# Chapter 4.0

# Process Information

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# 4.0 PROCESS INFORMATION

## 4.1 PROCESS DESCRIPTION

Mixed waste is managed by the Hanford Tank Waste Treatment and Immobilization Plant (WTP) using tanks, containment buildings, container storage areas, and miscellaneous unit systems. The floors and lower portions of the black cells and hot cell walls are lined with stainless steel for secondary containment. Black cells and hot cells will be equipped with an instrumented sump or sumps for leak detection. Liquids are removed from the black cell sumps by steam ejectors.

The pretreatment facility uses tank systems, miscellaneous unit systems (defined in Chapter 10, Section III.10.G of this Permit), and containment buildings to prepare waste feed from the Hanford Site double-shell tank (DST) system for vitrification. The low-activity waste (LAW) vitrification facility uses miscellaneous treatment unit sub-systems and equipment (defined in Chapter 10, Section III.10.H and III.10.I of this Permit), tank systems, and containment buildings to vitrify LAW feed. The high-level waste (HLW) vitrification facility uses miscellaneous treatment unit sub-systems and equipment (defined in Chapter 10, Section III.10.J and III.10.K of this Permit), tank systems, containment buildings, and container storage areas to vitrify HLW feed. A tank system and a container storage area are used at the analytical laboratory (LAB). Container storage is used in the balance of facilities (BOF) for waste management activities. These waste management activities are discussed in the following sections.

### 4.1.1 Process Overview

The WTP will store and treat waste feed from the Hanford Site double-shell tank (DST) system in the pretreatment plant. The pretreatment plant will separate the waste into two feed streams for the LAW and HLW melters. Feed from the DST system is expected to be of four major waste feed types, or waste feed envelopes. These waste feed envelopes are described as follows:

- Envelope A. This waste feed envelope will contain cesium at concentrations high enough to warrant removal of these radionuclides during pretreatment, to ensure that the immobilized low-activity waste (ILAW) glass will meet applicable requirements.
- Envelope B. This waste feed envelope will contain higher concentrations of cesium than envelope A. Cesium must be removed to comply with the ILAW specifications. This envelope may also contain concentrations of chlorine, chromium, fluorine, phosphates, and sulfates that are higher than those found in envelope A, which may limit the waste incorporation rate into the glass.
- Envelope C. This waste feed envelope will contain organic compounds containing complexed strontium and transuranics (TRU) that will require removal in a processing step unique to this waste envelope. As with envelopes A and B, cesium will also require removal in the pretreatment process to ensure that ILAW glass meets applicable requirements.

- Envelope D. HLW feed will be in the form of a slurry containing approximately 10 to 200 grams of unwashed solids per liter. The liquid fraction of the slurry will be separated from the solids and classified as envelope A, B, or C waste. The solid fraction will be envelope D waste.

The WTP treatment processes are designed to immobilize the waste constituents in a glass matrix by vitrification and to treat the offgas from the processes to a level that protects human health and the environment.

Two similarly designed vitrification systems will be used in the WTP. One system will immobilize the pretreated LAW feed and the second will immobilize the pretreated HLW feed. The dangerous waste constituents in the melter feed will be destroyed, removed, or immobilized in a glass matrix through the vitrification process. The ILAW and immobilized high-level waste (IHLW) produced by the WTP will be in the form of glass packaged in stainless steel containers for ILAW and stainless steel canisters for IHLW and placed in permitted treatment, storage, and/or disposal (TSD) facilities.

Secondary waste streams (e.g., dangerous and mixed solid waste, nonradioactive and nondangerous liquid effluents, mixed waste and dangerous liquid effluents) will be characterized and recycled into the treatment process, transported to permitted treatment, storage, and/or disposal (TSD) facilities located on the Hanford Site, or transported off-site, as appropriate. Nonradioactive dangerous waste will also be generated by laboratory and maintenance activities. This waste will be managed at the WTP until it can be transferred to an off-site TSD unit.

There are four primary components of the WTP: pretreatment, LAW vitrification, HLW vitrification, and the analytical laboratory. In addition, each of these waste treatment processes is supported by systems and utilities known as the balance of facilities. The following discussion presents an overview of these waste treatment processes and balance of facilities systems at the WTP. Figure 4A-1 presents a simplified process flow diagram of the WTP treatment processes.

Pretreatment

The waste feed will be stored and subsequently treated in the pretreatment plant prior to vitrification. The processes in the pretreatment plant will condition the waste feed and remove cesium, strontium, TRU compounds, and entrained solids. The waste feed will also be processed through ultrafiltration to separate the solids.

There will be three types of waste management units in the pretreatment plant, as follows:

- Tank systems
- Containment buildings
- Miscellaneous unit systems

The structure of the pretreatment plant is supported by a reinforced concrete foundation. The superstructure will be made of structural steelwork with a metal roof. Typically, the process cells within the pretreatment plant will be constructed of reinforced concrete. Secondary containment is provided as required for tank systems and miscellaneous unit systems managing dangerous or mixed waste. Secondary containment consists of either stainless steel liner or protective coating. Table 4-11 provides information on secondary containment. Figure 4A-2 and 4A-02A present simplified process flow diagrams of the pretreatment processes.

LAW Vitrification

The LAW vitrification plant will house the vitrification systems for production of the ILAW. Three types of waste management units will be located in the LAW vitrification plant, as follows:

- Tank systems
- Containment buildings
- Miscellaneous treatment unit sub-systems and equipment

The LAW vitrification plant will be constructed of reinforced concrete and structural steelwork. The below-grade portion of the building structure is made of reinforced concrete, and the superstructure will be made of reinforced concrete and structural steelwork with a metal roof. The plant structure will be supported by a reinforced concrete mat foundation. Secondary containment is provided as required for tank systems and miscellaneous unit sub-systems and equipment managing dangerous or mixed waste. Secondary containment consists of either stainless steel liner or protective coating. Table 4-11 provides information on secondary containment. Figure 4A-3 presents a simplified process flow diagram of the LAW vitrification treatment processes.

HLW Vitrification

The HLW vitrification plant will house the vitrification systems for producing IHLW. Four types of waste management units will be located in the HLW vitrification plant, as follows:

- Container storage areas
- Tank systems
- Containment buildings
- Miscellaneous treatment sub-systems and equipment

The HLW vitrification plant will be constructed of reinforced concrete and structural steelwork. The below-grade portion of the building structure is reinforced concrete construction, and the superstructure will be made of structural steelwork with a metal roof. The plant structure will be supported by a reinforced concrete mat foundation. Secondary containment is provided as required for tank systems and miscellaneous unit sub-systems and equipment managing dangerous or mixed waste. Secondary containment consists of either stainless steel liner or protective coating. Table 4-11 provides information on secondary containment. Figure 4A-4 presents a simplified process flow diagram of the HLW vitrification treatment processes.

Analytical Laboratory

The analytical laboratory will house the hot cells, laboratories, and systems for analyzing process samples and managing regulatory compliance samples. Two types of waste management units will be located in the analytical laboratory, as follows:

- Container storage areas
- Tank systems

The analytical laboratory will be constructed of reinforced concrete, structural steelwork, and a metal roof. The below-grade portions of the building structure will be constructed of reinforced concrete. The analytical laboratory structure will be supported by a reinforced concrete mat foundation. Secondary containment is provided as required for tank systems managing dangerous or mixed waste. Secondary containment consists of either stainless steel liner or protective coating. Table 4-11 provides information on secondary containment.

Balance of Facilities

The balance of facilities includes support systems and utilities required for the waste treatment processes within the pretreatment, LAW vitrification, HLW vitrification, and the analytical laboratory. The balance of facilities support systems and utilities include, but are not limited to, heating and cooling, process steam, process water, chilled water, primary and secondary power supplies, and compressed air. The balance of facilities also includes the glass former reagent system (GFR) that supplies glass former reagents to the LAW and HLW vitrification facilities. Regulated waste management units within the balance of facilities include the facility and the nonradioactive dangerous waste storage area.

### 4.1.2 Pretreatment Plant

The pretreatment plant is designed to receive mixed waste from the DST system and separate and prepare the LAW and HLW feed streams for vitrification. The main functions performed at the pretreatment plant are as follows:

- Receive waste feeds from the Hanford Site DST system
- Separate cesium, strontium, and TRU radionuclides from the waste feeds
- Segregate solids into the HLW feed stream
- Concentrate the separated radionuclides for incorporation into the HLW feed stream
- Adjust the concentration of the waste for vitrification
- Collect and monitor liquid effluents
- Blend waste fractions to optimize treatment steps

The purpose of this section is to describe the major systems associated with the pretreatment plant. Descriptions of process systems, ventilation systems, and mechanical support systems associated with the pretreatment plant are provided in the following sections.

The following figures found in Appendix 4A and drawings, found in WA7890008967, *Dangerous Waste Portion of the Hanford Facility Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste* (DWP), Attachment 51, Appendix 8, provide additional detail for the pretreatment plant:

- Simplified for the WTP
- Process flow figures and drawings for process information
- Typical system figures depicting main features for each regulated system
- General arrangement figures and drawings showing locations of regulated equipment
- Waste management area figures showing plant locations to be permitted

Vessels in black cells are designed for a 40-year life, and are of welded stainless steel construction. The black cells in the pretreatment facility are located adjacent to the hot cell. Hydraulic connections connect the black cells to each other and connect selected black cells to the hot cell. These hydraulic connections are used to cascade fluid flow between cells in the event that the black cell secondary containment hold-up volume is exceeded by the contents of a single leaking vessel in the black cell. As the liquid cascades from cell to cell it will reach the hot cell. The floors and lower portions of the black cells and hot cell walls are partially lined with stainless steel for secondary containment. This secondary containment will have a gradient designed to channel liquid to a low-point sump within each black cell. Black cells and hot cells will be equipped with an instrumented sump or sumps for detecting loss of vessel or piping integrity. Liquids are removed from the black cell sumps by steam ejectors.

The radiation monitor and valves with potential exposure to elevated radiation are contained within a shielded bulge attached to the outside wall of the black cell. The bulge provides secondary containment and is equipped with decontamination sprays, liquid level instrumentation, a drain to the Ultimate Overflow Vessel (PWD-VSL-00033).

Liquid level in the vessels will be monitored and maintained within low and high operating limits. Regulated WTP plant tank systems processes and leak detection systems instruments and parameters will be provided in Table III.10.E.E. Regulated miscellaneous treatment systems process and leak detection systems instruments and parameters will be provided in Table III.10.G.C.

At times, internal decontamination of vessels may be required. The primary permanent process vessels are fitted with wash rings for decontamination by flushing. Wash systems will be able to introduce water, caustic solution, or acid. The stainless steel lined floor provides secondary containment.

Instrumentation, alarms, controls, and interlocks will be provided for the tank systems and miscellaneous treatment systems to indicate or prevent the following conditions, as appropriate:

- Overfilling: Plant items are protected against overfilling by liquid level indication, high level instrumentation interlocks to shut off feed sources, and process control system control functions backed up by hard wired trips as required.

- Loss of containment: Plant items are protected against containment loss by liquid level indication, and by process control, system control and alarm functions as required, including shut off of feed sources. Each plant item that manages liquid mixed or dangerous waste is provided with secondary containment. Sumps associated with the management of liquid mixed or dangerous waste are provided with liquid level instrumentation and an ejector or pump to empty the sump as needed.

- Inadvertent transfers of fluids: System sequential operations are properly interlocked to prevent inadvertent transfers at the wrong time or to the wrong location.

- Loss of mixing function: Tank systems are instrumented (air pressure/flow indication) to prevent hydrogen accumulation and solids settling. A forced air in-bleed is provided to dilute hydrogen generated through radiolysis.

- Loss of process function: System vessels using reverse flow diverters incorporated dual reverse flow diverter system redundancy into the design to prevent loss of process function and to maintain appropriate liquid levels in vessels if one of the reverse flow diverters should fail.

- Overheating: Temperature regulation with chilled water is provided for those plant items where heat may be generated due to radiolysis. Chilled water lines will be monitored for contamination.

- Overpressurization: Relief is provided by use of rupture disks.

- Vacuum in vessels: Relief is provided through the PVP system during transfer of waste out of vessels.

- Loss of air flow: The ventilation system creates a pressure gradient which causes air to flow through engineered routes from an area of lower contamination potential to an area of higher contamination potential.

In addition to level control, temperature and pressure may be monitored for tank systems and miscellaneous treatment systems in some cases. Additional information may be found in the system logic descriptions located in DWP Attachment 51, Appendix 8.13.

#### 4.1.2.1 Waste Feed Receipt Process (FRP) System

Figure 24590-PTF-M5-V17T-P0003 presents a simplified process flow diagram of the waste feed receipt process system (FRP). The primary function of the FRP is to receive batch transfers of waste feed from the Double Shell Tank (DST) system, and to store the waste pending processing through pretreatment.

The main components of the FRP system are:

- Waste transfer lines
- Waste Feed Receipt Vessels (FRP-VSL-00002A/B/C/D)
- Vessel inlet and outlet valve headers
- Pumps, piping, and instrumentation for waste transfers
- Waste sampling equipment

Each Waste Feed Receipt Vessel (FRP-VSL-00002A/B/C/D) has a working volume of approximately 375,800 gallons, for a total working volume of approximately 1.5 million gallons. Waste feed will normally be transferred from the DST system in batches up to 1 million gallons into three of the four Waste Feed Receipt Vessels. The fourth vessel containing waste feed from the preceding transfer is used to sustain production while the current batch transfer is being mixed and sampled to verify waste characteristics.

The Waste Feed Receipt Vessels can also receive excess recycles or excess concentrate from the Waste Feed Evaporation Process (FEP) System and off-specification treated LAW from the treated LAW Concentrate Storage Process (TCP)System. The waste feed stored in the Waste Feed Receipt Vessels is batch-transferred forward for processing to either the FEP system or to the Ultrafiltration Process (UFP)System. The FRP system also has the capability to return stored waste to the DST system.

Waste feed is received from the DST system through the inner pipe of any one of three co-axial transfer lines. The inlet valve header routes the waste to the Waste Feed Receipt Vessels. The inlet and outlet valve headers and pumps are used in combination to facilitate the transfer of waste from one Waste Feed Receipt Vessel to another, forward transfer of waste to the pretreatment process, or the return of waste to the DST system using the transfer lines.

FRP system design features include:

- Capability to pressure-test both the inner and outer transfer lines for integrity
- Transfer line leak detection system for integrity indication during transfer
- Transfer line flushing and draining capability
- Instrumentation for monitoring vessel liquid level
- Vessel vent to the Pretreatment Vessel Vent Process (PVP)System
- Forced air purge and passive air purge of the vessel vapor space for mitigation of hydrogen gas buildup

- Internal pulse jet mixers (PJMs) for solids suspension and slurry mixing
- Remote sampling capability off the discharge of the transfer pump
- Vessel spray rings for vessel decontamination

#### 4.1.2.2 Waste Feed Evaporation Process (FEP) System

Figure 24590-PTF-M5-V17T-P0004001 and 24590-PTF-M5-V17T-P0004002 presents a simplified process flow diagram of the Waste Feed Evaporation Process (FEP)System. The primary process function of the FEP tanks and miscellaneous unit system is to concentrate waste streams from:

- the FRP system,
- the HLW Lag Storage and Feed Blending Process (HLP)System,
- the Plant Wash and Disposal Process (PWD)System and
- the Spent Resin Collection and Dewatering Process (RDP)System.

The main components of the FEP tank and miscellaneous unit system are as follows:

Tank system

- Waste Feed Evaporator Feed Vessels
- LAW Feed Evaporator Condensate Vessel
- Vessel outlet valve headers
- Pumps, piping, and instrumentation for waste transfers

Miscellaneous Unit systems

- Waste Feed Evaporator Separator Vessels
- Primary Condensers
- Inter-Condensers (FEP-COND-00002A/B)
- After-Condensers (FEP-COND-00003A/B)
- Reboilers (FEP-RBLR-00001A/B)
- Pumps

The Waste Feed Evaporator Separator Vessels (FEP-SEP-00001A/B) will deliver concentrate to the Ultrafiltration Process (UFP) System. Overhead vapors and noncondensables from the Waste Feed Evaporator Separator Vessels are routed to the Primary Condensers (FEP-COND-00001A/B). Process condensate from the Primary Condensers and steam condensate from the vacuum system are collected in the Waste Feed Evaporator Condensate Vessel (FEP-VSL-00005) and discharged to the Radioactive Liquid Waste Disposal Process(RLD) System. The noncondensables from the vacuum system are discharged to the PVP system.

During off-normal conditions, excess dilute recycles to the FEP Waste Feed Evaporator Feed Vessels (FEP-VSL-00017A/B), or excess concentrate from the FEP Waste Feed Evaporator

Separator Vessels can be routed to the FRP system for interim storage. Fluids generated from solids washing in the UFP system that are collected in the HLP system and are too dilute for feed to HLW vitrification can also be concentrated in the FEP system.

The FEP system includes two Waste Feed Evaporator Feed Vessels (FEP-VSL-00017A/B) for managing feed makeup from multiple sources. One Waste Feed Evaporator Feed Vessel will be in a makeup mode while the alternate vessel is feeding the evaporator trains.

The design features of the FEP evaporator feed system include:

- Internal pulse jet mixers for solids suspension
- Instrumentation for monitoring vessel liquid level
- Vessel vent to the PVP system
- Forced air purge and passive air purge of the vessel vapor space for mitigation of hydrogen gas buildup
- Pump and line flushing capability
- Transfer flow rate indication and transfer volume totalizer
- Remote sampling capability off the discharge of the transfer pumps
- Vessel spray rings for vessel decontamination

The FEP waste feed evaporator trains can be operated independently or at the same time depending on the evaporation needs. The Waste Feed Evaporator Separator Vessels (FEP-SEP-00001A/B) are forced-circulation units operating under vacuum to reduce the operating temperature. Recirculation pumps maintain a high flow rate from the Waste Feed Evaporator Separator Vessels (FEP-SEP-00001A/B) to the Reboilers (FEP-RBLR-00001A/B). Pumps maintain a high flow rate around the evaporation system. The pumps transfer the waste through the Reboilers and back into the Waste Feed Evaporator Separator Vessels. The recirculating waste stream is prevented from boiling in the reboiler tubes by maintaining sufficient hydrostatic head (submergence) to increase the boiling point above the temperature of the liquor in the Reboiler tubes.

As the liquid travels out of the Reboilers (FEP-RBLR-00001A/B), the hydrostatic head diminishes and flash evaporation occurs as the flow enters the Waste Feed Evaporator Separator Vessels (FEP-SEP-00001A/B). The liquid continues to flash and the vapor and liquid streams are separated (liquid-vapor disengagement). The liquid stream circulates in this loop and becomes more concentrated, while the vapor stream passes through a demisting section to the evaporator condensers. A portion of the concentrate is also pumped from the bottom of the Waste Feed Evaporator Separator Vessels (FEP-SEP-00001A/B) at the controlled liquid density and is discharged to Ultrafiltration Feed Preparation Vessels (UFP-VSL-00001A/B) in the UFP system, or is recycled to the FRP system.

The vapor stream exiting the Waste Feed Evaporator Separator Vessels (FEP-SEP-00001A/B) is condensed in a three-stage condenser system consisting of Primary Condensers

(FEP-COND-00001A/B), Inter-Condensers (FEP-COND-00002A/B), and After-Condensers (FEP-COND-00003A/B). The noncondensables exiting the After-Condenser are routed to the PVP system for treatment.

Design features of the evaporator trains include:

- Operating pressure indication and control
- Differential pressure indication across the Waste Feed Evaporator Separator Vessels (FEP-SEP-00001A/B) demister section
- Water sprays to the Waste Feed Evaporator Separator Vessels (FEP-SEP-00001A/B) demister section
- Process condensate radiation monitoring and recycle capability
- Low-pressure steam supply for heating the Reboilers (FEP-RBLR-00001A/B)
- Reboilers (FEP-RBLR-00001A/B) tube leak detection and diversion capability
- Reboilers (FEP-RBLR-00001A/B) steam condensate collection
- Instrumentation for monitoring and control of vessel liquid level
- Forced air purge of the vessel vapor space for mitigation of hydrogen gas buildup (passive venting of purge air via the downstream vessels connected to the vent header)
- Capability to drain, flush, and chemically clean the system

The condensed vapor from the FEP condensers is collected in the Waste Feed Evaporator Condensate Vessel (FEP-VSL-00005). One condensate vessel is used to collect condensate from both evaporator trains. A small fraction of the total condensate is recycled to the Waste Feed Evaporator Separator Vessels (FEP-SEP-00001A/B) demister water sprays. The balance of the condensate is transferred to the RLD system. Off-specification condensate is recycled to the Waste Feed Evaporator Feed Vessels (FEP-VSL-00017A/B).

Design features include:

- Instrumentation for monitoring and control of vessel liquid level
- Vessel vent to the PVP system
- Outlet valve header
- Remote sampling capability off the discharge of the transfer pumps
- Dip legs in the vessel that maintain a liquid seal (pressure boundary) between the vessel and the condensers
- Makeup recycle water as required for startup

#### 4.1.2.3 Ultrafiltration Process (UFP) System

Figure 24590-PTF-M5-V17T-P0009, 24590-PTF-M5-V17T-P0010, and 24590-PTF-M5-V17T-P0011 presents a simplified process flow diagram of the Ultrafiltration Process (UFP) System. The UFP tank system separates the waste feed from the HLW Lag Storage and Blending Process and the Waste Feed Receipt Process Systems and/or the Waste Feed Evaporation Process System into a high solids stream, referred to as the HLW feed stream, and a relatively solids free stream, referred to as the LAW feed stream. In the UFP system, the separated solids may undergo additional treatment (washing and/or leaching operations) to reduce the quantity of IHLW produced. In addition, the LAW feed stream may require Sr/TRU removal (Envelope C only). This operation will be performed in the UFP system prior to solids separation.

The main components of the UFP tank system are:

- Ultrafiltration Feed Preparation Vessels UFP-VSL-00001A/B)
- Ultrafiltration Feed Vessels (UFP-VSL-00002A/B)
- Two ultrafilter trains, each containing three individual Ultrafilters (UFP-FILT-00001A/1B/2A/2B/3A/3B)
- Associated ultrafilter backpulsing equipment
- Ultrafilter Permeate Vessels (UFP-VSL-00062A/B/C)
- Pumps, piping, and instrumentation for waste transfers

Ultrafiltration is a filtration process in which the waste stream is processed axially through the Ultrafilters (UFP-FILT-00001A/1B/2A/2B/3A/3B), which are long bundles of permeable tubes. Solids-free liquids pass radially through the permeable ultrafilter tubes surface while the concentration of the solids in the recirculating stream continuously increases. The resulting solids slurry may need treatment such as caustic leaching and/or water washing to reduce the quantity of IHLW glass produced.

Waste is received from the HLP, FRP, and/or the FEP systems into the Ultrafiltration Feed Preparation Vessels (UFP-VSL-00001A/B) of the UFP system. The waste may be sampled here to determine the ultrafiltration parameters. For envelope C feeds, chemicals are added to the Ultrafiltration Feed Preparation Vessels (UFP-VSL-00001A/B) to precipitate strontium and TRU elements contained in the incoming waste stream prior to solids concentration by ultrafiltration. Heat (if required) and agitation can be applied to ensure that the precipitation process is completed.

The Ultrafiltration Feed Preparation Vessels (UFP-VSL-00001A/B) feed the Ultrafiltration Feed Vessels (UFP-VSL-00002A/B), which feed the ultrafilters themselves. During the initial solids concentration, the solids-free stream generated by ultrafiltration is designated as the LAW feed stream, which is then routed to one of the three Ultrafilter Permeate Vessels (UFP-VSL-00062A/B/C). Here, the permeate is sampled for solids breakthrough (turbidity) prior to further processing, which includes cesium removal and additional evaporation prior to LAW vitrification.

The resulting concentrated slurry may then be washed in the Ultrafiltration Feed Vessels (UFP-VSL-00002A/B) with process water or caustic leached to remove interstitial liquid, soluble salts, and/or HLW glass-limiting compounds and further processed through the Ultrafilters (UFP-FILT-00001A/1B/2A/2B/3A/3B). The final concentrated HLW feed stream is transferred to the HLW Lag Storage Vessels (HLP-VSL-00027A/B) of the HLP system and then on to the HLW vitrification process. Permeate from solids treatment is also collected in Ultrafilter Permeate Vessels (UFP-VSL-00062A/B/C), but this stream is normally routed to the plant wash and disposal process system (PWD) for recycle.

During waste processing, the permeability of the Ultrafilters (UFP-FILT-00001A/1B/2A/2B/3A/3B) is reduced over time. Re-establishing the ultrafilters' permeability can be accomplished using one of two different methods: 1) backpulsing with filter permeate or 2) cleaning utilizing nitric acid or caustic. Backpulsing may be utilized while the filter is in operation, but cleaning requires the filters to be out of operation. Filter performance will be monitored to determine when cleaning is required.

The primary design features of the UFP system are:

- Pulse jet mixers in the Ultrafiltration Feed Preparation Vessels, the Ultrafiltration Feed Vessels, and in the Ultrafilter Permeate Vessels
- Cooling jackets on the Ultrafiltration Feed Preparation Vessels and on the Ultrafiltration Feed Vessels
- Passive vessel overflow routes for the Ultrafiltration Feed Preparation Vessels, the Ultrafiltration Feed Vessels, and in the Ultrafilter Permeate Vessels to the Ultimate Overflow Vessel (PWD-VSL-00033)
- Heating ejectors for the Ultrafiltration Feed Preparation Vessels and the Ultrafiltration Feed Vessels
- Emptying ejectors for the Ultrafiltration Feed Preparation Vessels
- Sampling capabilities for the Ultrafiltration Feed Preparation Vessels, the Ultrafiltration Feed Vessels, and in the Ultrafilter Permeate Vessels
- Vessel wash rings for the Ultrafiltration Feed Preparation Vessels , the Ultrafiltration Feed Vessels , and in the Ultrafilter Permeate Vessels Ventilation (both passive and forced) for the Ultrafiltration Feed Preparation Vessels, the Ultrafiltration Feed Vessels , and in the Ultrafilter Permeate Vessels

#### 4.1.2.4 HLW Lag Storage and Feed Blending Process (HLP) System

Figure 24590-PTF-M5-V17T-P0007 and 24590-PTF-M5-V17T-P0008 presents a simplified process flow diagram of the HLW Lag Storage and Feed Blending Process (HLP) System. The HLP system receives the Envelope D slurry from the DST system and the treated HLW slurry from the UFP system. This system provides receipt, storage, and transfer capability for the Envelope D feed, provides lag storage for the treated high-level waste solids slurry, and blends HLW vitrification feed prior to transfer and subsequent processing in the HLW vitrification plant. The system also provides for blending of separated cesium from the Cesium Nitric Acid

Recovery Process (CNP) System with the HLW feed stream prior to transfer to the HLW vitrification plant.

The main components of the HLP tank system are:

- HLW Feed Receipt Vessel (HLP-VSL-00022)
- HLW Lag Storage Vessels (HLP-VSL-00027A/B)
- HLW Feed Blending Vessel (HLP-VSL-00028)
- Pumps, piping, and instrumentation for waste transfers

HLW feed from the DST system is received into the HLW Feed Receipt Vessel (HLP-VSL-00022). The waste stored in this vessel is sampled and sent to either the UFP system, the Waste Feed Evaporation Process (FEP), System or the Waste Feed Receipt Process (FRP) System for processing.

Treated high solids waste (HLW feed stream) received from the UFP system is stored in the HLW Lag Storage Vessels. The waste stored in these vessels is sampled to determine blending and to comply with vitrification parameters of IHLW. In the HLP system, strontium/TRU precipitate slurry is segregated from the other HLW slurry and then blended in the HLW Feed Blending Vessel. The HLW Lag Storage Vessels are back up vessels to the HLW Feed Blending Vessel (HLP-VSL-00028).

The HLW feed stream is routed from the HLW Lag Storage Vessels to the HLW Feed Blending Vessel. The HLW Feed Blending Vessel also receives a cesium containing stream that has been recovered from the LAW feed stream in the waste treatment process. The cesium addition rates to the HLW feed stream are controlled based upon the results of the sampling previously conducted in the HLW Lag Storage Vessels (HLP-VSL-00027A/B). The final blended HLW feed stream is then transferred to the HLW vitrification plant for final treatment and immobilization. Alternatively, the blended HLW feed stream may be returned to the DST system.

The primary design features of the HLP system are:

- Internal pulse jet mixers in the HLW Feed Receipt Vessel the HLW Lag Storage Vessels, and the HLW Feed Blending Vessel for solids suspension
- Cooling jackets on the HLW Feed Receipt Vessel , the HLW Lag Storage Vessels , and the HLW Feed Blending Vessel
- Passive vessel overflow routes for the HLW Feed Receipt Vessel , the HLW Lag Storage Vessels , and the HLW Feed Blending Vessel to the Ultimate Overflow Vessel (PWD-VSL-00033)
- Sampling capabilities for the HLW Feed Receipt Vessel , the HLW Lag Storage Vessels , and the HLW Feed Blending Vessel

- Vessel wash rings for the HLW Feed Receipt Vessel , the HLW Lag Storage Vessels , and the HLW Feed Blending Vessel
- Ventilation (both passive and forced) for the HLW Feed Receipt Vessel , the HLW Lag Storage Vessels , and the HLW Feed Blending Vessel

#### 4.1.2.5 Cesium Ion Exchange Process (CXP) System

Figure 24590-PTF-M5-V17T-P00012, 24590-PTF-M5-V17T-P0013, and 24590-PTF-M5-V17T-P0025 presents a simplified process flow diagram of the Cesium Ion Exchange Process (CXP) System. The primary function of the CXP tank system is to remove cesium from the LAW feed stream. This is accomplished using a series of ion exchange columns containing a resin that preferentially extracts cesium. After caustic and water rinses to remove residual LAW feed, elution of the cesium-loaded resin is accomplished using dilute nitric acid. The cesium-loaded nitric acid is then routed to the Cesium Nitric Acid Recovery Process (CNP) system with the cesium ultimately processed in the HLW melter.

The main components of the CXP tank system are:

- Cesium Ion Exchange Columns (CXP-IXC-00001/2/3/4)
- Cesium Ion Exchange Feed Vessel (CXP-VSL-00001)
- Cesium Ion Exchange Caustic Rinse Collection Vessel (CXP-VSL-00004)
- Cesium Reagent Vessel (CXP-VSL-00005)
- Cesium Ion Exchange Treated LAW Collection Vessels (CXP-VSL-00026A/B/C)
- Pumps, piping, and instrumentation for waste transfers

The Cesium Ion Exchange Caustic Rinse Collection Vessel (CXP-VSL-00004) is used for receipt (from Ion Exchange Columns-CXP-IXC-00001/2/3/4) and transfer (to Cs IX Reagent Vessel-CXP-VSL-00005) of the caustic rinse. Transfer of the caustic rinse is accomplished using reverse flow diverters. The Cesium Reagent Vessel (CXP-VSL-00005) is used to supply demineralized water and caustic solutions, as well as to supply nitric acid for elution.

The Cesium Ion Exchange Feed Vessel (CXP-VSL-00001) receives LAW feed from the UFP system and provides feed buffer capacity to allow continuous operation of the ion exchange system. The CXP uses four Cesium Ion Exchange Columns (CXP-IXC-00001/2/3/4). At any given time, three of the columns are used in series to remove cesium from the LAW feed stream. The three columns are termed lead, lag, and polishing columns, depending on their position in the train. The fourth column is eluted and regenerated, and is then placed in a standby mode until the lead column reaches the desired cesium loading. At this point, the lead column is rotated out for elution, the lag column becomes the lead, the polishing column becomes the lag, and the standby column is rotated into the polishing position.

The concentration of cesium in the feed stream is monitored prior to and following each Cesium Ion Exchange Column (CXP-IXC-00001/2/3/4). When cesium is detected above an established set point following an ion exchange column, the lead column is taken out of the loading cycle, eluted, and the resin bed regenerated while the other columns are placed into the loading cycle.

Elution is part of a resin bed regeneration cycle that typically includes the following steps:

- Displacement of residual LAW feed stream in the column by rinsing with dilute caustic solution to prevent the potential of precipitating aluminum hydroxide from the LAW feed stream at low pH values. This caustic rinse is provided from the Cesium Ion Exchange Reagent Vessel (CXP-VSL-00005)
- Displacement of residual dilute caustic solution from the column with demineralized water to prevent an acid-base reaction during elution
- Elution of cesium ions with dilute nitric acid
- Displacement of residual acid from the column with demineralized water to prevent an acid-base reaction with the caustic solution
- Regeneration of the resin bed with caustic solution

After a number of loading and regeneration cycles, the resin is expected to lose performance and is termed “spent”. The number of cycles depends on LAW feed constituents, operating temperatures, properties of the resin, radiation exposure, and LAW feed throughput rates. The spent resin is slurried with recycled Ion Exchange resin flush solution and flushed out of the column into the Spent Resin Collection and Dewatering Process (RDP) System for resin disposal. A slurry of fresh resin is prepared in the Cesium Resin Addition Process (CRP) System and then added to the column as an ion exchange column bed replacement.

A standby elution system is provided by three tanks; one containing nitric acid, another containing demineralized water, and a third tank containing sodium hydroxide. Each tank has a volume sufficient to fully elute one fully loaded column, and one partially loaded column. The tanks are located at an elevation sufficiently high above the Cesium Ion Exchange Columns (CXP-IXC-00001/2/3/4) to provide enough hydrostatic head to induce flow through the Cesium Ion Exchange Columns (CXP-IXC-00001/2/3/4) and associated piping to the destination vessel.

Following cesium ion exchange, the treated LAW feed is transferred to the Cesium Ion Exchange Treated LAW Collection Vessels (CXP-VSL-00026A/B/C) for further treatment in the Treated LAW Evaporation Process (TLP) System and the Treated LAW Concentrate Storage Process (TCP) System.

The primary design features of the CXP system are:

- Instrumentation for monitoring and control of vessel liquid level.
- Pulse jet mixers in the Cs IX Caustic Rinse Collection Vessel (CXP-VSL-00004) and the Cesium Ion Exchange Treated LAW Collection Vessels (CXP-VSL-00026A/B).
- Passive vessel overflow routes from the Cs Ion Exchange Feed Vessel (CXP-VSL-00001), the Cs IX Caustic Rinse Vessel, the Cs IX Reagent Vessel (CXP-VSL-00005) and the Cesium Ion Exchange Treated LAW Collection Vessels.
- Remote sampling capabilities on the discharge of transfer pumps.

- Connection of the vessel vapor space to the Pretreatment Vessel Vent Process (PVP) System.

#### 4.1.2.6 Cesium Nitric Acid Recovery Process (CNP) System

Figure 24590-PTF-M5-V17T-P00014 presents a simplified process flow diagram of the Cesium Nitric Acid Recovery Process (CNP) System. The CNP system recovers nitric acid that was previously used for elution of the cesium ion exchange resin bed so it may be used as eluant. In addition, this system concentrates and transfers the cesium eluted from the ion exchange system to HLP-VSL-00028/27B for incorporation into the HLW melter feeds.

The CNP system is composed of tanks and miscellaneous unit systems, and consists of the following equipment.

Tank System

- Eluate Contingency Storage Vessel (CNP-VSL-00003)
- Cesium Evaporator Recovered Nitric Acid Vessel (CNP-VSL-00004)
- Cesium Evaporator Eluant Lute Pot (CNP-VSL-00001)
- Pumps, piping, and instrumentation for waste transfers

Miscellaneous Unit Systems

- Cesium Evaporator Separator Vessel (CNP-EVAP-00001)
- Cesium Evaporator Concentrate Reboiler (CNP-HX-00001)
- Cesium Evaporator Nitric Acid Rectifier (CNP-DISTC-00001)
- Cesium Evaporator Primary Condenser (CNP-HX-00002)
- Cesium Evaporator Secondary Condenser (CNP-HX-00003)
- Cesium Evaporator After-Condenser (CNP-HX-00004)
- High Efficiency Particulate Air Filter (CNP-HEPA-00006)
- Pumps, piping, and instrumentation for waste transfers

During the process of regenerating the cesium ion exchange resin beds, eluate composed of cesium-bearing nitric acid will be fed to the Cesium Evaporator Separator Vessel (CNP-EVAP-00001) operating under reduced pressure. A closed-loop circulation stream is fed from the evaporator to the steam-heated Cesium Evaporator Concentrate Reboiler (CNP-HX-00001) and back to the Cesium Evaporator Separator Vessel (CNP-EVAP-00001).

Vapor from the Cesium Evaporator Separator Vessel (CNP-EVAP-00001), composed primarily of water and nitric acid, is sent to the Cesium Evaporator Nitric Acid Rectifier (CNP-DISTC-00001) where the nitric acid is recovered for reuse as eluant. Recovered nitric acid is collected in the Cesium Evaporator Recovered Nitric Acid Vessel (CNP-VSL-00004) for reuse in the elution of cesium ion exchange column resin beds. Condensed water vapor is recovered from the Cesium Evaporator Primary Condenser (CNP-HX-00002), Cesium Evaporator Secondary Condenser (CNP-HX-00003), and Cesium Evaporator After-Condenser (CNP-HX-00004), and sent to the PWD system. These condensers are water-cooled shell-and-tube heat exchangers. Uncondensed vapors exiting from the after-condenser are routed to the PVP system for further treatment.

The cesium concentrated in the evaporator is routed to the HLW Feed Blending Vessel (HLP-VSL-00028) for blending and incorporation into the HLW melter feed streams. This cesium concentrate may also be stored in the Eluate Contingency Storage Vessel (CNP-VSL-00003), which is equipped with a cooling jacket for heat removal.

The Cesium Evaporator Separator Vessel (CNP-EVAP-00001) is fed through a break pot and the Cesium Evaporator Eluant Lute Pot (CNP-VSL-00001) in order to create a hydraulic seal to maintain a vacuum in the Cesium Evaporator Separator Vessel (CNP-EVAP-00001).

The recovered nitric acid is periodically sampled and, depending on the acid concentration of the recovered acid sample, some pH adjustment may be necessary. Fresh 2 molar nitric acid is available to the Cesium Evaporator Recovered Nitric Acid Vessel (CNP-VSL-00004) along with process condensate to adjust the recovered acid concentration as required.

The CNP system only operates when a Cesium Ion Exchange Column (CXP-IXC-00001/2/3/4) is in the process of having its resin bed regenerated through an elution process. When elution of a cesium ion exchange column is not taking place, the nitric acid recovery system is maintained in a standby mode. The major vessels of the CNP system are equipped with internal wash rings for decontamination of the system.

The primary design features of the CNP system are:

- Instrumentation for monitoring and control of vessel liquid level.
- Pulse jet mixers in the Eluate Contingency Storage Vessel (CNP-VSL-00003) and the Cs Evaporator Recovered Nitric Acid Vessel (CNP-VSL-00004).
- Passive vessel overflow routes from the Eluate Contingency Storage Vessel, and the Cs Evaporator Recovered Nitric Acid Vessel
- Connection of the vessel vapor space and condensers to the Pretreatment Vessel Vent Process (PVP) System.

#### 4.1.2.7 Cesium Resin Addition Process (CRP) System

Figure 4A-11 presents a simplified process flow diagram of the Cesium Resin Addition Process (CRP) System. The purpose of the CRP tank system is to provide a means to add fresh resin to the Cesium Ion Exchange Columns (CXP-IXC-00001/2/3/4). The system provides for preparation of the fresh cesium resin by hydraulically removing fines from the bulk of the resin particles as well as chemically conditioning the fresh resin. After conditioning, the resin is transferred to the ion exchange columns as a slurry, by gravity flow.

The main components of the CRP tank system are:

- Cesium Resin Addition Vessel (CRP-VSL-00001)

- Cesium Resin Addition Air Gap Vessel (CRP-VSL-00002)
- Cesium resin addition recycle pump
- Pumps, piping, and instrumentation for waste transfers
- Text provided for informational purposes only

Cesium is removed from the LAW feed using the ion exchange resin. Each batch of the resin has a limited useful operating life after which it must be removed from the ion exchange column and replaced with fresh resin.

Fresh resin is delivered per specification by the vendor. It is then transferred from bulk storage with the aid of handling equipment to the resin addition room. The resin is transferred from the shipping container to the Cesium Resin Addition Vessel (CRP-VSL-00001) with an eductor and demineralized water. After transfer, the cesium resin undergoes resin conditioning processes. The resin is then transferred to a Cesium Ion Exchange Column (CXP-IXC-00001/2/3/4) as a slurry by gravity flow.

There is a Cesium Resin Addition Air Gap Vessel (CRP-VSL-00002), located on the slurry downcomers to the Cesium Ion Exchange Columns (CXP-IXC-00001/2/3/4) in the resin addition valve bulge. The function of the Cesium Resin Addition Air Gap Vessel (CRP-VSL-00002) is to prevent back-flow of potentially contaminated gas, resin, or liquid, caused by a leaky or misaligned valve, from feeding back into the Cesium Resin Addition Vessel (CRP-VSL-00002). In the unlikely event of back-flow into the Cesium Resin Addition Air Gap Vessel (CRP-VSL-00002), gas is vented to the Pretreatment Vessel Vent Process (PVP) System and other constituents overflow into the Plant Wash Vessel (PWD-VSL-00044) of the Plant Wash and Disposal Process (PWD)System.

The cesium resin must be conditioned before processing the LAW feed stream through the Cesium Ion Exchange Columns (CXP-IXC-00001/2/3/4). The purpose of conditioning is to fully expand the resin and convert the resin into the right ionic form for cesium removal.

The primary design features of the CRP system are:

- Instrumentation for monitoring and control of vessel liquid level.
- Passive vessel overflow routes from the Cesium Resin Addition Vessel (CRP-VSL-00001).
- Connection of the Vessel vapor space to the Pretreatment Vessel Vent Process (PVP) System.

#### 4.1.2.8 Reserved

#### 4.1.2.9 Reserved

#### 4.1.2.10 Reserved

#### 4.1.2.11 Treated LAW Evaporation Process (TLP) System

Figure 24590-PTF-M5-V17T-P0005 and 24590-PTF-M5-V17T-P0006 presents a simplified process flow diagram of the Treated LAW Evaporation Process (TLP) System. The primary function of the TLP tank and miscellaneous unit system is to concentrate treated LAW from the Cesium Ion Exchange Process (CXP) System.

The main components of the TLP tank and miscellaneous unit system are as follows:

- Receive waste from the treated LAW collection vessels
- Receive and neutralize submerged bed scrubber purge from LAW vitrification
- Evaporate a portion of the feed (reducing the volume and increasing the sodium concentration)
- Transfer the waste to the Treated LAW Concentrate Storage Process System (TCP)
- Condense the overhead vapors and transfer the condensate to the Radioactive Liquid Waste Disposal System (RLD)
- Vent non-condensable gases to the PVP for treatment

Tank System

- LAW Submerged Bed Scrubber (SBS) Condensate Receipt Vessels (TLP-VSL-00009A/B)
- Treated LAW Evaporator Condensate Vessel (TLP-VSL-00002)
- Pumps, piping, and instrumentation for waste transfers

Miscellaneous Unit Systems

- Treated LAW Evaporator Separator Vessel (TLP-SEP-00001)
- Pumps, piping, and instrumentation for waste transfers
- Reboiler (TLP-RBLR-00001)
- Concentrate pumps with outlet valve header
- Primary Condenser (TLP-COND-00001)
- Inter-Condenser (TLP-COND-00002)
- After-Condenser (TLP-COND-00003)

Subsequent to sampling and analysis, the treated LAW is pumped continuously from one of three Cesium Ion Exchange Treated LAW Collection Vessels (CXP-VSL-00026A/B/C) to the evaporator system. The Treated LAW Evaporator Separator Vessel (TLP-SEP-00001) will deliver treated LAW concentrate to the Treated LAW Concentrate Storage Process (TCP) System.

The TLP system also evaporates recycle streams from the Treated LAW Concentrate Storage Process (TCP) System and the Radioactive Liquid Waste Disposal Process (RLD) System, and submerged bed scrubbers in the LAW Plant. Overhead vapors from the Treated LAW Evaporator Separator Vessel (TLP-SEP-00001) are routed to the Primary Condenser (TLP-COND-00001). Process condensate from the Primary Condenser, Inter-Condenser, and After-Condenser (TLP-COND-0001) are collected in the Treated LAW Evaporator Condensate Vessel (TLP-VSL-00002) and discharged to the RLD system. The noncondensables from the condenser train are discharged to the Pretreatment Vessel Vent Process (PVP) System.

