waste stabilization.

3.3 LVP Offgas HEPA Filters

Modeling indicates that the LVP offgas HEPA filters require LDR treatment for chromium. The ESRSWG indicates that LVP HEPA filters are likely to be a CH-MLLW-3 waste. This waste also has F-listed constituents and mobile radionuclide concentrations above the IDFWAC reporting limit. The LDR treatment for this waste stream is volume reduction and macroencapsulation which also meets the Category 3 radiological waste requirement.

3.4 LVP Carbon Bed Adsorber Media

The ESRSWG indicates that the LVP carbon bed media waste requires LDR treatment for mercury, 2,4-dinitrotoluene, and benzene and nitrobenzene (F001-F005) waste codes. The LVP carbon bed media is expected to be a CH-MLLW-1 waste. This waste also requires treatment for mobile radionuclides to meet HSSWAC and IDFWAC criteria for land disposal. The spent carbon bed media may be shipped to an offsite TSD for treatment of organic constituents and mercury followed by immobilization of mobile radionuclides. The LVP spent carbon bed media is a high volume waste stream with an estimated one hundred thirty six-55 gallon drums generated every 2 years from the LAW Facility.

3.5 HOP Carbon Bed Adsorber Media

The ESRSWG indicates that the spent HOP carbon bed media requires LDR treatment for mercury, 1,4-dichlorobenzene, 2,4-dinitrotoluene, chloroform, 1,1-dichloroethene, hexachlorobutadiene, 2,4,6-trichlorophenol, and F001-F005 wastes tetrachloroethene, carbon tetrachloride, benzene, and nitrobenzene. The HOP carbon bed media is expected to be a CH-MLLW-1 waste. This waste also requires treatment for mobile radionuclides to meet IDFWAC criteria for land disposal. The spent carbon bed media may be shipped to an offsite TSD for treatment of organic constituents and mercury followed by immobilization of mobile

radionuclides. The HOP spent carbon bed media is a high volume waste stream with an estimated ninety-55 gallon drums generated each year (24590-WTP-RPT-ENS-10-010).

3.6 HOP Silver Mordenite Media

The HOP silver mordenite media contains approximately 18% weight percent silver (24590-QL-POA-MBT0-00001-06-00003) and designates D011 for the silver. The silver in the silver mordenite filter media is used to extract halides (iodine-129, HCl, HF, etc.) from the HLW offgas. This waste stream also contains F-listed constituents and mobile radionuclides. It is anticipated that the HOP silver mordenite designates as a CH-MLLW-1 waste. The potential treatment for this waste is volume reduction and macroencapsulation/immobilization to address the LDR metals and mobile radionuclides. The challenge associated with treating silver mordenite media is high silver concentrations in a waste stream that contains mobile radionuclides. Typically, high concentrations of precious metals would be extracted and recycled. However, because this is a mixed waste, the process needs to immobilize both high silver concentrations and mobile radionuclides.

3.7 RLD Effluent Discharged to LERF/ETF

Based on current spreadsheet assumptions, the RLD effluent being discharged to LERF/ETF is a listed waste (F001-F005) and has one organic dangerous waste constituent that is above the characteristic concentration. This is nitrobenzene (D036, and F004). Nitrobenzene (at 8.2 mg/L) is above the dangerous waste threshold concentration of 2 mg/L, but below the LDR treatment standard of 14 mg/kg. The challenge to processing the RLD effluent lies primarily with its projected quantity, which when combined with other Hanford facility effluents, may exceed LERF/ETF capacities if LERF/ETF expansion does not occur.