The TLP feed system includes two LAW SBS Condensate Receipt Vessels (TLP-VSL-00009A/B) for managing submerged bed scrubber recycles from LAW vitrification and pretreatment process recycles. One vessel will be in an accumulation mode while the alternate vessel is feeding the Treated LAW Evaporator Separator Vessel (TLP-SEP-00001).

The primary design features of the TLP feed components include:

- Internal pulse jet mixers for solids suspension
- Instrumentation for monitoring of vessel liquid level
- Vessel vent to the PVP system
- Passive air purge of the vessel vapor space
- Pump and line flushing capability
- Transfer flow rate indication and transfer volume totalizer
- Remote sampling capability off the discharge of the transfer pumps
- Vessel spray rings for vessel decontamination

The Treated LAW Evaporator Separator Vessel (TLP-SEP-00001) is a forced-circulation unit operating under vacuum to reduce the operating temperature. A recirculation pump maintains a high flow rate from the evaporator separator vessel to the Reboiler (TLP-RBLR-00001). The pump transfers the waste through the Reboiler and back into the Treated LAW Evaporator Separator Vessel (TLP-SEP-00001). The recirculating waste stream is prevented from boiling in the reboiler tubes by maintaining sufficient hydrostatic head (submergence) above the reboiler tubes.

As the liquid travels out of the Reboiler (TLP-RBLR-00001), the hydrostatic head diminishes and flash evaporation occurs as the flow enters the Treated LAW Evaporator Separator Vessel (TLP-SEP-00001). The liquid continues to flash and the vapor and liquid streams are separated (liquid-vapor disengagement). The liquid stream circulates in this loop and becomes more concentrated, while the vapor stream passes through a demisting section to the evaporator condensers. A portion of the concentrate is also pumped from the bottom of the Treated LAW Evaporator Separator Vessel (TLP-SEP-00001) at the controlled liquid density and is discharged to the TCP system as feed to LAW vitrification.

The primary design features of the evaporator trains include:

- Operating pressure indication and control

- Differential pressure indication across the Treated LAW Evaporator Separator Vessel (TLP-SEP-00001) demister section
- Water sprays to the treated LAW Evaporator Separator vessel (TLP-SEP-00001) demister section
- Process condensate radiation monitoring and recycle capability
- Low-pressure steam supply for heating the Reboiler (TLP-RBLR-00001)
- Reboiler (TLP-RBLR-00001) tube leak detection and diversion capability
- Reboiler (TLP-RBLR-00001) steam condensate collection
- Instrumentation for monitoring and control of vessel liquid level
- Passive venting via the downstream vessels connected to the vent header
- Capability to drain, flush, and chemically clean the system

The vapor stream exiting the Treated LAW Evaporator Separator Vessel (TLP-SEP-00001) is condensed in a three-stage condenser system consisting of a Primary Condenser (TLP-COND-00001), an Inter-Condenser (TLP-COND-00002), and an After-Condenser (TLP-COND-00003). A two-stage high-pressure steam vacuum system between the condensers maintains an operating pressure of approximately 1 psi on the Treated LAW Evaporator Separator Vessel (TLP-SEP-00001). The noncondensables exiting downstream of the After-Condenser (TLP-COND-00003) are routed to the PVP system for treatment.

The primary design features for vapor stream management include:

- Instrumentation for monitoring and control of vessel liquid level
- Vessel vent to the PVP system to prevent pressurization of a vessel
- Remote sampling capability of the transfer pump discharge
- Dip legs in the vessel that maintain a liquid seal (pressure boundary) between the vessel and the condensers
- Makeup recycle water as required for startup

The condensed vapor from the condensers is collected in the Treated LAW Evaporator Condensate Vessel (TLP-VSL-00002). A small fraction of the total condensate is recycled to the Treated LAW Evaporator Separator Vessel (TLP-SEP-00001) demister water sprays. The balance of the condensate is transferred to the RLD system.

Condensate from the primary condenser is monitored for radioactivity. In the event of radioactivity breakthrough being detected, a Treated LAW Evaporator Separator (TLP) System shutdown is initiated and the contents of the Treated LAW Evaporator Condensate Vessel (TLP-VSL-00002) are transferred to a LAW SBS Condensate Receipt Vessels (TLP-VSL-00009A/B).

#### 4.1.2.12 Treated LAW Concentrate Storage Process (TCP) System

Figure 24590-PTF-M5-V17T-P0005 and 24590-PTF-M5-V17T-P0006 presents a simplified process flow diagram of the Treated LAW Concentrate Storage Process (TCP) System. The primary function of the TCP system is to receive treated LAW concentrate from the Treated LAW Evaporation Process (TLP) System and store the material for subsequent batch transfer to the LAW vitrification plant.

The main components of the TCP tank system are:

- Treated LAW Concentrate Storage Vessel (TCP-VSL-00001)
- Pumps for transferring treated LAW concentrate
- Three waste transfer lines to LAW vitrification
- Vessel inlet and outlet valve headers
- Pumps, piping, and instrumentation for waste transfers

Dilute treated LAW direct from the Cesium Ion Exchange Process (CXP) System can also be received and stored in the TCP system (evaporator by-pass option). The Treated LAW Concentrate Storage Vessel (TCP-VSL-00001) provides approximately 7 days of lag storage to sustain ILAW glass production if the pretreatment processing is interrupted.

Out-of-specification treated LAW concentrate can be recycled to the waste feed receipt process system (FRP) for rework through pretreatment, or recycled to the TLP system for blending and additional evaporation. Under strict administrative control (sampling and jumper installation), the Treated LAW Concentrate Storage Vessel (TCP-VSL-00001) can also receive washed and leached solids directly from the UFP system if the solids meet treated LAW feed specification.

During commissioning, treated LAW concentrate may be stored in a dedicated FRP vessel for additional lag storage capacity. Transfers from and to the TCP and FRP systems will also be under strict administrative control (sampling and jumper installation).

Treated LAW concentrate is batch-transferred from the tank to LAW vitrification through the inner pipe of any one of three co-axial transfer lines (two connected, one unconnected spare). The inlet and outlet valve headers and pumps are used in combination to facilitate circulation and sampling, forward transfer to LAW vitrification, and recycle to the TLP system or FRP system.

The primary design features of the TCP system include:

- Capability to pressure test both the inner and outer transfer lines for integrity
- Transfer line leak detection system for integrity indication during transfer
- Transfer line flushing and draining capability
- Instrumentation for monitoring vessel liquid level
- Vessel vent to the PVP system

- Direct steam injection to maintain the concentrate temperature above the saturation temperature to prevent precipitation
- Internal pulse jet mixers (PJMs) for solids suspension and slurry mixing
- Remote sampling capability off the discharge of the transfer pump
- Vessel spray rings for vessel decontamination
- Administrative controls and radiation monitoring to ensure that treated LAW transferred into and from the vessel meets waste specification for LAW vitrification.

The TCP system pumps and valve headers exposed to low radiation potential are located in a C3/R3 area for ease of maintenance.

#### 4.1.2.13 Spent Resin Collection and Dewatering Process (RDP) System

Figure 24590-PTF-M5-V17T-P00020 presents a simplified process flow diagram of the Spent Resin Collection and Dewatering Process (RDP) System. The RDP system provides for the periodic removal of spent ion exchange resin.

The primary components of the RDP system include:

- Spent Resin Slurry Vessels (RDP-VSL-00002A/B/C)
- Spent Resin Dewatering Moisture Separation Vessel (RDP-VSL-00004)
- Pumps, piping, and instrumentation for waste transfers

Resin is first eluted and then hydraulically discharged under pressure from the ion exchange column by fluidizing the bed of resin with demineralized water or caustic solution. The spent resin collection process is initiated by flushing an eluted Cesium and Ion Exchange Column (CXP-IXC-00001/2/3/4) and hydraulically discharging the contents into a Spent Resin Slurry Vessel (RDP-VSL-00002A/B/C). In these vessels, the resin slurry will be circulated, monitored for cesium content, and delivered to a sampling system to determine whether the resin is in compliance with the receiving TSD unit's waste acceptance criteria. Spent resins that meet the receiving TSD unit's waste acceptance criteria will be dewatered, containerized, and transferred to a TSD unit.

Spent resin is removed from each Cesium Ion Exchange Column (CXP-IXC-00001/2/3/4) independently as a batch operation. Spent resin slurry from the ion exchange columns is collected in the three spent resin collection vessels, which are interchangeable and will be capable of storing transport liquid and resin slurry. Once in the spent resin slurry vessel, the resin slurry will be mixed by pulse jet mixers and monitored for radiation (gamma) content in a circulation loop to determine if elution has sufficiently removed radionuclides from the resin for disposal.

Resin that does not meet the predetermined treatment limits will be routed back to the Cesium Ion Exchange Columns (CXP-IXC-00001/2/3/4) for additional elution. After completing the additional elution, the resin is transferred back to a Spent Resin Slurry Vessels (RDP-VSL-00002A/B/C/D) where it is processed again.

Following assurance that the spent resin is in compliance with the receiving TSD unit's acceptance criteria, the resin is pumped to the disposable spent resin dewatering container. When the transfer operation is completed, water is used to flush resin remaining in the transfer pump and line to the spent resin dewatering container.

There are three steps to resin dewatering. First, a gross dewatering removes excess water as the slurry is pumped to the disposal container. Next, a dewatering pump is used to remove standing water above the resin bed. Finally, circulation of a warm, dry air stream through the spent resin in the container evaporates the remaining liquid. The moist air stream leaving the dewatering container is cooled in the Spent Resin Dewatering Moisture Separation Vessel (RDP-VSL-00004) where the moisture is condensed and separated. The dry air from the spent resin dewatering moisture separation vessel is circulated past a heater and through the resin again. When the water content in the resin is reduced to an acceptable level, the dewatering operation is complete.

The primary design features of the RDP system are:

- Instrumentation for monitoring and control of vessel liquid level
- Pulse jet mixers in the Spent Resin Slurry Vessels (RDP-VSL-00002A/B/C).
- Passive vessel overflow routes from the Spent Resin Slurry Vessels.
- Remote sampling capabilities on the discharge transfer pumps.
- Connection of the vessel vapor spaces to the Pretreatment Vessel Vent Process (PVP) System.

#### 4.1.2.14 Pretreatment Maintenance

The pretreatment plant will include maintenance facilities that will enable remote and hands-on maintenance of process equipment, and will consist of the following systems:

- Pretreatment in-cell handling system (PIH)
- Pretreatment filter cave handling system (PFH)
- Radioactive solid waste handling system (RWH)

The individual systems and their primary functions are described below:

Pretreatment In-Cell Handling (PIH) System
The purpose of this system is to decontaminate and perform maintenance on equipment in the hot cell and/or dispose of hot cell equipment. The PIH system will perform the following functions:

- Decontaminate contaminated equipment using the wash down sprays followed by the Decontamination Soak Tank (PIH-TK-00001)
- Collecting liquids in catch pans
- Holding components while doing work using fixtures

- Disassembling, repairing, and reassembling failed contaminated process equipment remotely

Typical process equipment that the system will handle are pumps, valves, jumpers, small vessels, and other ancillary equipment and/or tools. Maintenance equipment requiring periodic servicing by this system will include cranes, manipulators, and decontamination and disassembly tools.

Equipment in this system will include:

- Overhead cranes
- Manipulators (powered and manual)
- Shield and airlock doors
- Size reduction equipment (cutters, shears, etc.)
- Crane deployed equipment, such as impact wrenches and spreader bars
- Fixtures
- Decontamination equipment (carbon dioxide, wash down, Decontamination Soak Tank [PIH-TK-00001])
- Manipulator-operated assembly/disassembly tools used in repair
- Turntables
- Pumps, piping, and instrumentation for waste transfers

Pretreatment Filter Cave Handling (PFH) System

The purpose of this system is to provide a method for performing maintenance on ventilation equipment in the filter cave. The equipment in this system will provide the following functions:

- Lifting, holding, transporting, installing/uncoupling primarily filters, some process equipment, and failed in-cell cranes and powered manipulators
- Providing fixtures for holding components while doing work
- Operation of some manual valves
- Decontamination and monitoring of contaminated equipment

Typical ventilation equipment the PFH system will handle are High Efficiency Particulate Air Filter (HEPA) and High-Efficiency Mist Eliminators (HEMEs), and duct isolation valves, inside the cell. Maintenance equipment requiring periodic servicing by this system will include cranes, manipulators, and decontamination and disassembly tools.

Equipment in this system will include:

- Overhead cranes
- Manipulators (powered and manual)
- Shield and airlock doors
- Crane deployed equipment, such as impact wrenches and spreader bars

- Decontamination equipment (carbon dioxide, wash down)
- Manipulator-deployed assembly/disassembly tools used in repair

Radioactive Solid Waste Handling (RWH) System
The purpose of this system is to provide a means to dispose of mixed waste contaminated equipment. This system interfaces with system PIH, system PFH, and the spent resin dewatering system. The main functions system RWH provides are:

- Lifting, holding, and transporting disposal containers
- Packaging disposal containers and preparing the containers for shipping
- Cleaning and remote monitoring of disposal containers
- Temporary shielding and confinement barriers

Typical process and ventilation equipment the system will handle are failed process equipment, such as pumps and valves, filters, jumpers, and maintenance equipment.

Equipment in this system will include:

- Overhead cranes
- Manipulators (manual)
- Carts for transporting waste containers
- Associated support equipment, like impact wrenches and spreader bars
- Decontamination systems, such as carbon dioxide
- Remote radioactive monitoring
- Temporary shielding and confinement barriers used for packaging
- Disposal containers

The primary design features of the PIH, PFH, and RWH systems are:

RESERVED

### 4.1.2.15 Plant Wash and Disposal (PWD) System

Figure 24590-PTF-M5-V17T-P0022001 and 24590-PTF-M5-V17T-P0022002 presents a simplified process flow diagram of the Plant Wash and Disposal (PWD) System. The primary function of the PWD tank system is to receive, store, and transfer effluent. It will collect plant wash, drains, and acidic or alkaline effluent from the pretreatment plant.

The primary components of the PWD tank system include:

- C3 Floor Drain Collection Vessel (PWD-VSL-00046)

- Acidic/Alkaline Effluent Vessels (PWD-VSL-00015/16)
- Plant Wash Vessel (PWD-VSL-00044)
- HLW Effluent Transfer Vessel (PWD-VSL-00043)
- Ultimate Overflow Vessel (PWD-VSL-00033)
- Pumps, piping, and instrumentation for waste transfers

Plant Wash Vessel (PWD-VSL-00044)

During operations, plant wash and drain effluents will be collected and mixed in with other effluents in the Plant Wash Vessel prior to transfer. The solution will be analyzed for pH and excess acidic effluent will be neutralized. Effluents will be recycled to the FEP system.

Pulse jet mixers are used to provide a uniform mixture during neutralization within the Plant Wash Vessel. Excess acidic effluent is neutralized with sodium hydroxide supplied from a reagent header. Wash rings are used for vessel washing. Vessel-emptying ejectors may be used for transfers to the Acidic/Alkaline Effluent Vessels (PWD-VSL-00016).

A reverse flow diverter supplies a representative sample of the contents of the Plant Wash Vessel (PWD-VSL-00044) for analysis. If the pH is confirmed to be above a predetermined value, reverse flow diverter(s) transfer the effluent from the Plant Wash Vessel (PWD-VSL-00044) to the Waste Feed Evaporator Feed Vessels (FEP-VSL-00017A/B). Normally, the contents of the Plant Wash Vessel is blended with the contents of the Acidic/Alkaline Effluent Vessels (PWD-VSL-00015/16) in the Waste Feed Evaporator Feed Vessels to maintain a consistent evaporator feed.

Acidic/Alkaline Effluent Vessels (PWD-VSL-00015/16)

The Acidic/Alkaline Effluent Vessels primarily receive alkaline cleaning effluent from the UFP system, caustic rinse from the Cesium Ion Exchange Process (CXP) System, and process condensate from the Cesium Nitric Acid Recovery Process (CNP) System. The effluents are sampled to confirm that the pH is above a predetermined value, and reverse flow diverters transfer the high-activity effluents to the Waste Feed Evaporator Feed Vessels (FEP-VSL-00017A/B) for reprocessing.

HLW Effluent Transfer Vessel (PWD-VSL-00043)

The HLW Effluent Transfer Vessel receives HLW acidic wastes from HLW vitrification line drains from HLW vitrification/pretreatment plant transfer lines, and laboratory drains. The vessel may also receive flush wastes from the HLW plant. These effluents are transferred to the Plant Wash Vessel (PWD-VSL-00044) to recycle the effluents back into the process system.

C3 Floor Drain Collection Vessel (PWD-VSL-00046)

The C3 Floor Drain Collection Vessel receives effluents from miscellaneous floor drains in the C3 areas, and liquids from the sump in the local pit. Sampling capability has been provided but will not normally be used. This effluent will be transferred to the Alkaline Effluent Vessels (RLD-VSL-00017A/B). The C3 Floor Drain Collection Vessel (PWD-VSL-00046) is vented locally through a high-efficiency particulate air filtration system.

Ultimate Overflow Vessel (PWD-VSL-00033)
The Ultimate Overflow Vessel receives overflows from vessels in the pretreatment plant. Additionally, this vessel receives line drains and flushes. The vessel operating level is maintained below a predetermined level to allow the vessel to hold 30 minutes of overflow at the highest transfer rate within the plant.

The primary design features of the PWD system are:

- Instrumentation for monitoring and control of vessel liquid level.
- Pulse jet mixers in the Ultimate Overflow Vessel (PWD-VSL-00033), the HLW Effluent Transfer Vessel (PWD-VSL-00043), the Acidic/Alkaline Effluent Vessels (PWD-VSL-00015/16), and the Plant Wash Vessel (PWD-VSL-00044).
- Passive vessel overflow routes from the Acidic/Alkaline Effluent Transfer Vessels, and the Plant Wash Vessel.
- Remote sampling capabilities on the discharge of transfer pumps.
- Connection of the vessel vapor spaces to the Pretreatment Vessel Vent Process (PVP) System.

#### 4.1.2.16 Radioactive Liquid Waste Disposal (RLD) System

Figure 24590-PTF-M5-V17T-P0022003 and 24590-PTF-M5-V17T-P0022004 presents a simplified process flow diagram of the Radioactive Liquid Waste Disposal (RLD) System. The primary function of the RLD tank system is to receive, store, and transfer contaminated liquid effluents. The RLD system will receive low-activity mixed waste effluents.

The primary components of the RLD tank system include:

- Process Condensate Tanks (RLD-TK-00006A/B)
- Alkaline Effluent Vessels (RLD-VSL-00017A/B)
- Pumps, piping, and instrumentation for waste transfers

These RLD vessels primarily receive effluent from the caustic scrubber purges from the LAW vitrification plant and from the C3 Floor Drain Collection Vessel in PTF (PWD-VSL-00046).

When these vessels reach a predetermined level, they are sampled, and if the sample meets the LERF/ETF waste acceptance criteria, it will be transferred to the Process Condensate Tanks (RLD-TK-00006A/B). If the effluent does not meet LERF/ETF waste acceptance criteria, it will be returned to the Treated LAW Evaporation Process (TLP) System for reprocessing.

Process Condensate Tanks (RLD-TK-00006A/B)
Process condensates are the effluent condensed vapors removed from the waste streams by the PTF evaporators. Waste Feed Evaporator Feed Process (FEP) effluents and Treated LAW Evaporation Process (TLP) condensates are normally received directly into the Process Condensate Tanks (RLD-TK-00006A). The effluents from the Process Condensate Tank

(RLD-TK-00006A) are recycled into the process or discharged to the Process Condensate Tank (RLD-TK-00006B).

The effluent in the Process Condensate Tanks will be sampled, to demonstrate compliance with the LERF/ETF waste acceptance criteria. It may also be sampled should a process upset occur. If analysis determines that the effluent is outside the waste acceptance criteria, it will be returned to the TLP for reprocessing.

The Alkaline Effluent Vessels (RLD-VSL-00017A/B) and Process Condensate Tanks (RLD-TK-00006A/B) are vented to the PVP system.

The primary design features of the RLD system are:

- Instrumentation for monitoring and control of vessel liquid level.
- Passive vessel overflow routes from the Alkaline Effluent Vessels (RLD-VSL-00017A/B).
- Remote sampling capabilities on the discharge of transfer pumps.
- Connection of the vessel vapor spaces to the Pretreatment Vessel Vent Process (PVP) System.

Figure 24590-PTF-M5-V17T-P0021001 presents a simplified process flow diagram of the Pretreatment Plant Vessel Vent Process and Exhaust (PVP/PVV) System. The Pretreatment Vessel Vent Process (PVP) System and Exhaust (PVV) system provide the function of air purging of the head spaces of various process vessels for radiolytic hydrogen control, collection of vent exhausts from process vessels, and process treatment and filtration of the vessel vent exhaust gases before discharging to the PTF stack.

The PVP and PVV systems are composed of tanks and miscellaneous treatment systems, as follows:

Tank System

- Vessel Vent HEME Drain Collection Vessel (PVP-VSL-00001)
- Pumps, piping, and instrumentation for waste transfers

Miscellaneous Unit Systems

- Caustic Scrubber (PVP-SCB-00002)
- High-Efficiency Mist Eliminators (PVP-HEME-00001A/B/C)
- Primary High-Efficiency Particulate Air Filters (PVV-HEPA-00001A/B)
- Secondary High-Efficiency Particulate Air Filters (PVV-HEPA-00002A/B)
- Volatile organic compound (VOC) Oxidizer Unit (PVP-OXID-00001)
- After-Cooler (PVP-CLR-00001)
- Carbon Bed Adsorbers (PVP-ADBR-00001A/B)
- Adsorber Outlet Filter (PVP-FILT-00001)

- Pumps, piping, and instrumentation for waste transfers
- Exhaust Fans (PVV-FAN-00001A/B)
- PVV stack(s)

Purge air supply

Continuous air purge to process vessels is the primary control strategy for radiolytic produced hydrogen. Additional airflow above the minimum hydrogen control rate may be introduced to each vessel to help balance the system and ensure that vessels are obtaining the minimum required flow.

The purge air in-bleed to vessels in the pretreatment area is a passive feature. The process vessels located in the C5 ventilation area will draw passive purge air in-bleed from the C5 ventilation area near the vessels via subheaders. Other vessels located in the C3 ventilation area and Process Condensate Tanks (RLD-TK-00006A/B) located outside the pretreatment building will draw air in-bleed from the C3 ventilation area nearest to the vessels through the inlet HEPA filters. The exhaust fans provide the motive force for airflow through each vessel by maintaining a negative pressure .

Forced purge air to the selected process vessels is also provided from the plant service air supply header. Each of the selected process vessels is provided with the required airflow to control the hydrogen concentration below 1% in the vessel during normal operation and below 4 % (lower flammability limit) during abnormal conditions. The supply line to each of these selected process vessels, which requires forced purge air during normal operation, is provided by two parallel trains of valves and flow elements to meet the high reliability requirements.

For the Waste Feed Evaporator Separator Vessels (FEP-SEP-00001A/B) and the Treated LAW Evaporator Separator Vessel (TLP-SEP-00001), which require forced purge air only during a shutdown or a loss of off-site power event, there are two separate trains of actuated valves and flow elements provided for each. The actuated valves for both of these trains are normally in closed position, but will fail open during the shutdown or loss of off-site power event.

Collection of vent gases (exhaust piping system)

From the individual process vessel, a vent line routes exhaust gases to a subheader, usually one for each cell. The connection to the subheaders from the process vessels are arranged, where possible, to maintain airflow from normally lower activity vessels to (or past) normally higher activity level vessels. Vent exhaust gases from various process vessels are combined to flow via subheaders to the Caustic Scrubber (PVP-SCB-00002). The vent gases from the vessels located in the C3 areas and the Process Condensate Tanks (RLD-TK-00006A/B), located outside the pretreatment building, will be collected via other subheaders that combine into the common exhaust header. Any condensate formed in the common exhaust header will flow by gravity into Plant Wash Vessel (PWD-VSL-00044).

Caustic Scrubber (PVP-SCB-00002)
The vessel vent exhausts flow into the Caustic Scrubber. The Caustic Scrubber is operated continuously to remove the nitrogen oxide and acid gases from the vessel vents. The vent gases flow to the inlet of the scrubber and flow upwards through a packed bed. Alkaline scrubbing liquid flows down through the packed bed. Contact between the gas and the scrubbing liquid in the bed causes part of the nitrogen oxide and acid gases present in the vent offgases to react with the caustic in the scrubbing liquid and to adsorb and form sodium salts, which stay in solution. The scrubbing liquid solution is collected in the scrubber sump vessel located below the packed bed section of the scrubber.

Two scrubber recirculation pumps (one operating and one in standby) continuously recirculate the scrubbing liquid solution to the top of the packed bed section of the scrubber. The operating pump also directly recirculates part of the solution into the sump vessel located below the scrubber to provide adequate mixing of the liquid in the vessel. The scrubber pump also transfers the collected condensate and scrubbing liquid normally once a day or on high level to the Plant Wash Vessel (PWD-VSL-00044). A section of dry packing located above the main packed section removes any entrained liquid droplets from the exit gases. A wash-water ring is provided above each of the packed sections to wash off any accumulation of solids. Fresh five molar caustic solution is added intermittently from the sodium hydroxide reagent process system (SHR). The caustic solution is added intermittently to scrubber sump vessel to maintain the pH range for the scrubbing liquid recirculating to the top of the main packed section.

When needed, demineralized water is also added to the Caustic Scrubber wash rings to clean the dry packing or for makeup requirements.

The outlet gases from the Caustic Scrubber (PVP-SCB-00002) flow to the HEMEs. The inlet, outlet, and bypass valves are provided for the Caustic Scrubber. The valves will be remotely operated by a manipulator in the pretreatment filter cave area.

High-Efficiency Mist Eliminators (PVP-HEME-00001A/B/C)
The HEMEs will be composed of deep-bed fiber filter elements configured in an annular shape to remove fine aerosols. Vent gases from the scrubber flow into two HEMEs, with the third HEME available as standby. Gases flow from the outside to the hollow core. The treated gas exits at the top and the liquid collects at the sealed bottom in a drainpipe. The HEMEs are operated wet at all times to allow drainage of soluble liquid aerosols that accumulate in the fibers, form a liquid film, and drop to the drain line below to the Vessel Ventilation HEME Drain Collection Vessel (PVP-VSL-00001). Atomizing spray of demineralized water is provided at the gas inlet nozzle for each operating HEME. An intermittent wash spray of the filter elements will be used to remove any accumulated debris, thus extending the service life of the HEME elements. Intermittent washing will normally be carried out off-line.

Three separate HEMEs will treat the vessel vent offgas stream. This configuration will permit washing each HEME while it is offline. The HEME effluent will be discharged to the Vessel Vent HEME Drain Collection Vessel (PVP-VSL-00001) and then to the Plant Wash Vessel (PWD-VSL-00044) in the PWD system.

After treatment in HEMEs, heated air is added from the inbleed HEPA filters to prevent condensation in the downstream PVV HEPA filters.

The PVV system also includes HEPA filters, exhaust fans, and the exhaust stack. The VOC Oxidation Unit (PVP-OXID-00001) and the Carbon Bed Adsorbers (PVP-ABS-00001A/B) will be part of the PVP system, which is located between the HEPA filters and the exhaust fans.

Primary HEPA Filters (PVV-HEPA-00001A/B/C)
The preheated vent exhaust gases from the heaters flow into one of the three Primary HEPA filters, which will be on line while the other two are available as standby offline. The HEPA filter will remove the particulates from the gas stream. The Primary HEPA Filters will be located in the pretreatment filter cave area (room P-0335) for remote maintenance.

Secondary HEPA Filters (PVV-HEPA-00002A/B/C)
The gases from the Primary HEPA Filter flow into one of the three Secondary HEPA Filters, which will be on line while the other two are available as standby offline. The Secondary HEPA Filter will remove the particulates from the exhaust gases.

After the Primary and Secondary HEPA Filters remove the particulates from the vessel vent exhaust stream in the PVV system, the filtered vent exhaust stream returns to the PVP system for abatement of volatile organic compounds. The volatile organic compound abatement process removes vapor-phase organic compounds from the PVP vent gas. This abatement process takes place within an oxidation system followed by an adsorption system. The oxidation system includes a VOC Oxidizer Unit (PVP-OXID-00001) and an After-Cooler (PVP-CLR-00001). The adsorption system includes Carbon Bed Adsorbers (PVP-ADBR-00001A/B) and a medium efficiency Adsorber Outlet Filters (PVP-FILT-00001A/B).

VOC Oxidizer Unit (PVP-OXID-00001)
To remove volatile organics compounds from the vessel vent stream, a skid-mounted electric, noncatalyzed oxidizer unit will be used. In this unit, volatile organic compounds are oxidized to carbon dioxide and water vapor at high temperature in the presence of excess oxygen.

The VOC Thermal Oxidizer will be a vendor-designed unit suitable for this specific application. By virtue of its heat recovery scheme, the unit is classified specifically as a regenerative thermal oxidizer. The oxidizer system will consist of three heat transfer beds, electric heat elements within the reaction section, and a downstream trim cooler (after-cooler). All high-temperature components of the system will be insulated to minimize heat losses.
Oxidation of organic compounds is an exothermic reaction; therefore, it significantly increases the offgas temperature. The offgas then enters the heat recovery unit to transfer the heat to the bed, which will then be used for preheating the incoming offgas. The cooled gas stream is then directed to the After-Cooler (PVP-CLR-00001). The treated gases are cooled by the cooling water. Any condensate generated by cooling of the gases will flow to the C3 Floor Drain Collection Vessel (PWD-VSL-00046).

Carbon Bed Adsorbers (PVP-ADBR-00001A/B)
Two parallel Carbon Bed Adsorbers are provided for the final treatment of vent gases. The adsorbers are filled with activated carbon. The adsorber will further reduce volatile organic compounds from the vessel vent exhaust gases. The VOC Oxidizer Unit (PVP-OXID-00001) will remove most of the volatile organic compounds from the vessel vent gases, and the Carbon Bed Adsorbers (PVP-ADBR-00001A/B) will remove the remaining volatile organic compounds. Normal operation will be one unit online while the other is in maintenance mode.

Adsorber Outlet Filters (PVP-FILT-00001)
The treated gases from the Carbon Bed Adsorbers (PVP-ADBR-00001A/B) will flow into this filter, wherein fine carbon particles, if any are present in the vent gases, will be filtered. This filter is also provided with a bypass line and isolation valves to enable replacement of the filter.

Exhaust Fans (PVV-FAN-00001A/B)
After the filtration in the Adsorber Outlet Filter (PVP-FILT-00001), the vent gases will flow into the Exhaust Fan in the PVV system. Two Exhaust Fans are provided. One will be in operation while the second one will be on standby. The Exhaust Fans provide the necessary motive force to extract the vent gases from the head spaces of various process vessels and provides for the required pressure drop through various treatment equipment in the PVP/PVV systems. The Exhaust Fans will maintain a constant suction pressure at the inlet to the Caustic Scrubber (PVP-SCB-00002). The Exhaust Fans (PVV-FAN-00001A/B) will have suitable speed control to accommodate variation in the vent gas flow rates from various vessels.

In addition to the instrumentation, alarms, controls, and interlocks addressed in section 4.1.2, the following will be provided for the PVP/PVV systems to indicate or prevent the following conditions:

- Purge air flow measurement:
  - Passive purge air flow rate will be measured for the process vessels including low flow alarm for each of these flow instruments.
  - Forced purge air flow rate will be measured and low flow alarmed for the process vessels that require the control of hydrogen concentration. These instruments will have important-to-safety instrument function.
- For the HEMEs;
  - The outlet pressure, pressure drop, and the flow rates will be monitored and controlled.
  - Demineralized water supply for HEMEs will have monitoring for the inlet pressure and flow rates.
- For the HEPA filters, the pressure drop will be monitored and controlled within the required limits.
- For the VOC Oxidizer Unit (PVP-OXID-00001):
  - The thermal oxidizer reaction zone, the outlet temperatures, and the pressure drop will be monitored and controlled.

- The oxidizer bypass valve cannot be opened unless the reaction zone temperature has been attained.
- For the carbon bed adsorber:
  - The pressure drop through the bed will be monitored and controlled.
  - The differential temperature across the carbon bed will be monitored.
- For the adsorber outlet filter, the pressure drop will be monitored and controlled.

The PVP and PVV systems have the following design features:

- Provide the function of air purging of the head spaces of various process vessels for radiolytic hydrogen control,
- Collect vent exhausts from process vessels
- Treat the combined exhaust gases to adsorb soluble nitrogen oxide(s) and acid gases, remove liquid droplets, condensate, mists, and solid particulates in the PVP system
- Preheat vent gases to control relative humidity and then remove particulates with two stages of High-Efficiency Particulate Air (HEPA) filters
- Provide additional treatment for the oxidation and removal of volatile organic compounds from the filtered exhaust gases in the PVP system. The filtered treated exhaust gases will then flow to the exhaust fans in the PVV system for venting to the atmosphere

#### 4.1.2.17 Pulse Jet Ventilation (PJV) System

Figure 4A-128 presents a simplified process flow diagram of the Pulse Jet Ventilation (PJV) System. The PJV system provides the safety function to treat the exhausts from reverse flow diverters and pulse jet mixers operating inside various process vessels before release to the atmosphere via the pretreatment plant stacks. The PJV system consists of process and HVAC equipment for removal of aerosols and particulates. The PJV system is composed of tanks and miscellaneous treatment systems, as follows:

Tank System

- PJV Drain Collection Vessel (PJV-VSL-00002)
- Pumps, piping, and instrumentation for waste transfers

Miscellaneous Unit Systems

- Demisters (PJV-DMST-00002A/B/C)
- Electric Heaters (PJV-HTR-00001A/B)
- Primary HEPA Filters (PJV-HEPA-00001A/B/C/D/E/F/G)
- Secondary HEPA Filters (PJV-HEPA-00002A/B/C/D/E/F)
- Exhaust Fans (PJV-FAN-00001A/B/C)
- Pumps, piping, and instrumentation for waste transfers

The PJV system provides the containment and confinement of exhausts from various reverse flow diverters and pulse jet mixers operating inside the PTF process vessels. This system provides the removal of mists and aerosols from the combined PJV exhausts stream by demisters (medium-efficiency mist eliminators). The treated exhaust gases are mixed with hot air in-bleed from the C3 ventilation area to adjust their relative humidity followed by two stages of HEPA filtration to remove particulates. The filtered effluent gases flow to the Exhaust Fans (PJV-FAN-00001A/B/C). The treated filtered exhaust stream will be monitored before it is discharged to the atmosphere.

Collection of Exhaust Gases (Exhaust Piping System)
The PJV system receives the exhaust via several subheaders from the reverse flow diverters and pulse jet mixers operating in various process vessels in the pretreatment area. The exhausts are combined from various subheaders to flow via the inlet header to the Demisters (PJV-DMST-00002A/B/C). The low points of the inlet header and subheaders are provided with drain lines, which drain condensate collected in the header to the PJV HEME Drain Collection Vessel (PJV-VSL-00002). This vessel is also provided with an overflow, which will flow to the Ultimate Overflow Vessel (PWD-VSL-00033) in the Pretreatment Plant Wash and Disposal (PWD) System. The condensate from the PJV HEME Drain Collection Vessel (PJV-VSL-00002) is periodically transferred by the drain transfer pumps to the Plant Wash Vessel (PWD-VSL-00044) in the PWD system.

Demisters (PJV-DMST-00002A/B/C)
The PJV system is provided with three Demisters (PJV-DMST-00002A/B/C), which are medium-efficiency mist eliminators. Two of these demisters are in service at a given time and one is available as a standby off-line.

Demisters are used to remove fine aerosols and mist, and exhibit medium removal efficiencies for submicron aerosols. They are passive devices with low maintenance requirements and high reliability. The demisters will adequately protect the HEPA filters, located downstream in this system, from excessive activity buildup, and provide the desired HEPA filter life of 4 to 5 years.

All Demisters (PJV-DMST-00002A/B/C) for this system are located, along with the HEPA filters, in the filter cave (room P-0335) in a C5 ventilation area due to the expected radionuclide loading. The Demisters (PJV-DMST-00002A/B/C) are either isolated, or put into service, by opening or closing isolation valves provided at the inlet and outlet of each Demister. These isolation valves are operated remotely by using the manipulator and the filter cave operating crane. The headers are designed without any bypass around the Demisters (PJV-DMST-00002A/B/C) to prevent the downstream HEPAs from accelerated loading of particulates. Remote change out capability for the Demister filter elements is provided.

The outlet gases from the Demisters (PJV-DMST-00002A/B/C) flow to the outlet header to the extract part of the PJV system, as described below.

Hot Air In-Bleed

Air in-bleed from a C3 ventilation area is filtered, heated, and then mixed with the exhaust gases from the Demister outlet to reduce the relative humidity of the stream flowing into the primary HEPA Filter banks. The in-bleed air is filtered with medium efficiency Air In-Bleed Filters (PJV-FLTH-00001A/B) and then heated to the temperature required to keep the humidity of the mixed gases below 70% and prevent the wetting of the HEPA Filters.

There are two Electric Heaters (PJV-HTR-00001A/B) arranged in parallel, one working and the other as standby, to provide the required heating of in-bleed air. Hot air in-bleed flows from the Electric Heaters to Air In-Bleed HEPA Filters (PJV-HEPA-00003A/B), one working and the other as standby. These provide protection against backflow of the PJV exhaust stream into the in-bleed system in the C3 ventilation area.

Primary Exhaust HEPA Filters (PJV-HEPA-00001A/B/C/D/E/F/G)

There are seven Primary HEPA Filter banks, arranged in parallel and configured in a running/standby arrangement to allow on-line filter change. There will be five Primary HEPA Filters in operation, and two Primary HEPA Filters will be on standby or in maintenance. The Primary HEPA Filters will be remote change type located in the pretreatment filter cave area. Filter inserts are radial type. Inlet and outlet isolation valves for the HEPA Filters are remotely operated by a manipulator and maintenance crane in the pretreatment filter cave (room P-0335).

Secondary HEPA Filters (PJV-HEPA-00002A/B/C/D/E/F)

Exhaust gases from the Primary HEPA Filters are routed to the outlet header, then to the Secondary HEPA Filters located in a C3 ventilation area. There are six Secondary HEPA Filter banks, arranged in parallel and configured in a running/standby arrangement to allow on-line filter change. There will be four Secondary HEPA Filters in operation, and two Secondary HEPA Filter banks will be on standby or in maintenance. Secondary HEPA Filters will be the safe change type.

PJV Exhaust Fans (PJV-FAN-00001A/B/C)

The filtered exhausts from the Secondary HEPA Filters will flow to three Exhaust Fans. Two fans will be in operation while the third fan will be on standby. The Exhaust Fans provide the necessary motive force to extract the vent gases from the fluidics discharge racks and provide for the required pressure drop through the treatment equipment in the PJV system. The Exhaust Fans (PJV-FAN-00001A/B/C) will maintain a constant suction pressure condition for the inlet gas stream to the Demisters. The Exhaust Fans will have suitable speed control to accommodate variation in the exhaust flow rates from reverse flow diverters and pulse jet mixers operating inside various vessels.

In the event of failure of one of the two Exhaust Fans in operation, the standby fan automatically starts. Each fan is provided with manual isolating dampers on the fan inlet and pneumatic actuated isolating dampers on the fan outlet. From the PJV Exhaust Fans, pulse jet mixer and reverse flow diverter treated effluents flow via a dedicated, continuously monitored flue to the PTF stack.

The PJV system has the following design features:

- Instrumentation for monitoring process flows and equipment performance
- Remote sampling system to confirm system performance.

In addition to the instrumentation, alarms, controls, and interlocks addressed in section 4.1.2, the following will be provided for the PJV system to indicate or prevent the following conditions:

- Flow rate for the combined exhaust gas entering the Demisters (PJV-DMST-00002A/B/C) will be monitored. Suction pressure for the inlet gas will be maintained by varying the speed for the Exhaust Fans (PJV-FAN-00001A/B/C)
- Pressure drop for the Demisters (PJV-DMST-00002A/B/C) will be monitored
- Each HEPA filter bank will be monitored and alarmed on high differential pressure

#### 4.1.2.18 Sodium Hydroxide Reagent (SHR) System

The PTF sodium hydroxide reagent (SHR) system, located on elevation 98', includes a vessel (SHR-VSL-00001), ancillary equipment, and instruments associated with its operation. Sodium hydroxide is stored in vessel SHR-VSL-00001for emergency elution of the cesium ion exchange (CXP) columns. The vessel SHR-VSL-00001 receives sodium hydroxide from the BOF sodium hydroxide reagent storage vessel after dilution to 0.1 M using ionized water. When the high temperature alarm is detected on the CXP columns, the sodium hydroxide is gravity transferred from the SHR-VSL-00001 to the cesium ion exchange system.

The SHR system does not manage dangerous waste and is provided here for completeness of the PTF process description.

#### 4.1.2.20 Pretreatment Plant Ventilation

Pretreatment plant ventilation includes the following systems:

- C1 ventilation system (C1V)
- C2 ventilation system (C2V)
- C3 ventilation system (C3V)
- C5 ventilation system (C5V)

The primary consideration in the design of the ventilation systems is to confine airborne sources of contamination to protect human health and the environment from exposure to hazardous materials during normal and abnormal operating conditions. Physical barriers or structures supported by the ventilation systems will ensure air released to the environment and residual contamination is well below acceptable, safe levels for public exposure.

The pretreatment plant will be divided into four numbered zones, listed below, with the higher number indicating greater hazard potential that needs greater control or restriction. The ventilation system zoning is based on the classifications assigned to building areas for potential contamination. Zones classified as C5 are potentially the most contaminated, such as the pretreatment cells. Zones classified as C1 are uncontaminated areas.

The confinement provided by physical barriers is enhanced by the ventilation system, which creates a pressure gradient and causes air to flow through engineered routes from an area of lower contamination potential to an area of higher contamination potential. There will be no C4 areas in the pretreatment plant. The cascade system, in which air passes through more than one area, will reduce the number of separate ventilation streams and, hence, the amount of air requiring treatment.

C1 Ventilation System (C1V)
C1 areas are normally occupied. C1 areas will typically consist of administrative offices, control rooms, conference rooms, locker rooms, rest rooms, and equipment rooms. C1 areas will be operated slightly pressurized relative to atmosphere and other adjacent areas.

C2 Ventilation System (C2V)
C2 areas typically consist of nonprocess operating areas, access corridors, and control/ instrumentation, and electrical rooms. Filtered air will be supplied to these areas by the C2 supply system and will be cascaded into adjacent C3 areas or HEPA filtered and exhausted by the C2 Exhaust system.

C3 Ventilation System (C3V)
C3 areas normally will be unoccupied, but operator access during maintenance will be allowed. C3 areas typically will consist of filter plant rooms, workshops, maintenance areas, and monitoring areas. Access from a C2 area to a C3 area will be via a C2/C3 subchange room. Air will generally be drawn from C2 areas and cascaded through the C3 areas into C5 areas. In general, air cascaded into the C3 areas will be from adjacent C2/C3 subchange rooms. In some areas, where higher flow may be required into C3 areas, a dedicated C2 supply will be provided with a backdraft damper on the C2 supply duct, which will be closed in the event of a loss of C3 extract. This system will shut down should there be a failure of the C5 exhaust system.

C5 Ventilation System (C5V)
The pretreatment plant C5 areas are designed with the cell or cave perimeter providing radiation shielding as well as a confinement zone for ventilation purposes. C5 areas typically consist of a series of process cells where waste will be stored and treated. The pretreatment plant hot cell will house major pumps and valves and other process equipment. Air will be cascaded into the C5 areas, generally from adjacent C3 areas, and extracted by the C5 extract system. The C5 exhaust system will be composed of Primary (PVP-HEPA-00001A/B/C) and Secondary (PVP-HEPA-00002A/B/C) HEPA Filters and variable speed Exhaust Fans (PJV-FAN-00001A/ B/C). Fans designed to maintain continuous system operation will drive the airflow. This system will also be interlocked with the C3 HVAC system, to prevent backflow by shutting down the C3 system if the C5 HVAC system shuts down.

### 4.1.3 LAW Vitrification

The purpose of this section is to describe the major systems associated with the LAW vitrification plant. Figure 4A-3 presents a simplified process flow diagram of the LAW vitrification processes. This plant will consist of several process systems designed to perform the following functions:

- Receive and store pretreated LAW feed
- Convert blended LAW feed and glass formers into glass
- Provide melter offgas treatment systems
- Treat melter offgas
- Handle ILAW containers
- Store ILAW containers
- Provide supporting equipment in the melter gallery
- Handle miscellaneous waste
- Ventilate the LAW vitrification plant

The following figures located in Appendix 4A and drawings found in DWP Attachment 51, Appendix 9, provide additional detail for the LAW vitrification plant:

- Simplified flow diagrams for the WTP and the LAW vitrification plant
- Process flow figures and drawings for process information
- Typical system figures depicting common features for each regulated system
- General arrangement figures and drawings showing locations of regulated equipment
- Waste management area figures and drawings showing plant locations to be permitted

Instrumentation, alarms, controls, and interlocks will be provided for the tank systems and miscellaneous treatment unit sub-systems to indicate or prevent the following conditions, as appropriate:

- Overfilling: Plant items are protected against overfilling by liquid level indication, high level instrumentation interlocks to shut off feed sources, and process control system control functions backed up by hard wired trips as required.

- Loss of containment: Plant items are protected against containment loss by liquid level indication, and by process control system control and alarm functions as required, including shut off of feed sources. Each plant item that manages liquid mixed or dangerous waste is provided with secondary containment. Sumps associated with the management of mixed or dangerous waste are provided with liquid level instrumentation and an ejector or pump to empty the sump as needed.

- Inadvertent transfers of fluids: System sequential operations are properly interlocked to prevent inadvertent transfers at the wrong time or to the wrong location.

- Loss of mixing function: Tank systems are instrumented (air pressure/flow indication) to prevent hydrogen accumulation and solids settling. Tanks with agitators are instrumented to prevent agitator and/or vessel damage at low liquid level.

- Unsafe or off-normal melter operating conditions

- Degraded emissions control equipment and/or operating conditions

- Loss of air flow: The ventilation system are designed to creates a pressure gradient which causes air to flow through engineered routes from an area of lower contamination potential to an area of higher contamination potential.

- Loss of site power

In addition to level control, temperature and pressure may be monitored for tank systems and miscellaneous treatment unit systems in some cases. Additional information may be found in the system logic descriptions located in DWP Attachment 51, Appendix 9.13. Regulated process and leak detection system instruments and parameters will be provided in DWP Table III.10.E.F for tank systems and in DWP Table III.10.H.C for miscellaneous treatment unit sub-systems.

Descriptions of the LAW vitrification process, melter offgas treatment systems, and ILAW glass container handling systems are provided in the following sections.

#### 4.1.3.1 LAW Melter Feed Process

The LAW melter feed consists of the following systems:

- LAW concentrate receipt process system (LCP)
- LAW melter feed process system (LFP)
- Glass former reagent system (GFR) (the GFR system does not manage dangerous waste and is provided for information only)

Figure 24590-LAW-M5-V17T-P0001 and 24590-LAW-M5-V17T-P0002 presents a simplified process flow diagram of the LAW Concentrate Receipt Process (LCP) System and the LAW Melter Feed Process (LFP) System. The LCP and LFP systems prepare feed for the LAW melters to produce a vitrified product. An analysis of the waste determines a glass additive formulation for the conversion of the waste to glass. The glass additives specified in the formulation are weighed and mixed with the waste. There are two melter feed trains to supply the two LAW melters. Each melter feed train consists of a melter concentrate receipt vessel, a

melter feed preparation vessel, and a melter feed vessel. The LCP system includes the melter concentrate receipt vessels. The LFP system includes the melter feed preparation vessel and the melter feed vessel for each of the two melters.

The LCP tank system consists of the following tanks and their associated ancillary equipment:

- Melter Concentrate Receipt Vessels (LCP-VSL-00001/2)

The LFP tank system consists of the following tanks and their associated ancillary equipment:

- Melter Feed Preparation Vessels (LFP-VSL-00001/3)
- Melter Feed Vessels (LFP-VSL-00002/4)

Melter Concentrate Receipt Vessels (LCP-VSL-00001/2)
The Melter Concentrate Receipt Vessels receive melter feed concentrate from the pretreatment plant. The Melter Feed Preparation Vessels are located in two process cells, and each process cell contains a Melter Concentrate Receipt Vessel, a Melter Feed Preparation Vessel, and a Melter Feed Vessel. The vessels are equipped with the following:

- Mechanical agitator
- Pumps to transfer LAW concentrate
- Instrumentation for liquid level
- Internal spray wash nozzles
- Overflow nozzle to C3/C5 Drains/Sump Collection Vessel (RLD-VSL-00004)
- Spare nozzles

Valves are located in the valve bulge. Valving in each bulge allows the LAW concentrate to be routed to the Melter Feed Preparation Vessels (LFP-VSL-00001/3), or to the Plant Wash Vessel (RLD-VSL-00003) if the Melter Concentrate Receipt Vessels (LCP-VSL-00001/2) are being cleaned out or if the contents of the vessels cannot be satisfactorily processed. In addition, LAW concentrate can be pumped between the two Melter Concentrate Receipt Vessels (LCP-VSL-00001/2).

Glass Former Reagent (GFR) System
The GFR system contains the glass former feed hoppers that receive blended glass formers and sucrose by dense-phase pneumatic conveyors from the glass former system.

The feed hoppers are equipped with filters to remove the dust from air used for pneumatic conveying and blending. It is anticipated that a series of single filter cartridges will be mounted on the top of the hoppers. The filters are cleaned by introducing compressed air through the cleaning nozzle to blow accumulated dust back into the hoppers.

The feed hoppers are equipped with load cells to weigh the glass formers to confirm that the material in the upstream blending silo is conveyed to the feed hoppers and to confirm that the glass formers are transferred out of the feed hoppers to the Melter Feed Preparation Vessels.

The glass formers are gravity-fed with a rotary feeder into the Melter Feed Preparation Vessels, where the glass formers are mixed with the waste feed. This equipment is located in an isolated area that serves as a contamination barrier between the melter feed preparation vessels and the glass former supply. The rotary valve controls the rate of glass former addition into the melter feed preparation vessels.

Melter Feed Preparation Vessels

The Melter Feed Preparation Vessels mix LAW concentrate from the Melter Concentrate Receipt Vessels with glass formers and sucrose from the glass former feed hoppers. The vessels are equipped with the following:

- Mechanical agitator
- Pumps
- Instrumentation for liquid level measurement
- Internal spray wash nozzles
- Overflow nozzle to the C3/C5 Drains/Sump Collection Vessel (RLD-VSL-00004)
- Spare nozzles

The two pumps transfer waste using a valve bulge. Valves in the valve bulge allow melter feed to be routed to the associated Melter Feed Vessel (LFP-VSL-00002/4) or to the Plant Wash Vessel (RLD-VSL-00003). The vessel contents can be circulated through the pump and injected back into the vessel in the recirculation mode. In addition, melter feed can be pumped between the two Melter Feed Preparation Vessels (LFP-VSL-00002/4).

Melter Feed Vessels (LFP-VSL-00002/4)

The Melter Feed Vessels receive blended melter feed, consisting of LAW concentrate and glass formers, from the Melter Feed Preparation Vessels (LFP-VSL-00001/3). The vessels are equipped with the following:

- Mechanical agitator
- Air displacement supply (ADS) pumps to transfer feed to the corresponding LAW melter
- Feed vessel pump
- Instrumentation for liquid level measurement
- Miscellaneous solution addition line
- Internal spray wash nozzles
- Overflow nozzle to the C3/C5 Drains/Sump Collection Vessel (RLD-VSL-00004)
- Spare nozzles

The feed vessel pump transfers waste feed through a valve bulge. Valving in the bulge allows the waste feed to be pumped between all four vessels: the two Melter Feed Preparation Vessels (LFP-VSL-00001/3) and the two Melter Feed Vessels (LFP-VSL-00002/4). Waste feed can also be transferred from the Melter Feed Vessels to the Plant Wash Vessel (RLD-VSL-00003) for vessel cleanout. Normally, ADS pumps transfer the melter feed from the melter feed vessel to the melter.

#### 4.1.3.2 LAW Melter Process System (LMP)

Figure 4A-21 presents a simplified process flow diagram of the LAW Melter Process (LMP)System. The purpose of the LMP system is to convert a blended slurry of liquid LAW feed and glass former additives into a durable ILAW product. The LAW melter system design is based on operating two joule-heated ceramic melters in a C3 environment. Key functions of LMP include containment, joule heated melting, melter feed, and glass discharge.

Miscellaneous Treatment Unit Sub-Systems

- LAW Melters (LMP-MLTR-00001/2)

The LAW Melters (Appendix 4A, Figure 4A-48) have a nameplate capacity of 15 metric tons of glass per melter per day. The LAW Melter has a single internal glass chamber with a rectangular surface area. The melter is powered by three sets of electrodes mounted on opposite walls of the glass pool. The glass is discharged through either of two discharge chambers located within one of the long axis walls of the melter. The lid of the melter is composed of a layer of refractory backed by a corrosion-resistant metal plate and support structure. The lid also supports the components that are submerged in the melt pool and suspended in the melter plenum. The melter is encased in an integral shielding and secondary containment enclosure.

The refractory is part of the melter containment and can be described as two separate sections. These sections are the refractory in contact with the molten glass pool and the refractory surrounding the gas space above the glass pool, which is referred to as the plenum. The glass pool refractory, used in conjunction with active cooling provided by a water jacket, will provide glass containment, thermal insulation, and electrical isolation. The plenum refractory is primarily designed to resist thermal breakdown, resist corrosion by offgases, and resist corrosion by splashed feed and glass.

The melter shell consists of the lid and base plate as well as the structure needed to support the lid and provides a gas barrier. The melter shell inner surface is designed to allow operation of the melter at a negative pressure. This inner surface will also minimize the release of melter gases and contaminants in the event of melter pressurization. A small air purge will be provided for the annular space between the cooling panels and the shell to reduce the deposition of materials. This purge will be driven by melter vacuum.

The LAW melter system has been designed to shield and contain the melter so that no additional shielding or contamination control will be required for normal operations. This has been accomplished by enclosing the melter assembly in a steel box. Shielding is provided by the entire enclosure. Access panels are provided through the external shielding. When removed, these panels will allow access to the jack-bolts, electrodes, electrode thermocouples, viewing cameras, and so forth.

The heat for the LAW melter startup is provided by temporarily installed radiant electric heaters mounted on the roof of the melter. These heaters melt glass formers sufficiently to make it ionically conductive between the melter's joule heating electrodes. When a conducting path is established, the melter is heated in a controlled manner by passing more and more current between the electrodes through the glass (a process known as *joule heating*). After some time, the melter reaches its operating temperature and slurry feeding can start. As water evaporates, the feed forms a "cold cap" on the surface of the melt. As more slurry is fed, molten glass is formed by vitrification of the cold cap materials into the glass melt. When the melt level rises to a predetermined level, it is discharged into a container.

The melter plenum is maintained at a controlled vacuum with offgas system fans and injection of air into the offgas line near the melter exhaust. This assures containment and avoids pressurization.

Joule Heating

The joule heating system contains the melter electrodes, melter electrode power supplies, melter glass pool thermocouples, and the melter electrode control system.

The electrode configuration for each LAW Melter will consist of three pairs of plate electrodes mounted parallel to each other on the long axis of the melter. The electrodes will have forced-air cooled electrode extensions. The extensions will penetrate the side of the melter below the glass level to minimize the effects of thermal expansion and to minimize the potential for corrosion by sulfate. Active cooling of the extensions and the use of a water-cooling jacket will prevent glass from migrating through the refractory package adjacent to the electrode extension penetrations. Power to the electrodes will be single-phase alternating current applied across opposing electrodes. The nominal glass melt pool temperature is approximately 1,150 °C. This is measured with thermocouples in thermowells submerged into the pool at various locations. The power to the electrodes is regulated to maintain the temperature within a selected range.

Melter Feed System

Feed will be introduced to the melter as a slurry through nozzles in the melter lid. Water and volatile constituents in the slurry will evaporate, leaving behind a layer of material known as the cold cap. Waste feed components in the cold cap will undergo chemical reactions, be converted to their respective oxides, and dissolve in the molten glass. The feed rate determines the cold cap coverage on the glass melt pool. The feed rate can be controlled based on the average plenum temperature measured by plenum thermocouples mounted in the melter lid. New slurry will be added at about the same rate as the cold cap dissolves, maintaining the quantity of cold cap material at a steady level. Air injectors will be used to mix and agitate the molten glass. When the melt level rises to a predetermined upper limit, an air lift mechanism is actuated and glass is discharged to a container.

Glass Discharge System

Melter glass pool level measurement will be used to indicate when to start and stop glass discharge. It also provides alarms for high or low glass pool levels. Each LAW Melter has two identical and independently operated glass discharge systems located adjacent to each other on one side of the melter. Each of these systems includes an airlift riser, a glass pour trough, a heated discharge chamber, and other components and instruments needed to control the discharge of glass. When the canister is required for filling, it is taken out of the buffer rack in the Canister Handling Cave and transferred into the Pour Tunnel bogie. The bogie travels to a position under the pour spout. As the bogie moves into position under the pour spout, the pour spout glass catch tray is pushed back and signals that a canister is present. A proximity switch detects that the bogie is in position, the bogie is then locked into position, and the canister is filled with glass.

The glass discharge from the melter is initiated by injecting air or an inert gas at the bottom of the airlift riser. As the gas bubbles rise in the glass they will entrain glass in the riser, which is replaced by glass flowing in from the pool through the riser throat. The glass is lifted to the inlet of the trough, where the air bubbles disengage and the entrained glass flows into the trough. The glass then flows down the trough due to gravity and falls from the pour tip at the end of the trough into the container. The rate of glass discharge is controlled by adjusting the rate at which air is injected into the bottom of the riser.

Instrumentation, alarms, controls, and interlocks will be provided for the LMP to indicate or prevent the following conditions:

- Decrease or loss of melter plenum vacuum
- Glass temperature too high
- Electrode extension temperature too high
- Loss of melter cooling water
- Plugged feed nozzle
- Overfilling of glass container

#### 4.1.3.3 LAW Melter Offgas System

The LAW Melter Offgas System consists of the following process systems:

- LAW Primary Offgas Process (LOP) System
- LAW Secondary Offgas/Vessel Vent Process (LVP) System

Figure 24590-LAW-M5-V17T-P0007 and 24590-LAW-M5-V17T-P0008 presents a simplified process flow diagram of the LAW Primary Offgas Process (LOP) System. The LOP tank system consists of the following tanks and miscellaneous treatment unit sub-systems and their associated ancillary equipment:

Tank System

- LAW Melter SBS Condensate Vessels (LOP-VSL-00001/2)
- Pumps
- Eductor (LOP-EDUC-00001)

Miscellaneous Treatment Unit Sub-Systems

- Primary and Secondary Film Coolers (LOP-FCLR-00001/2/3/4), one set for each melter
- Melter 1 and Melter 2 Submerged Bed Scrubbers (SBS)(LOP-SCB-00001/2)
- Melter 1 and Melter 2 Wet Electrostatic Precipitators (WESP) (LOP-WESP-00001/2)

Figure 24590-LAW-M5-V17T-P0010 and 24590-LAW-M5-V17T-P0011 presents a simplified process flow diagram of the LAW Secondary Offgas/Vessel Vent Process (LVP)System. The LVP tank system consists of the following tanks and miscellaneous treatment unit sub-systems and their associated ancillary equipment.

Tank System

- LAW Caustic Collection Tank (LVP-TK-00001)

Miscellaneous Treatment Unit Sub-Systems

- Caustic Scrubber (LVP-SCB-00001)
- Electric Heaters (LVP-HTR-00001A/1B/2)
- Selective Catalytic Oxidizer (LVP-SCO-00001)
- Selective Catalytic Reducer (LVP-SCR-00001)
- Heat Exchanger (LVP-HX-00001)
- Offgas Mercury Adsorbers (LVP-ADBR-00001A/1B)
- HEPA Filters (LVP-HEPA-00001A/1B/2A/2B/3A)
- Melter Offgas Exhausters (LVP-EXHR-00001A/B/C)
- LAW stack

Melter offgas is generated from the vitrification of LAW feed in the two joule-heated ceramic melters. The rate of generation of gases in the melter is dynamic. The melters generate offgas resulting from decomposition, oxidation, and vaporization of feed material. Constituents of the offgas include:

- Nitrogen oxides from decomposition of metal nitrates in the melter feed

- Chloride, fluoride, and sulfur as oxides, acid gases, and salts
- Particulates and aerosols
- Entrained feed material and glass
- Mercury

In addition, the LAW Melters generate small quantities of other volatile compounds including iodine-129, carbon-14, tritium, and volatile organic compounds. Carbon-14 and tritium are in the form of carbon dioxide and water, respectively.

The purpose of the LAW Melter offgas system is to cool and treat the melter offgas and vessel ventilation offgas to a level that is protective of human health and the environment. The offgas system must also provide a pressure confinement boundary that will control melter pressure and prevent vapor release to the cell. The design of the melter offgas system must accommodate changes in offgas flow from individual melters without causing the melter to pressurize and without allowing variations in the flow from one melter to impact the other melter.

Separate systems are provided for the initial treatment of offgas from each melter. This is considered the primary offgas treatment system. This primary offgas system is designed to handle intermittent surges of seven times steam and three times noncondensables nominal flow from feed. The primary system consists of a Film Coolers (LOP-FCLR-00001/3), Submerged Bed Scrubbers (LOP-SCB-00001/2), and a Melter Wet Electrostatic Precipitator (LOP-WESP-00001/2). This system cools the offgas and removes particulates.

There is a second offgas line from the Melter to the Submerged Bed Scrubbers (LOP-SCB-00001/2) consisting of a Standby Film Cooler (LOP-FCLR-00002/4) and a butterfly valve as the isolation device. The melter is operated under negative pressure. In the event that the primary offgas line plugs or the melter surges beyond design basis, the butterfly valve opens allowing offgas flow to the submerged bed scrubber through the second offgas line, thereby preventing melter pressurization. The line is designed to handle surges up to seven times condensable and three times noncondensable from feed without causing melter pressurization. In the event that the melter surge is much higher than the system is designed to handle, a pressure relief valve opens venting the offgas to the wet process cell. Offgas from the wet process cell is drawn through HEPA Filters to remove particulates before discharged to the atmosphere. Once the melter pressure returns to the desired set point, the valve closes.

The vessel ventilation system offgas consists primarily of air, water vapor, and minor amounts of aerosols generated by the agitation or movement of vessel contents. The vessel ventilation system header joins the primary offgas system after the Wet Electrostatic Precipitators (LOP-WESP-00001/2), and the combined offgas is routed to the secondary offgas treatment system.

The secondary offgas system (from HEPA preheater to final discharge) is designed to handle maximum sustained flowrate from the two melters assuming both melters are operating. The system is also capable of operating effectively if only one melter is running. The secondary offgas system consists of HEPA Filters (LVP-HEPA-00001A/1B/2A/2B) with Electric Heater

(LVP-HTR-00001A/1B/3A/3B), Exhauster Fans (LVP-EXHR-00001A/B/C), Mercury Adsorbers (LVP-ADBR-00001A/B), a Selective Catalytic Oxidizer (LVP-SCO-00001)/Selective CatalyticReducer (LVP-SCR-00001/2) which houses the heat recovery unit (plate Heat Exchanger) (LVP-HX-00001), Electric Heater (LVP-HTR-00002), the catalyst for volatile organic compound oxidation and the catalyst for nitrogen oxides reduction, and a Caustic Scrubber (LVP-SCB-00001). The following sections provide descriptions of major melter offgas treatment components.

#### 4.1.3.3.1 LAW Primary Offgas Process (LOP) System

Figure 24590-LAW-M5-V17T-P0007 and 24590-LAW-M5-V17T-P0008 presents a simplified process flow diagram of the LAW Primary Offgas Process (LOP) System. The purpose of the LOP tank system and miscellaneous treatment unit sub-systems is to cool the offgas and remove aerosols generated by the melter. The primary components consist of a film cooler, submerged bed scrubber, and a wet electrostatic precipitator.

Film Cooler (LOP-FCLR-00001/2/3/4)
The primary function of the Film Cooler miscellaneous treatment unit sub-system is to cool the offgas and entrained molten glass droplets below the glass sticking temperature to minimize glass deposition on the offgas piping walls. The offgas exits the melter and is mixed with steam or steam/air mixture in the offgas Film Cooler. The Film Cooler is a double-walled pipe designed to introduce air/steam axially along the walls of the offgas pipe through a series of holes or slots in the inner wall. Each melter has a primary and a secondary Film Cooler.

Submerged Bed Scrubber (LOP-SCB-00001/2)
Each LAW Melter has a dedicated Submerged Bed Scrubber miscellaneous treatment unit sub-system. After each Film Cooler (LOP-FCLR-00001/3), the offgas enters the Submerged Bed Scrubber column for further cooling and solids removal. The Submerged Bed Scrubber is a passive device designed for aqueous scrubbing of entrained particulates from melter offgas, cooling and condensation of melter vapor emissions, and interim storage of condensed fluids. It will also quench the offgas to a desired discharge temperature through the use of coiling coils/ jacket. The offgas leaves the Submerged Bed Scrubber in approximate thermal equilibrium with the scrubbing solution.

The Submerged Bed Scrubbers (LOP-SCB-00001/2) have two offgas inlets, one for the normal operations line and one for the standby line. Secondary Film Coolers (LOP-FCLR-00002/4) can be routed to either Submerged Bed Scrubber. The offgas enters the Submerged Bed Scrubber through the appropriate inlet pipe that runs down through the center of the bed to the packing support plate. The bed-retaining walls extend below the support plate creating a lower skirt to allow the formation of a gas bubble underneath the packing. The entire bed is suspended off the floor of the Submerged Bed Scrubber to allow the scrubbing solution to circulate freely through the bed. After formation of the gas bubble beneath the packing, the injected offgas then bubbles up through the packed bed. The rising gas bubbles also cause the scrubbing liquid to circulate up through the packed bed, resulting in a general recirculation of the scrubbing solution. The packing breaks larger bubbles into smaller ones to increase the gas to water contacting surface, thereby increasing particulate removal and heat transfer efficiencies. The warmed scrubbing solution then flows downward outside of the packed bed through cooling coils/jacket.

To maintain a constant liquid level within the Submerged Bed Scrubbers (LOP-SCB-00001/2), it will be equipped with an overflow line that allows for the continuous discharge of offgas condensate and some scrubbed particulates to the Melter SBS Condensate Vessels (LOP-VSL-00001/2) located next to the Submerged Bed Scrubber. The Melter SBS Condensate Vessels are equipped with a cooling jacket. The rate of condensate discharge is determined by how much the offgas temperature is lowered below its dew point. The condensate and some collected particulates overflow into the Melter SBS Condensate Vessels. To minimize the buildup of the solids in the bottom of the Submerged Bed Scrubber, condensate from the Melter SBS Condensate Vessels (LOP-VSL-00001/2) will be re-circulated back to the Submerged Bed Scrubber and injected through multiple lances to agitate and suspend solids on the submerged bed scrubber floor. The collected solids will then be pumped directly off the Submerged Bed Scrubber vessel floor to the Melter SBS Condensate Collection Vessel (RLD-VSL-00005). This purging and recycling process occurs simultaneously. Submerged Bed Scrubber condensate from the SBS Condensate Collection Vessels (LOP-VSL-00001/2) ultimately flows to the TLP system. Venting of the Melter SBS Condensate Vessels is via the Submerged Bed Scrubber into the main offgas discharge pipe.

The scrubbed offgas discharges through the top of the Submerged Bed Scrubbers (LOP-SCB-00001/2) and is routed to the Melter Wet Electrostatic Precipitators (one per melter) (LOP-WESP-00001/2) for further particulate removal.

In addition to the instrumentation, alarms, controls, and interlocks addressed in section 4.1.3, the following will be provided for the Submerged Bed Scrubber to indicate or prevent the following conditions:

- High scrubber liquid temperature
- Low scrubber liquid level
- High condensate vessel liquid level
- Loss of chilled water supply
- Extremely high-pressure differential across the unit

Melter Wet Electrostatic Precipitators (LOP-WESP-00001/2)
The Submerged Bed Scrubber (LOP-SCB-00001/2) discharge is routed to the Melter Wet Electrostatic Precipitator miscellaneous treatment unit sub-system for removal of aerosols down to and including submicron size. Each melter system has a dedicated Melter Wet Electrostatic Precipitator (LOP-WESP-00001/2). The offgas enters the unit and passes through a distribution plate. The evenly distributed saturated gas then flows up through tubes which act as positive the electrodes. Each of the tubes has a single negatively charged electrode, which runs down the center of the tube. A high voltage, direct current transformer supplies power to the electrodes. A strong electric field is generated along the electrodes giving a negative charge to the aerosols passing through the tubes. The negatively charged particles move towards the positively charged

tube walls for collection. Collected particles are then washed from the tube walls along with collected mists. The final condensate is collected in the Melter Wet Electrostatic Precipitators' (LOP-WESP-00001/2) dished bottom area. A water spray may be used periodically to facilitate washing collected aerosols from the tubes. The tube drain and wash solution are routed to the C3/C5 Drains/Sump Collection Vessel (RLD-VSL-00004).

In addition to the instrumentation, alarms, controls, and interlocks addressed in section 4.1.3, the following will be provided for the Melter Wet Electrostatic Precipitators to indicate or prevent the following conditions:

- Loss of electrical power to the unit
- High differential pressure across the unit
- Accumulation of liquid
- Loss of process water supply

Standby Offgas Line
The standby line consists of an offgas pipe from the melter to a Submerged Bed Scrubber (LOP-SCB-00001/2), a Secondary Film Cooler (LOP-FCLR-00002/4), and a butterfly valve as the isolation device. During a melter surge or potential offgas pipe becoming plugged, this valve will open rapidly, providing an alternative path for the melter offgas to flow to the Submerged Bed Scrubbers (LOP-SCB-00001/2). With this alternative routing, pressure control on the melter plenum can be maintained. This standby offgas pipe will extend to the bottom of the Submerged Bed Scrubber packed bed, identical to the main offgas line. It is the same size as the main offgas line, thus providing a doubling of flow cross-section for melter-generated gases.

The LAW Melters are also equipped with a maintenance bypass line allowing offgases from one melter to be routed to the other's Submerged Bed Scrubber for cooling. The gas will be processed through both a primary and secondary offgas treatment system in the same manner as the normal path. The purpose of this line is to provide melter ventilation during idling conditions in the unlikely event that a Submerged Bed Scrubber (LOP-SCB-00001/2) or Melter Wet Electrostatic Precipitator (LOP-WESP-00001/2) requires maintenance. Prior to initiating use of the maintenance bypass line, waste feed would be secured, and the melters placed into an idle condition. No waste feed would be fed to the melters when the maintenance bypass line is in use.

Idling emissions from the melter are mainly heated air at a lower gas volume than expected during slurry feeding. The gas will be processed through secondary offgas treatment system that includes HEPA filtration, thermal catalytic oxidation, and selective catalytic reduction.

#### 4.1.3.3.2 LAW Secondary Offgas/Vessel Vent Process (LVP) System

Figure 24590-LAW-M5-V17T-P0010 and 24590-LAW-M5-V17T-P0011 presents a simplified process flow diagram of the LAW Secondary Offgas/Vessel Vent Process (LVP) System. The offgas system prevents migration of waste contaminants into the process cells and potentially

operating areas. It does this by maintaining the various LAW process vessels under a slight vacuum relative to the cell. The composition of the ventilation air is expected to be primarily air with slight mixed waste particulate contamination.

The vessel ventilation air is combined with the melter offgas prior to entering the secondary offgas system HEPA filter electric preheaters. The combined air streams are treated together in the remaining sections of the secondary offgas treatment systems. A pressure control valve is used to regulate the pressure between the vessel ventilation offgas system and the melter offgas system.

The melter offgas stream that is treated through the primary offgas system is combined with the vessel ventilation offgas stream and treated through the LVP tanks and miscellaneous treatment sub-systems. The secondary offgas system removes the remaining particulate, mercury and miscellaneous acid gases, gaseous nitrogen oxide compounds, carbon monoxide, and volatile organic compounds.

Descriptions of the tanks and miscellaneous treatment sub-systems comprising the LVP are provided below:

HEPA Filters, Electric Preheaters, and Exhausters
The purpose of these HEPA Filters miscellaneous treatment unit sub-system (LVP-HEPA-00001A/1B/2A/2B/3A) is to provide a final protection against dispersion of particulate. This helps protect the downstream equipment from particulate contamination. The combined offgas stream is first passed through the LAW melter offgas HEPA Electric Heaters (LVP-HTR-00001A/1B/2). Preheating increases the gas temperature above its dew point to avoid condensation in the melter offgas HEPA Filters. The offgas then passes through radial flow HEPA Filters. The system is composed of two parallel trains of two filter banks each in series. The offgas passes through one train while the other remains available as an installed backup. Motive force for the ventilation is provided by the Melter Offgas Exhausters (LVP-EXHR-00001A/B/C).

Instrumentation, alarms, controls, and interlocks will be provided for the LVP system to indicate or prevent the following conditions:

- High or low differential pressure across a HEPA filter signaling to switch to the redundant unit
- Loss of electric heater element

Additional information to the instrumentation, alarms, controls, and interlocks for the LVP system addressed in section 4.1.3 are described in the *LAW Vitrification Offgas Bypass Analysis*, 24590-LAW-PER-PR-03-001.

Offgas Mercury Adsorber (LVP-ADBR-0001A/B)
The Offgas Mercury Adsorbers (LVP-ADBR-00001A/B) miscellaneous treatment sub-system removes volatile mercury, iodine, and acid gases from the offgas. The offgas flows through two internal activated carbon beds normally operated in series. When gaseous mercury is detected breaking through the leading activated carbon bed, indicating that the carbon is loaded, the offgas flow is manually changed to make the trailing bed the leading bed. Only one activated carbon bed is used while the loaded activated carbon is removed and replaced. The flow is then changed to make the fresh activated carbon bed the trailing bed.

The activated carbon is batch loaded into the adsorber by gravity. The loaded activated carbon is batch removed by gravity and transferred by conveyor for collection in containers. A water fire suppression system may be included as a precaution against activated carbon fires, if required.

Instrumentation, alarms, controls, and interlocks will be provided for the Offgas Mercury Adsorbers (LVP-ADBR-00001A/B) to indicate or prevent the following conditions:

- Mercury breakthrough in the leading carbon bed signaling to switch to the trailing carbon bed
- High inlet/outlet carbon monoxide concentration difference activates a water deluge fire suppression system. The offgas inlet isolation damper is automatically closed and offgas flow is automatically diverted to the other carbon bed or to the bypass

Selective Catalytic Oxidizer (LVP-SCO-00001) and Selective Catalytic Reducers (LVP-SCR-00001)

The offgas is passed through a catalytic oxidizer/reducer skid (LVP-SKID-00002) housing a heat recovery exchanger (LVP-HX-00001), an electric heater (LVP-HTR-00002), VOC catalyst (LVP-SCO-00001), and SCR catalyst (LVP-SCR-00001) miscellaneous treatment unit sub-systems to remove volatile organics compounds, carbon monoxide, nitrogen oxide compounds, and acid gases in the offgas stream.

The heat recovery exchange first raises the offgas temperature using the hot offgas from the catalyst beds. The electric heater is used to supplement the heat recovery exchange primarily during start-up and when operating with low $NO_x$ concentrations. The heated offgas is passed through the VOC catalyst to oxidize VOCs and carbon monoxide to carbon dioxide and water vapor. The offgas is then injected with a mixture of ammonia vapor and C3 air from an ammonia/air dilution skid. Following ammonia injection, the offgas is passed through the SCR catalyst to reduce $NO_x$ to nitrogen and water vapor. The reduction reaction is exothermic, significantly increasing the offgas temperature. The outgoing hot offgas is cooled down in the heat exchanger and concurrently serves as the heating media for the incoming offgas. The cooled offgas stream is then directed to the Caustic Scrubber for acid gas removal and final cooling.

Instrumentation, alarms, controls, and interlocks will be provided for the Selective Catalytic Oxidizer / Selective Catalytic Reducers to indicate or prevent the following conditions:

- High differential pressure across each catalyst bed

- Loss of ammonia gas supply to the nitrogen oxides selective catalytic reduction unit
- Failure of the electric heater
- Ammonia analyzer to indicate ammonia slip in the outlet.
- Low offgas temperature entering the unit
- High temperature differential across the unit
- High nitrogen oxide concentration in the unit outlet stream
- High volatile organic compound concentration in the unit outlet stream

Caustic Scrubber (LVP-SCB-00001)
The LAW Melters' offgas Caustic Scrubber miscellaneous treatment unit sub-system further treats the offgas by removing iodine and acid gases and providing final offgas cooling. The offgas stream enters the bottom of the scrubber and flows upward through a packed bed. Contaminants in the offgas stream are absorbed into the liquid stream through interaction of the gas, liquid, and packing media. To neutralize the collected acid gases, a sodium hydroxide solution is added periodically to the LAW Caustic Collection Tank (LVP-TK-00001). The clean offgas is then discharged through an internal mist eliminator to prevent droplet carryover. The scrubbing liquid flows downward through the packing bed and drains into the LAW Caustic Collection Tank (LVP-TK-00001). This tank is periodically purged to the pretreatment plant. After passing through the Caustic Scrubber (LVP-SCB-00001), the offgas is released to the environment via a flue in the plant stack.

In addition to the instrumentation, alarms, controls, and interlocks addressed in section 4.1.3, the following will be provided for the Caustic Scrubber to indicate or prevent the following conditions:

- Loss of recirculation pump
- Loss of caustic supply
- Loss of process water supply
- High differential pressure across the column
- Low scrubbing liquid level
- High scrubbing liquid level
- Loss of transfer pump
- Low pH
- High specific gravity (density)

#### 4.1.3.4 Radioactive and Nonradioactive Liquid Waste Disposal (RLD and NLD) Systems

DWP Attachment 51, Appendix 9.1 contains a process flow diagram of the Radioactive and Nonradioactive Liquid Waste Disposal (RLD and NLD) System. The RLD receives LAW vitrification process effluents for storage and transfer.

The RLD tank system consists of three main vessels:

- Plant Wash Vessel (RLD-VSL-00003)
- C3/C5 Drains/Sump Collection Vessel (RLD-VSL-00004)
- SBS Condensate Collection Vessel (RLD-VSL-00005)

The SBS Condensate Collection Vessel (RLD-VSL-00005) and the Plant Wash Vessel (RLD-VSL-00003) are located in the LAW effluent cell. The C3/C5 Drains/Sump Collection Vessel (RLD-VSL-00004) is located below grade to provide fire protection water collection and to collect effluents from the wet electrostatic precipitator, a gravity floor drain system, and a pumped sump system.

Sources of effluents into the RLD system are production and nonproduction-related activities. Production effluents are mixed waste liquids or slurries routinely or periodically generated by the waste treatment process. These effluents are routed directly or indirectly to the SBS Condensate Collection Vessel (RLD-VSL-00005). Liquid effluent from nonproduction activities, such as vessel, equipment and cell/cave washes, and sump discharges, are routed to one of the three vessels, depending on the nature of the effluent. Dangerous or mixed waste is routed to either the Plant Wash Vessel (RLD-VSL-00003) or the C3/C5 Drains/Sump Collection Vessel (RLD-VSL-00004). Liquid that is nondangerous/nonradioactive is routed to the C1/C2 Floor Drain/Sump Collection Tank in the NLD system.

The functional purpose of the RLD system is to receive effluents for interim storage and to transfer the effluent to the pretreatment plant. In addition, mixing and sampling of the effluent may be performed in this system as required.

Plant Wash Vessel (RLD-VSL-00003)
This vessel is designed to receive the total volume of either the largest vessel in the LAW vitrification plant or the largest volume from the vessel/equipment wash or drain in the LAW vitrification plant. The largest volume is from the SBS Condensate Collection Vessel (RLD-VSL-00005). Effluent sources for the Plant Wash Vessel (RLD-VSL-00003) are vessel washes and the overflow from the SBS Condensate Collection Vessel (RLD-VSL-00005). The vessel is fitted with level instrumentation. The vessel is vented into a common vessel ventilation header that drains into the C3/C5 Drains/Sump Collection Vessel (RLD-VSL-00004). During normal operation, the effluent characterized in the Plant Wash Vessel (RLD-VSL-00003) is expected to be transferred to the pretreatment plant.

C3/C5 Drains/Sump Collection Vessel (RLD-VSL-00004)
This vessel is designed to contain the maximum amount of fire protection water and the volume equivalent to the largest C3/C5 floor area wash. The C3/C5 Drains/Sump Collection Vessel (RLD-VSL-00004) routinely collects liquid drained from the Melter Wet Electrostatic Precipitators (LOP-WESP-00001/2). The overflow from the Melter Concentrate Receipt Vessels (LCP-VSL-00001/2) is also routed to the C3/C5 Drains/Sump Collection Vessel.

The C3/C5 Drains/Sump Collection Vessel (RLD-VSL-00004) is fitted with level instrumentation. The C3/C5 Drains/Sump Collection Vessel is vented into a common vessel ventilation header. Condensate that forms in the header drains into the C3/C5 Drains/Sump Collection Vessel. Sampling capability is provided using a sampling leg off the pump recirculation line to an autosampler unit.

Routine process-related effluent from Wet Electrostatic Precipitator drains will be pumped from this vessel to the SBS Condensate Collection Vessel, as necessary. Effluent generated from other sources will be pumped to the Plant Wash Vessel (RLD-VSL-00003) until it reaches a predetermined level to maintain adequate capacity for fire protection water.

The C3/C5 Drains/Sump Collection Vessel is located in an enclosed C3/C5 cell area. The C3/C5 Drains/Sump Collection Vessel overflows to a sump in the same cell. During normal operation, the effluent characterized in the C3/C5 Drains/Sump Collection Vessel is expected to be transferred to the TLP system via the SBS Condensate Collection Vessel (RLD-VSL-00005).

SBS Condensate Collection Vessel (RLD-VSL-00005)
This vessel is designed to store SBS column purge effluent. The SBS Condensate Collection Vessel (RLD-VSL-00005) routinely receives effluent from the Submerged Bed Scrubber (LOP-SCB-00001/2) and the C3/C5 Drains/Sump Collection Vessel (RLD-VSL-00004).

The SBS Condensate Collection Vessel is fitted with level instrumentation and is vented into a common vessel ventilation header that drains into the C3/C5 Drains/Sump Collection Vessel (RLD-VSL-00004). Sampling capability is provided using a sampling leg off the pump recirculation line to an autosampler unit. The SBS Condensate Collection Vessel overflows to the Plant Wash Vessel (RLD-VSL-00003). During normal operation, the effluent characterized in the SBS Condensate Collection Vessel is expected to be transferred to the TLP system.

#### 4.1.3.5 Radioactive Solid Waste Handling (RWH) System

The primary functions of this system will be to provide equipment for the change out of LAW process vessels and other miscellaneous mixed wastes. This system provides the equipment to move waste out of the building.

The vessels are designed for 40 years of service. However, in the event of a failure, the process vessel will be prepared for export by rinsing, disconnection of the process lines, and decontamination. The vessel will be lifted out of the process cell and covered to prevent a spread of contamination. The vessel will be placed in an approved package staged for vessel receipt. Once closed and secured, the package, containing the vessel, will be delivered to an appropriate TSD facility. A similar process in reverse will be used for the introduction and installation of new LAW process vessels.

It is anticipated that LAW Melters will require replacement at some point. When the end of a melter's operational life is reached, residual molten glass will be removed as immobilized product, as much as is practical. The LAW Melter will be allowed to cool and then will be disconnected. The steel box in which the melter is enclosed will be sealed, decontaminated if required, and transported to an appropriate TSD facility.

Disposal of miscellaneous mixed waste streams created during operation will be done by packaging at the point of generation. Localized collection points and disposal routes will be established at logical and optimal locations to accommodate maintenance and operations. Waste containers will be transferred to a staging area where packages will be weighed, labeled, and decontaminated for nonfixed contamination, if needed, prior to export. The packaged waste forms will then be stored at the WTP until final disposition.

#### 4.1.3.6 ILAW Glass Container Handling

The ILAW glass container handling activities will consist of the following systems:

- LAW container receipt handling system (LRH)
- LAW container pour handling system (LPH)
- LAW container finishing handling system (LFH)
- LAW container export handling system (LEH)

The individual systems and their primary functions are described below:

LAW Container Receipt Handling (LRH) System
The LRH system takes delivery of new ILAW containers and provides a means to transfer these empty containers to the LPH transfer bogie (wheeled cart for container transfer).

Container Receipt
After removal of the shipping overwrap and initial receiving inspection, the containers are placed on a conveyor system and transferred into the plant as needed. New containers are then logged into the tracking system.

Container Import
Prior to the need for additional containers, a final inspection and transfer takes place in the container import bay. Each new container is moved to a container inspection stand. This allows an operator to assess the upper head/lifting flange area, including the “fill” opening, and to observe the inside of the container with a light.

The rest of the container is inspected as required, then the container is placed on the import line 1 or 2 staging conveyer, and the tracking log is updated. If the container inspection fails, it is logged and tagged appropriately and set aside.

Each time a container is placed on the conveyor, an operator initiates a conveyor transfer. The transfer serves to index containers on the staging conveyor forward so there is always a container in the “pickup” position on the airlock conveyor.

Container import instrumentation, alarms, controls, and/or interlocks will be provided as follows:

- The hatches are interlocked with the hoist and bogies so the hatch cannot be opened unless a process crane is positioned above the hatch. Conversely, the process cranes cannot leave hatch positions unless the hatch is closed and locked.
- The hatches are interlocked with the bogies so that the hatches can not open unless a bogie is positioned below the hatch. The interlock prevents the bogie from leaving the hatch position unless the hatch is closed.

LAW Container Pour Handling (LPH) System
Each of the LAW melters has two glass discharges that operate independently. Each melter discharge chamber is aligned with a glass pour cave under the melter cell with associated features for filling a container with glass. Containers can be filled using one pour cave, using alternating caves, or both caves at the same time using alternating lifts. The LPH system handles and positions product containers for filling with LAW glass product. The major pieces of equipment include the container turntable, container elevator, transfer bogies, and monorail hoists.

Container Turntable, Container Elevator, Glass Pour Seal Head
A container turntable is provided in each pour cave for handling containers. The turntable accommodates three containers and rotates to position them at three stations: the container transfer station, the container fill station, and the container cooling station. At each container location in the turntable is a lower overpack section that locates the containers and provides support. Containers remain in the overpack during the elevating and glass filling cycle.

As containers are filled and cooled, the turntable rotates to the transfer station where container changeout occurs. Cooled, full product containers are removed from the turntable and replaced with empty containers. The turntable is rotated to position the empty container at the fill station. The container elevator raises the empty container and lower overpack up to the glass pour seal head for container filling.

The elevator is equipped with features to provide a weight of the product container being supported. Weight is used to verify that a container is present and that it is empty. The weight must be between established minimum and maximum values for glass pouring to occur. Additionally, the weight can be used to ensure that container filling is occurring and to provide the rate of glass pouring. The elevator weight is not intended to give an accurate weight of the container; it is merely used as an indication of container presence and condition.

The glass pour seal head is the interface between the melter discharge and the product container during glass pouring. The seal head consists of a metal bellows arrangement that is connected to the melter discharge with the other end of the bellows open for interface with product containers.

Container fill level is monitored by a thermal imaging camera. The camera provides a view of the diameter and the upper one-half of a container. The thermal imaging camera indicates container fill level for primary control of fill rate and pour shut off. In the event of primary level detection failure, a gamma detector activates a high-high level shutdown.