3.8 Melters

3.8.1 LAW Melters

Although the low-activity waste melters carry the F001-F005 waste codes due to contact with tank waste, they were not shown to exceed characteristic dangerous waste levels in WTP modeling for other RCRA regulated constituents. The LAW melters were, however, shown to contain Category 3 concentrations of radionuclides or mobile radionuclides. The required treatment for the LAW melters is macroencapsulation. Due to the size and weight of the melters, they need to be treated and disposed of on the Hanford site. In-cell macroencapsulation is not currently an option at the IDF without permit modification and negotiation with the regulatory agencies. One option may include macroencapsulation at a location adjacent to the disposal cell. The TOC has developed a LAW melter transportation evaluation document, RPP-RPT-58204, *Spent/Failed Low-Activity Melter Transport System Evaluation Report* which outlines options for loading, transporting, treating, and off-loading of the melters. This report assumes that macroencapsulation and void filling will be required. This report makes recommendations for the transporter and loading/unloading equipment, but no plan has been finalized.

3.8.2 HLW Melters

Current ESRWG data indicate that the concentration of TRU constituents cause the HLW melters to be designated as a TRU waste. The LDR treatment standards for the HLW melter are met by the macroencapsulation of the melter in an 8-inch thick welded carbon steel shielded overpack. RCRA metals are not identified as constituents of interest because of the application of the 40 CFR 268 HLVIT treatment standard and the proposed macroencapsulation (MACRO) treatment standard of the melter within the overpack. Through these assumptions, it is believed that these melters are conservatively considered TRU waste and need to be stored onsite until disposal preparations are completed (24590-WTP-RPT-ENS-10-003). The validity of the assumptions requires further investigation.

A regulatory and cost-benefit analysis is needed to evaluate alternatives to determine if other approaches are more cost effective, and produce less regulatory burden than producing TRU melters. For example, one alternative is to evaluate modification of the melter feed process at or near the end of melter life to reduce the probability that the HLW melters would be TRU. Near the end of normal melter life, melter waste feed could be stopped and the melter fed glass formers to reduce the concentrations of TRU and other radioactive constituents. This approach is likely to produce HLW glass canisters that do not meet the current WTP contract criteria, requiring the evaluation of a new disposal path for these waste canisters.

The provisions outlined in the previous paragraph apply to spent HLW melters and do not address the possibility of failed HLW melters. Melters that fail unexpectedly or are shut down in an emergency most likely exhibit very high levels of radioactive and dangerous waste constituents. These constituents include ^{137}Cs, ^{90}Sr, ^{238}Pu, ^{239}Pu, ^{241}Pu, $^{242}Pu^{241}Am$, ^{243}Am ^{237}Np, ^{99}Tc, ^{79}Se and several uranium isotopes in varying concentrations. The HLW melters are considered treatment and disposal risks until such time as a Waste Determination establishing the HLW melters as waste incidental to reprocessing is approved.

3.9 Secondary Solid Waste Gap Analysis

In 2012, the One System team developed a secondary solid waste gap analysis for WTP. This analysis included communications with vendors on treatment and disposal options and capabilities. This was documented in WRPS-1201383-OS, *Waste Treatment and Immobilization Plant Radioactive Solid Waste Management, Treatment and Disposal Analysis*. A summary of the information pertaining to these seven waste streams is presented in Table 3-1.

For six of the seven difficult to treat waste streams, at least 2 vendors and 3 disposal sites are capable of handling each waste stream. Most of the proposed treatments involve stabilization, macroencapsulation, or both. LLW and MLLW are not approved for off-site disposal. Other disposal site are included for completeness. These are the Nevada National Security Site (NNSS), the Federal Waste Facility (operated by Waste Control Specialists), and the Energy*Solutions* Clive facility.
The only treatment path proposed for the liquid waste is the Hanford Effluent Treatment Facility.