The container is filled using several pours. The pour process occurs more quickly than glass can be made in the melter, resulting in lag time between pours. Rapid pouring allows molten glass to flow out to all edges of the container. Following the final glass pour batch, the container remains in position to provide initial container cooling and containment of final glass discharges. The container is then lowered to the turntable. The turntable is again rotated, placing the recently filled container at the cooling/venting station. Container cooling continues while another container undergoes the fill cycle. Once cooled, the container is rotated to the transfer position for export and the process is repeated.

Container Transportation
Another function of the LPH system is to provide product container transportation between the container transfer bogie and the pour cave turntable. The system transfers empty product containers from the container transfer bogie to the melter turntable, and transfers full product containers from the turntable to the transfer bogie in a manner that supports the plant throughput goals.

Concrete walls separate the pour caves from the bogie transfer tunnel. These walls have doorways large enough to allow the hoist units loaded with new or filled product containers to pass through them. The doorways are fitted with steel shield doors.

Concrete walls also separate the monorail maintenance facility from the bogie transfer tunnel. These walls have openings sized to prevent an ILAW container from entering the maintenance area. These doorways are also fitted with steel shield doors that provide radiological shielding from sources in the transfer tunnel during hands-on maintenance activities in the monorail maintenance facility.

Pour cave transfer operations are conducted remotely with only a few exceptions. Maintenance and recovery operations in the bogie transfer tunnel, such as a jammed grapple, may require hands-on intervention. Monorail hoist maintenance operations conducted in the maintenance facility are completely hands-on. Monorail hoist recovery operations can become a hands-on/ remote combination depending on the failure details.

The LPH system provides a buffer storage area for ILAW containers in the event downstream processing lines become backed up. Additionally, ILAW container rework is conducted in the buffer storage area. Anticipated activities include ILAW container transfers into the buffer storage area from the container transfer bogies, container transfers within the buffer storage area, container transfer from the buffer storage area to the transfer tunnel, and container rework. The buffer storage area is adjacent to a crane maintenance facility. The crane maintenance area is shielded from the buffer storage area to allow hands-on maintenance in the crane maintenance facility and transfer tunnel while containers are present in the buffer storage area.

The LPH transfer tunnel runs from the bogie maintenance area on the west end of the plant to the buffer storage area at the east end of the building. The buffer storage area import/export positions are located within the container transfer corridor. Concrete walls with passages for

ILAW containers separate the north and south buffer storage areas and the container transfer corridor. The passages are equipped with manually operated steel shield doors to support maintenance or bogie recovery operations that might be required in this portion of the transfer tunnel. The LFH hoists operating in the lidding area above this section of the container transfer corridor transfer ILAW containers to and from the buffer storage area import/export position.

Buffer storage area container transfer operations are conducted with the use of a bridge crane. The crane rails begin in the crane maintenance facility adjacent to the north end of the buffer storage area and extend south. The runway provides crane coverage to the crane maintenance area, the ILAW container buffer storage area, the container transfer corridor, and the two container import/export positions. There are container storage positions in the north and south portions of the store, and one rework position also in the south portion of the store. The rework position is located in the southeast corner of the ILAW container buffer storage area/rework area. The rework position can be fitted with a powered turntable, a pair of master-slave manipulators. A shielded window is located in this area. Directly east of the rework position, on the cold side of the buffer storage area, is a rework area operating platform that provides operator access to the master-slave manipulators and shielded window.

A winch is provided to support maintenance operations on the buffer storage area bridge crane. A steel shield door and a concrete wall separate the crane maintenance facility from the buffer storage area, allowing maintenance operations to be conducted while the buffer storage area contains full ILAW containers.

LAW Container Finishing Handling (LFH) System

Figure 4A-24 presents a simplified process flow diagram of the LAW container finishing handling system (LFH). There are two LFH finishing lines. The functions of the LFH system are to verify the container fill level, determine if inert fill is required, complete closure of the ILAW container, decontaminate the exterior of the container, and verify surface contamination levels before exporting the container. The system also has the ability to sample the solidified glass, place the glass shards in a vial, and make these vials available for transfer to the laboratory.

The filled containers are raised from the transfer tunnel into one of two finishing lines and placed on a bogie. The bogie with the container travels to the shard sampling station. A sample of the glass may be taken with the glass shard sampler. Based on the measured level in the container, inert fill is added as needed. From there the bogie travels to the container lidding station where the lid is mechanically secured to the container. After mechanically sealing the lid to the container, the bogie travels to the decontamination area.

At the decontamination station, the container is decontaminated with carbon dioxide pellets. Debris produced during decontamination is collected with a HEPA filtered exhaust system. This gas stream is then routed to the plant vent system where it is passed through the plant's HEPA filters before being discharged through the stack.

Once the container is decontaminated, it is transported to the swabbing station where it is surveyed for loose surface contamination to verify it meets the contamination requirements. The swabbing machine uses a power manipulator to maneuver the swabs over the surface. The contaminated swabs are then monitored to determine gamma-beta levels for smearable contaminates. If contamination levels exceed C2 contamination criteria, the container can go through the carbon dioxide decontamination station. If the container meets C2 contamination criteria, the bogie moves into the monitoring/export station. As the container is transported into the monitoring/export station from the swabbing station, gamma monitoring measures the surface dose rate of the decontaminated container. If the container exceeds the contamination requirement, it is classified as an out-of-specification container. Otherwise, the dose rate is measured and is recorded with the container's records. Out-of-specification ILAW containers are routed back through the decontamination stations until the radiological contamination levels are within specification. The container is then exported for shipment to the disposal site.

Instrumentation, alarms, controls, and interlocks will be provided for the LRH system to indicate or prevent the following conditions:

- Opening of personnel access door when container is present in the line transfer station
- Opening of personnel access door when either line transfer trap doors are open
- Opening of both line transfer trap doors at the same time
- Opening of personnel access door if airborne contamination levels are higher than design contamination classification within the line transfer station

Decontamination Station

A decontamination station is located within each of the finishing lines in the LAW vitrification plant. After the ILAW container has been sealed, it is transported to the decontamination station. Equipment items located in the decontamination station include the carbon dioxide decontamination manipulator, turntable, and exhaust system. Most other items are located outside of the decontamination station, including the carbon dioxide pelletizer, the transport air compressor, and the liquid carbon dioxide storage and delivery system, exhaust fans, and HEPA filters.

The containers are decontaminated using carbon dioxide pellets. The carbon dioxide decontamination manipulator is fitted with an exhaust recovery hood to recover the effluent from the decontamination operation. Debris produced during decontamination is collected with a HEPA filtered exhaust system. This gas stream is then routed to the plant vent system where it is passed through the plant's HEPA filters before being discharged through the stack.

Once the container is decontaminated, it is transported from the decontamination station to the swabbing station.

Instrumentation, alarms, controls, and interlocks will be provided for the decontamination station to indicate or prevent the following conditions:

- Opening of the decontamination or decontamination/swabbing containment door during decontamination
- Opening of the decontamination and decontamination/swabbing containment door at the same time

Swabbing and Swabbing-Monitoring Station

At the swabbing station, containers are surveyed for loose surface contamination to verify that they meet the contamination requirement. The swabbing machine maneuvers the swabs over the container surface. After a prescribed area is covered, the contaminated swabs are exported away from radioactive source for monitoring to determine gamma-beta levels for smearable contaminates. If contamination levels exceed C2 criteria, the container is transported back into the decontamination station for rework. If the container meets C2 criteria, the turntable bogie moves into the export station.

Once the container is transported into the monitoring/export station from the swabbing station, a gamma monitor measures the dose rate of the decontaminated container. If the container exceeds the specified dose requirement, it is classified as an out-of-specification container; otherwise, the dose rate is measured and is recorded within the container's records. The container is then exported out of the monitoring/export station for shipment to the disposal site.

Instrumentation, alarms, controls, and interlocks will be provided for the swab monitoring station to indicate or prevent the following conditions:

- Personnel access when a container is present in swab monitoring station
- Opening of decontamination/swabbing or swabbing/export containment door during swabbing
- Opening of personnel access door when container is present in the swabbing station
- Opening of personnel access door if airborne contamination levels are higher than design contamination classification within the decontamination area
- Opening of personnel access door if high concentration of carbon dioxide is present within the decontamination area
- Rotation of posting turntable during swabbing
- Export of swab if radiation levels from swab are higher than design radiation classification in the operational area

LAW Container Export Handling (LEH) System

The purpose of the LEH system is to load ILAW containers onto a transportation vehicle for transfer to a Hanford Site TSD unit. This system is contained in a truck bay on the east end of the LAW vitrification plant.

Under normal operations the ILAW container will be received from the LFH system through a hatch. Radiological dose rate and contamination level are determined and verified to be within limits prior to entering the LEH system. An overhead crane lifts the ILAW container through the hatch and places it on the transportation vehicle.

Operations are remote and maintenance is "hands-on" in the LEH system. The overhead crane is provided with closed circuit television cameras for operation when radiological conditions do not permit personnel access during the ILAW container loading.

#### 4.1.3.7 LAW Melter Equipment Support Handling (LSH) System

The primary function of the LSH system is to provide the equipment and support necessary to complete maintenance tasks on all melters and equipment in the melter gallery of the LAW vitrification plant. The primary equipment used in support of the maintenance efforts are:

- Consumable change-out boxes
- Consumable change-out boxes storage racks
- Consumable change-out boxes preparation stand
- Melter gallery process cranes
- Consumable change-out boxes handler
- Lifting head
- Melter gamma gate
- Shield cover removal tool

Melter consumables will be removed through the top of the melter shielding. Melter consumable items will be those that require routine and nonroutine maintenance, but provide necessary functions to continue melter operations. The routine consumable items will be bubbler assemblies. New bubbler assemblies will be shipped to the plant and will be installed into the melter. Spent bubblers will be extracted from the melter and packaged into a box for disposal.

Refractory thermocouples, airlifts, level detectors, feed nozzles, and film coolers will be considered nonroutine and are replaced on an as-needed basis according to the appropriate procedures and with appropriate equipment.

#### 4.1.3.8 LAW Vitrification Plant Ventilation

The LAW vitrification plant will be divided into four numbered zones (the C4 designation is not used) listed and defined below, with the higher number indicating greater radiological hazard potential and therefore a requirement for a greater degree of control or restriction. The zoning of the ventilation system will be based on the classifications assigned to building areas for potential radiological contamination. Zones classified as C5 are potentially the most contaminated and include the pour caves, buffer storage area, and process cells. Zones classified as C1 are uncontaminated areas.

Containment will be achieved by maintaining C5 areas at the greatest negative pressure, with airflows cascaded through engineered routes from C2 areas to C3 areas and on to the C5 areas.

The cascade system, in which air passes through more than one area, will reduce the number of separate ventilation streams and hence the amount of air requiring treatment. Adherence to this concept in the design and operation of the LAW vitrification plant will ensure that the ventilation air does not become a significant source of exposure to operators, and that the air emissions do not endanger human health or the environment.

An exhaust air radiation monitoring system, consisting of sensors to monitor radiation in the exhaust air stream, or a representative sampling system is provided in the discharge header downstream of the exhaust fans. A monitoring system would consist of probe assemblies, vacuum pumps, a stack flow sensor, temperature sensor, and radiation sensors. A temperature transmitter is also provided in the discharge header downstream of the exhaust fans for continuous monitoring of exhaust air temperature.

C1 Ventilation (C1V) System
C1 areas are normally occupied. C1 areas will typically consist of administrative offices, control rooms, conference rooms, locker rooms, rest rooms, and equipment rooms. C1 areas will be operated slightly pressurized relative to atmosphere and other adjacent areas.

C2 Ventilation (C2V) System
C2 areas will typically consist of nonprocess operating areas, equipment rooms, stores, access corridors, and plant rooms adjacent to areas with higher contamination potential. The C2V is served by dedicated air handling units and exhaust fans. Ventilation air supplied to C2 areas will be exhausted by the C2 exhaust system and cascaded into adjacent C3 areas. The sum of the volumetric flow rates exhausted by the C2 exhaust system and cascaded into adjacent C3 areas will be greater than the volumetric flow rate supplied to C2 areas. This will cause the C2 areas to maintain a nominal negative pressure relative to atmosphere. C2 exhaust will pass through one stage of HEPA filters and be discharged to the atmosphere by the exhaust fans. Supply and exhaust fans are provided with variable frequency drives.

C3 Ventilation (C3V) System
C3 areas are normally unoccupied, but allow operator access, for instance during maintenance. C3 areas will typically consist of filter plant rooms, workshops, maintenance areas, and monitoring areas. Air will generally be drawn from C2 areas and, wherever possible, cascaded through the C3 areas into C5 areas, or alternatively exhausted from the C3 areas by the C3 exhaust system. In general, air cascaded into the C3 areas will be from adjacent C2/C3 subchange rooms. C3 exhaust will pass through one stage of HEPA filters and be discharged to the atmosphere by the exhaust fans. C3 exhaust fans are provided with variable frequency drives.

C5 Ventilation (C5V) System
Where there is in-bleed air from the C3 system to the C5 system, fan cascade trip interlocks protect the system from backflow.

The C5 areas in the LAW vitrification plant will be composed of the following:

- Pour caves
- Container transfer tunnel
- Buffer storage area
- C3/C5 drains/sump collection vessel room
- Process cells
- Finishing line

Air will be cascaded into the C5 areas and exhausted by the C5 exhaust system. Engineered ventilation pipe entries (air in-bleeds) through the C5 confinement boundary will be protected by backflow isolation dampers. C5 exhaust will pass through two stages of HEPA filters and be discharged to the atmosphere by the exhaust fans. C5 exhaust fans are provided with variable frequency drives.

#### 4.1.3.9 LAW Melter Handling (LMH) System

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### 4.1.4 HLW Vitrification Plant

Figure 4A-4 presents a simplified process flow diagram of the HLW vitrification processes. The HLW vitrification plant will consist of several process systems designed to perform the following functions:

- Receive pretreated HLW slurry
- Convert blended HLW slurry and glass formers into glass
- Treat melter offgas
- Handle IHLW canisters
- Store IHLW canisters
- Provide supporting equipment in the melter cave
- Handle miscellaneous secondary waste
- Ventilate the HLW vitrification plant

The following figures located in Appendix 4A and drawings found in DWP Attachment 51, Appendix 10 provide additional detail for the HLW vitrification plant:

- Simplified flow diagram for the WTP
- Process flow figures and drawings for process information
- Typical system figures depicting common features for each regulated system
- General arrangement figures and drawings showing locations of regulated equipment
- Waste management area figures and drawings showing plant locations to be permitted

Instrumentation, alarms, controls, and interlocks will be provided for the tank systems and miscellaneous treatment systems to indicate or prevent the following conditions, as appropriate:

- Overfilling: Plant items are protected against overfilling by liquid level indication, high level instrumentation interlocks to shut off feed sources, and process control system control functions backed up by hard wired trips as required.

- Loss of containment: Plant items are protected against containment loss by liquid level indication, and by process control system control and alarm functions as required, including shut off of feed sources. Each plant item that manages liquid mixed or dangerous waste is provided with secondary containment. Sumps associated with the management of mixed or dangerous waste are provided with liquid level instrumentation and an ejector or pump to empty the sump as needed.

- Inadvertent transfers of fluids: System sequential operations are properly interlocked to prevent inadvertent transfers at the wrong time or to the wrong location.

- Loss of mixing function: Tank systems are instrumented (air pressure/flow indication) to prevent hydrogen accumulation and solids settling. Tanks with agitators are instrumented to prevent agitator and/or vessel damage at low liquid level.

- Unsafe or off-normal melter operating conditions

- Degraded emissions control equipment and/or operating conditions

- Loss of air flow: The ventilation system is designed to create a pressure gradient which causes air to flow through engineered routes from an area of lower contamination potential to an area of higher contamination potential.
- Loss of site power

In addition to level control, temperature and pressure may be monitored for tank systems and miscellaneous treatment systems in some cases. Regulated process and leak detection system instruments and parameters will be provided in DWP Table III.10.E.G for tank systems and in DWP Table III.10.J.C for miscellaneous treatment sub-systems.

Descriptions of the HLW vitrification process, melter offgas treatment systems, and IHLW glass canister handling systems are provided in the following sections.

#### 4.1.4.1 HLW Melter Feed Process

The following HLW melter feed description is identical for both Melter 1 (HMP-MLTR-00001) and Melter 2 (HMP-MLTR-00002). The HLW melter feed process consists of the following:

- HLW concentrate receipt process (HCP) system
- HLW melter feed process (HFP) system
- HLW glass formers reagent (GFR) system (the GFR system does not manage dangerous waste and is provided for information only)

The primary function of this tank system is to receive HLW feed slurry from the pretreatment plant, mix glass formers with HLW feed to form a uniform blend, and provide a blended feed to the HLW melter. An analysis of the waste determines a glass additive formulation for the conversion of the waste to glass. The glass additives specified in the formulation are weighed and mixed with the waste.
The HCP system consists of the transfer piping from PTF to HLW and one sump and ancillary equipment.

The HFP system consists of the following vessels and associated ancillary equipment:

- Feed Preparation Vessel (HFP-VSL-00001/5)
- HLW Melter Feed Vessel (HFP-VSL-00002/6)

The HFP system receives waste from the HLW Feed Blend Vessel (HLP-VSL-00028) or its backup HLW Lag Storage Vessel (HLP-VSL-00027B) located in the Pretreatment Plant. Waste is transferred from the HLP system, through underground waste transfer piping between the PTF and HLW plants, to either of the Feed Preparation Vessels (HFP-VSL-00001/5) for blending with glass formers from the glass former feed hopper. Process control samples are collected from these vessels and analyzed to determine the glass former formulation. After completion of sample analysis, a batch of The glass former feed hopper receives blended glass formers and reductant (such as silica, boric acid, calcium silicate, ferric oxide, lithium carbonate, and sucrose) from the balance of facilities glass former system. After the blending, the glass formers are gravity-fed into the feed preparation vessel, where the blended glass formers are mixed with the HLW concentrate to form a uniform slurry. The slurry is then fed to either of the HLW Melter Feed Vessels (HFP-VSL-00002/6) and then to the HLW melter process (HMP) system.

- Controls developed to prevent or mitigate equipment malfunction are incorporated into the design. The *Description of HLW Vitrification Bypass Events*, 24590-HLW-PER-PR-03-001 describes the operating conditions that require interlocking with the melter feed involve individual components within the offgas system that could result in over pressurization of the melter.

The HLW GFR system contains glass former feed hoppers, located at the 58 ft. elevation of the HLW vitrification plant, that receive blended glass formers and sucrose by dense-phase pneumatic conveyors from transporters. The transporters are located in the glass formers' room within the balance of facilities building.

The feed hoppers are equipped with filters to remove the dust from air used for pneumatic conveying and blending. It is anticipated that a series of single filter cartridges will be mounted on the top of the hoppers. The filters are cleaned by introducing compressed air through the cleaning nozzle to blow accumulated dust back into the hoppers. The feed hoppers are equipped with load cells to weigh the glass formers to confirm that the material in the upstream blending silo is conveyed to the feed hoppers. The load cells also confirm that the glass formers are transferred out of the feed hoppers to the melter Feed Preparation Vessels (HFP-VSL-00001/5).

Following the blending cycle, the glass formers are gravity-fed with a rotary feeder into the melter Feed Preparation Vessels (HFP-VSL-00001/5), where the blended glass formers are mixed with the waste feed. This equipment is located in an isolated area that serves as a contamination barrier between the Feed Preparation Vessels (HFP-VSL-00001/5) and the glass former supply. The rotary valve controls the rate of glass former addition into the Feed Preparation Vessels (HFP-VSL-00001/5).

#### 4.1.4.2 HLW Melter Process (HMP) System

Figure 4A-27 presents a simplified process flow diagram of the HLW melter process (HMP) system. The primary functions of this miscellaneous treatment sub-system are to convert blended waste feed and glass formers into molten glass, deliver molten glass to HLW canisters, fill the canisters with molten glass waste, and monitor and control glass waste level during waste filling. The following melter process system, HMP, is identical for both HLW Melters (HMP-MLTR-00001/2).

The HMP system includes the HLW Melters (HMP-MLTR-00001/2), two discharge chambers and two pour spouts per melter, and primary and secondary canister level detection systems. The melter and pour spout will be remotely operated in a C5/R5 cell. There will be no personnel access to this cell after processing of the HLW feed stream begins.

HLW Melters (HMP-MLTR-00001/2)
The two HLW Melters (HMP-MLTR-00001/2), located in melter cave no. 1 and melter cave no. 2, respectively, are rectangular in shape with an outer steel casing. Each is lined with refractory material designed to withstand corrosion by molten glass. The steel casing for the melter area is provided with water cooling to maintain a thermal gradient in the bricks for corrosion control, prevent migration of glass through the bricks, and reduce heat load to the process cell. The lid of the HLW Melter will be sealed to the melter shell in order to provide gas containment. The lid will provide a support structure through which subcomponents can be mounted. Penetrations are sealed by appropriate fittings that allow remote removal and replacement.

Waste feed will be introduced to the melter as a slurry through nozzles in the melter lid. Each feed nozzle will be individually supplied from a slurry pump. The water and volatile feed constituents in the slurry will evaporate, leaving behind a layer of material known as the cold cap. Waste feed components that remain in the cold cap will undergo chemical reactions, be converted to their respective oxides, and dissolve in the molten glass. As the slurry is fed, molten glass is formed that accumulates in the glass tank. New slurry will be added at about the same rate as the cold cap dissolves, maintaining the quantity of cold cap material at a steady level. The molten glass level in the melter is maintained between the top of the electrodes and below the upper edge of the glass contact refractory blocks. The rate of feed addition to the melter determines the cold cap coverage in the melt pool. The feed addition rate can be controlled based on the average plenum temperature measured by thermocouples mounted in the melter lid. Air injectors may be used to mix and agitate the molten glass. When the melt level rises to a predetermined upper limit, it is discharged to a canister.

Each Melter (HMP-MLTR-00001/2) includes three important regions: the glass pool, two discharge chambers, and a plenum just above the glass pool. Melter pool level measurement is used throughout melter operations in conjunction with alarms for high or low glass pool levels. Each discharge chamber is a heavily insulated box on the south side of the melter, housing the discharge trough and a connection flange for the pour spout assembly. The plenum is lined with refractory to withstand hot corrosive gases, thermal shock, and slurried waste splatter.

The power to the electrodes is regulated by the process control system to maintain the temperature at the set point value. The heat for the HLW Melter startup is provided by temporarily installed radiant electric heaters mounted on the lid of the melter. These heaters melt the glass formers sufficiently to make it ionically conductive between the Melter's joule heating electrodes. When a conducting path is established, the Melter is heated in a controlled manner by passing more and more current between the electrodes through the glass (a process known as *joule heating*). After some time the Melter reaches its operating temperature (generally in the range of 1100°C to 1200°C) and slurry feeding can start. As the slurry is fed, molten glass is formed by vitrification of the cold cap materials into the glass melt. When the melt level rises to a predetermined level, it can be discharged into a canister.

The gas produced during melting is mainly steam and contains volatile components and airborne matter that require removal prior to discharge to the atmosphere. This offgas is diluted by air from four sources; inadvertent air in-leakage through the Melter lid and discharge port, instrumentation and sparging, film cooler air, and air added to control the Melter vacuum. The Melter plenum is maintained at a vacuum with offgas system blowers and control injection of air into the offgas line near the Melter exhaust. This assures containment and avoids Melter pressurization. This vacuum is sensed at a location near the plenum where blockage and feed splatter is unlikely. The sensed vacuum is used to drive a control valve that regulates the draft in the Melter exhaust line.

The glass level in the Melters (HMP-MLTR-00001/2) is maintained between the top of the upper electrodes and below the upper edge of the tank blocks. The level is determined directly by two bubbler tubes that indicate density and glass depth. Thermocouples housed in thermowells that penetrate the cold cap and are immersed in the molten glass also indicate molten glass level. Level measurement is used throughout melter operations in conjunction with alarms for high or low glass pool levels.

Glass Discharge System

Discharge is achieved by transferring glass from the bottom of the melt pool up through a riser and out of the Melter through a side discharge chamber. Under each of the two discharge chambers there is a pour spout that connects the Melter discharge chamber to the respective HLW canister.

The glass level in the Melter is maintained between the top of the electrodes and the overflow level of the discharge trough. The Melter glass pool level will be measured to indicate when to start and stop glass discharge. Each Melter has two independently operated glass discharge systems, adjacent to each other on one side of the Melter. Each system includes an airlift riser, an airlift lance, a glass pour trough, and a heated discharge chamber. Glass is discharged by introducing gas into the molten glass in the discharge riser. The gas increases the level in the riser, causing the molten glass to flow down the trough and fall from the tip of the trough into the canister. When the desired level in the canister is reached, the air lift gas is turned off, and the glass level in the riser recedes stopping the flow of glass to the canister. During pouring operations, a remote camera is used to view the pour stream within the pour spout assembly. The camera is for observation only and is not a regulated operation.

Level Detection

The purpose of each canister level detection system is to monitor the molten glass level within the HLW canister and to prevent canister overfilling. During glass pour, the level detection system is used to monitor the glass level to ensure the canister is filled to the desired level. The level detection system also will be able to monitor the rate at which the glass level is rising in the canister. There is a primary and a secondary monitoring system, which is consistent with standard vessel level control. A primary system that operates through the process control system is used for normal operations, and a secondary "hard-wired" system is used to back up the primary system and automatically shut down the fill before the overflow limit is reached. The primary level detection system is a thermal imaging system that provides continuous level monitoring over the entire canister. In the event that the primary thermal imaging system malfunctions, the backup discrete point radiation detection system will indicate a filled canister.

During glass pour, the level detection system will display a thermal image on a monitor and will utilize a serial connection to interface with the process control system for indication and control purposes. The imaging software will be used to continuously monitor the level of glass in the canister and will provide an output of the glass level to control loops in the process control system. A high-level condition will be indicated by the process control system, which will initiate alarms and/or control sequences to control the melter pour. The infrared image will be available through the plant closed circuit television system. The control system will be able to store the level of the glass in a canister between batch pours when the temperature in the canister could be cooled down sufficiently to prevent the thermal imaging system from detecting the glass level. The level is reset to zero with each new canister. The control system will also be used to monitor the average temperature of the glass near the top of the pour. If the temperature is lower than a set point value, an alarm will be initiated by the process control system.

Another function of the system is to detect the rate at which the glass level is rising in the canister. This gives an indication of deviation between expected normal pour rates. Deviation could indicate a malfunction of the glass discharge system, and an alarm would be initiated.

In the event that the primary thermal imaging system malfunctions, the backup discrete point radiation detection system would prevent a canister overfill. This system is designed only to detect a discrete high glass level, producing a contact closure when the high level is sensed. When the high level has been reached, the system will automatically shut down the melter gas lift which, in turn, will stop the glass pour. The system is limited to discrete levels of glass fill, not continuous monitoring.

Instrumentation, alarms, controls, and interlocks will be provided for the HMP system to indicate or prevent the following conditions:

- The melter cannot pour without verification that the bogie is present
- The melter cannot pour without verification that the canister is present
- The melter cannot pour if the canister is greater than 95% full

#### 4.1.4.3 Melter Offgas Treatment Process (HOP) System

The HOP system is composed of tanks and miscellaneous treatment sub-systems, separated into the primary and secondary melter offgas treatment systems.

Melter offgas is generated from the vitrification of HLW in the joule-heated ceramic melter. The rate of generation of gases in the melter is dynamic and not steady state. Each HLW Melter (HMP-MLTR-00001/2) generates offgas resulting from decomposition, oxidation, and vaporization of feed material. Constituents of the offgas include:

- Nitrogen oxides from decomposition of metal nitrates in the melter feed
- Chloride, fluoride, and sulfur as oxides, acid gases, and salts
- Particulates and aerosols
- Entrained feed material and glass

In addition, the HLW Melters (HMP-MLTR-00001/2) generate small quantities of other volatile compounds including iodine-129, carbon-14, tritium, and volatile organic compounds. The carbon-14 and tritium emissions are in the form of carbon dioxide and water, respectively.

The HOP system is divided into a primary system and a secondary system. The purpose of the HOP system is to cool and treat the Melter offgas and vessel ventilation offgas to a level that is protective of human health and the environment. The offgas system must also provide a pressure confinement boundary that will control Melter pressure and prevent vapor release to the plant. The design of the melter offgas system must accommodate changes in offgas flow from the Melter (HMP-MLTR-00001/2) without causing the melter to pressurize.

Initial decontamination of offgas from the melter is provided by the primary offgas treatment system. This primary offgas system is designed to handle intermittent surges of seven times steam flow and three times non-condensable flow from feed. The primary system consists of a film cooler, submerged bed scrubber, a wet electrostatic precipitator, a high efficiency mist eliminator, and high efficiency particulate air (HEPA) filters. This system cools the offgas and removes particulates.

Additionally, an extra line from the Melter (HMP-MLTR-00001/2) to the Submerged Bed Scrubber (HOP-SCB-00001/2) is provided in the unlikely case that the primary offgas line plugs. This extra line includes a valve as the isolation device. As soon as the Melter vacuum decreases to a set point, the valve is actuated and offgas flow is allowed through the line to the Submerged Bed Scrubber, thereby preventing melter pressurization. In the event that the Melter surge is much higher than the system is designed to handle, a pressure relief valve acts as the pressure relief point venting the offgas to the melter cave. Offgas from the Melter cave is drawn through HEPA Filters to remove particulates and discharged to the atmosphere. Once the Melter pressure is back to the desired set point, the valve closes.

The vessel ventilation system offgas consists primarily of air, water vapor, and minor amounts of aerosols generated by the agitation or movement of vessel contents. The vessel ventilation header joins the primary offgas system after the Wet Electrostatic Precipitators (HOP-WESP-00001/2). After the HEPA Filters (HOP-HEPA-00001A/1B/2A/2B/7A/7B/8A/8B), the offgas is routed to the secondary offgas treatment system.

The following sections provide descriptions of major melter offgas treatment components and are identical for both Melter 1 (HMP-MLTR-00001) and Melter 2 (HMP-MLTR-00002).

#### 4.1.4.3.1 Primary Melter Offgas Treatment (HOP) System

DWP Attachment 51, Appendix 10.1 contains a process flow diagrams of the primary melter offgas treatment process (HOP) system (24590-HLW-M5-V17T-P0003 and 24590-HLW-M5-V17T-P20003). The purpose of the primary offgas treatment system is to cool the melter offgas and to remove offgas aerosols and particulates generated by the Melter (HMP-MLTR-00001/2) and from the vessel ventilation air. This treatment system consists of the following:

Tank System

- SBS Condensate Receiver Vessels (HOP-VSL-00903/4)

Miscellaneous Treatment Unit Sub-Systems

- Film Coolers (HOP-FCLR-00001/2)
- Submerged Bed Scrubbers (HOP-SCB-00001/2)
- Wet Electrostatic Precipitators (HOP-WESP-00001/2)
- High-Efficiency Mist Eliminators (HEME)(HOP-HEME-00001A/1B/2A/2B)
- HEPA Preheaters (HOP-HTR-00001B/2A/5A/5B)

- High Efficiency Particulate Air (HEPA) Filters (HOP-HEPA-00001A/1B/2A/2B/7A/7B/8A/8B)

Film Coolers (HOP-FCLR-00001/2)
The function of the Film Cooler (HOP-FCLR-00001/2) is to cool the offgas and entrained molten glass droplets below the glass sticking temperature to minimize glass deposition on the offgas piping walls. The offgas exits the Melter (HMP-MLTR-00001/2) and is mixed with air in the offgas Film Cooler. The Film Cooler is a double-walled pipe designed to introduce injected gas axially along the walls of the offgas pipe through a series of holes or slots in the inner wall. Each melter has a single Film Cooler.

A mechanical reamer may be mounted on the Film Cooler (HOP-FCLR-00001/2) to periodically remove solids build-up on the inner film cooler wall. The reaming device (wire brush or drill) would be periodically inserted into the film cooler for mechanical solids removal.

Submerged Bed Scrubber (HOP-SCB-00001/2)
The offgas from the HLW melter Film Cooler (HOP-FCLR-00001/2) enters the Submerged Bed Scrubber (HOP-SCB-00001/2) for further cooling and solids removal. The Submerged Bed Scrubber is a passive device designed for aqueous scrubbing of entrained particulate from melter offgas, cooling and condensation of melter vapor emissions, and interim storage of condensed fluids. It will also quench the offgas to a desired discharge temperature through the use of cooling coils/jacket. The offgas leaves the Submerged Bed Scrubber in thermal equilibrium with the scrubbing solution.

The Submerged bed Scrubber (HOP-SCB-00001/2) has one offgas inlet. The offgas enters the Submerged Bed Scrubber through the inlet pipe that runs down through the center of the bed to the packing support plate. The bed-retaining walls extend below the support plate, creating a lower skirt to allow the formation of a gas bubble underneath the packing. The entire bed is suspended off the floor of the Submerged Bed Scrubber to allow the scrubbing solution to circulate freely through the bed. After formation of the gas bubble beneath the packing, the injected offgas then bubbles up through the packed bed. The rising gas bubbles also cause the scrubbing liquid to circulate up through the packed bed, resulting in a general recirculation of the scrubbing solution. The packing breaks larger bubbles into smaller ones to increase the gas to water contacting surface, thereby increasing particulate removal and heat transfer efficiencies. The warmed scrubbing solution then flows downward outside of the packed bed through cooling coils/jacket.

To maintain a constant liquid level within the Submerged Bed Scrubber (HOP-SCB-00001/2), it will be equipped with an overflow line that allows for the continuous discharge of offgas condensate and some scrubbed particulates to the SBS Condensate Receiver Vessels (HOP-VSL-00903/4). The SBS Condensate Receiver Vessels are also equipped with a cooling jacket. The rate of condensate discharge is determined by how much the offgas temperature is lowered below its dew point. The condensate and some collected particulates overflow into the SBS Condensate Receiver Vessel. To minimize the buildup of the solids in the bottom of the Submerged Bed Scrubber, condensate from the SBS Condensate Receiver Vessels

(HOP-VSL-00903/4) will be re-circulated back to the Submerged Bed Scrubber and injected through multiple lances to agitate and suspend solids on the Submerged Bed Scrubber vessel floor. The collected solids will then be pumped directly off the Submerged Bed Scrubber vessel floor to the Plant Wash and Drains Vessel (RLD-VSL-00008). This purging and recycling process occurs simultaneously. Venting of this condensate receiver vessel is via the submerged bed scrubber into the main offgas discharge pipe.

The scrubbed offgas discharges through the top of the submerged bed scrubber and is routed to the Wet Electrostatic Precipitator (HOP-WESP-00001/2) for further particulate removal.

Wet Electrostatic Precipitator (HOP-WESP-00001/2)

The Submerged Bed Scrubber offgas is routed to the Wet Electrostatic Precipitator (HOP-WESP-00001/2) for removal of aerosols down to and including submicron size. The offgas enters the unit and may pass through a distribution plate. The evenly distributed saturated gas then flows up through the tubes which act as the positive electrodes. Each of these tubes has a single negatively charged electrode, which runs down the centerline of each tube. A high-voltage, direct current transformer supplies the power to the electrodes. A strong electric field generated along the electrodes gives a negative charge to the aerosols. The negatively charged particles move toward the positively charged tube walls for collection. Collected particles are then washed from the tube walls along with collected mists. As the gas passes through the tubes, the first particles captured are the water droplets. As the water droplets gravity drain through the electrode tubes the collected particles are washed off and the final condensate is collected in the wet electrostatic precipitator dished bottom area. A water spray may be used periodically to facilitate washing collected aerosols from the tubes. The tube drain and wash solution is routed to the SBS Condensate Receiver Vessels (HOP-VSL-00903/4).

High-Efficiency Mist Eliminators (HOP-HEME-00001A/1B/2A/2B)

Further removal of aerosols is accomplished using the High-Efficiency Mist Eliminator (HEME). The HEMEs also reduce the dust-loading rate on the HEPA filters. Each HEME is essentially a high-efficiency demister that has a removal efficiency of greater than 99% for aerosols down to the submicron size. As the offgas passes through the HEME (HOP-HEME-00001A/1B/2A/2B), the liquid droplets and other aerosols within the offgas interact with High-Efficiency Mist Eliminators' filaments. As the aerosols contact the filaments they adhere to the filaments surface by surface tension. As the droplets agglomerate and grow, they eventually acquire enough mass to fall by gravity to the bottom of the unit, thus overriding the original surface tension, friction with the filaments, and the gas velocity. These collected droplets are assumed to contain the majority of the offgas radioactivity and will be collected in the bottom of the High-Efficiency Mist Eliminators (HOP-HEME-00001A/1B/2A/2B). The collected condensate will gravity drain into the SBS Condensate Receiver Vessel (HOP-VSL-00903/4). As the condensate flows down through the filter bed, a washing action is generated that will help wash collected solids from the filter elements. However, some solids may accumulate in the bed over time, causing the pressure drop across the filter to increase. When the pressure drop across the High-Efficiency Mist Eliminators reaches a predefined level, it is washed with water to facilitate removal of accumulated solids. Some insoluble solids may remain, and their accumulation will eventually lead to the replacement of the High-Efficiency Mist Eliminators' filter elements.

HEPA Preheaters (HOP-HTR-00001B/2A/5A/5B) and Filters (HOP-HEPA-00001A/1B/2A/2B/7A/7B/8A/8B)
Next, the offgas is heated using HEPA Preheaters (HOP-HTR-00001B/2A/5A/5B) to a temperature above the gas streams dew point and then passed through dual set of HEPA Filters (HOP-HEPA-00001A/1B/2A/2B/7A/7B/8A/8B) to provide high-efficiency submicron removal. The offgas is heated to avoid condensation in the HEPA Filters. When the differential pressure drop across the filters becomes too high, they will be remotely changed out. The system is composed of two parallel HEME/HEPA Preheater/HEPA Filter trains. The offgas passes through one train while the other remains available as an installed backup.

Maintenance Ventilation Bypass
A maintenance bypass will also be installed, allowing the Melter offgas to bypass the Film Cooler (HOP-FCLR-00001/2), the Submerged Bed Scrubber (HOP-SCB-00001/2), and the Wet Electrostatic Precipitator (HOP-WESP-00001/2). The bypass line would feed into the HEME/HEPA filtration and other gas cleaning steps. Prior to initiating use of the maintenance ventilation line, waste feed would be secured, and the melter placed into an idle condition. No waste feed would be fed to the affected melter when the maintenance ventilation line is in use. The *Description of HLW Vitrification Bypass Events*, 24590-HLW-PER-PER-03-001, provides additional information on HLW bypass events.

#### 4.1.4.3.2 Secondary Offgas Treatment (HOP) System

There is one secondary offgas treatment train for each HLW Melter. The combined primary offgas stream and vessel ventilation offgas stream is discharged to the secondary offgas treatment system. The secondary offgas system will treat the combined offgas to a level protective of human health and the environment. Specifically, the secondary offgas treatment system will remove radioactive iodine, volatile organic compounds, and acid gases, as required, to meet the facility's air discharge requirements. The secondary offgas treatment system consists of the following miscellaneous treatment sub-systems:

- Activated Carbon Adsorbers (HOP-ADBR-00001A/1B/2A/2B)
- Silver Mordenite Columns (HOP-ABS-00002/3)
- Offgas Organic Oxidizers (HOP-SCO-00001/4)
- Selective Catalytic Reducers (HOP-SCR-00001/2)
- Heat Exchangers (HOP-HX-00001/2/3/4)
- Booster Fans (HOP-FAN-00001A/1B/1C/9A/9B/9C)
- Stack Fans (HOP-FAN-00008A/8B/8C/10A/10B/10C)
- HLW stack.

Activated Carbon Adsorbers (HOP-ADBR-00001A/1B/2A/2B)
The Activated Carbon Adsorber miscellaneous treatment sub-system removes volatile mercury from the offgas. The activated carbon adsorber will contain a total of four beds (two per Melter). The offgas normally flows through both beds in series. When gaseous mercury is detected breaking through the leading bed, the offgas flow is manually changed to make the trailing bed

the leading bed, and only one adsorber is used while the exhausted bed is removed and replaced. The flow is then changed to make the fresh bed the trailing bed.

The activated carbon particles are batch loaded into the bed by gravity. The spent activated carbon is batch removed by gravity and a pneumatic conveyor for collection in canisters. A water fire suppression system is included as a precaution against activated carbon fires.

Silver Mordenite Columns (HOP-ABS-00002/3)
Two Silver Mordenite Column assemblies (one for each Melter) will be located in the HLW vitrification plant. The Silver Mordenite Columns will be used to remove gaseous radioactive iodine (I-129) and other gaseous halogens, such as fluorine and chlorine. The Silver Mordenite Columns (HOP-ABS-00002/3) will consist of approximately 36 silver mordenite adsorbers mounted in a bank configuration to a mounting frame within a housing. Offgas will enter the upper (or inlet) plenum of each Silver Mordenite Column, flow in parallel through the adsorbers to the lower (or exit) plenum, pass through a replaceable roughing filter, and exit. The columns' design will allow manual removal and replacement of adsorbers. Adsorbers will be sized to fit into standard 55 gallon waste drums for disposal.

The silver mordenite adsorbers are essentially cartridges filled with silver mordenite. Silver mordenite is a silver zeolite adsorption media in the form of cylindrical pellets. Halogens will react with the silver in the bed and become trapped within the matrix. Halogens are not loaded uniformly within the Silver Mordenite Adsorber cartridges. Adsorption reactions occur within an action zone (or mass transfer zone) that varies in length depending on the temperature of the bed and the gas velocity through the bed. Halogens will begin loading at the beginning of the silver mordenite beds and progressively load the silver through the column until breakthrough is reached at the end of the column. Once halogen breakthrough occurs or a predetermined lifespan is reached, the silver mordenite adsorbers will require replacement.

Offgas Organic Oxidizer (HOP-SCO-00001/4) and Selective Catalytic Reducer (HOP-SCR-00001/2)

The offgas is passed through catalytic oxidizer/reducer skids (HOP-SCO-00002/3) housing a heat recovery exchanger (HOP-HX-00001/3), an electric heater (HOP-HTR-00001/7), VOC catalyst (HOP-SCO-00001/4), and SCR catalyst (HOP-SCR-00001/2) miscellaneous treatment unit sub-systems to remove volatile organics compounds, carbon monoxide, nitrogen oxide compounds, and acid gases in the offgas stream.

The heat recovery exchange first raises the offgas temperature using the hot offgas from the catalyst beds. The electric heater is used to supplement the heat recovery exchange primarily during start-up and when operating with low $NO_x$ concentrations. The heated offgas is passed through the VOC catalyst to oxidize VOCs and carbon monoxide to carbon dioxide and water vapor. The offgas is then injected with a mixture of ammonia vapor and C3 air from an ammonia/air dilution skid. Following ammonia injection, the offgas is passed through the SCR catalyst to reduce $NO_x$ to nitrogen and water vapor. The reduction reaction is exothermic, significantly increasing the offgas temperature. The outgoing hot offgas is cooled down in the heat exchanger and concurrently serves as the heating media for the incoming offgas. The cooled offgas stream is then directed to the exhaust stack.

#### 4.1.4.4 Process Vessel Vent (PVV) System

The process vessel vent system consists of vessel ventilation piping and the header that is combined with the primary offgas treatment system. The vessel ventilation header joins the primary offgas system after the Wet Electrostatic Precipitators (HOP-WESP-00001/2) prior to entering high efficiency mist eliminators (HOP-HEME-00001A/B/2A/B). The vessel ventilation system offgas consists primarily of air, water vapor, and minor amounts of aerosols generated by the movement of vessel contents.

The process vessel vent system provides a vacuum on connected vessels relative to the host cell. The vacuum is controlled by an automatic pressure control valve system on the vessel vent header. The vessels attached to the vessel vent system are the melter feed and feed preparation vessels (HFP-VSL-00001/2/5/6), waste neutralization vessel (HDH-VSL-00003), acidic waste vessel (RLD-VSL-00007), the plant wash and drains vessel (RLD-VSL-00008) indirectly via the acidic waste vessel, and breakpots.

#### 4.1.4.5 HLW Pulse Jet Ventilation (PJV) System

The PJV system consists of the following miscellaneous treatment sub-systems:

- HEPA Filters (PJV-HEPA-00004A/4B/5A/5B)
- Electric Heaters (PJV-HTR-00002)
- Pulse Jet Fans (PJV-FAN-00002A/B)

The PJV system draws exhaust air from selected HLW vessels, primarily those that use fluidic equipment, pulse jet mixers (PJMs) and reverse flow diverters (RFDs), for mixing and transfer of process fluids out of vessels for processing or sampling. Fluidic equipment use a column of air to lift and drop the liquid level in PJM or RFD vessels, which are located inside process vessels. Fluidic equipment will produce gaseous exhaust air as part of their normal operations. Fluidic exhaust air from individual vessels combines in a common header. Prior to discharge to the atmosphere, the exhaust air is heated in the electric heater (PJV-HTR-00002) to eliminate aerosols and reduce relative humidity of the gas stream and filtered by the HEPA filters (PJV-HEPA-00004A/4B/5A/5B) to remove particulates that may be present. The exhaust air is then pulled through the PJV extraction fans (PJV-FAN-00001A/B) and discharged through a dedicated stack. The HLW vessels attached to the PJV system are SBS condensate receiver vessels (HOP-VSL-00903/904), SBS (HOP-SBC-00001/2), acidic waste vessel (RLD-VSL-00007), plant wash and drains vessel (RLD-VSL-00008) and canister decon vessels (HDH-VSL-00002/4).

#### 4.1.4.6 Radioactive Liquid Waste Disposal (RLD) System

The primary functions of the RLD tank system are to receive, store, and transfer various effluents from different HLW treatment systems. Various operations, such as neutralization, mixing, and sampling of the waste, are performed by these systems as required.

The RLD system contains three tanks located in the HLW vitrification plant wet process cell:

- Acidic Waste Vessel (RLD-VSL-00007)
- Plant Wash and Drains Vessel (RLD-VSL-00008)
- Offgas Drains Collection Vessel (RLD-VSL-00002)

The RLD system receives mixed waste effluent from the HOP system, the HLW canister decontamination handling (HDH) system, and periodic plant and vessel washes within the HLW vitrification plant.

These effluents include the following:

- Purge liquid from the Submerged Bed Scrubbers (HOP-SCB-00001/2)
- Drains from the Wet Electrostatic Precipitators (HOP-WESP-00001/2)
- Drains from the High-Efficiency Mist Eliminators (HOP-HEME-00001A/1B/2A/2B)
- Various plant and vessel washes and sump water
- Miscellaneous mixed waste streams, including vessel vent, bulge, and cabinet drains and canister decontamination effluents

Acidic Waste Vessel (RLD-VSL-00007)
This vessel collects liquid from the Submerged Bed Scrubber (HOP-SCB-00001/2) and the SBS Condensate Receiver Vessel (HOP-VSL-00903/4). The collected liquid waste consists of submerged bed scrubber purge, wet electrostatic precipitator drain, and high-efficiency mist eliminator drain. Sampling will be performed by an automated sample system to characterize the liquid waste. The contents are transferred to the PWD system in the pretreatment plant for treatment, as required.

Plant Wash and Drains Vessel (RLD-VSL-00008)
This vessel collects drains from vessels, sumps, and plant washes within the HLW vitrification plant, including wash water from cell floors, equipment exterior surfaces, stainless steel cladding, and bulges. This vessel also collects the C3 area fire water. Sampling will be performed by an automated sample system to characterize the liquid waste. The contents are transferred to the PWD system in the pretreatment plant for treatment, as required.

Offgas Drains Collection Vessel (RLD-VSL-00002)
This vessel receives condensate from the HOP pipes and PJV drains downstream from the High-Efficiency Mist Eliminator (HOP-HEME-00001A/1B/2A/2B) during off-normal operation. The

contents are transferred to the Plant Wash and Drains Vessel (RLD-VSL-00008) in the HLW vitrification plant for processing.

#### 4.1.4.7 IHLW Glass Canister Handling Process

The IHLW glass canister handling will consist of the following systems:

- HLW canister receipt handling (HRH) system
- HLW canister pour handling (HPH) system
- HLW canister decontamination handling (HDH) system
- HLW canister export handling (HEH) system

The individual systems and their primary functions are described below:

HLW Canister Receipt Handling (HRH) System
The HRH system consists of the equipment, controls, and interlocks required for importing a clean canister into the plant. This system consists of the canister import truck bay, the canister import room, and the canister import tunnel. These areas are located on the south side of the plant.

The sequence of operations and the equipment used for canister import are as follows:

- The shipping crates are unloaded from the transport truck with the canister import crane and placed in the staging area.
- The canisters are then individually removed from the shipping crate and set on the canister inspection/rotation table.
- The canister import room roller shutter door is opened and the canister inspection/rotation table rotates the canister to vertical. The canister import monorail hoist and grapple lift and transfer the canister to the canister import room. The canister is either set in the canister import buffer rack or placed in the canister import bogie. When the canister is transferred to the canister import tunnel, the shielded clean canister import hatch is opened and the canister is lowered into the canister import bogie below, and the hatch is closed and sealed.
- The canister import bogie is transferred under the canister handling cave to the shielded canister handling cave import hatch location. The canister handling cave hatch is then opened and the canister handling cave crane and grapple raises the canister into the canister handling cave. The canister handling cave import hatch is closed and the canister import bogie is returned to under the clean canister import hatch.

Instrumentation, alarms, controls, and/or interlocks will be provided for the HRH system as follows:

- Sealed hatch will be interlocked with canister import room roller shutter door preventing backflow of C3 air into canister import room or truck bay

- Prevent rotation/inspection table from rotating when roller shutter door is closed
- The HRH system will be designed such that only one door or hatch will be open at any one time
- Gamma interlock will be provided to prevent shielded personnel access door in canister import tunnel from being opened when radiation/contamination levels exceed limits or if the canister handling cave import hatch is open
- Gamma interlock will be provided to prevent clean canister import hatch in the canister import room from being opened when radiation/contamination levels exceed limits or if the canister handling cave import hatch is open

HLW Canister Pour Handling (HPH) System The primary functions of the HPH system are to transport empty product canisters and full IHLW canisters within the plant and perform product canister sampling, canister closure, and canister rework activities. The HPH system includes the canister handling cave, which includes two weld stations. The crane decontamination and crane maintenance areas are also part of the HPH system, located west of the canister handling cave. Pour tunnels no. 1 and no. 2, which include the bogie decontamination and maintenance areas, are also part of this system.

The primary functions of this system are to provide equipment to the transport canister, provide equipment for decontamination and maintenance, and provide equipment for remote viewing.

The primary functions of the canister handling cave are as follows:

- Receive canister from HRH system canister receipt handling
- Transport empty canister to import racks
- Transfer empty canister to pour tunnel 1 or 2
- Receive full canister from pour tunnel 1 or 2
- Transport full canister to cooling rack
- Transport canister to weld station
- Transfer canister to HDH system canister decontamination handling
- Provide equipment for canister import and buffer store

This section describes activities that will be performed in HLW pour tunnel no. 1 (H-B032) and pour tunnel no. 2 (H-B005A).

Pour Tunnel

The pour tunnels are at the -21 ft level and extend from north-south beneath the south end of the melter cave to an area below the canister handling cave. Bogie decontamination is performed in the tunnels, and bogie maintenance areas are provided in a designated shielded area at the south end of the tunnels. The tunnels will have a hatch that segregates the pour tunnels and the canister handling cave. The tunnels will also have a bogie maintenance shield door. The bogie maintenance area has a shield personnel access door and a roof access plug from the corridor above. The pour tunnels are designated as C5 areas.

Canister Transport

The HPH system supports both HLW Melters (HMP-MLTR-00001/2). Canisters are transported within the canister handling cave by means of an overhead crane. A standby crane is available in the event of the primary overhead crane failure. Viewing windows and camera are provided for viewing of equipment and operations within the cave area. Integrated networks of programmable logic controllers, which form part of the process control system, are used to control the mechanical handling.

Clean canisters are transferred from the HRH system to the HPH system through the canister import tunnel hatch. The hatch opens and the handling cave crane raises the canister into the canister handling cave. The hatch is closed and the canister is taken to the buffer storage area racks. When a canister is required for filling, it is taken out of the buffer rack using the canister handling cave crane and transferred above the appropriate pour tunnel hatch. The hatch is opened and the canister is lowered into the pour tunnel bogie below. The grapple is released and raised and the hatch is closed. The bogie travels to a position under the pour spout. As the bogie moves into position under the pour spout, the pour spout glass catch tray is pushed back and signals that a canister is present. A proximity switch detects that the bogie is in position, the bogie is then locked into position, and the canister is filled with glass. Canister filling is controlled and monitored by the canister level detection system (system HMP melter process). After completion of filling, the canister remains at the pour spout for approximately one hour to allow a "skin" to form over the glass that provides a seal to prevent additional offgassing. The filled canister is allowed to cool prior to removal from the pour tunnel. After cooling, the canister is moved south in the pour tunnel until it is beneath the canister handling cave hatch. The hatch is opened, the canister handling cave crane removes the full canister, and the hatch is closed. The filled canister is then cooled in cooling racks in preparation for welding the lid in place.

After cooling, in the cooling racks, a crane transfers the canister for lid welding, sampling of glass, and/or rework. The canister is lowered into the welding station table and the grapple released from the canister. After the welding station operations, the crane transfers the canister to the buffer storage racks or to the decontamination system rinse bogie, via the decontamination hatch.

The canister handling cave is classified as a C5 area; therefore, activities in the handling cave will be conducted remotely. This will be accomplished with viewing windows, cameras, manipulators, and overhead cranes. Windows are strategically located above the transfer hatches for viewing the canisters as they are raised and lowered. The crane decontamination area is located on the west end of the canister handling cave. The decontamination area is classified as a C3/C5 area. The crane maintenance area is located west of the crane decontamination area. The crane maintenance area is classified as a C3 area.

Canister Weld, Glass Sampling, and Rework

The following system supports both HLW Melters (HMP-MLTR-00001/2). The canister lid welding, glass sampling, canister inspections, and rework will be performed at one of two welding stations located along the south wall of the canister handling cave. Each station is located next to a shield window. Master-slave manipulators, closed circuit television, and lights are provided to assist weld station operations.

After the canister is cooled in the canister handling cave, the overhead crane moves the canister from the cooling rack into a port on the welding table. The canister is weighed and confirmed to be below the maximum allowable weight. While the canister is being lowered, cameras inspect the outside of the canister. Typically, glass waste residue is not expected on the exterior of the canister. However, prior to welding the lid on the canister, the canister is inspected. If glass is found on the canister, the glass will be removed using a needle descaler manually operated with the master-slave manipulator. A vacuum system will be used to capture the removed glass and prevent the spread of debris. The canister is then checked to confirm that its temperature is within the allowable range for welding. This is done using a thermocouple at the weld station. Glass samples are collected using a master-slave manipulator-operated glass sampling tool that uses a vacuum to draw shards of glass from the top surface. These shards are then transferred into sample vials and transferred to the laboratory using a pneumatic transfer system.

The lid is placed on the canister and welding is performed using an automated welder. The welding parameters are recorded in the plant tracking system. The finished weld is visually inspected using in-cave inspection cameras. Rejected welds may be repaired by re-melting the weld, mechanically removing the weld and re-welding, or welding a secondary lid over the primary lid. The sealed canister is then transferred to the HDH system.

Instrumentation, alarms, controls, and interlocks will be provided for the HLW canister handling system to indicate or prevent the following conditions:

- The crane decontamination shield doors are interlocked with the crane maintenance shield door to prevent both sets of doors from being open simultaneously.
- Interlocks will prevent the inadvertent access of personnel or equipment movement
- The bogie maintenance shield door is interlocked with the shielded personnel access door to ensure that personnel do not enter the bogie maintenance area when the bogie maintenance shield door is open.
- Radiation monitoring equipment is interlocked to the shielded personnel access door to ensure no personnel are able to access the maintenance area if a radiation/contamination source above prescribed limits is present.

HLW Canister Decontamination Handling (HDH) System

The primary function of the HLW canister decontamination handling system (HDH) is to decontaminate the IHLW canisters and to swab and monitor IHLW canisters.

The HDH system includes the process and equipment to perform the cerium nitrate canister decontamination process, surface swabbing, and swab monitoring process. The following vessels and their associated ancillary equipment are included in the HDH system:

- Canister Rinse Tunnel Canister Rinse Vessel (HDH-VSL-00001)
- Waste Neutralization Vessel (HDH-VSL-00003)
- Canister Decon Vessels (HDH-VSL-00002/4)

The HDH system consists of a canister rinse tunnel, canister decontamination station, swabbing and monitoring station, bogie maintenance areas, crane maintenance area, and canister transfer tunnel. The decontamination system consists of two stations: the decontamination station, which is located in-cave, and a mixing station, which is located out-cave. Vertical separation between the stations facilitates gravity flow of process solutions from the mixing station to the Canister Decon Vessels (HDH-VSL-00002/4). Beneath the canister decon cave is a canister rinse tunnel and a canister storage transfer tunnel. The canister rinse tunnel houses the canister rinse bogie, which transfers the canister from the canister handling cave to the canister decon cave while performing a prewash at an intermediate station. The canister storage transfer tunnel houses the canister storage transfer bogie, which transfers the decontaminated canisters from the canister decon cave to the canister export cave.

A filled, cooled, and welded IHLW canister is initially transported to the HDH system via a crane located in the canister handling cave. The IHLW canister is loaded into the canister rinse bogie and washed in a sealed vessel using low-pressure demineralized water to remove loose contamination. This water wash is performed in the Canister Rinse Tunnel Canister Rinse Vessel (HDH-VSL-00001) mounted on the canister rinse bogie, which travels from below the canister handling cave to below the canister decon cave. After the water wash, the canister is transferred by a crane to the canister decon vessel for further decontamination by chemically etching a thin layer of stainless steel from the canister surface, using cerium ion in a dilute nitric acid. The canister is then washed with nitric acid, followed by a second washing with de-mineralized water. After draining de-mineralized water from the Canister Decon Vessel, the canister remains in the vessel to dry. The decontamination fluids are pumped into a Waste Neutralization Vessel (HDH-VSL-00003) to which hydrogen peroxide is added to neutralize remaining cerium ion. Following neutralization, the fluid is transferred to the plant waste stream, or recycled back into the HLW Melters (HMP-MLTR-00001/2) via the pretreatment plant. The decontaminated canister is transported by overhead crane to the canister swabbing and monitoring area.

After decontamination and drying, the canister is swabbed using an automated power manipulator. If the contamination is below acceptable limits, the IHLW canister is placed into a canister storage transfer bogie located below the canister decon cave floor, and transported to the HLW canister export handling system.

In addition to the instrumentation, alarms, controls, and interlocks addressed in section 4.1.4, the following will be provided in for the HDH system to indicate or prevent the following conditions:

- Interlocks will be provided on bogie decontamination/maintenance area shield door to protect plant personnel from radiation and contamination exposure.
- Interlocks will be provided on crane maintenance area shield door to protect plant personnel from contamination exposure.

HLW Canister Export Handling (HEH) System
The primary functions of this system are to store filled IHLW canisters in racks, transfer the IHLW canisters into the canister export cave, load the IHLW canisters into product casks, evaluate product casks for contamination, and load IHLW product casks into transport vehicles. The HEH system consists of a canister export cave, a cask handling tunnel, a cask loading area, and a truck bay, and is equipped to support both HLW Melters.

Decontaminated IHLW canisters are transferred to the canister export cave from the HDH system using a bogie and an overhead crane and placed in the canister storage racks. When a IHLW canister is ready for exporting to an appropriate Hanford Site TSD unit, a dedicated transport vehicle is dispatched to the IHLW truck bay. The empty product cask is removed from the vehicle and placed on a cask transfer bogie located in the cask handling tunnel. The bogie transfers the cask to a lid lifting station where the lid is removed, and then to a canister receiving station. The IHLW canister is visually inspected in the canister storage cave and its identification confirmed. After the inspection information is recorded, the canister is lifted by overhead crane and placed into the product cask. The bogie then returns the cask to the lid lifting station where the lid is replaced and bolted. The product cask is then transferred to the export station where the cask is lifted by an overhead crane and placed on the transport vehicle. Swab samples are taken, and when the cask exterior is verified to be below the acceptable radioactive contamination level, the cask is transported to a Hanford Site storage facility.

Closed circuit television cameras will provide general viewing of the canisters and the storage area. Descriptions of inspections of IHLW canister storage areas are included in Chapter 6 of this permit. An IHLW canister tracking system will retain required information such as the IHLW identification number, weight, and dimensions of the IHLW canisters.

In addition to the instrumentation, alarms, controls, and interlocks addressed in section 4.1.4, the following will be provided for the HEH to indicate or prevent the following conditions:

- Interlocks to prevent the canister storage cave import hatch and the canister storage cave export hatch from being open at the same time
- Gamma monitoring and keyed interlocks to prevent the cask export hatch from opening when high radiation levels exist
- Interlock to prevent the canister storage cave export hatch from being open at the same time as the cask export hatch

- Gamma detectors/interlock to prevent cask handling bogie travel to the cask export hatch unless the cask lid is properly installed
- Interlock to prevent both truck bay "exit" and "entrance" (external) roller shutter doors from being open at the same time
- Interlock to prevent the truck bay inner roller shutter door from being open at the same time as either of the "exit" or "entrance" roller shutter doors
- The shielded personnel access door in the canister export cave crane maintenance area is interlocked with the canister export cave crane maintenance horizontal and vertical shield door. The shielded personnel access door is also interlocked with a gamma monitor to prevent opening when a source is present.
- The canister export cave import hatch is interlocked to prevent opening unless the following conditions are satisfied. The canister export cave export hatch is closed. The crane maintenance area shield horizontal and vertical shield doors are closed. The decontamination cave export hatch is closed. The canister storage transfer bogie is in position under the canister export cave import hatch.
- The canister export cave export hatch is interlocked to prevent opening until the following conditions are satisfied. The canister export cave import hatch is closed. The cask export hatch is closed. The cask handling bogie is under the canister export cave export hatch. The cask handling tunnel shielded personnel access door is closed.
- The process crane is prevented from striking the crane maintenance area shield door by end of travel and over-travel limit switches.

#### 4.1.4.8 HLW Melter Cave Mechanical Systems

Each HLW melter cave mechanical system will consist of the following individual systems:

- HLW melter handling (HMH) system
- HLW melter cave support handling (HSH) system

The individual systems and their primary functions are described below:

HLW Melter Handling (HMH) System

The primary function of the following system is identical for both Melters (HMP-MLTR-00001/2). The HMH system provides the equipment and controls necessary to:

- Transport new melter units into the HLW melter cave in conjunction with the HSH system
- Remove spent melter units from the HLW melter cave
- Decontaminate and monitor the spent melter overpacks

A multi-axle transporter will be used to move a new overpacked HLW Melter to the HLW vitrification plant loading dock. The overpacked melter will be offloaded, transferred through the rollup doors to the melter cave airlock, transferred through the airlock, and docked to the melter cave shield door. After opening the shield and overpack doors, the melter will be moved out of its overpack and installed in the melter cave.

The process of removing a spent HLW Melter from a cave and loading it back into its overpack is the reverse of the installation. The overpack will provide a shielded disposal/storage canister for the spent melter. After the outside surfaces of the overpack have been checked for radiological contamination and decontaminated as required, the spent melter and its overpack will be moved through the melter airlock through the rollup doors and placed on the transporter, to be moved out of the HLW vitrification plant.

Decontamination of the overpack in the C3/C5 airlock, before it is exported, will be performed manually using moist cloths. The HLW Melter overpack's primary function is to serve as a shielded, box-like enclosure for the storage, transport, and disposal of the HLW Melter. The overpack performs a radiological shielding function of the highly radioactive spent HLW Melter. Due to the high radiation levels associated with a spent HLW Melter, the walls on all sides of the HLW Melter overpack will be seal-welded and have a nominal thickness of approximately 8 in. of carbon steel. The estimated weight of the HLW Melter overpack is 250 tons with an empty melter, and 350 tons when carrying a payload of the HLW Melter full of glass. The spent Melter weight when full of glass is a worst case in the event that the residual glass removal described in section 4.1.4.7 cannot be performed. After 3 to 5 years of service, an HLW Melter is expected to reach the end of useful life service, and will be placed in the overpack before removing it from the HLW vitrification plant. The overpack, with the spent HLW Melter inside, will be moved to the HLW failed melter storage facility prior to land disposal. The overpack with spent HLW Melter will be disposed at the Hanford Site if it meets the land disposal facility waste acceptance criteria Regulatory issues and permitting actions associated with onsite disposal of spent and/or failed HLW melters will be addressed in the future.

Justification for on-site burial of the 8 in. carbon steel overpack results from a corrosion study of submarine reactors based on chemical content, resistivity, aeration, and burial methods. The predicted maximum pitting corrosion penetration for a 100-year period was 0.350 in. for reactors buried in geologic conditions similar to those in which the overpacks will be buried. (*Prediction of Pitting Corrosion Performance of Submarine Reactor Compartments After Burial at Trench 94, Hanford, Washington, March 1992*).

Prior to disposal, the spent Melter will be stored in the failed melter storage facility. If a Melter fails to meet the receiving TSD waste acceptance criteria, it will be stored until the HLW vitrification plant operating conditions are suitable for the spent melter to be returned to the melter cave for further decontamination, treatment, repackaging, and/or other process to enable the spent melter to meet the receiving facility's waste acceptance criteria.

HLW Melter Cave Support Handling (HSH) System

The primary function of this system is to provide remotely operated equipment to perform these support activities in each melter cave:

- Melter maintenance and replacement
- Melter component and consumable maintenance and replacement
- Melter component and consumable dismantling, sorting, and loading
- Equipment decontamination and hands-on maintenance

Decontamination Tanks (HSH-TK-00001/2) and associated ancillary equipment are included in the HSH system.

Each melter cave will contain an HLW Melter (HMP-MLTR-00001/2), Feed Preparation Vessels (HFP-VSL-00001/5), and HLW Melter Feed Vessels (HFP-VSL-00002/6), and the following offgas system components:

- Film Coolers (HOP-FCLR-00001/2)
- Submerged Bed Scrubbers (HOP-SCB-00001/2)
- High-Efficiency Mist Eliminators (HOP-HEME-00001A/1B/2A/2B)

Overhead cranes, hoists, and master-slave and power manipulators will be the primary equipment used to carry out various replacement, size reduction, and packaging tasks. Auxiliary tools will include impact wrenches, nut-runners, and hydraulic shears.

In addition, the HSH system will provide the means to dismantle and reduce the size of spent melter components or consumables for export out of the cave in waste canisters. Various size reduction tools will be used to cut down the equipment. The waste will be placed on a sorting table for screening and segregation prior to packaging and export.

Prior to Melter replacement, residual glass will normally be removed from a spent Melter. Lid heaters will keep the glass pool at the desired temperature ranges. Air and vacuum lines will be inserted to draw the molten glass into a canister. The spent Melter will then be disconnected and prepared for transport out of the cave.

A consumable bucket, equipped with interchangeable lid cutouts called templates, will be used to import and export melter consumables. The HFP vessels will be organized such that power manipulators can disconnect connections and prepare failed vessels and components for export. Components of the HOP system found in this cave will also be organized for similar activities.

The HSH system will provide a Decontamination Tank (HSH-TK-00001/2) in the equipment decontamination area, to allow for decontamination of consumables and equipment before hands-on maintenance in the crane maintenance area. In the Decontamination Tank, the equipment will be soaked in demineralized water and/or nitric acid. The equipment decontamination area will be used to additionally decontaminate equipment using manipulators before items can be removed for hands-on maintenance. A crane decontamination area is located above the C3/C5 airlock.

**HLW Filter Handling (HFH) System**

The filter cave is at grade level west of the melter cave 2. The walls, ceiling, and floor of the filter cave are of reinforced concrete. The filter cave contains the spent filter export hatch, which interfaces with the drum transfer tunnel. Gross decontamination of filter cave equipment will be performed in the filter cave. The filter cave also contains a pair of shield doors at the interface between the filter cave and the crane maintenance area. The shield doors provide the barrier between the filter cave and the man-accessed maintenance area. The filter cave is designated as a C5 area.

The C5 filter system in the filter cave will consist of three two-stage HEPA housings (one for melter cave no. 1, another for melter cave no. 2, and one for the canister handling cave and the filter cave itself). In addition, there will be two HEPA filter housings for each melter offgas and PJV systems.

The filter housings will be of stainless steel. The filter lids will be flush with a stainless steel clad false floor (filter cave deck) that covers the entire cave at 14 ft elevation. The following equipment will be used for replacement of HEPA Filters and with other in-cave activities.

- Power manipulators
- Crane and cable reeling system
- Spent filter export hatch

#### 4.1.4.9 Radioactive Solid Waste Handling (RWH) System

The following system supports both HLW Melters (HMP-MLTR-00001/2) and the HLW filter cave. The primary functions are to:

- Provide canisters for removal of miscellaneous solid waste from the HLW melter cave and filter cave
- Transport filled and empty waste canisters
- Provide external radiological monitoring of waste canisters
- Decontaminate waste canisters as required
- Supply and load waste canisters into transport casks

The RWH system consists of three major operational areas: the drum transfer tunnel, the swabbing and monitoring area, and the cask handling area. Mixed waste is generated in melter caves 1 and 2, the canister handling cave, and the filter cave. Mixed waste generated in the canister handling cave is transferred to either melter cave via the pour tunnels and then exported from the melter caves to the drum transfer tunnel. The drum transfer tunnel runs beneath these areas and provides a common area for receipt of waste to consolidate the separate waste streams into a single export path. The RWH system receives waste from the HSH system (melter caves 1 and 2) and the HFH system (filter cave) contained in lidded waste baskets that are lowered through the transfer ports in the ceiling of the drum transfer tunnel.

The RWH system introduces empty 55-gallon drums into the HLW plant for packaging radioactive solid waste for disposal. Empty 55-gallon drums are placed into shielded casks in the canister export truck bay. The cask is transferred on the cask transport vehicle into the cask import/export area for ultimate transfer from the plant.

The cask is positioned under the monorail hoist. It is then lifted, transferred to, and positioned onto the cask transfer bogie. A shield door is opened and the bogie is moved to the cask lidding station. The cask lid pintle is aligned with the lifting claw of the cask lidding machine and the cask lid is removed. The cask is then positioned under the cask transfer hatch. The drum, lid, and clamping ring are imported into the swabbing and monitoring area and manually staged on a stand in front of the shield window.

The drum transfer bogie rolls to position beneath a transfer hatch of either melter cave no. 1, melter cave no. 2, or the filter cave. With the drum positioned under the selected cave transfer port, a loaded waste basket is lowered into the drum by the interfacing cave system's crane and grapple. With the basket located in the drum, the grapple is detached and raised by the system crane. The full 55-gallon drum is relocated back to the position under the drum transfer hatch to the swab and monitoring area. The drum is lifted into the swab and monitoring area using the overhead crane and drum grapple.

The RWH system transports loaded drums into the lidding, swabbing, and monitoring area for lidding, swabbing, external monitoring, and decontamination (if required). The system then exports the filled 55-gallon drums through the import/export area.

The following operations are performed:

- The crane lifts the drum to the swabbing and monitoring station. Two master-slave manipulators will be mounted on the wall of the swabbing and monitoring area and will provide the operator interface for installation of the drum outer lid and clamping ring while the drum is positioned on the drum turntable.
- The robotic swabbing arm and turntable swab the surface of the drum. The swabs are placed in the shielded posting of the swab analyzing station. Following preliminary measurement of the swab, the posting port is actuated to move the swab into the swabbing and monitoring glovebox where the sample is analyzed and bagged out for disposal.
- If the swabs are within acceptable limits, the crane lifts the drum from the drum swabbing turntable and positions the drum over the cask transfer hatch and places it in the shielded cask on the cask transport bogie.
- If the drum requires decontamination, additional swabbing of the drum will be performed to remove the contamination. Remote-handled decontamination equipment is available in the cave to be used if additional swabbing is insufficient to meet disposal requirements.

- The cask transfer bogie moves to the cask lidding station where the cask lid is replaced onto the cask. The bogie then moves to a gamma monitor where radiation levels are verified before the import/export shield door is opened and the cask transfer bogie moves into the import/export area. Once the cask is in the import/export area and the import/export shield door is closed, operators enter to bolt the lid onto the cask. The monorail then moves the cask to the cask handling truck. The cask handling truck positions the cask under the truck bay crane. From the cask import/export area, the crane positions the cask on a vehicle for transfer from the plant.

### 4.1.4.10 HLW Vitrification Plant Ventilation

The HLW vitrification plant will be divided into four numbered zones listed and defined below, with the higher number indicating greater radiological hazard potential and, therefore, a requirement for a greater degree of control or restriction. The zoning of the ventilation system will be based on the classifications assigned to building areas for potential radiological contamination. Zones classified as C5 are potentially the most contaminated and include the pour caves, buffer storage area, and process cells. Zones classified as C1 are uncontaminated areas.

Containment will be achieved by maintaining C5 areas at the greatest negative pressure, with airflows cascaded through engineered routes from C2 areas to C3 areas and on to the C5 areas. The cascade system, in which air passes through more than one area, will reduce the number of separate ventilation streams and, hence, the amount of air requiring treatment. Adherence to this concept in the design and operation of the HLW vitrification plant will ensure that the plant air does not become a significant source of exposure to operators, and that the air emissions do not endanger human health or the environment.

An exhaust air radiation monitoring system, consisting of sensors to monitor radiation in the exhaust air stream, or a representative sampling system is provided in the discharge header downstream of the exhaust fans. A monitoring system would consist of probe assemblies, vacuum pumps, a stack flow sensor, temperature sensor, and radiation sensors. A temperature transmitter is also provided in the discharge header downstream of the exhaust fans for continuous monitoring of exhaust air temperature.

C1 Ventilation (C1V) System
C1 areas will typically consist of offices, workshops, control rooms, and equipment rooms. They will be slightly pressurized if they are adjacent to areas with higher contamination potential to eliminate backflow from those areas.

C2 Ventilation (C2V) System
C2 areas will typically consist of operating areas, equipment rooms, stores, access corridors, and plant rooms adjacent to areas with higher contamination potential. The C2V is served by dedicated exhaust fans. Air supplied to the C2 areas that is not cascaded to the C3 or C5 areas is discharged to the atmosphere by the exhaust fans. Both exhaust fans are provided with variable frequency drives. A manual isolation damper is provided upstream of each exhaust fan, and a

pneumatically actuated isolation damper is provided downstream. Each damper is provided with local/remote position monitoring.

C3 Ventilation (C3V) System
C3 areas are normally unoccupied, but allow operator access, for instance during maintenance. C3 areas will typically consist of filter plant rooms, workshops, maintenance areas, and monitoring areas. Air will generally be drawn from C2 areas and, wherever possible, cascaded through the C3 areas into C5 areas, or alternatively exhausted from the C3 areas by the C3 exhaust system. In general, air cascaded into the C3 areas will be from adjacent C2/C3 subchange rooms. When sufficient air cannot be cascaded into C3 areas, a dedicated C2 supply equipped with appropriate backflow prevention will be used.

C5 Ventilation (C5V) System
Where there is in-bleed air from the C3 to C5 system, fan cascade trip interlocks protect the system from backflow.

The C5 areas in the HLW vitrification plant will be composed of the following:

- Pour caves
- Transfer tunnel
- Buffer storage area
- Process cells

Air will be cascaded into the C5 areas and exhausted by the C5 exhaust system. Engineered duct entries (air in-bleeds) through the C5 confinement boundary will be protected by backflow filter isolation dampers, with penetrations through the boundary sealed.

### 4.1.5 Analytical Laboratory

The analytical laboratory will be designed to incorporate the features and capability necessary to ensure efficient WTP operations and meet permitting, process control, authorization basis, and waste form qualification requirements. The design will be validated with information from tank utilization modeling of the process tankage and operational research modeling of the treatment process, as appropriate. Figure 4A-107 in DWP Attachment 51 provides a general layout of the first floor of the WTP analytical laboratory where analytical, maintenance, administrative, and waste management activities take place. The following attributes are outlined in the facility design figures described above:

- Workstations have been defined as required by the sampling and analysis plan for WTP process control and waste form qualification
- Capability to provide limited process technology will be provided
- Contamination controls has been incorporated for reliability of laboratory service to the WTP processes

- Management of DST system samples for receipt and analysis by an outsource laboratory

Figures 4A-108 through 4A-117 found in DWP Attachment 51 provide additional detail for the analytical laboratory:

- General arrangement figures showing locations of analytical laboratory activities
- Process flow figures for process information
- Typical system figures depicting the analytical laboratory tank systems
- Figures depicting the ventilation system

The WTP analytical laboratory will contain high-activity and low-activity laboratories. High-activity samples will be managed in the analytical hotcell laboratory equipment (AHL) system. Low-activity samples will be managed and analyzed in the analytical radiological laboratory equipment (ARL) system also known as the rad labs. The ARL system also includes a sample management area designed to manage the inflow of manually transported samples. Most samples sent to offsite laboratories will be low-activity and environmental samples. Analytical methods and equipment selected to support laboratory analyses will be in accordance with applicable requirements.

The second floor of the analytical laboratory will be dedicated to the mechanical room, which contains the C1 and C2 air handling units. The Radioactive Liquid Waste Disposal (RLD) System vessels will be located at approximately 19 ft below grade.

The facility will also be designed to coordinate the management of samples that will be outsourced and analyzed at offsite laboratories. Outsource laboratories will be used to analyze the majority of very low-activity samples such as water quality and air emission samples. Outsource laboratories may also be used to analyze DST system unit characterization samples.

Samples will be transported to the analytical laboratory in two ways. The majority of samples will be collected and transported from the processing facilities via the autosampling (ASX) system. Samples will be collected in a sample bottle or vial and transferred into a sample carrier. High-activity samples from the pretreatment and HLW vitrification plants will be pneumatically transferred to the hotcell sample receipt area through a dedicated transfer system for high-activity samples. Low-activity samples from the LAW vitrification plant and nonradioactive samples from the balance of facilities will be transferred directly to the sample receipt laboratory area through a dedicated low-activity transfer system. A small percentage of samples will be transported to the laboratory manually in appropriately shielded transportation casks or containers.

Regulated analytical laboratory tank system process and leak detection system instruments and parameters will be provided in DWP Table III.10.E.H.

#### 4.1.5.1 Analytical Radiological Laboratory Equipment System

The rad labs are being designed to support the preparation and analysis of low-to-moderately mixed waste samples. The rad labs also support the analyses of high-activity mixed waste plant samples collected, diluted, and processed in the hotcell facility. Samples will be manually transferred from the hotcell facility to the rad labs. The rad labs will be capable of receiving low-to-moderate activity samples transferred from the process facilities via the ASX system as well as manually transported low-to-moderate activity samples from the process facilities and other DOE facilities.

The rad labs include the facilities and equipment required to support activities such as:

- Sample receipt and (manual) transport
- Dissolution/dilution
- Distillation/titration
- Standard/reagent preparation
- X-ray fluorescence spectrometry and x-ray diffraction analysis
- Fourier transformation infrared spectrometry (FT-IR)
- Total inorganic analyses
- Quantitation of metals and anions
- Ultraviolet and visible spectroscopy
- Preparation of glass samples for elemental analysis
- General physical properties analysis
- Radionuclide separation and counting
- Management of outsourced samples

#### 4.1.5.2 Analytical Hotcell Laboratory Equipment (AHL) System

The analytical hotcell laboratory equipment system will be designed to provide sample preparation and analysis of high-activity samples collected at the WTP and other DOE facilities. The hot cells will be capable of accepting samples from each of the production facilities using pneumatic transport or transported manually. The samples will be transported to the hot cells or to the rad labs either directly, after dilution, or after stripping off the radioactive content.

The analytical hotcell laboratories will include facilities and equipment necessary to perform activities such as:

- Sample receipt and transport to other hot cells and the rad labs
- General physical properties analysis
- Dilution, fusion, and acid digestion required to prepare samples for subsequent analysis
- Waste management activities

#### 4.1.5.3 Autosampling (ASX) System

Samples will be collected into a sample bottle or vial and then transferred into a sample carrier. Sample carriers are then pneumatically transferred to either the laboratory hot cell or radiological laboratory depending on where the sample was collected. The ASX system consists of high-activity and low-activity sampling systems. The high-activity sampling system collects and pneumatically transfers samples from the PTF and HLW plants to the receipt cell within the hot cell laboratory. Low-activity samples collected from low-activity waste streams are pneumatically transferred directly to the radiological laboratory.

#### 4.1.5.4 Solid Waste Management

Solid mixed and dangerous waste will be accumulated in the hot cells and periodically placed in waste drums. Waste from the individual hot cells will be transferred to a waste management cell where waste management, consolidation, and packaging activities are conducted. The waste cell contains tools and equipment to complete size reduction. These solid mixed and dangerous wastes as well as organic lab pack wastes will be transferred into waste drums prior to being transferred to the laboratory waste drum management area. Ventilation flow from the hot cell area, including the waste cell, will be routed to the C5 HEPA filtration system.

Solid mixed and dangerous waste and organic lab pack wastes from the rad labs and maintenance areas will be accumulated in the individual labs and shops until they are transferred to the laboratory waste management area for waste consolidation and volume reduction. Waste consolidation will be completed in the volume reduction and lab pack rooms in the waste drum management area.

Waste drums will be transferred to a permitted TSD site or low level radioactive waste facility. Lab pack drums or waste drums containing liquid mixed or dangerous wastes will be managed on spill pallets. The management area will be coated with a special protective coating and the area will be ventilated to the C2 ventilation system. Floor drains from the waste management area will flow into the Laboratory Floor Drains Collection Vessel (RLD-VSL-00163).

#### 4.1.5.5 Radioactive Dangerous Liquid Waste Disposal (RLD) System

The analytical laboratory RLD system is primarily composed of the following:

- Floor Drain Collection Vessel (RLD-VSL-00163)
- Laboratory Area Sink Collection Vessel (RLD-VSL-00164)
- Hotcell Drain Collection Vessel (RLD-VSL-00165)
- Associated ancillary equipment

The Floor Drain Collection Vessel (RLD-VSL-00163) collects, contains, and transfers noncontaminated liquid effluent. Although the floor drain collection vessel is identified as part of the RLD system, it is not designed or permitted to manage mixed or dangerous wastes. If a spill or release were to occur that contaminated this vessel, the vessel would be discharged to the Laboratory Area Sink Collection Vessel (RLD-VSL-00164) or the Hotcell Drain Collection Vessel (RLD-VSL-00165) and rinsed with water prior to being returned to service. This vessel collects effluent from radiological laboratory floor drains, eyewash, and safety shower equipment. The vessel also collects effluent from the C2 area floor drains located in areas such as the laboratory area corridors, hotcell bay area, and the filter room.

#### 4.1.5.6 Laboratory Maintenance

The analytical laboratory maintenance shop provides space for performing preventive and corrective maintenance on laboratory equipment. There will be two shops, located in different potential contamination areas. The C3 shop allows decontamination, maintenance, and storage of contaminated equipment such as hotcell manipulators. The C3 maintenance shop will be ventilated to the C3 ventilation system, and effluent from the C3 maintenance shop discharges to the Laboratory Area Sink Collection Vessel (RLD-VSL-00164). The C2 shop will provide space for the maintenance of equipment that is not expected to be radioactively contaminated such as electrical components, utilities systems components, and instruments, and will be ventilated to the C2 ventilation system. A list of proposed maintenance activities that will be performed in the analytical laboratory maintenance shops is provided below.

**Analytical Laboratory Maintenance and Waste Management Activity Summary**

| Task Description | Lab C3 Shop | In Situ Activities |
|---|---|---|
| Filter change out [a] | | X |
| Manipulator repair [b] | X | X |
| Valve maintenance | X | X |
| Pump maintenance | X | X |
| Exhaust fan maintenance | X | X |
| Repair and fabricated equipment | X | X |
| Instrument calibration | X | X |

a Spent filters will be disposed of following filter change out using approved maintenance, waste management, and radiological procedures.

b Manipulators requiring extensive repairs will be pulled and transferred to the C3 workshop for decontamination. Once the contamination levels are reduced to within acceptable limits for hands-on maintenance, the manipulator will be repaired using approved maintenance and radiological procedures.

#### 4.1.5.7 Laboratory Ventilation Systems

The analytical laboratory ventilation systems include C1V, C2V, C3V, and C5V systems that aid in the containment and confinement of mixed and dangerous constituent hazards. Clean occupied areas without contamination potential are classified as C1 and will be isolated from normally clean occupied areas with the potential for contamination (C2) and from areas with restricted occupancy, normal radiological hazards and higher contamination potential (C3 and C5).

C3 areas are restricted occupied areas and allow operator access under administrative controls as required for scheduled maintenance and operations. C5 areas have the highest contamination potential and will normally be unoccupied. These areas have, by virtue of their location and the activities performed within them, an increased potential for the release of contamination. The analytical laboratory C5 ventilation system will be an integral part of the complete analytical laboratory HVAC system. The design objectives of the analytical laboratory HVAC system, and therefore the C5 area ventilation system, will be as follows:

- Aid in the confinement and containment of mixed and dangerous constituent contamination sources
- Remove airborne particulates from the discharge air to ensure that emissions are within prescribed limits
- Maintain space temperatures within the indoor design conditions
- Satisfy safety requirements and codes and standards that are a part of the Safety Requirements Document

The C5 area ventilation system is being designed to maintain a negative pressure in the C5 areas with respect to the surrounding areas. Hotcell ventilation, the Hotcell Drain Collection Vessel (RLD-VSL-00165), and the C3 maintenance shop glovebox will be exhausted to the C5 ventilation system. Fume hoods within the rad labs, the waste reduction and lab pack room, and the C3 maintenance shop will be exhausted to the C3 ventilation system. The ventilation from C2, and C3 areas will be filtered through a single stage of HEPA filters and exhausted through the analytical laboratory stacks. Air cascading into the C5 areas from the adjacent C2 and/or C3 areas will be exhausted through the analytical laboratory building stack by the C5 exhaust fans after passing through two stages of HEPA Filter banks.

### 4.1.6 Balance of Facilities (BOF)

The balance of facilities will provide support systems and utilities required for the waste treatment processes within the pretreatment plant, LAW vitrification plant, HLW vitrification plant, and analytical laboratory. These will include, but will not be limited to, heating and cooling, process steam, process ventilation, chilled water, primary and secondary power supplies, and compressed air.

#### 4.1.6.1 Plant Service Air (PSA) Systems

The process plant service air system will provide a continuous supply of compressed air for the process tanks and vessels in the pretreatment plant, analytical laboratory, LAW vitrification plant, HLW vitrification plant, and other miscellaneous uses.

Critical users (those who would be compromised or damaged by loss of process air) will include the following systems, components, or controls:

- Instrument air system
- The ultrafiltration system
- Melter support systems

The compressors will be located in the chiller/compressor building.

#### 4.1.6.2 Plant Cooling Water System (PCW)

The cooling water system will supply cool water to heat exchangers supporting process equipment coolers. Cooling water will remove heat from plant equipment coolers in the process buildings and return the heated water to a multi-cell mechanical draft-cooling tower where the heat will be released. The cooling water system is designed to remain uncontaminated by mixed waste constituents. The cooling water will be chemically treated to promote system operability and extend service life to 40 years.

#### 4.1.6.3 Low-Pressure Steam System (LPS)

This system will provide a continuous supply of low-pressure steam for various users in the pretreatment plant, LAW vitrification plant, and HLW vitrification plant. The process plants' main use of steam will be for tank heating for the evaporation process, and for HVAC heating coils.

The low-pressure steam system will be supplied from the high-pressure steam system through pressure-reducing stations. The steam condensate and feed system will collect condensate from the low-pressure steam users, monitor for mixed waste contamination, and return it to the steam plant for re-use.

#### 4.1.6.4 High-Pressure Steam System (HPS)

The system will provide a continuous supply of high-pressure steam for the ejectors in the pretreatment plant, LAW vitrification plant, and HLW vitrification plant.

The steam plant will house the boilers that produce the steam.

#### 4.1.6.5 Demineralized Water System (DIW)

This system will distribute demineralized water to various plant locations, after drawing it off the process water system (described below).