Table 3-1 Treatment and Disposal Options

Waste Stream	Treatment	Disposal
Cs IX resin	3 vendors capable of stabilization and immobilization for radionuclides and RCRA constituents	• Hanford (^{99}Tc limited) • NNSS • Federal Waste Facility
ILAW glass detritus	2 vendors capable of volume reduction and macroencapsulation 1 vendor is capable of stabilization	• Hanford • NNSS • Federal Waste Facility
LAW LVP HEPA filters	3 vendors capable of macroencapsulation 2 vendors recommended volume reduction prior to encapsulation	• Hanford • NNSS • Federal Waste Facility • Clive facility
LVP carbon bed adsorber media	2 vendors capable of thermal treatment for organics and stabilization of mercury and radionuclides	• Hanford • NNSS • Clive facility
HOP carbon bed adsorber media	2 vendors capable of thermal treatment for organics and stabilization of mercury and radionuclides	• Hanford • NNSS • Clive facility
HOP silver mordenite media	3 vendors capable of macroencapsulation	• Hanford • NNSS • Federal Waste Facility • Clive facility
RLD effluent discharged to LERF/ETF	Treatment capabilities include: filtration, reverse osmosis, ion exchange, peroxide, UV oxidation, and stabilization[1]	Effluent Treatment Facility

[1] The 2010 evaluation reported the only constituent of concern is nitrobenzene which is treated with UV oxidation. Other capabilities listed for completeness and assurance that other contaminates can be treated.

For the LAW melters, all three vendors recommended macroencapsulation. In-cell macroencapsulation would eliminate the need to transport the melters after treatment. In-cell macroencapsulation may be available at the Federal Waste Facility or Energy*Solutions* Clive facility. Transportation of the melters is an issue due to the weight and size of the melters. Potentially, the IDF could be permitted to allow in-cell macroencapsulation or macroencapsulation in an area adjacent to the cells.

The proposed treatment for spent and failed HLW melters is macroencapsulation in the overpack. At this time, the melters are expected to be designated as TRU. They need to be prepared for disposal and remain on the Hanford site until WIPP is ready to receive them.

4 Conclusion

The 2010 report, 24590-WTP-RPT-ENS-10-003, *Evaluation of WTP Secondary Mixed Wastes for Dangerous Waste Treatment and Disposal,* did not identify any WTP secondary waste streams that from a qualitative risk perspective may cause or may significantly contribute to an exceedance of applicable environmental standards at a disposal facility and that would require submittal of information by December 2015, as required in the DWP condition III.10.C.2.n.v.

The 2010 report identified seven waste streams that are potentially difficult to treat. Based on the available and planned treatment, storage, and disposal capabilities advertised by the vendors, the projected WTP radioactive solid waste appears to have a provisional path forward to treatment and disposal, including the seven identified streams. Multiple vendors are able to provide treatment or treatment and disposal services for six of these waste streams.

The treatments for chemical and radiological hazards have been addressed for the LAW and HLW melters: however, administrative and programmatic issues remain regarding handling, treatment, storage, and disposal. These issues have been evaluated further in the LAW melter transportation evaluation and the HLW waste generation and export evaluation. Additional waste determinations, studies, reports, and interface agreements are needed to close these issues.

5 References

24590-HLW-ES-ENG-14-004, Rev. 0, *HLW Secondary Waste Generation and Export*

24590-WTP-PL-PENG-14-0006, Rev. 0, *Secondary Wastes Compliance Plan*

24590-WTP-RPT-ENS-10-003, Rev. 1, *Evaluation of WTP Secondary Mixed Wastes for Dangerous Waste Treatment and Disposal*

24590-WTP-RPT-ENS-10-010, Rev. 0, *WTP Estimate of Secondary Radioactive Solid Waste Generation*

HNF-EP-0063, Rev. 16, *Hanford Site Solid Waste Acceptance Criteria* WRPS-1201383-OS, Rev. 0, *Waste Treatment and Immobilization Plant Radioactive Solid Waste Management, Treatment and Disposal Analysis*

RPP-RPT-58204, Rev. 00, *Spent/Failed Low-Activity Melter Transport System Evaluation Report*

Codes and Standards

Protection of Environment – Land Disposal Restrictions, 40 CFR 268 (2014)