The system can deliver demineralized water for the following processes:

- Fresh ion exchange resin addition
- Wash rings

- Decontamination
- Melters
- Analytical laboratory

#### 4.1.6.6 Process Service Water System (PSW)

This system will supply filtered water to end users. This water will serve processes such as offgas treatment, plant wash systems, and make-up to chilled water systems.

#### 4.1.6.7 Chilled Water (CHW) System

This closed-loop system will supply chilled water to various HVAC unit cooling coils and plant equipment coolers for the WTP. Chilled water will be used in various systems throughout the WTP. The chilled water system is designed to remain uncontaminated by mixed waste constituents. The chilled water will be chemically treated to promote system operability and extend the service life to 40 years.

#### 4.1.6.8 Glass Former Reagent (GFR) System

The glass former reagent system provides glass former reagents and sucrose to the LAW and HLW vitrification facilities.

## 4.2 WASTE MANAGEMENT UNITS

The following sections provide information on the waste management units at the WTP:

- Containers, including management and storage areas - Section 4.2.1
- Tanks systems for storage and treatment - Section 4.2.2
- Miscellaneous units - Section 4.2.3
- Containment buildings - Section 4.2.4

### 4.2.1 Containers [D-1]

This section of the permit identifies the containers and container management practices that will be followed at the WTP. The term "container" is used as defined in Washington Administrative Code (WAC) 173-303-040. Note that in the permit, terms other than containers may be used, such as canisters, boxes, bins, flasks, casks, and overpacks.

The container storage areas located in the HLW vitrification plant consists of:

- IHLW canister storage cave (immobilized glass) (H-0132)
- HLW east corridor El. 0 ft (secondary waste) (HC-0108/09/10)
- HLW loading area (secondary waste) (H-0130)

The container storage areas (secondary waste) located within the analytical laboratory consists of:

- Waste Drum Management Room (A-0139)
- Lab Pack Room (A-0139A)
- Airlock (A-0139B)
- Volume Reduction Room (A-0139C)
- Airlock/Clean Drum Export Room (A-0139D)

The container storage areas (secondary waste) located within the balance of facilities consists of:

- Nonradioactive dangerous waste storage area
- Failed melter storage facility

Container storage area dimensions at the WTP are summarized in Table 4-2.

The following sections address waste management containers:

- Description of Containers - section 4.2.1.1
- Container Management Practices - section 4.2.1.2
- Container Labeling - section 4.2.1.3
- Containment Requirements for Storing Waste - section 4.2.1.4
- Prevention of Ignitable, Reactive, and Incompatible Wastes in Containers - section 4.2.1.5

#### 4.2.1.1 Description of Containers [D-1a]

Four types of waste will be managed in containers:

- IHLW (immobilized glass)
- ILAW (immobilized glass)
- Miscellaneous mixed waste (secondary waste)
- Miscellaneous nonradioactive dangerous waste (secondary waste)

The waste form dictates the type of containers used for waste management. The following paragraphs describe these four types of containerized waste that are managed by the WTP.

Immobilized Glass Waste

The immobilized glass waste is a mixed waste that will be managed in ILAW containers and IHLW canisters specially designed to remain stable during receipt of glass waste, and which are capable of remote handling. The Permittees are developing a petition to delist IHLW.

The ILAW containers will be approximately 90 in. high and 48 in. in diameter, with a wall thickness of approximately 0.187 in. and a nominal capacity of 90 $ft^3$. ILAW containers will be constructed of austenitic (304) stainless steel.

The IHLW canisters will be approximately 177 in high and in. in diameter, with a wall thickness of approximately 0.1345 in. and a nominal capacity of 43 $ft^3$. The IHLW canisters will be constructed of austenitic (304L) stainless steel.

Based on results from the programs at the Oak Ridge National Laboratory and Savannah River Technology Center, the 304L stainless steel is physically and chemically compatible with the IHLW glass waste.

**Miscellaneous Mixed Waste**

Generally, miscellaneous mixed wastes are secondary wastes that may include, but are not limited to, the following items:

- Spent or failed equipment
- Spent, dewatered ion exchange resins in the pretreatment plant
- Offgas HEPA filters
- Melter consumables
- Analytical laboratory waste
- Spent melters

Spent equipment and offgas filters will typically be managed in commercially-available containers such as steel drums or steel boxes, of varying size. The containers for miscellaneous mixed waste will comply with transportation requirements, with receiving TSD waste acceptance criteria, and will be compatible with the miscellaneous mixed waste. These containers may or may not include a liner. Final container selection, container and waste compatibility, and the need for liners, will be based on the physical, chemical, and radiological properties of the waste being managed.

Spent ion exchange resins will be dewatered and managed in containers. This waste will be generated and managed in the pretreatment plant, until it is transferred to a suitable TSD unit for further management.

Melter consumables are routinely generated wastes and include spent feed tubes, pressure transducers, bubblers, and discharge risers. LAW melter consumables will be placed into approved disposal containers of varying size. HLW melter consumables will be remotely size reduced and placed into steel baskets with lids. The baskets will be placed into drums and the drums placed into shielded casks for export from the facility.

The LAW Locally Shielded Melter (LSM) will be classified as hazardous debris for land disposal restrictions purposes. After a spent HLW Melter is deemed to meet criteria and regulations for onsite disposal, it will be and placed in a welded carbon steel container (overpack) or other acceptable packaging in accordance with waste acceptance criteria for the receiving TSD. Regulatory issues and permitting actions associated with onsite disposal of spent and/or failed melters will be addressed in the future.

Each miscellaneous mixed waste container will have associated documentation that describes the contents, such as waste type, physical and chemical characterization, and radiological characterization. This information will be retained within the plant information network.

Most miscellaneous secondary mixed wastes will be spent equipment and consumables such as pumps, air lances, HEPA filters, etc., and are not expected to contain liquids. If wastes are generated that contain liquids, these wastes may be treated to remove or absorb liquids, to comply with the receiving TSD waste acceptance criteria. In addition, the analytical laboratory will generate containerized liquid waste (lab packs).

Miscellaneous Nonradioactive Dangerous Waste

Each nonradioactive dangerous waste container will have associated documentation that describes the contents, such as waste type and physical and chemical characterization. Typically, commercially available containers will be used. The types of containers used for packaging nonradioactive dangerous waste will comply with the receiving TSD waste acceptance criteria and transportation requirements. However, final container selection, container and waste compatibility, and the need for liners will be based on the physical and chemical properties of the waste being managed.

#### 4.2.1.2 Container Management Practices [D-1b]

The following paragraphs describe how each of the containers used at the WTP are managed.

##### 4.2.1.2.1 Immobilized Glass Waste Containers

Immobilized glass waste ILAW containers and IHLW canisters will be moved remotely due to the high radiation content of the waste. A brief discussion of how the containers move through the WTP is presented below.

ILAW Containers

An empty container will be transported to a LAW glass pour cave and placed on a turntable designed to hold three containers. There are two ILAW pour caves at each melter, each with the capacity to manage three containers at a time. The container will be sealed to the Melter discharge with a pour head connection. The glass waste will fill the container during the course of approximately 10 hours.

The filled ILAW container will be lowered back onto the turntable. The filled container will cool for 10 to 30 hours to reach glass transition temperature (approximately 400 °C to 500 °C), which characterizes the transformation from an equilibrated melt to a “frozen” glass structure. At this stage, the waste glass does not contain liquid and is in a viscous state that ultimately stabilizes to a solid. Once the container has cooled, it will be rotated to the transfer position. The container will then be lifted by a remotely operated crane onto a bogie and transported to the finishing line. In the event the finishing line becomes backed up, the container may be transported to the ILAW container buffer storage containment building. The containers will not be stacked. Storage area dimensions are summarized in Table 4-12.

The container will be transported to the ILAW container finishing line (see Section 4.2.4), where the level of waste glass will be measured and additional inert filler will be added, if needed. A sample of the glass may also be collected in this location prior to inert filling. Glass within the neck of the container will be removed by abrasion and the lid will be attached to the container. The debris generated from residual glass removal will be collected with a vacuum system and disposed of as a secondary waste.

After the lid is mechanically sealed, the container will be moved to the decontamination cell where contamination will be removed. Using a turntable, the container will revolve while a power manipulator tracks the entire surface with decontamination equipment. The dry decontamination process will use carbon dioxide pellets. The container will then be transported to of the swabbing cell, where its surface will be swabbed. The radiation levels of the swab will be remotely monitored, and the results will determine whether the ILAW container will be ready for transportation to the disposal site, or go through decontamination again.

IHLW Canisters

The empty canister will be remotely transported to the IHLW pour station. The canister will be sealed to the melter pour spout with a pour head. After filling, the canister will be allowed to cool to glass transition temperature (approximately 400 °C to 500 °C), which characterizes the transformation from an equilibrated melt to a "frozen" glass structure, prior to transportation to the IHLW canister weld containment building unit (see Section 4.2.4).

The IHLW canister will be transferred to the IHLW canister handling cave containment building unit by means of bogie. Here it will be stored on an open rack for up to three days, until it cools to normal operating temperature. Normal operating temperature is the temperature at which the canister can be lidded. This temperature range is 70 °F to 350 °F. In addition to providing a cooling area, the IHLW canister handling cave containment building unit can be used as a buffer to hold canisters awaiting lid welding or decontamination.

After it has cooled, the volume of glass in the canister will be determined. The canister will then be inspected for glass spatter on its exterior. If glass is found, it will be removed using a needle gun, and the debris generated will be collected with a vacuum system and disposed of as a secondary waste. The lid will be attached by welding, to seal the canister completely and permanently.

The sealed canister will be transported to the canister decon cave (HB035). The canisters are first rinsed with de-ionized water and then decontaminated using a cerium nitrate and nitric acid bath. It will then be rinsed with nitric acid, followed by a de-ionized water rinse, and then wiped or swabbed with a soft absorbent material at the canister swabbing and monitoring area near the canister decontamination vessels. The radiation levels of the swab will be monitored.

The canister will then be moved to the IHLW canister storage cave (H-0132) where it will be stored until transported off-site inside a shielded shipping cask. The canisters will not be stacked. Storage area dimensions and maximum waste storage volumes are summarized in Table 4-2.

Other IHLW Canister Storage Requirements
As stated in WAC 173-303-630(5)(c), a 30 in. separation is required between aisles of containers holding dangerous waste. In addition, WAC 173-303-340(3) requires a 30 in. separation to allow unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment in an emergency.

Evaluation of the 30-in. aisle spacing requirement by the DOE, WTP, the EPA, and Ecology for IHLW canisters concluded that aisle spacing in the range of 4 to 16 in. was adequate based on the following factors:

- Personnel access into the immobilized glass container storage areas will be restricted. High radiation dose rates from immobilized glass waste containers will preclude personnel entry into the process and storage areas, and inspection of the ILAW and IHLW containers will be performed remotely. (See Chapter 6 for the inspection approach.)
- Water-based fire suppression systems will not be used in the container storage areas. Because of its inert nature, the glass waste will present a low fire hazard, and a minimal amount of combustible material will be present. The only potentially combustible material that may be present in the immobilized glass waste container storage areas is insulation on crane motors and associated cables. To ensure no water is introduced into the container storage areas, a dry chemical fire suppressant system may be installed.
- Spill control equipment will not be necessary within the IHLW canister storage areas. Spills or leaks from the stored containers will not occur because the glass waste will be in a solid form and will not contain free liquid. The glass transition temperature characterizes the transformation from an equilibrated melt to a "frozen" glass structure

The IHLW canisters will be stored in a storage rack to allow airflow. No stacking of the containers will occur in the ILAW or the IHLW container storage areas. Closed circuit television cameras will enable general viewing of both areas.

Miscellaneous Mixed Waste Containers
Miscellaneous mixed waste (secondary waste) will be managed in:

- HLW East corridor (HC-0108/09/10)
- HLW loading area (H-0130)
- Failed melter storage facility (balance of facilities)
- Laboratory waste management area (A-0139A/B/C/D)

Containers will be kept closed unless waste is being added, removed, or sampled while in the containment storage areas. Containers stored in these areas will be placed on pallets, or otherwise elevated to prevent contact with liquid, if present. Table 4-2 summarizes the dimensions and maximum capacity of miscellaneous mixed waste storage areas. Containers will be managed in designated areas throughout the WTP, and then transferred to a suitable TSD facility.

The HLW East corridor (HC-0108/09/10) will be located in the eastern portion of the main floor (0 ft elevation) of the HLW vitrification plant. This unit will be used as a storage location prior to export of secondary waste containers out of the plant. Aisle space will be 30, and waste containers may or may not be stacked. This units' storage capacity is listed in Table 4-2.

The HLW loading area (H-0130) will be located in the eastern portion on the ft elevation of the HLW vitrification plant. The unit will be used for storage of the miscellaneous waste containers prior to shipment to a suitable TSD facility. The aisle space will be 30 in. and waste containers may or may not be stacked. This units' storage capacity is listed in Table 4-2.

The failed melter storage facility will be a stand-alone building. It will be used primarily to manage HLW melters that have completed their useful service life. The failed melters storage facility may also receive containerized miscellaneous mixed waste, if needed.

The laboratory waste management area (A-0139) will be located in the southern portion on the 0 ft elevation of the analytical laboratory. The unit will be used for storage of miscellaneous waste containers prior to disposition to a receiving TSD facility. The aisle space will be 30 in. and waste containers may or may not be stacked. This unit's storage capacity is listed in Table 4-2.

**Miscellaneous Nonradioactive Dangerous Waste Containers**

Miscellaneous dangerous waste containers will typically be managed in the nonradioactive dangerous waste container storage area, or in non-permitted waste management units (satellite accumulation areas and less-than-90-day storage areas) located throughout the WTP. The nonradioactive dangerous waste container storage area will consist of a concrete pad approximately 25 ft by 30 ft. The area may include a metal roof or portable storage buildings such as cargo containers or storage lockers. Containers will be kept closed unless waste is being added, removed, or sampled. They will routinely be moved by forklift or drum cart, and will be managed in a manner that prevents ruptures and leaks. The storage capacity for the nonradioactive dangerous waste container storage area is listed in Table 4-2. The containers in that area may be stacked two high and aisle spacing will be at least 30 in. between rows of containers. Containers stored in this area will be placed on pallets, or otherwise elevated to prevent contact with liquid, if present.

#### 4.2.1.2.2 Waste Tracking

The plant information network interfaces with the integrated control network and is designed to collect and maintain plant information. The plant information network is currently planned to the following systems:

- Plant data warehouse and reporting system
- Laboratory information management system
- Waste tracking and inventory system

Inventory and Batch Tracking

The waste tracking and inventory system will interface with the information system data historian to provide reporting information such as tank volumes, waste characteristics, and facility inventories of process waste. The waste tracking system will also be used to query operations parameters at any time information is needed, as specified by operations, to manage the process system. IHLW canisters and ILAW containers will be tracked within the facility using an operations developed system: for example, manually recording on a board, manually inputting into the information network, or if available automated through the integrated control network.

Secondary Waste Stream Tracking

Containerized secondary waste streams and equipment will be tracked and managed through commercially available database management software. Containers will be mapped in each plant and updated during the inspection process using a commercially available drawing software application.

Laboratory Information Management System

The laboratory information management system (LIMS) will be an integral feature of the plant information network. The LIMS will serve as an essential tool for providing data management of regulatory and processing samples. The chosen LIMS will be a commercial off-the-shelf software package designed for performing laboratory information management tasks as described in ASTM E1578-93, *Standard Guide for Laboratory Information Management Systems (LIMS)*.

The LIMS will track the flow of samples through the laboratory. Samples received in the laboratory will be identified with a unique identification label. The identification label provides details of the sample process stream. Baseline analyses are defined by the requesting plant. Additional analyses, as required, will be input into LIMS by laboratory analysts. Data will be input into LIMS manually or by data transfer using LIMS/instrument interface. Analyses will be performed using approved and validated analytical procedures.

Analytical results will be compiled by the LIMS and held pending checking and approval by appropriate staff. Approved results will be reported to the requesting plant.

#### 4.2.1.3 Container Labeling [D-1c]

Immobilized Waste Glass Containers

Due to the radioactivity and handling requirements of the immobilized waste containers, conventional labeling of the immobilized waste containers will not be feasible and an alternative to the standard labeling requirements will be used. This alternative labeling approach will use a unique alphanumeric identifier that will be welded onto each immobilized glass waste container. The welded “identifier” will ensure that the number is always legible, will not be removed or damaged during container handling, will not be damaged by heat or radiation, emits no gas upon heating when waste glass enters the container, and will not degrade over time.

The identifier will be welded onto the shoulder and side wall of each immobilized glass container at two locations 180 degrees apart. Characters will be approximately 2 in. high by 1.5 in. wide. The identifier will be formed by welding on stainless steel filler material at the time of container fabrication. This identifier will be used to track the container from receipt at the WTP, throughout its subsequent path at the WTP, until it leaves the plant to be disposed or stored.

Each identifier will be composed of eight coded alphanumeric characters. For example, HL123456 would be an immobilized waste glass container storing ILAW with the unique number 123456, and HH123456 would denote an IHLW canister. This unique number will be maintained within the plant information network and will list data pertaining to the waste container including waste numbers and the major risk(s) associated with the waste.

Personnel access into the immobilized glass waste container storage areas will be limited and controlled administratively. Signs designating the hazards associated with the immobilized waste glass will be posted at appropriate locations outside the container storage areas.

Miscellaneous Mixed Waste Containers

The miscellaneous mixed waste containers will be labeled with the accumulation or generation start date, as appropriate, the major risk(s) associated with the waste, and the words “hazardous waste” or “dangerous waste.” A waste tracking and inventory system will be implemented. Labels and markings will be positioned so that required information is visible. The label will meet the WAC 173-303-630(3) requirements, and the dangerous waste number will be clearly identified.

The labels on the overpack for the spent melters will carry the accumulation or generation start date, the major risk(s) associated with the waste, and the words “hazardous waste” or “dangerous waste”. A waste tracking and inventory system will be implemented. Labels and markings will be positioned so that required information is visible, and the dangerous waste number will be clearly identified.

Miscellaneous Dangerous Waste Containers

The miscellaneous dangerous waste drums will be labeled with the accumulation or generation start date, as appropriate, the major risk(s) associated with the waste, and the words “hazardous waste” or “dangerous waste”. A waste tracking and inventory system will be implemented. Labels and markings will be positioned so that required information is visible. The label will meet the WAC 173-303-630(3) requirements, and the dangerous waste number will be clearly identified.

#### 4.2.1.4 Containment Requirements for Storing Waste [D-1d]

Secondary containment requirements for the waste managed in the immobilized waste container storage areas and the limited amount of other materials present are discussed below.

##### 4.2.1.4.1 Secondary Containment System Design [D-1d(1)]

Secondary containment is required for areas in which containers hold free liquids. It is also required for areas managing wastes exhibiting the characteristics of ignitability or reactivity as defined in WAC 173-303-090(5) and (7).

IHLW
Secondary containment requirements do not pertain to the IHLW (canister) container storage area, as these canisters will not contain free liquids or wastes that are designated ignitable or reactive.

Miscellaneous Mixed Waste
Miscellaneous mixed waste storage areas may contain waste requiring secondary containment. If wastes containing liquids or wastes exhibiting the characteristics of ignitability or reactivity are generated, portable secondary containment that meets the requirements of WAC 173-303-630(7) will be provided.

Miscellaneous Dangerous Waste
The nonradioactive dangerous waste storage area may contain waste requiring secondary containment. If wastes containing liquids or wastes exhibiting the characteristics of ignitability or reactivity are generated, portable secondary containment that meets the requirements of WAC 173-303-630(7) will be provided.

##### 4.2.1.4.2 System Design [D-1d(1)(a)]

IHLW
There will be one container storage area for the IHLW canisters in the HLW vitrification plant, as follows:

- IHLW canister storage cave (H-0132)

The IHLW canister storage cave will be located in the HLW vitrification plant, which is designed to be seismically qualified, as outlined in DWP Attachment 51, Supplement 1. A secondary containment system will not be needed because the immobilized glass waste will not contain liquid. In addition, because liquid will not be present in the IHLW container storage area, the floor will not be sloped and will not contain drains or sumps.

Liquid will not be present within the IHLW container storage area for the following reasons:

- Administrative controls will ensure that liquid does not enter inside filled IHLW canisters
- The IHLW container storage area will be completely enclosed with a metal roof
- Penetrations to the storage area will be sealed to prevent water ingress
- Rainwater will be directed away using roof drains

The location of the IHLW container storage areas are shown on general arrangement drawings in DWP Attachment 51, Appendix 10.4.

Miscellaneous Mixed Waste

There will be four miscellaneous mixed waste (secondary waste) container storage areas at the WTP, as follows:

- HLW east corridor El. 0 ft (HC-0108/09/10)
- HLW loading area (H-0130)
- Failed melter storage facility
- Laboratory waste management area (A-0139 and A-0139A)

The HLW waste container storage areas will be located within the HLW vitrification plant. The laboratory waste management area will be located within the analytical laboratory. Therefore, these units will be completely enclosed within the plants, which will have metal roofing, roof insulation, and a vapor barrier. Penetrations to the storage areas will be sealed to prevent water ingress, and rainwater will be directed away using roof drains.

The failed melter storage facility will be used primarily to manage HLW Melters that have completed their useful service life. These units will be received in carbon steel overpack containers allowing limited hands-on contact. These overpacks will not be opened while the waste melters are located in this storage facility. The facility is capable of storing up to three waste melters at any given time. The spent HLW Melters will not be stacked.

The failed melter storage facility may also receive containerized miscellaneous mixed waste, if needed. These waste containers will be sealed prior to transport to the failed melter storage facility. The containers will not be opened while at this storage facility. The waste containers will not be stacked more than two containers high. The failed melter storage facility will be a stand-alone building located in the southern portion of the WTP.

Miscellaneous Dangerous Waste

Waste containing liquid may be present in the nonradioactive dangerous waste storage area. Containers with liquids will be provided with portable secondary containment meeting the requirements of WAC 173-303-630(7).

#### 4.2.1.4.3 Structural Integrity of the Base [D-1d(1)(b)]

The storage areas will be constructed to support storage and transportation of containers within the container storage areas and will be designed with the following:

- Containment system capable of collecting and holding spills and leaks
- Base will be free of cracks and gaps and sufficiently impervious to contain leaks
- Positive drainage control
- Sufficient containment volume
- Sloped to drain or remove liquid, as necessary

#### 4.2.1.4.4 Containment System Capacity [D-1d(1)(c)]

IHLW
Because liquids will not be present in the containment system IHLW storage areas, a containment system capacity demonstration is not required.

Miscellaneous Mixed Waste
The HLW container storage areas do not require secondary containment because storage of liquids in these units is not anticipated. If the waste is found to contain liquid, portable secondary containment will be provided that meets the requirements of WAC 173-303-630(7). The waste container will function as the primary containment while the portable containment device will function as the secondary containment. Each portable secondary containment will have the capacity to contain 10% of the volume of all containers within the containment area, or the volume of the largest container, whichever is greater.

Liquid waste may be stored in the laboratory and waste management area. Each container holding liquid dangerous waste will be placed into portable secondary containment that meets the requirements of WAC 173-303-630(7). The waste container will function as the primary containment while the portable containment device will function as the secondary containment. Each portable secondary containment will have the capacity to contain 10% of the volume of all containers within the containment area, or the volume of the largest container, whichever is greater.

Miscellaneous Dangerous Waste
Waste containing liquid may be present in the nonradioactive dangerous waste container storage area. Each container holding liquid nonradioactive dangerous waste will be placed into portable secondary containment. The waste container will function as the primary containment while the portable sump will function as the secondary containment. Each portable secondary containment will have the capacity to contain 10% of the volume of all containers within the containment area, or the volume of the largest container, whichever is greater. Typically, the waste containers will be steel drums.

#### 4.2.1.4.5 Control of Run-On [D-1d(1)(d)]

IHLW

The IHLW container storage areas will be located in the HLW vitrification plant. The requirements for this section do not apply because the immobilized glass waste container storage areas are within the vitrification plants and therefore will not be exposed to run-on.

Miscellaneous Mixed Waste

Run-on will not reach the interior of the miscellaneous mixed waste storage areas, because they will be located within buildings, which will have roof gutters to remove precipitation.

Miscellaneous Dangerous Waste

Run-on will not reach the interior of the nonradioactive dangerous waste container storage area, because waste will be managed in buildings with walls and roof to remove precipitation.

#### 4.2.1.4.6 Removal of Liquids from Containment System [D-1d(2)]

IHLW

No liquids will be present in the containment system; therefore, the requirements of this section do not apply to the immobilized waste glass container storage areas.

Miscellaneous Mixed Waste

Portable secondary containment sumps will be provided for individual containers that contain liquids. Hand pumps or similar devices will be used to remove liquid released to the portable secondary containments.

Miscellaneous Dangerous Waste

Portable secondary containment sumps will be provided for individual containers that contain liquids. Hand pumps or similar devices will be used to remove liquid released to the portable secondary containments.

**4.2.1.4.7** Demonstration that Containment is not Required because Containers do not Contain Free Liquids, Wastes that Exhibit Ignitability or Reactivity, or Wastes Designated F020-023, F026 or F027 [D-1e]

IHLW

The IHLW glass canister storage area will not contain liquids. The vitrification process volatilizes water or other liquid materials existing at ambient conditions in the waste slurry feed that enters the melter.

The waste numbers for ignitability (D001) and reactivity (D003) will not be managed in the immobilized glass container storage areas. Wastes with the F020-F023, F026, and F027 numbers are not identified for the DST system unit. Therefore, these waste numbers will not be present at the WTP.

Miscellaneous Mixed Waste

Liquids may be present in wastes in the laboratory waste management area. Secondary containment will be provided for individual containers that manage liquids. The laboratory waste management area may manage D001 and D003 waste. Wastes with the F020-F023, F026, and F027 numbers are not identified for the DST system. Therefore, these waste numbers will not be present at the WTP.

Miscellaneous Dangerous Waste
The nonradioactive dangerous waste container storage area may manage liquids and D001 and D003 waste; therefore, secondary containment will be provided. Wastes with the F020-F023, F026, and F027 numbers are not identified for the DST system unit. Therefore, these waste numbers will not be present at the WTP.

**4.2.1.5** Prevention of Reaction of Ignitable, Reactive, and Incompatible Wastes in Containers [D-1f]

Ignitable, Reactive, or Incompatible IHLW
Immobilized glass waste will not be ignitable, reactive, or incompatible with the wastes managed in the IHLW canister storage areas. The requirements of this section are not applicable to the immobilized glass waste containers, including spent melters.

Ignitable, Reactive, or Incompatible Miscellaneous Mixed Waste and Miscellaneous Dangerous Waste
Potentially incompatible wastes are not expected to be managed in the miscellaneous mixed waste storage areas, except for the laboratory waste management area and the nonradioactive dangerous waste container storage area. If such wastes are managed in one of these areas, the containers of incompatible waste or chemicals will not be stored in close proximity to each other. Acids and bases will be stored on separate portable secondary containment sumps; oxidizers will be stored in areas separate from combustible materials; and corrosive chemicals will be stored on a separate secondary containment sump. These separate storage areas within the unit will be clearly marked with signs indicating the appropriate waste to be stored in each area. Potentially incompatible waste will be stored at least one aisle width apart.

### 4.2.2 Tank Systems [D-2]

This section contains descriptive information for each tank system used for managing mixed waste. The term "tank systems" refers to mixed waste storage or treatment tanks and their associated ancillary equipment and containment systems. Figures and permit drawings depicting design features of tank systems are found in DWP Attachment 51.

The following text uses the terms "vessel" and "tank". The term "vessel" is an engineering term and denotes more robust construction than a typical mixed waste storage or treatment tank. The term "vessel" is included due to the use of the term in the American Society of Mechanical Engineers (ASME) codes and specifications, which will be followed for most tank construction at the WTP.

#### 4.2.2.1 Design, Installation, and Assessment of Tank Systems [D-2a]

This section describes the attributes of tank systems that will contain mixed waste. Tanks and ancillary equipment containing only additives or reagents, such as glass-forming chemicals, precipitation reagents, or unused resin, are not regulated under RCRA or the Washington State Dangerous Waste Program, and are therefore not included.

Tank systems that will contain mixed waste are designed to comply with worst-case scenarios, such as extreme pH, temperature, and pressure conditions. The WTP will be entirely new construction, and there will be no "existing tanks" in the plant. Tank systems, with the exception of the two outside tanks at the pretreatment plant, will be located indoors and within process cells, process rooms, or caves with controlled access.

#### 4.2.2.1.1 Design Requirements [D-2a(1)]

Tanks

Most of the tanks that come in contact with the waste will be operated under atmospheric pressure conditions at the WTP. The mixed waste tanks will be designed, at a minimum, to *Boiler and Pressure Vessel Code* (ASME 2000), the American Petroleum Institute (API) codes, or other appropriate design codes. Tank integrity will be reinforced by additional requirements of the tank group and seismic category assignment to each tank.

The vessels will be designed for seismic loading in accordance with the *Uniform Building Code* (UBC) standard for Zone 2B (UBC 1997).

The codes and standards that will be followed for design, construction, and inspection for the tanks are identified below, as applicable:

| | |
|---|---|
| ANSI | American National Standards Institute |
| API | American Petroleum Institute |
| ASME | American Society of Mechanical Engineers |
| ASNT | American Society of Non-Destructive Testing |
| ASTM | American Society for Testing and Materials |
| EPA | US Environmental Protection Agency |
| NBBPVI | The National Board of Boilers and Pressure Vessel Inspectors |
| OSHA | Occupational Safety and Health Administration |
| PFI | Pipe Fabrication Institute |
| UBC | *Uniform Building Code* |
| WRC | Welding Research Council |

Permit documents describing tank design requirements are located in DWP Attachment 51, Appendix 7.7:

- *Specification for Pressure Vessel Design and Fabrication*, 24590-WTP-3PS-MV00-TP001
- *Seismic Qualification Criteria for Pressure Vessels*, 24590-WTP-3PS-MV00-TP002
- *Specification for Pressure Vessel Fatigue Analysis*, 24590-WTP-3PS-MV00-TP003

Piping and Pipe Support Design
The design code of the WTP piping and pipe supports is ASME B31.3 Code (ASME 1996), as well as the DOE seismic requirements. In compliance with DOE seismic requirements (DOE 1996), response spectrum method or UBC (UBC 1997) static method is used for the seismic analysis of the piping systems.

Additional information for piping and pipe support design is included in the following documents, which are included in DWP Attachment 51 Appendices as indicated:

- *Material for Ancillary Equipment*, 24590-WTP-PER-M-02-002 (Appendix 7.9)
- *Piping Material Class Description*, 24590-WTP-PER-PL-02-001 (Appendix 4)
- *Ancillary Equipment Pipe Support Design*, 24590-WTP-PER-PS-02-001 (Appendix 7.5)

#### 4.2.2.1.2 Physical Information for Tanks

Tables 4-3 through Table 4-6 list current tank design information (capacity, materials of construction, and dimensions). The tank systems are grouped by plant and process system.

Tank operation is generally automated. However, operator intervention can be used when human decisions or approval are required for initiation and termination of a process operation. Descriptions of tank system operation for major WTP process systems are identified in sections 4.1 and 4.2.2.

### 4.2.2.2 Ancillary Equipment Requirements [D-2a(1)]

Information concerning ancillary equipment is provided in the following subsections.

#### 4.2.2.2.1 Transfer or Pressure Control Devices

Several fluid transfer devices will be used in the WTP. These devices include mechanical pumps, reverse flow diverters, and steam ejectors. Breakpots and seal pots, although not fluid transfer devices, are an important component of vessel operations. These components are discussed in the following sections.

Mechanical Pumps
Mechanical pumps will be used for operations that require high-flow pumps (such as through the evaporator circuits) or high-pressure head pumps (such as for pumping a waste stream through ultrafiltration circuits). Mechanical pumps will be located in process cells, process rooms, or caves. In general, mechanical pumps will be repaired in place, or removed to a maintenance area. However, remotely maintained pumps will be used in areas where maintenance activities would result in a significant radiation dose to the operators.

For normal process operating sequences, mechanical pumps and associated valves will be controlled by the process control system. In systems where off-normal conditions would require pump shutdown, the design will include an alarm mechanism that will also trip the transfer device. The pump system is designed to allow for the drainage of liquid from the pump, and for the introduction of flush liquids at the end of transfers to reduce residual contamination.

Reverse Flow Diverters

Reverse flow diverters will provide for the maintenance-free pulsed or metered transfer of liquids or slurries throughout the treatment process. A reverse flow diverter does not need to be fully submerged in order to remove the contents of a vessel, and it maintains a small and predictable volume of tank contents following its use. Operation of the reverse flow diverter is cyclical, following timed phases: suction phase, drive phase, and blowdown. The following paragraphs describe a typical reverse flow diverter system arrangement.

*Suction phase:* In the suction phase, the secondary automatic valve A is open, admitting air to the suction jet pump. Valve B is shut and liquid is drawn from the supply tank through the reverse flow diverter and into the charge vessel. The suction ejector is designed so that it cannot produce a vacuum capable of lifting liquid higher than a certain valve known as the "suction lift". After a short time, the liquid reaches this "suction lift" height and stops, then valve A is shut.

*Drive phase:* When valve A is shut, valve B is opened, admitting air to the drive nozzle. Air passes through the nozzle and pressurizes the charge vessel. Liquid is forced across the reverse flow diverter and into the delivery pipe. The delivery pipe is quickly filled with liquid that flows into the delivery vessel.

*Blowdown phase:* When the charge vessel is nearly empty, valve B is shut; no air is supplied to either jet pump. The compressed air in the charge vessel passes back through the paired jet pumps, down the vent pipe, and into vessel vent system.

Shortly after blowdown begins, the pressure in the charge vessel falls below the delivery head, and the flow of liquid into the delivery vessel is halted. The liquid in the delivery vessel then falls back down the pipe, across the reverse flow diverter, and into the charge vessel. After a short time, the pressure in the charge vessel falls to zero (gauge). The cycle is now complete.

Steam Ejectors

Steam ejectors are used to transfer process liquids, or to reduce the operating pressure of a system by gas removal. They empty liquid from vessels by means of suction lift, using a simple control system.

An automated control valve supplies high-pressure steam to the steam ejector. This steam accelerates through a nozzle, creating a differential pressure along a submerged suction leg within the vessel. The pressure than forces the liquid up the suction pipe. This effect is known as *striking*. The steam then conveys the liquid to the destination vessel, normally via a breakpot. Control is established using liquid level instrumentation in the vessel being emptied, and using a temperature indicator, such as a thermocouple, within the breakpot.

Seal Pots
A seal pot is a type of hydraulic seal. A hydraulic seal is used primarily to maintain a separation between vessel vent or offgas systems for feed and receipt vessels. This separation is necessary to prevent migration of airborne contamination between the vessels. Without the seal, airflow could occur due to the different pressures in the vent systems. The seal is a slug of liquid in the interconnecting pipe work that remains after each liquid transfer is completed, blocking airflow between vessels.

The seal can be provided by constructing a simple "U" shape in the piping. Different piping arrangements are used for different purposes. A seal pot is a small vessel with one (inlet or outlet) pipe submerged in the liquid slug in the lower part of the pot, while the other pipe terminates in the top of the pot, above the static liquid level. The pot may be provided with a level indicator or alarm, if necessary, to ensure adequate liquid level. Periodic liquid additions may be needed to maintain the seal, especially if the pipeline is infrequently used.
Breakpots
The main function of the breakpot is to reduce the amount of mixed waste material entrained into the vessel ventilation system. Breakpots are provided on transfer lines that use steam ejectors for moving liquids by pressure flow. These types of transfers create the potential for air entrainment of mixed waste contamination. Breakpots function to convert steam from pressure flow to liquid gravity flow, thereby reducing both the effluent loading on the downstream vessel ventilation treatment system and the mixed waste contamination levels in the vessel vent ductwork. Breakpots also serve a secondary purpose by providing a siphon break for other transfer systems where siphoning could occur.

Breakpots are typically placed at a high point in the discharge line from the steam ejector. Liquid will be pumped into the breakpot through an inlet nozzle in its wall. The incoming liquid will be directed towards a baffle. Within the baffle, noncondensed steam and gases will disengage. The breakpot will be self-draining; the liquid will drain through the breakpot discharge pipe to the destination vessel.

Above the inlet nozzle(s) will be a packed bed where disentrainment of the gas stream will occur. The exiting gas from the packed section will pass into the vessel ventilation system. The packed bed can be washed periodically using a wash ring permanently installed above the packed bed.

#### 4.2.2.2.2 Bulges

Bulges are intended to allow hands-on maintenance of equipment after process fluids are flushed from the bulge piping and components. Bulges provide shielding to personnel during process operation and allow vulnerable or failure prone components to be located outside the process environment. The cell wall provides shielding between the cell and the bulge interior. The bulge includes shielding and contamination control as needed, depending on the process fluid within the bulge piping. A typical bulge consists of a metal frame attached to the cold-side wall of a process cell; the frame is used to support the piping and components as well as the shielding plates (usually steel), which are bolted to the frame.

There are two classifications of bulges used at the WTP. One is a "process" bulge; the other is a "service" bulge. The process bulge contains valves, pumps, piping, etc. The service bulge contains valves used to transfer reagents, steam, etc., to the in-cell process equipment. The design of the two bulges is similar.

Bulges are equipped with several wash systems, facilitating washing both internal and external piping, components, and bulge confinement surfaces. Decontamination of the equipment internals and associated piping is achieved by externally connecting a flushing system located on the outside of the bulge. Wash fluids could be water or more aggressive media such as nitric acid, provided compatibility with the bulge materials is ensured.

Additional information on process bulges may be found in *Process Bulge Design and Fabrication* (24590-WTP-3PS-MX00-TP001), located in DWP Attachment 51, Appendix 7.7.

**4.2.2.2.3 Description of WTP Piping System**

Detailed information on piping is included in *Piping Material Class Description* (24590-WTP-PER-PL-02-001), located in DWP Attachment 51, Appendix 4.

Interplant Piping Transfer Lines
Waste feed from the DST system will be transported to the WTP via the waste transfer lines.

The waste feed transfer lines will be double-walled pipe. The inner pipe will be constructed of stainless steel, while the outer pipe will be constructed of carbon steel. The carbon steel outer pipe will be coated with a corrosion-resistant material. In addition, the coated outer pipe for the waste transfer lines from the DST to the pretreatment plant will be surrounded by insulation and a seamless high-density polyethylene outer shell. This extra layer of protective material will isolate the waste transfer lines from soil. The waste transfer lines between the pretreatment plant and the other WTP process plants will not have this extra barrier from the soil, but will be cathodically protected as described later in this section.

A leak detection system will be provided for the entire length of the waste transfer line. Pumping will be terminated, and reception of waste feed from the DST system unit will stop, when a leak is identified by the leak detection system.

The inner pipe will be supported by guides, saddles, support keys, or anchors within the outer pipe. The inner pipe will transport waste and maintain the pressure boundary, while the outer pipe will provide secondary containment for the inner pipe. The piping system will be buried under a minimum depth of soil for radiation shielding. The minimum depth of soil will be finalized at the detail design phase and will be not less than the 2 ft freeze depth. A heat trace system is not required for pipes buried below freeze depth.

The piping system will have a continuous slope down toward the pretreatment plant. Released liquids resulting from leaks to the outer pipe can be removed as required by WAC-173-640(4)(b). The piping system will be designed to allow water flushing to occur in both directions.

Liquid Effluent Transfer Lines

Liquid effluent generated at the WTP will be routed to the pretreatment plant for recycling through the WTP or disposal to the LERF and ETF. An effluent line will be routed from the pretreatment plant to the LERF and ETF. This line is a buried pipe, constructed of materials that are compatible with the waste, under a minimum 2 ft of soil serving as freeze protection. The pipes will have a continuous downwards slope towards the LERF and ETF, and will be designed to maintain structural integrity. A leak detection system will be provided for the LERF/ETF waste transfer lines.

Intraplant Piping

Within plants, the pipelines associated with the tank system will be single-walled. Secondary containment will be provided for piping within the plants by double-walled pipe or partially lined process cells, process rooms, or caves. If needed, other containment methods such as a bulge or concrete ducts with liners will be provided at appropriate locations. The bulge or concrete ducts will be provided with a low point which will drain to process cells, process rooms, or caves. The leak detection equipment located within the process cells, process rooms, and caves will warn of a piping leak through alarms.

Piping between plants and the two outdoor tanks at the pretreatment plant will be double-walled below grade and below the freeze line, similar to the waste transfer line.

Cathodic Protection

An impressed current cathodic protection system will be used for eliminating or mitigating corrosion on underground piping. The cathodic protection system will maintain a negative polarized potential between the protected pipe and a saturated copper/copper sulfate reference electrode.

The impressed current cathodic protection system uses direct current provided by a rectifier that is powered from the plant's normal 480 Vac power system. The direct current from the rectifier is connected across the buried anode wire and the protected pipe. The current flows from the anode wire, which is positive, through the electrolyte, to the protected pipe, which is negative, completing the electrical circuit.

An annual survey, recommended by NACE International (formerly the National Association of Corrosion Engineers), will be performed on the overall system. Test stations will be provided to permit potential measurements. Additional information on inspections is provided in Chapter 6.

The following waste transfer lines are provided with cathodic protection at the WTP. The waste transfer lines are double encased and constructed of materials that are compatible with the waste:

- Mixed waste transfer lines between the pretreatment plant and the HLW vitrification plant
- Mixed waste transfer lines between the pretreatment plant and the LAW vitrification plant
- Mixed waste transfer line between the analytical laboratory and the pretreatment plant

- The incoming DOE waste feed pipelines that interface with the WTP pipelines are not cathodically protected; therefore, the waste feed lines routed between the DOE interface point and the pretreatment plant (which are similarly configured) are not intentionally cathodically protected. They are, however, bonded at the crossing of the plant service air piping between the pretreatment plant and the HLW vitrification plant on the opposite end (which is adjacent protected piping). The waste feed lines, therefore, may receive small amounts of protective cathodic protection current in the area where they are bonded. This area is defined as the "zone of influence." Bonding is required to eliminate stray electrical currents that may occur in the zone of influence and thereby eliminate the possible corrosion process. The waste feed lines are also provided with test stations at both ends to allow potential tests that will indicate if corrosion is a concern.
- Radioactive/dangerous waste effluent transfer lines to ETF/LERF

##### 4.2.2.2.4 Description of Foundations

Tank systems containing mixed waste will be located indoors in process cells or caves, which will be integral parts of the pretreatment plant, analytical laboratory, the LAW vitrification plant, and the HLW vitrification plant with the exception of two outdoor tanks. Therefore, the design requirements of the tank systems will be met by the structural integrity of the plants. WTP compliance with UBC seismic design requirements, found in DWP Attachment 51, Supplement 1, provides the seismic design requirements for the WTP. The outdoor tanks will be located outside of the pretreatment plant on a protectively-coated concrete pad and concrete berm. The concrete pad for these tanks will be sufficient to support the tanks.

Additional information on the design criteria, load definitions, load combinations, and methodology for the structural design and analysis may be found in *Secondary Containment Design* (24590-WTP-PER-CSA-02-001), located in DWP Attachment 51, Appendix 7.5.

#### 4.2.2.3 Integrity Assessments [D-2a(2)]

A written assessment of the adequacy of the design of tank systems, and miscellaneous treatment systems will be prepared on a system-by-system basis. Separate reports are prepared for tanks, tank system ancillary equipment, and associated secondary containment systems. Each assessment will be reviewed and certified by an independent, qualified, registered professional engineer to attest that the tank and miscellaneous treatment systems are adequately designed for managing dangerous waste. Each assessment will include an evaluation of the foundation, structural support, seams, connections, pressure controls, compatibility of the waste with the materials of construction, and corrosion controls for each mixed waste management system, as appropriate. Assessment reports are located in DWP Attachment 51, Appendix 8.11 for the pretreatment plant, Appendix 9.11 for the LAW vitrification plant, Appendix 10.11 for the HLW vitrification plant, and Appendix 11.11 for the Lab.

#### 4.2.2.4 Additional Requirements for Existing Tanks [D-2a(3)]

Tanks and vessels to be permitted in the WTP will be newly constructed; pre-existing tanks will not be used. Therefore, the requirements of this section do not apply.

### 4.2.2.5 Additional Requirements for New Tanks [D-2a(4)]

Installation of tank systems will be performed in a manner designed to prevent damage to the tank system. The WTP uses an independent, qualified installation inspector, or an independent qualified registered professional engineer to perform tank system installation inspections. Inspection activities will include testing tanks for tightness, verifying protection of ancillary equipment against physical damage and stress, and evaluating evidence of corrosion. The inspections will document weld breaks, punctures, coating scrapes, cracks, corrosion, and other structural defects. Installation inspections will conform to permit requirements and consensus-recognized standards. Inspection findings and corrective actions, as appropriate, will be documented in post-inspection reports.
Additional information describing the installation of tank systems and associated inspections are provided in *Installation of Tank Systems and Miscellaneous Unit Systems,* 24590-WTP-PER-CON-02-001.

#### 4.2.2.5.1 Additional Requirements for New On-Ground or Underground Tanks [D-2a(5)]

The majority of the tanks and vessels to be constructed in the WTP will be located within the pretreatment plant, the analytical laboratory, the LAW vitrification plant, and the HLW vitrification plant. Therefore, the requirements of this section do not apply to the indoor tanks.

The two outdoor Proces Condensate Tanks located at the pretreatment plant (RLD-TK-00006A/B) will be located within a bermed and lined secondary containment system and will not be in direct contact with soil. The design of the outdoor tanks' concrete pad will address backfill, soil saturation, seismic forces, and freeze thaw effects. The ancillary piping for the unit will be in contact with the soil, and the effects of corrosion on the piping will be addressed in the final design.

### 4.2.2.6 Secondary Containment and Release Detection for Tank Systems [D-2b]

This section provides information about the secondary containment for tank systems that will contain mixed waste in the WTP. Descriptions of equipment and procedures used for detecting and managing releases or spills from tank systems are also provided.

A number of documents are provided in appendices to DWP Attachment 51 that provide detailed information regarding the design of the secondary containment system. These documents include the following:

- *Secondary Containment Design*, 24590-WTP-PER-CSA-02-001, located in Appendix 7.5
- *Material Selection for Building Secondary Containment/Leak Detection*, 24590-WTP-PER-M-02-001, located in Appendix 7.9
- *Leak Detection - Sump Level Measurement in Secondary Containment Systems*, 24590-WTP-PER-J-02-001, located in Appendix 7.5
- *Flooding Volume for PT Facility*, 24590-PTF-PER-M-02-005, located in Appendix 8.8
- *Sump Data for PT Facility*, 24590-PTF-PER-M-02-006, located in Appendix 8.5

- *Flooding Volume for 28 Ft Level of PT Facility*, 24590-PTF-PER-M-03-001, located in Appendix 8.8
- *Flooding Volume for LAW Facility*, 24590-LAW-PER-M-02-003, located in Appendix 9.8
- *LAW Facility Sump Data*, 24590-LAW-PER-M-02-001, located in Appendix 9.5
- *Flooding Volume for HLW Facility*, 24590-HLW-PER-M-02-003, located in Appendix 10.8
- *HLW Facility Sump Data*, 24590-HLW-PER-M-02-001, located in Appendix 10.5
- *Sump Data for LAB Facility, 24590-LAB-PER-M-02-002,* located in Appendix 11.5
- *LAB Minimum Leak Rate Detection Capabilities for Leak Detection Boxes, Cell Sumps, and Pit Sumps*, 24590-LAB-PER-M-04-0001, located in Appendix 11.8.
- *Flooding Volume for 56ft Level in PTF,* 24590-PTF-PER-M-04-001, located in Appendix 8.8
- *Flooding Volume for 72ft Level in PTF,* 24590-PTF-PER-M-04-003, located in Appendix 8.8
- *Leak Detection for Underground Transfer Line,* 24590-PTF-PER-M-06-0006, located in Appendix 8.8
- *Flooding Volume for Room P-0150 in the PT Facility,* 24590-PTF-PER-M-04-0008, located in Appendix 8.8.
- *Sump Data for PT Facility – Room P-0150,* 24590-PTF-PER-M-04-0009, located in Appendix 8.8.

#### 4.2.2.6.1 Secondary Containment System Requirements [D-2b(1)]

Most of the tank systems containing mixed waste will be located within the plants, although two tanks will be located outside the pretreatment plant. Tank systems containing mixed waste that are located within the plants will be arranged within process cells, process rooms, caves, or other areas provided with secondary containment liners or coatings. The outside tanks will be located on a coated, bermed, concrete pad within concrete berms that will provide secondary containment.

The secondary containment systems will be designed, installed, and operated to prevent migration of waste or accumulated liquid to soil, groundwater, or surface water. The piping associated with the tank systems will be located in the process cells, process rooms, caves, berms, or bulges. Secondary containment for piping systems will be incorporated into the design.

Tank systems and wet miscellaneous treatment systems will be provided with secondary containment that can contain 100 % of the volume from the largest tank within the containment area. In the Pretreatment plant, the 15 black cells and the hot cell at the 0' (foot) elevation are inter connected through hydraulic connections (open penetrations that interconnect adjacent cells) such that the combined secondary containment volume is available, if necessary, to contain a 100% leak from the largest tank. A leak to the hot cell floor, if large enough, will drain to the overflow vessels in the pit at -45' (foot) elevation and ultimately to the -45' (foot) pit secondary containment if the volume of the overflow vessel(s) is exceeded. Secondary containment areas lined with stainless steel will have a gradient (minimum 1%) designed to channel fluids to a sump. In some cases, there may be more than a single sump. For example, the hot cell in the Pretreatment plant has three instrumented sumps for leak detection. Fire suppression water is included as appropriate in determining the height of the secondary containment. Table 4-11 summarizes the calculated minimum liner height at the four process plants. The flooding volume documents identified above present the secondary containment height for each plant.

A concrete berm with protective coating will be used for the pretreatment plant outdoor tanks. This secondary containment area will be capable of holding 100% of the volume from the largest tank within the berm, plus the precipitation from a 25-year, 24-hour rainfall event, as required under WAC 173-303-640(4)(e)(i)(B).

The WTP uses selected industry standards to ensure secondary containment systems have sufficient strength, thickness, and compatibility with waste. The design includes an engineered structural base to protect against failure resulting both from excess force applied during catastrophic events or settlement, and from the stress of daily operation. In the event of a spill or release, the secondary containment design will prevent released mixed waste from reaching the environment, and will safely contain the waste until it can be transferred to an appropriate collection tank.

The following subsections provide detailed descriptions of typical secondary containment systems that will be used at the WTP.

Process Cells

Process cells will be located within process plants. Process cells will typically be constructed of concrete walls to protect plant operators and the environment from radiological exposure and to prevent migration of waste or accumulated liquid to soil, groundwater, or surface water. Operator access to the process cells will not be allowed during normal operations.

Black Cells

A black cell is a type of process cell that may contain vessels, evaporators, and piping systems that are used to support process waste stream storage and blending functions. No active equipment (i.e., equipment with moving parts) components are located in the black cell. The design for the vessels and piping is all welded construction. Some instrumentation (e.g., thermocouples, radiation detectors) are remotely replaceable by insertion into sealed pipe wells. The black cell vessels and design do not possess design features for remote replacement. The black cell concept is used in areas where the risk of vessel or piping failure due to corrosion or erosion is low. The WTP Pretreatment plant contains fifteen black cells and the HLW Vitrification plant contains three black cells.

Hot Cell

Alternatively, a hot cell is a type of process cell that contains active equipment and will periodically need to be remotely accessed for equipment maintenance or replacement.

All process cells will be provided with secondary containment as required. The floor will be sloped to a collection sump to allow for collection and removal of accumulated liquid within the sump.

Process Rooms

Process rooms will be located in the LAW vitrification plant and will be very similar to process caves. Access to process rooms will not be allowed during normal operations. However, access will be allowed for certain areas within WTP for nonroutine operations such as equipment replacement or maintenance. Process rooms will be provided with secondary containment as required. Systems within process rooms that manage mixed waste will have secondary containment (for example, the locally shielded melter and piping).

Caves

Caves will be located within process plants. Caves will typically be constructed with concrete walls thick enough to protect personnel from exposure to mixed waste. Caves will house mechanical handling equipment designed for remote operation and maintenance. They will generally have viewing windows and closed circuit television to allow observation of the cave operations and for overseeing remote maintenance. The cave floors and portions of the walls will be provided with secondary containment as required. The floor of the cave will be sloped to a collection sump to allow for collection and removal of accumulated liquid within the sump.

Berms

Concrete berms will be used at the LAW plant for the Condensate Collection Tank (LVP-TK-00001) and the two outdoor Process Condensate Tanks (RLD-TK-00006A/B) at the pretreatment plant. The berms will be of sufficient structural strength and height to contain the 100 % of the volume of the largest tank plus, for the outdoor Process Condensate Tanks, the amount of precipitation that results from the 24-hour, 25-year storm event. A protective coating will be applied to the concrete pad and a portion of the berms to prevent contaminant penetration into the concrete. The containment system will be designed to allow for the discharge of storm water after visual or other testing.

Sump and Secondary Containment Drain Systems

The sump and secondary containment drain systems for the three process plants and the analytical laboratory are described in the following sections. Systems will monitor and collect liquids managed in the system. Sumps and secondary containment drains will be provided with a stainless steel liner or equivalent to act as the secondary containment. The sumps within the process areas will provide a low point for each secondary containment. The sumps will serve the following functions:

- Low point containment
- Removal of material by means of sump emptying ejectors or pumps
- Sampling of material by means of sump sampling ejectors

The following sections describe the type of sump used at the WTP and the secondary containment drains.

***Dry Sumps***

Dry sumps are part of the secondary containment system provided for tank systems and wet miscellaneous treatment systems. Sumps are located at a low point in the secondary containment systems, and are equipped with leak detection instrumentation and corresponding alarm. Mechanical or fluidic pumps are used to remove liquid that may accumulate in the sump. Details of each sump are included in the sump data documents identified at the beginning of section 4.2.2.6.

***Secondary Containment Drains***

Many of the bulges and some process areas will have secondary containment drains with remotely-removable plugs. This type of liquid collection system will be located in a low spot in the cell formed by the sloping floor. Liquid detection instrumentation will be present on the top of a remotely removable plug. After the plug is removed, liquid collected will gravity-drain to a collection vessel with a tank level indicator. The liquid managed could be waste released from a tank system, including ancillary equipment, or water used to wash the exterior of tanks or the walls of the room.

Design Requirements
The process cells, process rooms, or caves with mixed waste vessel or tank systems will be partially lined with stainless steel, which will cover the floor and extend up the sides of the process cell or cave to a height that can contain 100 percent of the volume from the largest tank within the process cell or cave. The height of the liners will not take into account fire suppression material, as the tanks will not manage ignitable waste. The concrete surfaces of the ceiling and the wall above the liner will be covered with a coating that is compatible with the waste feed to provide a splash shield zone. A sealant, compatible with the liner and the waste feed and wall coating, will be used to seal the liner-to-wall interface. Table 4-11 presents the calculated minimum liner height at the four process plants. Calculations for the liner size necessary in each cell and cave are available upon request.

A concrete berm with protective coating will be used for the pretreatment plant outdoor tanks. This secondary containment area will be capable of holding 100 % of the volume from the largest tank within the berm, plus the precipitation from a 25-year, 24-hour rainfall event, as required under WAC 173-303-640(4)(e)(i)(B).

The WTP uses consensus-recognized standards to ensure that the process cells, process rooms, caves, or berms provide secondary containment with sufficient strength, thickness, and compatibility with waste. The design includes an engineered structural base to protect the cells, caves, berms and tank systems against failure resulting both from excess force applied during catastrophic events or settlement, and from the stress of daily operation. In the event of a spill or release, the structural and foundation design for tank and process cells, process rooms, caves and berms will prevent released mixed waste from reaching the environment, and will safely contain the waste until it can be transferred to an appropriate collection tank.

**4.2.2.6.2 Management of Release or Spill to Sump and Secondary Containment Drain Systems [D-2B(1)] .**

The WTP uses dry sumps as part of the secondary containment and leak detection systems.

Sumps are instrumented to inform the operator to investigate the cause of the liquid detected in the sump. Secondary containment systems are sloped to direct flow of leaks or spills to the sump. To remove liquid from the sumps in a timely fashion, sumps will be equipped with mechanical or fluidic pumps.

Detection of liquid in the sump will be investigated to determine its cause. Mixed waste released from the primary system and collected in the sumps will be removed within 24 hours, or in as timely a manner as possible. If the released material cannot be removed within 24 hours, Ecology will be notified.

**4.2.2.6.3 Additional Requirements for Secondary Containment [D-2b(2)]**

Ecology considers the WTP dangerous waste storage tanks to have vault-type secondary containments that have either of the following configurations that the Department of Ecology has approved as equivalent to a coating/water stop system.:

- an impermeable interior coating that is compatible with the stored waste and a polymeric filler material at interior corners and construction joints that performs a function equivalent to a water stop,
- a welded stainless steel liner attached to walls and floors.

Ancillary equipment such as piping is addressed within section 4.2.2. Other types of ancillary equipment such as pumps, seal pots, and reverse flow diverters are provided with secondary containment. Inspection of ancillary equipment is addressed in Chapter 6.

**4.2.2.7 Variances from Secondary Containment Requirements [D-2c]**

No variances from secondary containment requirements are sought for the WTP tank systems. Tank systems will be provided with secondary containment as identified in the flooding volume documents described in the previous sections.

**4.2.2.8 Tank Management Practices [D-2d]**

The following provides the basic philosophy for the WTP vessel overflow systems. Three types of barriers exist to prevent overfill of process equipment: preventive controls, detectors, and regulators. Preventive controls promote controlled filling within normal process ranges. Detectors recognize if a vessel is being overfilled and alert an operator. Lastly, if preventive controls and detectors fail to stop overfill from occurring, regulators trip a control sequence that stops inflow and/or initiates outflow. The principal design concept to control vessel overflow is to prevent an overflow from occurring. The engineering design will minimize the likelihood of tank, ancillary equipment, and containment system overflows, and over-pressurization, ruptures, leaks, corrosion, and other failures.

In general, overflows will be prevented by inventory control in conjunction with level monitoring. The fluid levels in a vessel will be maintained within low- and high-level ranges. Appropriate alarm settings will be used to note deviations from the designed settings. Automatic trip action will be designed to shut down feed to the vessel when the high-level settings are exceeded. These automatic trip actions will be provided for vessels with the potential for high operational and environmental impact in case of an accident or release.

Most of the WTP tank systems will be designed to incorporate minimal or zero maintenance requirements and will be based on a design life of approximately 40 years. The design emphasis of zero maintenance will minimize the likelihood of spills and overflows in the tank systems. In the event that the process controls fail to prohibit vessel overfilling, engineered overflows will be provided to prevent liquid from entering the vessel ventilation systems. Vessels that are nominally operating at atmospheric pressure will have a suitable gravity or engineered overflow system, unless an overflow can be shown not to be possible. Vessels or systems that normally operate at above atmospheric pressures will not be provided with overflows.

The following principles apply when designing an engineered overflow system:

- The overflow system for vessels must be instantaneously and continuously available for use.
- Overflowed process streams must be returned to the waste treatment process.
- Overflow systems must meet the requirements of WAC 173-303*, Dangerous Waste Regulations*, Section 640, Tank Systems. In meeting these requirements, overflowing direct to the cell floor will only be considered as the last overflow in a cascaded system. Where an overflow is from a vessel to the cell, the overflow system will maintain segregation of the cell and vessel ventilation systems. The compatibility of the overflowing liquid and the recipient vessel will be considered.
- A vessel overflow line is sized to handle the maximum inflow to the vessel without the liquid level in the overflowing tank reaching an unacceptably high level. No valves or other restrictions are permitted in the overflow line. This line is also designed to prevent the buildup of material that could cause blockages.
- The overflow receiver is sufficiently sized to contain the overflow.
- Inspections will be performed on the various tank and overflow systems, using the example schedules described in DWP Chapter 6.

#### 4.2.2.9 Labels or Signs [D-2e]

Tanks managing mixed or dangerous waste will be labeled according to the requirements of DWP permit conditions DWP III.10.E.5.e, for routinely non-accessible tanks, and DWP III.10.E.5.f, for tanks not addressed in DWP III.10.E.5.e.. They will inform employees and emergency personnel of the types of waste present, warn of the identified risks, and provide other pertinent information.

#### 4.2.2.10 Air Emissions [D-2f] and [D-8]

This section describes air emissions from vessel ventilation systems and reverse flow diverter exhausts. Organic emissions from vents associated with evaporator or distillation units are also discussed.

##### 4.2.2.10.1 Tank System Emissions [D-2f]

Most of the tanks will be connected to a vessel ventilation system to collect vapors. Vessel vents will be located on major tanks, breakpots, and other small vessels. Exhaust from reverse flow diverters and pulse jet mixers will also be collected.

##### 4.2.2.10.2 Process Vents [D-8a]

The air emission regulations, specified under WAC 173-303-690 and 40 CFR 264 Subpart AA, apply to process vents associated with distillation, fractionation, thin-film evaporation, and air or steam stripping operations that manage mixed waste with total organic carbon concentrations of at least 10 parts per million by weight. The WTP does not use these regulated processes; therefore, this regulation does not apply to the WTP.

##### 4.2.2.10.3 Equipment Leaks [D-8b]

Regulations provided in WAC 173-303-691 and 40 CFR 264 Subpart BB contain the "Air Emission Standards for Equipment Leaks". These air emission standards do not apply to the WTP because waste feed entering the WTP contains less than 10% total organic carbon by weight and is excluded under 40 CFR 264.1050(b).

##### 4.2.2.10.4 Tanks and Containers [D-8c]

The regulations specified under WAC 173-303-692 and 40 CFR 264 Subpart CC do not apply to the WTP mixed waste tank systems and containers. These tanks and containers qualify as waste management units that are "used solely for the management of radioactive dangerous waste in accordance with applicable regulations under the authority of the Atomic Energy Act and the Nuclear Waste Policy Act" and are excluded under 40 CFR 264.1080(b)(6). Containers bearing nonradioactive, dangerous waste, such as maintenance and laboratory waste, that is not excluded under 40 CFR 264.1080 (b)(2) or 40 CFR 264.1080(b)(8), will comply with the tank and container standards specified under 40 CFR 264 Subpart CC.

#### 4.2.2.11 Management of Ignitable, Reactive and Incompatible Waste in Tanks [D-2g] and [D-2h]

Mixed waste from the DST system unit will initially be designated as both ignitable (D001) and reactive (D003). The D001 and D003 waste numbers will be as described in the waste analysis plan in DWP Attachment 51, Appendix 3A. The vessels will be located in a manner that meets the National Fire Protection Association (NFPA) buffer zone requirements for vessels, as contained in Tables 2-1 through 2-6 of the *NFPA-30 Flammable and Combustible Liquids Code*

(NFPA 1981). The vessels will be designed to store the waste in such a way that it will be protected from materials or conditions that could cause the contents to ignite or react. Vessel contents will be constantly mixed and will be actively vented to process stacks, which will be equipped with vapor collection and treatment systems that will manage emissions. Further information on waste numbers is contained in DWP Attachment 51, Appendix 3A.

Ignitable or reactive waste may be generated from laboratory or maintenance activities. This waste will be accumulated and managed in compliance with regulatory requirements, in approved containers. Potentially incompatible waste generated from laboratory or maintenance activities will not be stored in the tank systems.

A potential for incompatibility may exist, for example when nitric acid is used to elute waste components from ion-exchange column resins that were previously regenerated with sodium hydroxide. To minimize a reaction, water flushes will be performed between batches.

Process reagents that could react with waste in the tank systems will be stored in areas that are separated by physical barriers from process tanks. Potentially incompatible wastes generated from laboratory or maintenance activities will not be stored in proximity to each other in the tank systems.

### 4.2.3 LAW and HLW Miscellaneous Treatment Sub-Systems [WAC 173-303-680 and WAC 173-303-806(4)(i)]

The LAW vitrification system and HLW vitrification system consist of the vitrification melters, offgas treatment equipment, and associated equipment. The melters immobilize mixed waste in a glass matrix. The LAW vitrification systems and the HLW vitrification system contain two melters each. The following sections provide additional information on the vitrification systems.

Other miscellaneous treatment sub-systems, and their associated process control features, are described in section 4.2.2.

#### 4.2.3.1 Melter Capacity and Production

For the melters, throughput is defined on the basis of quantity of glass waste produced. In turn, the quantity of glass waste produced depends on the degree to which the feed can be incorporated into the glass matrix. The maximum design throughput of the LAW Melter systems will be approximately 15 metric tons per day of glass waste for each melter and approximately 30 metric tons per day. The production rate of the HLW Melters is approximately 3 metric tons per day for each melter and approximately melter 6 metric tons per day throughput.

#### 4.2.3.2 Description of Melter Units [WAC 173-303-806(4)(i)(i)]

The LAW Melter systems are located in the melter galleries and the HLW Melters are housed within the melter caves as depicted in the general arrangement plan and section permit drawings, which are found in DWP Attachment 51, Appendix 9.4 for the LAW vitrification plant and Appendix 10.4 for the HLW vitrification plant. The following subsections provide detailed descriptions of the melter units.

Low-Activity Waste Melter Units

Figure 4A-48 provides a sketch of an LAW Melter. Each LAW Melter (LMP-MLTR-00001/2) is a rectangular furnace, lined with refractory material, with an outer steel casing. An additional outer steel casing with access panels will be provided to enclose the LAW Melter. This outer steel casing is designed to provide local shielding and containment. Each LAW Melter has a nominal design capacity of approximately 15 metric tons of glass waste per day. Each will have a molten glass surface area of approximately 108 $ft^2$. Each of the two LAW melters has external dimensions of approximately 26 × 21 × 16 ft high, and weighs approximately 270 metric tons empty and 290 metric tons with glass. The operating temperature of the melter is between 1100 °C and 1200 °C.

The locally shielded LAW Melter (LMP-MLTR-00001/2) will be operated and maintained in a personnel access area. The melter will be maintained at a lower pressure than the surrounding room to prevent escape of contaminants. Consumable melter parts will be replaced through access panels. The melters will be transported in and out of the gallery on a rail system. A transporter will move the melters to and from the LAW vitrification plant.

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.

The refractory package is housed in a steel shell and provides containment for the molten glass. Active cooling on the exterior of the melter is provided by water jackets. The water jackets will be in the intermediate loop of a two-loop system that will transfer heat from the LAW Melter through heat exchangers to cooling towers. The intermediate loop containing the water jacket will be a closed system that isolates the water circulating through the water jacket from the water in the cooling water loop circulating to the cooling tower. Mixed waste material leaking into the intermediate loop cooling water will be prevented from becoming an inadvertent discharge via the cooling tower. The refractory package will provide adequate containment if there is a temporary loss of cooling. Penetrations in the melter system are sealed using appropriate gaskets and flanges. This system is designed for plenum temperatures of up to 1,100 °C. The LAW melter lid is composed of steel and refractory material layers.

Each LAW Melter (LMP-MLTR-00001/2) will use two independent discharge chambers. An air lift pumps molten glass from the bottom of the melter pool, through a riser, into a discharge chamber, and pours it into an ILAW container. The ILAW is then allowed to cool, forming a highly durable borosilicate glass waste form within the container.

Spent LAW Melters will initially be managed within the LAW melter gallery containment building unit. Spent LAW Melters will be removed from the melter gallery and transported using a transport and rail system. If necessary, the melter exterior surfaces will be decontaminated prior to transfer to a Hanford Site TSD unit.

High-Level Waste Melter Units

Figure 4A-54 provides a sketch of an HLW Melter. Each HLW Melter (HMP-MLTR-00001/2) is a rectangular furnace, lined with refractory material, with outer casings. They have four compartments: a glass tank, two discharge chambers, and a plenum just above the glass tank. The tanks are lined with refractory material designed to withstand corrosion by molten glass.

The HLW Melter systems consist of two melters. Each HLW Melter (HMP-MLTR-00001/2) is designed for glass production rates up to 3 metric tons per day (MTG/d). The normal operating temperature of the melter is between 1100 °C and 1200 °C. The HLW Melters have a molten glass surface area of approximately 40 $ft^2$. The HLW Melters have external dimensions of approximately 11 ft high × 14 ft deep × 14 ft wide. The glass contained in a full HLW Melter has a volume of approximately 145 $ft^3$ and weighs approximately 9.1 metric tons. An entire melter, including the supporting structure and transport mechanism, weighs approximately 90 metric tons empty and approximately 99 metric tons full.

The HLW Melters (HMP-MLTR-00001/2) have been designed to be remotely operated and maintained. Remote maintenance will be performed by a power manipulator, overhead crane, and auxiliary hoist, or by through-wall master-slave manipulators. The melter will be positioned within the HLW vitrification plant for ease of access and viewing of both discharge chambers during operations, and for viewing access to the melter lid to facilitate removal and replacement of subcomponents, if needed. A rail and bogie transport system will facilitate remote removal and replacement of the entire melter structure.

The HLW Melters (HMP-MLTR-00001/2) will use a refractory package similar to the LAW melter to contain the molten glass. The refractory package is designed to serve as a mechanical, thermal, and electrical barrier between the molten glass inside the melter and the melter shell.

The HLW Melters will also use an outer shell, which, with the refractory package, will contain the molten glass and melter offgas. Active cooling on the exterior of the melter will be provided by a water jacket, which will be in a two-loop system that will transfer heat from the HLW Melter through heat exchangers to cooling towers. The loop containing the water jacket will be a closed system that isolates the water circulating through the water jacket from the water in the cooling water loop circulating to the cooling tower. Mixed waste material leaking into the intermediate loop cooling water will be prevented from becoming an inadvertent discharge through the cooling tower. The refractory package will provide adequate containment should there be a loss of cooling. The HLW Melter lid will be constructed of a steel outer shell and insulated from the melter plenum by refractory material.

The HLW Melter will use two independent discharge chambers. Discharge will be achieved by transferring the molten glass from the bottom of the melter pool, through a riser, from which it will be poured into a stainless steel IHLW canister. Glass waste transfer will be accomplished through air lifting. The IHLW will then be allowed to cool, forming a highly durable borosilicate glass waste form.

Waste HLW Melters will be removed from the melter cave and placed in an overpack. The spent melter will be treated as newly generated waste, and will initially be managed within the HLW melter containment buildings. If necessary, the overpack will be decontaminated using a dry process. Waste HLW Melters will be stored in the melter storage facility.

#### 4.2.3.3 Automatic Waste Feed Cut-Off System

The LAW and HLW Melters will be equipped with the ability to cut off waste feed. Automatic waste feed cut-off systems terminate feed to the Melter if a specified operating condition is exceeded. This design approach is consistent with the WAC 173-303-680 regulatory requirements.

The LAW (LMP-MLTR-00001/2) and HLW (HMP-MLTR-00001/2) Melters are fed via air displacement slurry pumps that utilize pressurized air as the motive force. These pumps supply feed to the melters in slugs that act to keep lines from plugging. The feed is injected into the melters through the feed nozzles on top of the Melter creating a "cold cap", where waste feed undergoes several physical and chemical changes. The glass product in the melter is then "air lifted" through the discharge chamber and into the glass container. Melter offgas is generated from the vitrification of LAW and HLW of which the rate of generation is dynamic and not steady state. The offgas is then carried away and treated via a dedicated offgas system.

The melter systems are designed to minimize the need for automatic waste feed cut-off functions. Control of melter level and plenum pressure, process alarming, and optimized operating procedures will be in place to reduce the occurrences of interlocking. Given the processing speeds and the relatively slow rates of change in the operating states of the melter, operators should have adequate time to react to upset conditions. An example of the slow rate of change can be seen in the volume of feed per air displacement slurry pump feed cycle when increasing melter level. Each pump cycle adds approximately 1 gallon of slurry into the melter. At 1 gallon of volume, the liquid level rises no greater than 0.01 in. inside the melter. This provides ample time for operator response.

Previous operating experience with similar melters has shown that two types of operating conditions existed that warranted automatic waste feed cut off: 1) high melter pressure and 2) high melter glass level. These interlocks have been sufficient to allow continued melter operations without inadvertent feed cut off signals, yet provide a sufficient safety margin.

#### 4.2.3.4 Offgas Treatment System

The offgas treatment system will remove steam, aerosols, entrained particulates, decomposition products, and volatile contaminants that are generated from the vitrification processes and the vessel ventilation systems. The principal constituents contained in the melter offgas stream are as follows:

- Nitrogen oxides from decomposition of metal nitrates in the melter feed
- Chloride, fluoride, and sulfur as oxides, acid gases, and salts
- Particulates and aerosols

- Entrained feed material and glass

A detailed description of the current offgas treatment trains for the LAW (LMP-MLTR-00001/2) and HLW (HMP-MLTR-00001/2) Melters is provided in sections 4.1.4 and 4.1.5, respectively.

#### 4.2.3.5 Miscellaneous Unit Emissions Performance

The WTP melter systems are thermal treatment units classified as miscellaneous units in Washington Administrative Code (WAC) 173-303-680. The dangerous waste regulations require that permits for miscellaneous units include such terms, conditions, and provisions that are necessary to protect human health and the environment and are appropriate for the miscellaneous unit being permitted. Ecology has determined that regulations that are most appropriate to apply to the melters and offgas systems (melter systems) are found in the tank requirements (WAC 173-303-640) and applicable sections of the incinerator requirements (WAC 173-303-670) and 40 CFR Section 63.1203. As applied to the melter systems, the tank regulations primarily provide requirements for structural integrity, material compatibility, secondary containments, etc. The incinerator regulations primarily provide operational requirements for parameters such as temperature, pressure, feed rate, demonstration testing, and performance standards. etc. Ecology determined and incorporated into the final WTP Dangerous Waste Permit issued in September 2002 the standards specified in 40 CFR Section 63.1203 in the following table apply to the WTP melter system miscellaneous units.

| Miscellaneous Unit Emissions Performance Standards | |
|---|---|
| **Pollutant** | **Ecology-directed requirement** |
| PODC | 99.99% DRE |
| Dioxins and Furans | 0.20 ng TEQ/dscm |
| Mercury | 45 µg/dscm |
| Lead and Cadmium | 120 µg/dscm, combined emissions |
| Arsenic, Beryllium, Chromium | 97 µg/dscm, combined emissions |
| Carbon Monoxide and Hydrocarbons | Carbon monoxide not in excess of 100 ppmv over an hourly rolling average, dry basis, and hydrocarbons not in excess of 10 ppmv over an hourly rolling average, dry basis, and reported as propane, at any time during the DRE test runs or their equivalent, or hydrocarbons not in excess of 10 ppmv, over an hourly rolling average, dry basis, and reported as propane |
| Hydrochloric Acid and Chlorine Gas | 21 ppmv, combined emissions, expressed as hydrochloric acid equivalents, dry basis |
| Particulate Matter | 34 mg/dscm |

| Miscellaneous Unit Emissions Performance Standards | |
|---|---|
| **Pollutant** | **Ecology-directed requirement** |
| • TEQ is dioxin/furan toxicity equivalence defined in 40 CFR 63.1201(a)<br>• dscm is dry standard cubic meter<br>• ppmv is parts per million by volume<br>• Rolling average is the average of all 1- minute averages over the averaging period [40 CFR 63.1201(a)] | |

DOE intends that the melter systems be designed and constructed so that they operate in compliance with the appropriate and applicable standards. Environmental performance demonstrations during cold commissioning of the HLW and LAW vitrification plants will be used to verify compliance with the DRE and other as applicable air emission standards. The final WTP Dangerous Waste Permit issued in September 2002 also requires periodic demonstration testing will be performed after the WTP has begun processing radioactive wastes (Ecology, 2001).

#### 4.2.3.6 Physical and Chemical Characteristics of Waste [WAC 173-303-680(2)(a)(i)]

A description of the waste characteristics of the LAW and HLW feeds is presented in DWP Attachment 51, Chapter 3 (see Appendix 3A). The immobilized waste generated by the vitrification processes will be in the form of glass that maintains its chemical and physical integrity during long-term storage. The waste analysis plan (Appendix 3A) describes the types and frequency of analysis that will be performed on the glass waste.

#### 4.2.3.7 Treatment Effectiveness Report [WAC 173-303-806(4)(i)(iv)]

A treatment effectiveness report evaluating the performance of the miscellaneous treatment sub-systems, and their effectiveness in treating the LAW and HLW, will be located in DWP Attachment 51, Appendix 9 for LAW and Appendix 10 for HLW. The report will use the results of the environmental performance demonstration and the risk assessment activities to document treatment effectiveness of miscellaneous treatment sub-systems.

#### 4.2.3.8 Environmental Performance Standards for Melter Systems [WAC 173-303-680(2)]

An environmental performance demonstration will be conducted to demonstrate the efficiency of the LAW and HLW Melter systems and their respective air pollution control systems. Emissions from the LAW and HLW systems will be sampled and analyzed during an environmental demonstration performed during cold commissioning. The data developed during the environmental performance demonstration will support the screening-level risk assessment, which will support the development of environmental performance standards for the LAW and HLW Melter systems.

The operational activities of the WTP include methods intended to ensure proper performance of equipment and processes. These methods include sampling of materials, use of direct process controls, development of equipment life specifications and ongoing maintenance.

**4.2.3.8.1 Protection of Groundwater, Subsurface Environment, Surface Water, Wetlands and Soil Surface [WAC 173-303-680(2)(a) and (b)]**

The LAW Melters will be located in the LAW melter gallery (L-0112) within the LAW vitrification plant. The HLW Melters will be located in the HLW melter caves (H-0117, H-0106) within the HLW vitrification plant. Both plants are designed to comply with standards that ensure protection of the surface and subsurface environments. The vitrification plants will be completely enclosed and are designed to have sufficient structural strength and corrosion protection to prevent collapse or other structural failure. In addition, the melter systems, melter feed systems, and related piping will be provided with secondary containment, to minimize the potential for release. The LAW melter gallery (L-0112) and the HLW melter caves (H-0117, H-0106) will be permitted as containment buildings and are described in section 4.2.4.

Floors within the vitrification plants will be protected in a manner consistent with the intended usage of the space. The floor and portions of the walls of HLW Melter cave will be partially lined with stainless steel. Nonradioactive materials usage areas requiring heavy equipment will have concrete floors with hardener and sealer finishes.

The *Hanford Facility Dangerous Waste Permit Application General Information Portion*, section 5.4 (DOE-RL 1998), provides climatological data, topography, hydrogeological and geological characteristics, groundwater flow quantity and direction, groundwater quality data, and surface water quantity and quality data for the area around the WTP.

**4.2.3.8.2 Protection of the Atmosphere [WAC 173-303-680(2)(c)]**

A risk assessment will be performed to evaluate the impacts of the WTP emissions on human and ecological receptors. Actual offgas emissions will be measured during an environmental performance demonstration that will be performed as part of the WTP commissioning activities. The data will be used during a screening-level risk assessment that will be performed to determine ecological and human health risk. The emissions data and the results of the screening level risk assessment will be used to establish operating conditions for the melters that do not endanger human health and the environment.

**4.2.3.9 Approach to Risk Assessment [WAC 173-303-680(2)(c)(i) through (vii)]**

A screening level risk assessment is being conducted to evaluate any possible human health and ecological risk posed by the thermal treatment of mixed wastes. The risk assessment will provide information about the potential terrestrial, aquatic, and food pathways for exposure of human and ecological receptors to dangerous waste constituents. This risk assessment will present the quantitative methods, detailed assumptions, and numerical parameters that will be used to estimate the nature, extent, and magnitude of potential risks from operation of the WTP. The primary regulatory guidance followed for this risk assessment is found in the *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (EPA 1998a) and the *Screening-Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (EPA 1999a)

Treated air emissions through the stack will be the only planned direct releases into the environment from the WTP. Other waste streams will be transferred to a permitted facility and will not be released directly into the environment. Thus, the overall risk assessment process will focus primarily on air emissions.

Major components of the human health and ecological risk assessment process for evaluating airborne emissions will be as follows:

- Risk assessment work plan
- Pre-demonstration test risk assessment
- Final risk assessment

The overall approach for the risk assessment will be to identify potential risks associated with various receptors, their locations, exposure pathways, and activity patterns in two broad exposure scenarios, as follows:

- Plausible exposure scenario
- Worst-case exposure scenario

The plausible exposure scenarios will be based on where potential receptors currently exist or may reasonably be expected to exist within the foreseeable future. The worst-case assumptions will be based on locations of maximum concentration even though it is not expected that such receptors will ever actually exist at these locations. Both scenarios will reflect current uses of the surrounding land and habitat and reasonable assumptions about future uses of the land and habitat.

During the environmental performance demonstration, emission samples will be collected and analyzed, and the data will be used to evaluate risk to the human population and ecological (such as wildlife) receptors. Operating conditions will be established for the WTP, which limit risks to human health and the environment to acceptable levels.

### 4.2.4 Containment Buildings

This section describes how these units are designed and operated, in accordance with the requirements of WAC 173-303-695, which incorporates 40 CFR 264 Subpart DD, "Containment Buildings", by reference. Regulatory citations in this section list the applicable section of the CFR to make it easier for readers to find the requirement. A typical containment building is illustrated in Appendix 4A, Figure 4A-59.

There are twenty containment buildings at the WTP: four located within the pretreatment plant; six in the LAW vitrification plant; and ten in the HLW vitrification plant. The regulated units are:

- Pretreatment hot cell containment building (P-0123)
- Pretreatment maintenance containment building (PM0124, P-0121A, P-0122A, P-0123A, P-0124, P-0124A, P-0125, P-0125A, P-0128, P-0128A)
- Pretreatment filter package maintenance containment building (P-0223)
- Pretreatment air filter package containment building (P-0335)
- LAW LSM gallery containment building (L-0112)
- ILAW container finishing containment building (L-0109B,L-0109C, L-0109D, L-0109E, L-0115B, L-0115C, L-0115D, L-0115E, L0116A)
- LAW vitrification plant consumable import/export containment building (L-0119B)
- LAW vitrification plant C3 workshop containment building (L-226A)
- LAW pour cave containment building (L-B015A, L-B013C, L-B013B, L-B011C, L-B011B, and L-B009B)
- LAW container buffer storage containment building (L-B025C, L-B025D)
- HLW melter cave no. 1 containment building (H-0117, H-0116B, H-0310A)
- HLW melter cave no. 2 containment building (H-0106, H-0105B, and H-0304A)
- IHLW canister handling cave containment building (H-0136)
- IHLW canister swabbing and monitoring cave containment building (H-0133)
- HLW vitrification plant C3 workshop containment building(H-0311A, H-0311B)
- HLW filter cave containment building (H-0104)
- HLW pour tunnel no. 1 (H-B032)
- HLW pour tunnel no. 2 (H-B005A)
- HLW drum swabbing and monitoring area (H-0126A, H-0126B, H-B028)
- HLW waste handling area (H-410B, and H-411)

Table 4-12 summarizes the units within the WTP. The following figures and drawings found in DWP Attachment 51 provide further detail for the WTP containment buildings:

- Figure 4A-59 depicting common features of containment buildings
- General arrangement figures and drawings showing locations of containment buildings
- Waste management area figures showing containment building locations to be permitted

Control of fugitive emissions from containment buildings is described in *Fugitive Emissions Control Description* (24590-WTP-PER-HV-02-001).

The following sections address each of the containment buildings.

#### 4.2.4.1 Pretreatment Hot Cell Containment Building (P-0123)

The first containment building in the pretreatment plant is located in the central portion of the pretreatment plant and stretches nearly the entire length of the building.

The process equipment is remote handled in case of failure and is removed by an overhead crane or powered manipulator. Manipulators assist in the decontamination and remote repair. The unit also contains a crane and powered manipulator repair area. The failed equipment is placed inside disposal boxes and transported through a series of airlock and shield doors to a truck load-out area on the outside of the building.

Process equipment, such as pumps, valves, and jumpers, are located in this containment building. Typical waste management activities performed in this containment building include the removal and staging of failed, remote-handled process equipment prior to decontamination, repair, and/or packaging of waste for disposal. Jumpers connecting process equipment may leak waste when the jumper connection is broken. Although some decontamination capability is present in the pretreatment hot cell containment building, some quantities of waste, especially solids, will remain following decontamination. The design features associated with the pretreatment hot cell containment building, discussed below, ensure the capability to manage residual waste from process jumper leakage throughout the 40-year design lifetime of the pretreatment plant.

Pretreatment Hot Cell Containment Building Design

The pretreatment hot cell containment building is designed as a completely enclosed area within the pretreatment plant. It is designed to prevent the release of dangerous constituents and their exposure to the outside environment. The design and construction of the hot cell and the pretreatment plant exterior will prevent water from running into the plant. The approximate dimensions of the unit are summarized in Table 4-12.

Pretreatment Hot Cell Containment Building Structure

The pretreatment hot cell containment building will be a concrete-walled structure fully enclosed within the pretreatment plant. Therefore, structural requirements for the containment building will be met by the design standards of the pretreatment plant. The roof of the pretreatment plant will consist of metal roofing, roof insulation, and vapor barrier. Rainwater run-off will be collected by roof drains and drainage systems with overflow roof drains. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the pretreatment plant meet or exceed the Uniform Building Code Seismic Design Requirements.

Pretreatment Hot Cell Containment Building Materials

The pretreatment hot cell containment building will be constructed of steel-reinforced concrete. The interior floor and a portion of the walls of the unit will be partially lined with stainless steel. The balance of the walls will have an impervious coating.

Use of Incompatible Materials in the Pretreatment Hot Cell Containment Building
A partial stainless steel liner will be provided for this unit. Stainless steel will be compatible with the equipment waste that will be managed, which will include failed pumps, ultrafilters, and valves containing a minimal amount of waste constituents. Activities in the unit will include, but not be limited to, decontamination, size reduction, and packaging the waste components into drums or waste boxes. Treatment reagents that could cause the liner to leak, corrode, or otherwise fail will not be used within the unit.

Primary Barrier Integrity in the Pretreatment Hot Cell Containment Building
The pretreatment hot cell containment building is designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria identified in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the Pretreatment Hot Cell Containment Building
Prior to initial receipt of dangerous and mixed waste startup of operations, a certification by a qualified registered professional engineer that the pretreatment hot cell containment building meets the design requirements of 40 CFR 264.1101(a), (b), and (c) will be obtained.

Operation of the Pretreatment Hot Cell Containment Building
Operational and maintenance controls and practices will be established and followed to ensure containment of the waste within the pretreatment hot cell containment building as required by 40 CFR 264.1101(c)(1).

Maintenance of the Pretreatment Hot Cell Containment Building
The partial stainless steel lining of the unit will be constructed and maintained in a manner that will be free of significant cracks, gaps, corrosion, or other deterioration. The partial stainless steel liner will remain free of corrosion or other deterioration because it is compatible with materials that will be managed in the containment building. The failed equipment that will be managed in the containment building unit will be compatible with stainless steel. Only decontamination chemicals that are compatible with the liner will be used.

Measures to Prevent Tracking Wastes from the Pretreatment Hot Cell Containment Building
The pretreatment hot cell containment building is designed to isolate failed equipment from the accessible environment and to prevent the spread of contaminated materials. Very little dust is expected to be generated in the unit. Personnel access to the unit, which is classified as a C5 contamination area, will be restricted. Waste leaving the unit may or may not be enclosed within containers. Equipment leaving the unit will be decontaminated before being released for removal.

Procedures in the Event of Release or Potential for Release from the Pretreatment Hot Cell Containment Building
The design and operation of the unit makes it very unlikely that releases will occur. The design and operational measures will minimize the generation of dust and contain it within the unit.

The ventilation system will also use negative air pressure to keep contamination from spreading to areas of lesser contamination. Offgas will be routed to the pretreatment ventilation system.

Inspections will identify conditions that could lead to a release. Such conditions will be corrected as soon as possible after they are identified. In the unlikely event that a release of dangerous wastes from the containment building is detected, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Specific administrative and operating methods that will be used to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste. These methods will be followed to repair conditions that could lead to a release.

Inspections of the Pretreatment Hot Cell Containment Building
An inspection program will be established to detect conditions that could lead to a release of wastes from the pretreatment hot cell containment building. The inspection and monitoring schedule and methods that will be used to detect releases from the unit are included in DWP Attachment 51, Chapter 6.

#### 4.2.4.2 Pretreatment Maintenance Containment Building (PM0124, P-0121A, P-0122A, P-0123A, P-0124, P-0124A, P-0125, P-0125A, P-0128, P-0128A)

The pretreatment plant will have a second area that meets the definition of a containment building. The pretreatment maintenance containment building comprises the majority of the east end of the building. Typical waste management activities performed in this containment building include equipment maintenance, including decontamination, size reduction, and packaging of spent equipment. This unit consists of the interim storage, lag storage, manipulator decontamination and repair, resin handling, waste packaging, tool cribs, and subchange rooms. The unit will include hatches to import or export spent equipment. An overhead crane will facilitate movement of equipment and removal or placement of the spent equipment in the waste containers.

Pretreatment Maintenance Containment Building Design
The pretreatment maintenance containment building is designed as a completely enclosed area within the pretreatment plant. The unit is designed to prevent the release and exposure of dangerous constituents to the outside environment. The design and construction of the pretreatment plant exterior will prevent water from running into the plant. The roof of the pretreatment plant will consist of metal roofing, roof insulation, and a vapor barrier. Rainwater run-off will be collected by roof drains and drainage system with overflow roof drains. The approximate dimensions of the unit are summarized in Table 4-12.

Pretreatment Maintenance Containment Building Structure
The pretreatment maintenance containment building will consist of several rooms within the concrete-walled, fully enclosed pretreatment plant. Therefore, structural requirements for the containment building will be met by the design standards of the pretreatment plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the pretreatment plant meet or exceed the Uniform Building Code Seismic Design Requirements.

Pretreatment Maintenance Containment Building Materials

The pretreatment maintenance containment building will be constructed of steel-reinforced concrete. The interior floor and portions of the walls of the unit will be lined with stainless steel. The balance of the walls will have an impervious coating.

Use of Incompatible Materials in the Pretreatment Maintenance Containment Building

A partial stainless steel liner will be provided for the unit. Stainless steel will be compatible with the equipment wastes that will be managed, which will include failed pumps, ultrafilters, and valves. Activities in the unit will be limited to decontamination, size reduction, and packaging the waste components into drums or waste boxes. Treatment reagents that could cause the liner to leak, corrode, or otherwise fail will not be used within the unit.

Primary Barrier Integrity in the Pretreatment Maintenance Containment Building

The pretreatment maintenance containment building is designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria identified in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the Pretreatment Maintenance Containment Building

Prior to initial receipt of dangerous and mixed waste, certification by a qualified registered professional engineer that the pretreatment maintenance containment building meets the design requirements of 40 CFR 264.1101(a), (b), and (c) will be obtained.

Operation of the Pretreatment Maintenance Containment Building

Operational and maintenance controls and practices will be followed to ensure containment of the waste within the pretreatment maintenance containment building as required by 40 CFR 264.1101(c)(1).

Maintenance of the Pretreatment Maintenance Containment Building

The stainless steel lining of the unit will be constructed and maintained in a manner that will be free of significant cracks, gaps, corrosion, or other deterioration. The stainless steel liner will remain free of corrosion or other deterioration because it will be compatible with materials that will be managed in the containment building, which will include failed equipment. Only decontamination chemicals that are compatible with the liner will be used.

Measures to Prevent Tracking Wastes from the Pretreatment Maintenance Containment Building

The pretreatment maintenance containment building is designed to isolate failed equipment from the accessible environment and to prevent the spread of contaminated materials. A dust cleanup system will minimize the potential for dust to be tracked from the unit by humans or equipment. The containment building will be classified as a C3/C5 contamination area and, therefore, personnel access will be limited, and may be restricted. Wastes leaving the unit may be enclosed within containers. If necessary, these containers will be decontaminated in the unit prior to transportation to a permitted storage area. Equipment leaving the unit will be decontaminated before being released for removal from the cell.

Procedures in the Event of a Release or Potential Release from the Pretreatment Maintenance Containment Building

The design and operation of the unit makes it very unlikely that releases will occur. The design and operational measures that will be used will minimize the generation of dust and contain it within the unit. The ventilation system will also use negative air pressure to keep contamination from spreading to areas of lesser contamination.

In the unlikely event that a release of dangerous wastes from the containment building is detected, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Specific administrative and operating methods that will be used to satisfy this requirement will be developed initial receipt of dangerous and mixed waste. These methods will be followed to repair condition that could lead to a release.

Inspections of the Pretreatment Maintenance Containment Building

An inspection program will be established as required under WAC 173-303-695 to detect conditions that could lead to the release of wastes from the pretreatment maintenance containment building. Such conditions will be corrected as soon as possible after they are identified. The inspection and monitoring schedule and methods that will be used to detect a release are included in DWP Attachment 51, Chapter 6.

#### 4.2.4.3 Pretreatment Filter Package Maintenance Containment Building (P-0223)

The pretreatment filter package maintenance containment building is the third containment building within the pretreatment plant, located in the southeast portion of the plant. Typical waste management activities performed in this containment building include, waste storage, decontamination, and equipment repair. A crane transports spent HEPA and HEME filters and then places them inside a disposal container. The disposal container is then transported via cart, through an air lock and shield doors and to a load-out area for storage pending final disposal. The containment building also houses a hands-on crane decontamination and repair area.

Pretreatment Filter Package Maintenance Containment Building Design

The pretreatment Filter package maintenance containment building will be completely enclosed within the pretreatment plant, and will be designed to prevent the release and exposure of dangerous constituents to the outside environment. The design and construction of the pretreatment plant exterior will prevent water from running into the plant. The roof of the pretreatment plant will consist of metal roofing, roof insulation, and a vapor barrier. Run-off will be collected by roof drains and a drainage system with overflow drains. The interior floor and a portion of the walls will be lined with a protective coating. The approximate dimensions of the containment building are summarized in Table 4-12.

Pretreatment Filter Package Maintenance Containment Building Structure

Because the pretreatment filter package maintenance containment building will be a concrete-walled structure fully enclosed within the pretreatment plant, its requirements will be met by the design standards of the pretreatment plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the pretreatment plant meet or exceed the Uniform Building Code Seismic Design Requirements.

Pretreatment Filter Package Maintenance Containment Building Materials
The pretreatment filter package maintenance containment building will be constructed of steel-reinforced concrete. A protective coating will be provided for the containment building.

Use of Incompatible Materials for the Pretreatment Filter Package Maintenance Containment Building.

The protective coating will be compatible with the wastes that will be managed in the unit, which will include spent HEPA and HEME filters. Activities in the unit will be limited to waste packaging. Treatment reagents that could cause the protective coating to leak, corrode, or otherwise fail will not be used within the unit.

Primary Barrier Integrity in the Pretreatment Filter Package Maintenance Containment Building
The pretreatment filter package maintenance containment building will be designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the Pretreatment Filter Package Maintenance Containment Building
Prior to initial receipt of dangerous and mixed waste, certification by a qualified registered professional engineer that the pretreatment filter package maintenance containment building meets the design requirements of 40 CFR 264.1101(a) and (c) will be obtained. The requirements of 40 CFR 264.1101(b) do not apply to this design because waste containing liquids will not be managed in the unit and waste will not be treated with liquids.

Operation of the Pretreatment Filter Package Maintenance Containment Building
Operational and maintenance controls and practices will be established to ensure containment of the waste within the pretreatment filter package maintenance containment building, as required by 40 CFR 264.1101(c)(1).

Maintenance of the Pretreatment Filter Package Maintenance Containment Building
The protectively-coated concrete floor and walls of the unit will be constructed and maintained in a manner that will be free of significant cracks, gaps, corrosion, or other deterioration. The protective coating will be compatible with materials that will be managed in the containment building, which will include spent HEPA and HEME filters. No decontamination chemicals that are incompatible with the coated concrete will be used.

Measures to Prevent Tracking Wastes from the Pretreatment Filter Package Maintenance Containment Building

The pretreatment filter package maintenance containment building is designed to manage spent HEPA and HEME filters. Conducting these activities in a C5 zone will prevent the spread of contaminated materials. Restricted personnel access and controlled movement of equipment into and out of the unit will decrease the possibility that waste will be tracked from the unit.

Personnel access to the pretreatment plant filter package maintenance containment building, which is classified as a C5 contamination area, will be restricted. Access to the unit will be allowed only under limited circumstances, thereby limiting the potential for contacting the waste and tracking it from the unit.

Procedures in the Event of Release or Potential for Release from the Pretreatment Filter Package Maintenance Containment Building

Conditions that could lead to a release from the pretreatment filter package maintenance containment building will be corrected as soon as possible after they are identified. In the unlikely event of a release of dangerous wastes from the containment building, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Specific administrative and operating methods that will be used to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste.

Inspections of the Pretreatment Filter Package Maintenance Containment Building
An inspection program will be established to detect conditions that could lead to a release of wastes from the pretreatment filter package maintenance containment building. The inspection and monitoring schedule, and methods that will be used to detect releases from the unit, are included in DWP Attachment 51, Chapter 6.

#### 4.2.4.4 Pretreatment Filter Cave Room Containment Building (P-0335)

The Pretreatment Filter Cave Room Containment Building is the fourth containment building within the pretreatment plant, in the southeast portion of the plant. Typical waste management activities performed in this containment building include waste storage, decontamination, and equipment repair. A crane transports the spent HEPA and HEME filters and places them inside a disposal container. The disposal container is then transported via cart through an air lock and shield doors and to a load-out area for storage pending final disposal. The containment building also houses a dedicated crane maintenance area.

Pretreatment Filter Cave Room Containment Building Design
The Pretreatment Filter Cave Room Containment Building will be completely enclosed within the pretreatment plant, and will be designed to prevent the release and exposure of dangerous constituents to the outside environment. The design and construction of the pretreatment plant exterior will prevent water from running into the plant. The roof of the pretreatment plant will consist of metal roofing, roof insulation, and a vapor barrier. Run-off will be collected by roof drains and a drainage system with overflow drains. The approximate dimensions of the containment building are summarized in Table 4-12.

Pretreatment Filter Cave Room Containment Building Structure

Because the Pretreatment Filter Cave Room Containment Building will be a concrete-walled structure fully enclosed within the pretreatment plant, its requirements will be met by the design standards of the pretreatment plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the pretreatment plant meet or exceed the Uniform Building Code Seismic Design Requirements.

Pretreatment Filter Cave Room Containment Building Unit Materials

The Pretreatment Filter Cave Room Containment Building will be constructed of steel-reinforced concrete. The interior floor and a portion of the walls will be lined with a protective coating.

Use of Incompatible Materials for the Pretreatment Filter Cave Room Containment Building

The protective coating will be compatible with the wastes that will be managed in the unit, which will include spent HEPA and HEME filters. Activities in the unit will be limited to waste packaging. Treatment reagents that could cause the protective coating to leak, corrode, or otherwise fail will not be used within the unit.

Primary Barrier Integrity in the Pretreatment Filter Cave Room Containment Building

The Pretreatment Filter Cave Room Containment Building will be designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the Pretreatment Filter Cave Room Containment Building

Prior to initial receipt of dangerous and mixed waste, certification by a qualified registered professional engineer that the Pretreatment Filter Cave Room Containment Building meets the design requirements of 40 CFR 264.1101(a) and (c) will be obtained. The requirements of 40 CFR 264.1101(b) do not apply to this design because waste containing liquids will not be managed in the unit and waste will not be treated with liquids.

Operations of the Pretreatment Filter Cave Room Containment Building

Operational and maintenance controls and practices will be established to ensure containment of the waste within the Pretreatment Filter Cave Room Containment Building, as required by 40 CFR 264.1101(c)(1).

Maintenance of the Pretreatment Filter Cave Room Containment Building

The protectively coated concrete floor and walls of the unit will be constructed and maintained in a manner that will be free of significant cracks, gaps, corrosion, or other deterioration. The protective coating will be compatible with materials that will be managed in the containment building, which will include spent HEPA and HEME filters. No decontamination chemicals that are incompatible with the coated concrete will be used.

Measures to Prevent Tracking Wastes from the Pretreatment Filter Cave Room Containment Building

The Pretreatment Filter Cave Room Containment Building is designed to manage spent HEPA and HEME filters. Conducting these activities in a C5 zone will prevent the spread of contaminated materials. Restricted personnel access and controlled movement of equipment into and out of the unit will decrease the possibility that waste will be tracked from the unit.

Personnel access to the Pretreatment Filter Cave Room Containment Building, which is classified as a C5 contamination area, will be restricted. Access to the unit will be allowed only under limited circumstances, thereby limiting the potential for contacting the waste and tracking it from the unit.

Procedures in the Event of Release or Potential for Release from the Pretreatment Filter Cave Room Containment Building

Conditions that could lead to a release from the Pretreatment Filter Cave Room Containment Building will be corrected as soon as possible after they are identified. In the unlikely event of a release of dangerous wastes from the containment building, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Specific administrative and operating methods that will be used to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste.

Inspections of the Pretreatment Filter Cave Room Containment Building

An inspection program will be established to detect conditions that could lead to a release of waste from the Pretreatment Filter Cave Room Containment Building. The inspection and monitoring schedule and methods that will be used to detect releases from the unit are included in DWP Attachment 51, Chapter 6.

#### 4.2.4.5 LAW LSM Gallery Containment Building (L-0112)

There will be six containment buildings in the LAW vitrification plant. The first is the LAW locally shielded melter (LSM) gallery containment building, which will house the two LAW Melters. The LAW Melters are designed to include a roller or wheel assembly that will be used to move the melters in and out of the containment building. Spent LAW Melters will be disconnected from the offgas system, feed lines, electrical lines, and instrumentation. Open ports will be sealed. The sealed exterior of the melter will be decontaminated, if needed, prior to removal from the containment building.

LAW LSM Gallery Containment Building Design

The LAW LSM gallery containment building will be completely enclosed within the LAW vitrification plant. The unit will be designed to prevent the release and exposure of dangerous constituents to the outside environment. The design and construction of the LAW vitrification plant exterior will prevent water from running into the plant. The roof of the LAW vitrification plant will consist of metal roofing, roof insulation, and a vapor barrier. Rainwater run-off will be collected by roof drains and a drainage system with overflow drains. The approximate dimensions of the unit are summarized in Table 4-12.

The melter feed slurry will be introduced to the LAW melters through double-walled stainless steel feed lines. The feed lines will also be provided with bulges that will function as secondary containment. A low point within the bulge will be incorporated into the design to allow drainage to a sump located in the adjacent process room.

The only other sources of liquids that will be present in the cave are the waterline to the two film cooler pipe washout spray rings, and the melter water jacket and connecting piping. These clean water lines will be instrumented to detect leaks automatically. A rupture of either water line or a waste feed line would be an abnormal event and the liquid would be contained within the outer melter shield box and corrective measures would be initiated. Corrective action would start with closure of the supply line and draining of remaining water outside the melter shield box, and could require feed cutoff and melter idling or shut down. The amount of water that could be released into the containment building would be unlikely to exceed a few gallons, which would rapidly evaporate into the ambient air due to the high temperature in the cave under normal operating conditions.

LAW LSM Gallery Containment Building Structure

The LAW LSM gallery containment building will be fully enclosed within the LAW vitrification plant. Therefore, structural requirements for the containment building will be met by the design standards of the LAW vitrification plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. Within the containment building will be partitions between the LSMs. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the LAW vitrification plant meet or exceed the Uniform Building Code Seismic Design Requirements.

LAW LSM Gallery Containment Building Materials

The LAW LSM gallery containment building will be constructed of steel-reinforced concrete. The interior floor and the walls of the unit will be covered with a protective coating.

Use of Incompatible Materials for the LAW LSM Gallery Containment Building

A protective coating will be applied to the concrete floor and a portion of the walls of the unit. The coating will be compatible with the wastes that will be managed in the containment building. The wastes to be managed will include LAW LSM melters and consumables, which may be metallic parts and failed equipment. Very little or no glass waste is expected to be present on the exterior of the LSM, due to the design of the melter. Reagents that could cause the liner to leak, corrode, or otherwise fail will not be used within the unit.

Primary Barrier Integrity in the LAW LSM Gallery Containment Building

The LAW LSM gallery containment building will be designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the LAW LSM Gallery Containment Building
Prior to initial receipt of dangerous and mixed waste, certification by a qualified registered professional engineer that the LAW LSM gallery containment building meets the design requirements of 40 CFR 264.1101(a), (b), and (c) will be obtained.

Operation of the LAW LSM Gallery Containment Building
Operational and maintenance controls and practices will be established and followed to ensure containment of the waste within the LAW LSM gallery containment building, as required by 40 CFR 264.1101(c)(1). Activities in the building will be remotely conducted.

Maintenance of the LAW LSM Gallery Containment Building
The protectively-coated concrete floor of the containment building will be constructed and maintained in a manner that will be free of significant cracks, gaps, corrosion, or other deterioration The concrete and protective coating will be free of corrosion or other deterioration because it will be compatible with materials that will be managed in the containment building, including the glass waste and containerized or uncontainerized waste and equipment.

Measures to Prevent Tracking Wastes from the LAW LSM Gallery Containment Building
The unit is designed to manage LAW melters. The melters will be disconnected from systems when determined to be waste. The ports where the melter was attached to systems will be sealed and glass waste will be contained within the melter. This design will prevent waste from entering the containment building and thus from being tracked from the unit.

The unit will be classified as a C3 contamination area, which allows only limited personnel access. Access will be required only for nonroutine events such as when melters are determined to be waste, once every 4 to 5 years, or when equipment must be dismantled. Dry decontamination methods using cloth will be used.

Procedures in the Event of Release or Potential for Release from the LAW LSM Gallery Containment Building
Conditions that could lead to a release from the LAW LSM gallery containment building will be corrected as soon as possible after they are identified.

In the unlikely event of a release of dangerous wastes from the containment building, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Specific administrative and operating methods that will be used to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste. The methods will be followed to repair conditions that could lead to a release.

Inspections of the LAW LSM Gallery Containment Building
An inspection program will be established to detect conditions that could lead to release of wastes from the LAW LSM gallery containment building. The inspection and monitoring schedule and methods that will be used to detect releases from the unit are included in DWP Attachment 51, Chapter 6.

#### 4.2.4.6 ILAW Container Finishing Line Containment Building (L-0109B, L-0109C, L-0109D, L-0109E, L-0115B, L-0115C, L-015D, L-0115E)

The ILAW container finishing line containment building will be located in the LAW vitrification plant. It will be used for managing ILAW containers that have cooled sufficiently to be closed and prepared for finishing. Typical waste management activities performed in this containment building include storage of uncontainerized waste and decontamination. An ILAW container is transported from an inert filling and lidding room, to a decontamination room, and finally to a swab and monitor room, and then out of the containment building. This sequence of rooms is considered a finishing line. There are two finishing lines within the ILAW container finishing line containment building.

ILAW Container Finishing Containment Building Design
The ILAW container finishing containment building will be completely enclosed within the LAW vitrification plant. It will be designed to prevent the release and exposure of dangerous constituents to the outside environment. The design and construction of the LAW vitrification plant exterior will prevent water from running into the plant. The roof of the LAW vitrification plant will consist of metal roofing, roof insulation, and a vapor barrier. Roof drains and drainage system with overflow drains will collect run-off. The approximate dimensions of the unit are summarized in Table 4-12.

ILAW Container Finishing Containment Building Structure
Because the ILAW container finishing containment building will be a concrete-walled structure fully enclosed within the LAW vitrification plant, its structural requirements will be met by the design standards of the LAW vitrification plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the LAW vitrification plant meet or exceed the Uniform Building Code Seismic Design Requirements.

ILAW Container Finishing Containment Building Materials
The ILAW container finishing containment building will be constructed of steel-reinforced concrete. The interior floor and a portion of the walls of the decontamination rooms will be lined with a protective coating.

Use of Incompatible Materials for the ILAW Container Finishing Containment Building
The primary barrier will have a protective coating. This coating will be compatible with the waste managed in the unit. The waste to be managed includes vitrified waste glass within the stainless steel containers. This coating will be present in the two inert fill rooms, the fixative application room, and the two swab and monitor rooms.

A protective coating will be present in the decontamination rooms. The coating will be compatible with the wastes that will be managed, which will include filled ILAW containers. No glass waste is expected to be present on the exterior of the containers, due to the design of the melter pour stations. The interior is the only portion of the container that will be exposed to the glass waste. Additionally, the removal of glass will occur in the inert fill and lidding rooms. Carbon dioxide pellets, also compatible with the stainless steel, will be used to remove contamination from the container surface. Reagents that could cause the liner to leak, corrode, or otherwise fail will not be used within the unit.

Primary Barrier Integrity in the ILAW Container Finishing Containment Building

The ILAW containment building will be designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the ILAW Container Finishing Containment Building

Prior to initial receipt of dangerous and mixed waste, certification by a qualified registered professional engineer that the ILAW containment building meets the design requirements of 40 CFR 264.1101(a) and (c) will be obtained. The requirements of 40 CFR 264.1101(b) do not apply to this design because the waste managed in the unit will not contain free liquids and free liquids will not be used to treat the waste.

Operation of the ILAW Container Finishing Containment Building

Operational and maintenance controls and practices will be established to ensure containment of the waste within the ILAW containment building, as required by 40 CFR 264.1101(c)(1). Activities in the building will be remotely conducted.

Maintenance of the ILAW Container Finishing Containment Building

The protectively-coated concrete floor and walls of the of the containment building will be constructed and maintained in a manner that will be free of significant cracks, gaps, corrosion, or other deterioration. The coated concrete will be free of corrosion or other deterioration because it will be compatible with materials that will be managed in the containment building, which will include glass waste and containerized waste and equipment. The protective coating in the decontamination rooms will be constructed and maintained in a manner that will be free of significant cracks, gaps, corrosion, or other deterioration. The coating will remain free of corrosion or other deterioration because it will be compatible with materials that will be managed in the containment building, which will include failed equipment. Wastes managed in the containment building will not be stacked.

Measures to Prevent Tracking Wastes from the ILAW Container Finishing Containment Building

The ILAW containment building is designed to sample, seal, and decontaminate the filled ILAW containers. Conducting these activities in a C3 zone prevents the spread of contaminated materials from the unit as air flow is managed in the LAW vitrification plant ventilation system. The containment building is under negative pressure. Air flow through this containment building goes to a C5 air system, which passes through HEPA filters before exiting the plant stack.

A vacuum cleanup system, located in the two inert fill rooms, is expected to be infrequently used to collect dust from the inert filling activities, and thereby minimize the potential for dust to be tracked from the unit. The dust will be disposed of as secondary waste. Additionally, personnel access to the containment building, which is classified as a C3 contamination area, will be allowed only under limited circumstances, reducing the potential for contacting the waste and tracking it from the unit.

Procedures in the Event of Release or Potential for Release from the ILAW Container Finishing Containment Building
Conditions that could lead to a release from the ILAW containment building will be corrected as soon as possible after they are identified. In the unlikely event of a release of dangerous wastes from the containment building, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Specific administrative and operating methods to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste. The methods will be followed to repair conditions that could lead to a release.

Inspections of the ILAW Container Finishing Containment Building
An inspection program will be established to detect conditions that could lead to a release of wastes from the ILAW container finishing containment building. The inspection and monitoring schedule and methods that will be used to detect releases from the unit are included in DWP Attachment 51, Chapter 6.

#### 4.2.4.7 LAW Vitrification Plant Consumable Import/Export Containment Building (L-0119B)

The LAW vitrification plant consumable import/export containment building will be located in the west end of the LAW vitrification plant on the 3 ft elevation. Typical waste management activities performed in this containment building include decontamination, size reduction, and packaging of spent equipment. Simple decontamination of components will be performed to allow contact handling. Waste streams generated within the workshop will be volume reduced as necessary by means of disassembly or other suitable means to fit standard packaging such as drums and/or small boxes.

LAW Vitrification Plant Consumable Import/Export Containment Building Design
The LAW vitrification plant consumable import/export containment building will be designed as a completely enclosed area within the LAW vitrification plant. It is designed to prevent the release of dangerous constituents and their exposure to the outside environment. The design and construction of the LAW vitrification plant exterior will prevent water from running into the plant. The roof of the LAW vitrification plant will consist of metal roofing, roof insulation, and vapor barrier. Rainwater run-off will be collected by roof drains and drainage systems with overflow roof drains. The approximate dimensions of the unit are summarized in Table 4-12.

LAW Vitrification Plant Consumable Import/Export Containment Building Structure
The LAW vitrification plant consumable import/export containment building will be a concrete-walled structure fully enclosed within the LAW vitrification plant. Therefore, structural requirements for the containment building will be met by the design standards of the LAW vitrification plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the LAW vitrification plant meet or exceed the Uniform Building Code Seismic Design Requirements.

LAW Vitrification Plant Consumable Import/Export Containment Building Materials

The LAW vitrification plant consumable import/export containment building will be constructed of steel-reinforced concrete. The interior floor and a portion of the walls of the unit will be lined with a protective coating.

Use of Incompatible Materials in the LAW Vitrification Plant Consumable Import/Export Containment Building

A protective coating will be provided for the floor of this unit. The protective coating will be compatible with the wastes that will be managed. Activities in the unit will be limited to decontamination, size reduction, and packaging the waste components into drums or waste boxes. Treatment reagents that could cause the liner or coating to leak, corrode, or otherwise fail will not be used within the unit.

Primary Barrier Integrity in the LAW Vitrification Plant Consumable Import/Export Containment Building

The LAW vitrification plant consumable import/export containment building will be designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the LAW Vitrification Plant Consumable Import/Export Containment Building

Prior to receipt of dangerous and mixed waste, a certification by a qualified registered professional engineer that the LAW vitrification plant consumable import/export containment building meets the design requirements of 40 CFR 264.1101(a), (b), and (c) will be obtained.

Operation of the LAW Vitrification Plant Consumable Import/Export Containment Building

Operational and maintenance controls and practices will be established and followed to ensure containment of the wastes within the LAW vitrification plant C3 containment building unit as required by 40 CFR 264.1101(c)(1).

Maintenance of the LAW Vitrification Plant Consumable Import/Export Containment Building

The protective coating of the unit will be constructed and maintained in a manner that will be free of significant cracks, gaps, corrosion, or other deterioration. The protective coating will remain free of corrosion or other deterioration because it is compatible with materials that will be managed in the containment building. The failed equipment that will be managed in the containment building unit will be compatible with the protective coating. Only decontamination chemicals that are compatible with the coating will be used.

Measures to Prevent Tracking Wastes from the LAW Vitrification Plant Consumable Import/Export Containment Building

The LAW vitrification plant consumable import/export containment building will be designed to isolate failed equipment from the accessible environment and to prevent the spread of contaminated materials. Very little dust is expected to be generated in the unit.

The containment building will be classified as a C3 contamination area, which allows only limited access by personnel. Wastes leaving the unit will be enclosed within containers. If necessary, these containers will be decontaminated in the unit prior to release and transportation to a permitted storage area. Equipment leaving the unit will be decontaminated, when necessary, before being released for removal from the cells.

Procedures in the Event of Release or Potential for Release from the LAW Vitrification Consumable Import/Export Containment Building. The design and operation of the unit makes it very unlikely that releases will occur. The design and operational measures will minimize the generation of dust and contain it within the unit. The ventilation system will also use negative air pressure to keep contamination from spreading to areas of lesser contamination.

Inspections will identify conditions that could lead to a release. Such conditions will be corrected as soon as possible after they are identified. In the unlikely event that a release of dangerous wastes from the containment building is detected, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Specific administrative and operating methods that will be used to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste. These methods will be followed to repair conditions that could lead to a release.

Inspections of the LAW Vitrification Plant Consumable Import/Export Containment Building
An inspection program will be established to detect conditions that could lead to a release of wastes from the LAW vitrification plant consumable import/export containment building. The inspection and monitoring schedule and methods that will be used to detect releases from the unit are included in DWP Attachment 51, Chapter 6.

#### 4.2.4.8 C3 Workshop Containment Building (L-226A)

The C3 workshop containment building will be located in the west side of the LAW vitrification plant at elevation 28 ft.

Typical waste management activities performed in this containment building include decontamination, size reduction, and packaging of spent equipment. Equipment will be transported to the unit contained in shielded casks, drums, or in a standard waste box. In the workshop, the equipment will be decontaminated to enable hands-on maintenance. Spent equipment parts will be bagged and placed in standard waste containers or boxes for disposal. Size reduction may be performed to facilitate packaging. Other spent equipment will be packaged in drums or standard waste boxes.

C3 Workshop Containment Building Design
The C3 workshop containment building will be a completely enclosed area within the LAW vitrification plant. It will be designed to prevent the release of dangerous waste and their exposure to the outside environment. The design and construction of the LAW vitrification plant exterior will prevent water from running into the plant. The roof of the LAW vitrification plant

will consist of metal roofing, roof insulation, and vapor barrier. Rainwater run-off will be collected by roof drains and drainage systems with overflow roof drains. The approximate dimensions of the unit are summarized in Table 4-12.

C3 Workshop Containment Building Structure
The C3 workshop containment building will be fully enclosed within the LAW vitrification plant. Therefore, structural requirements for the containment building will be met by the design standards of the LAW vitrification plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the LAW vitrification plant meet or exceed the Uniform Building Code Seismic Design Requirements.

C3 Workshop Containment Building Materials
The C3 workshop containment building will be constructed of a steel-reinforced concrete floor and plasterboard partition walls.

Use of Incompatible Materials in the C3 Workshop Containment Building
Activities in the unit will be limited to decontamination, size reduction, and packaging the waste components into drums or waste boxes. Treatment reagents that could cause the liner or coating to leak, corrode, or otherwise fail will not be used within the unit.

Primary Barrier Integrity in the C3 Workshop Containment Building
The C3 workshop containment building is designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the C3 Workshop Containment Building
Prior to initial receipt of dangerous and mixed waste, a certification by a qualified registered professional engineer that the C3 workshop containment building meets the design requirements of 40 CFR 264.1101(a) and (c) will be obtained. The requirements of 40 CFR 264.1101(b) do not apply to this design because the waste managed in the unit will not contain free liquids or be treated with free liquids.

Operation of the C3 Workshop Containment Building
Operational and maintenance controls and practices will be established and followed to ensure containment of the wastes within the C3 workshop containment building unit as required by 40 CFR 264.1101(c)(1).

Maintenance of the C3 Workshop Containment Building
The concrete will be constructed and maintained in a manner that will be free of significant cracks, gaps, corrosion, or other deterioration. The concrete will remain free of corrosion or other deterioration because it is compatible with materials that will be managed in the containment building. The failed equipment that will be managed in the containment building

unit will be compatible with the concrete. Only decontamination chemicals that are compatible with the concrete will be used.

Measures to Prevent Tracking Wastes from the C3 Workshop Containment Building
The C3 workshop containment building will be designed to isolate failed equipment from the accessible environment and to prevent the spread of contaminated materials. Very little dust is expected to be generated in the unit.

The containment building classified as a C3 contamination area, which allows only limited access by personnel. Personnel access will be via a C2/C3 subchange room. Equipment will enter and exit the workshop via a C2/C3 airlock. Wastes leaving the unit will be enclosed within containers. If necessary, the containers will be decontaminated in the unit prior to transportation to a permitted storage area. Equipment leaving the unit will be decontaminated, when necessary, before being released for removal from the cells.

Procedures in the Event of Release or Potential for Release from the C3 Workshop Containment Building
The design and operation of the unit makes it very unlikely that releases will occur. The design and operational measures will minimize the generation of dust and contain it within the unit. The ventilation system will also use negative air pressure to keep contamination from areas of lesser contamination. Offgas will be routed to the LAW offgas treatment system.

Inspections will identify conditions that could lead to a release. Such conditions will be corrected as soon as possible after they are identified. In the unlikely event that a release of dangerous wastes from the containment building is detected, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Specific administrative and operating methods that will be used to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste. These methods will be followed to repair conditions that could lead to a release.

Inspections of the C3 Workshop Containment Building
An inspection program will be established to detect conditions that could lead to a release of wastes from the C3 workshop containment building. The inspection and monitoring schedule and methods that will be used to detect releases from the unit are included in DWP Attachment 51 Chapter 6.

#### 4.2.4.9 LAW Pour Cave Containment Building (L-B009B, L-B011B, L-B011C, L-B013B, L-B013C, L-B015A)

The LAW pour cave containment building (rooms L-B009B, L-B011B, L-B011C, L-B013B, L-B013C, L-B015A) will be located in the LAW vitrification plant, elevation -21 ft. It will be used for managing ILAW containers as they are filled with glass from the LAW Melters (LAW-MLTR-00001/2). The filled ILAW containers will be allowed to cool with the lids off the container. Cooled ILAW containers will be transferred to the ILAW container finishing line containment building for lidding and preparation for export to a storage facility.

LAW Pour Cave Containment Building Design

The LAW pour cave containment building will be completely enclosed within the LAW vitrification plant, which will be designed to prevent the release and exposure of dangerous constituents to the outside environment. The design and construction of the LAW vitrification plant exterior will prevent precipitation from entering into the plant. The roof of the LAW vitrification plant will consist of metal roofing, roof insulation, and a vapor barrier. Roof drains and drainage system with overflow drains will collect run-off. The approximate dimensions of the unit are summarized in Table 4-12.

LAW Pour Cave Containment Building Structure

Because the LAW pour cave containment building will be a concrete-walled structure fully enclosed within the LAW vitrification plant, its structural requirements will be met by the design standards of the LAW vitrification plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the LAW vitrification plant meet or exceed the Uniform Building Code Seismic Design Requirements.

LAW Pour Cave Containment Building Materials

The LAW pour cave containment building will be constructed of steel-reinforced concrete.

Use of Incompatible Materials for the LAW Pour Cave Containment Building

The waste to be managed includes vitrified waste glass within the stainless steel containers. No glass waste is expected to be present on the exterior of the containers, due to the design of the melter pour stations. The interior is the only portion of the container that will be exposed to the glass waste. Reagents that could cause corrosion or other failure will not be used within the unit.

Primary Barrier Integrity in the LAW Pour Cave Containment Building

The LAW pour cave containment building will be designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in *RPP-WTP Compliance with Uniform Building Code Seismic Design Requirements*, DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the LAW Pour Cave Containment Building

Prior to initial receipt of dangerous and mixed waste, certification by a qualified registered professional engineer that the LAW pour cave containment building meets the design requirements of 40 CFR 264.1101(a) and (c) will be obtained. The requirements of 40 CFR 264.1101(b) do not apply to this design because the waste managed in the unit will not contain free liquids and free liquids will not be used to treat the waste.

Operation of the LAW Pour Cave Containment Building

Operational and maintenance controls and practices will be established to ensure containment of the waste within the LAW pour cave containment building, as required by 40

CFR 264.1101(c)(1). Activities in the building will be remotely conducted during normal operation when ILAW containers are present.

Maintenance of the LAW Pour Cave Containment Building
The concrete will be free of corrosion or other deterioration because it will be compatible with materials that will be managed in the containment building, which will include containerized glass waste and equipment. Wastes managed in the containment building will not be stacked.

Measures to Prevent Tracking Wastes from the LAW Pour Cave Containment Building
The LAW pour cave containment building is designed to manage the filling and movement of ILAW containers. Conducting these activities in a C5 zone prevents the spread of contaminated materials from the unit as airflow is managed in the LAW vitrification plant ventilation system. The containment building is under negative pressure. Airflow through this containment building goes to a C5 air system, which passes through HEPA filters before exiting the plant stack. Personnel access will be restricted during normal operation since it is classified as a C5 contamination area. The containment building may be reclassified as a C3 area for equipment maintenance.

Procedures in the Event of Release or Potential for Release from the LAW Pour Cave Containment Building
Conditions that could lead to a release from the LAW pour cave containment building will be corrected as soon as possible after they are identified. In the unlikely event of a release of dangerous wastes from the containment building, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Specific administrative and operating methods to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste. The methods will be developed to repair conditions that could lead to a release.

Inspections of the LAW Pour Cave Containment Building
An inspection program will be established to detect conditions that could lead to a release of wastes from the LAW pour cave containment building. The inspection and monitoring schedule and methods that will be used to detect releases from the unit are included in DWP Attachment 51, Chapter 6.

#### 4.2.4.10 LAW Container Buffer Storage Containment Building (L-B025C, L-B025D)

The LAW container buffer storage containment building (rooms L-B025C, L-B0025D) will be located in the LAW vitrification plant, elevation -21 ft. It will be used for managing ILAW containers as after they are filled with glass from the LAW Melters (LAW-MLTR-00001/2). The filled ILAW containers will be allowed to cool with the lids off the container. Cooled ILAW containers will be transferred to the ILAW container finishing line containment building for lidding and preparation for export to a storage facility.

LAW Container Buffer Storage Containment Building Design
The LAW container buffer storage containment building will be completely enclosed within the LAW vitrification plant, which will be designed to prevent the release and exposure of

dangerous constituents to the outside environment. The design and construction of the LAW vitrification plant exterior will prevent precipitation from entering into the plant. The roof of the LAW vitrification plant will consist of metal roofing, roof insulation, and a vapor barrier. Roof drains and drainage system with overflow drains will collect run-off. The approximate dimensions of the unit are summarized in Table 4-12.

LAW Container Buffer Storage Containment Building Structure

Because the LAW container buffer storage containment building will be a concrete-walled structure fully enclosed within the LAW vitrification plant, its structural requirements will be met by the design standards of the LAW vitrification plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the LAW vitrification plant meet or exceed the Uniform Building Code Seismic Design Requirements.

LAW Container Buffer Storage Containment Building Materials

The LAW container buffer storage containment building will be constructed of steel-reinforced concrete.

Use of Incompatible Materials for the LAW Container Buffer Storage Containment Building

The waste to be managed includes vitrified waste glass within the stainless steel containers. No glass waste is expected to be present on the exterior of the containers. The interior is the only portion of the container that will be exposed to the glass waste. Reagents that could cause corrosion or other failure will not be used within the unit.

Primary Barrier Integrity in the LAW Container Buffer Storage Containment Building

The LAW container buffer storage containment building will be designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in *RPP-WTP Compliance with Uniform Building Code Seismic Design Requirements*, DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the LAW Container Buffer Storage Containment Building

Prior to initial receipt of dangerous and mixed waste, certification by a qualified registered professional engineer that the LAW container buffer storage containment building meets the design requirements of 40 CFR 264.1101(a) and (c) will be obtained. The requirements of 40 CFR 264.1101(b) do not apply to this design because the waste managed in the unit will not contain free liquids and free liquids will not be used to treat the waste.

Operation of the LAW Container Buffer Storage Containment Building

Operational and maintenance controls and practices will be established to ensure containment of the waste within the LAW container buffer storage containment building, as required by 40 CFR 264.1101(c)(1). Activities in the building will be remotely conducted during normal operation when ILAW containers are present.

Maintenance of the LAW Container Buffer Storage Containment Building
The concrete will be free of corrosion or other deterioration because it will be compatible with materials that will be managed in the containment building, which will include containerized glass waste and equipment. Wastes managed in the containment building will not be stacked.

Measures to Prevent Tracking Wastes from the LAW Container Buffer Storage Containment Building
The LAW container buffer storage containment building is designed to manage the movement and storage of ILAW containers. Conducting these activities in a C5 zone prevents the spread of contaminated materials from the unit as airflow is managed in the LAW vitrification plant ventilation system. The containment building is under negative pressure. Airflow through this containment building goes to a C5 air system, which passes through HEPA filters before exiting the plant stack. Personnel access will be restricted during normal operation since it is classified as a C5 contamination area. The containment building may be reclassified as a C3 area for equipment maintenance.

Procedures in the Event of Release or Potential for Release from the LAW Container Buffer Storage Containment Building
Conditions that could lead to a release from the LAW container buffer storage containment building will be corrected as soon as possible after they are identified. In the unlikely event of a release of dangerous wastes from the containment building, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Specific administrative and operating methods to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste. The methods will be developed to repair conditions that could lead to a release.

Inspections of the LAW Container Buffer Storage Containment Building
An inspection program will be established to detect conditions that could lead to a release of wastes from the LAW container buffer storage containment building. The inspection and monitoring schedule and methods that will be used to detect releases from the unit are included in DWP Attachment 51, Chapter 6.

#### 4.2.4.11 HLW Melter Cave No. 1 Containment Building (H-0117, H-0116B, H-0310A) and HLW Melter Cave No. 2 Containment Buildings (H-0106, H-0105B, H-0304A)

The HLW melter cave no. 1 and HLW melter cave no. 2 containment buildings are located in the central portion of the HLW vitrification plant. Each of the containment buildings will house an HLW melter cave, an overpack C3/C5 airlock, and an equipment decontamination area.

Typical waste management activities performed in these containment buildings include the dismantling and packaging of spent consumables and decontamination of equipment for hands-on maintenance. The types of spent consumables will include waste recirculators, lid heaters, bubblers, thermocouples, and jumpers. When spent consumables are ready for change out, they will be placed on a consumable storage rack while awaiting size reduction. The consumables will be reduced in size by dismantling or cutting the spent equipment, or both. This process will be remotely conducted on tables in the containment building. The spent consumables will be placed in baskets and lowered into containers in a transfer tunnel that passes under the HLW melter cave no. 1 and 2 containment buildings (H-0117, H-0116B, H-0310A and H-0106, H-0105B, H-0304A). The C3/C5 airlocks will be used for packing or unpacking melters or their components.

In case of a HLW melter failure, the melter will be evaluated for meeting the receiving TSD waste acceptance criteria, particularly in terms of the radiological contamination in the HLW glass residue present in the melter, before it is placed in an overpack.

The equipment decontamination area located within the melter cave containment building will house the Decontamination Tanks (HSH-TK-00001/2) where equipment removed from the melter cave will be decontaminated prior to maintenance. The equipment will be initially decontaminated by soaking in the decontamination tank. After evaluation, additional decontamination may be performed using manipulators before the levels are acceptable for hands-on maintenance.

Located within the melter cave containment building will be the HLW melter; the submerged bed scrubber and HEMEs, which will function as part of the melter offgas system, the Feed Preparation Vessels (HFP-VSL-00001/5), and the HLW Melter Feed Vessels (HFP-VSL-00002/6). These tank systems will have secondary containment and are addressed section 4.2.2.

HLW Melter Cave No. 1 and HLW Melter Cave No. 2 Containment Building Design
The two HLW melter containment buildings are completely enclosed within the HLW vitrification plant. Each of the melter cave containment buildings will house an HLW melter cave, an overpack C3/C5 airlock cell, and an equipment decontamination area. Both melter cave containment buildings are designed to prevent the release of dangerous constituents and exposure to the outside environment. The design and construction of the HLW vitrification plant exterior will prevent water from running into the plant. The roof of the HLW vitrification plant will be metal. Run-off will be collected by roof drains and a drainage system with overflow roof drains.

The containment building design requirements of 40 CFR 264.1101(b) do not apply because the liquid dangerous wastes managed in the HLW melter containment building are addressed under tank systems (see section 4.2.2).

HLW Melter Cave No. 1 and HLW Melter Cave No. 2 Containment Building Structure
The HLW melter cave no. 1 and 2 containment buildings will be a fully enclosed, concrete-walled structure within the HLW vitrification plant. Therefore, its structural requirements will be met by the design standards of the HLW vitrification plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the HLW vitrification plant meet or exceed the Uniform Building Code Seismic Design Requirements.

HLW Melter Cave No. 1 and HLW Melter Cave No. 2 Containment Building Materials

The HLW melter cave no. 1 and 2 containment buildings will be constructed of steel-reinforced concrete. The interior floor and a portion of the walls of the unit will be lined with stainless steel, except for the C3/C5 airlock. The height of the lining is summarized in Table 4-11.

Use of Incompatible Materials for the HLW Melter Cave No. 1 and HLW Melter Cave No. 2 Containment Buildings

A partial stainless steel liner will be provided for the containment buildings, except for the C3/C5 airlock. The C3/C5 airlock will be partially lined with a protective coating. The stainless steel will be compatible with the wastes that will be managed, which will include spent melters and consumables, including air spargers, metallic parts, and refractory bricks. Treatment reagents that could cause the liner to leak, corrode, or otherwise fail will not be used within the unit.

Primary Barrier Integrity in the HLW Cave No. Melter 1 and HLW Melter Cave No. 2 Containment Buildings

The HLW melter cave no. 1 and 2 containment buildings are designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the HLW Cave No. Melter 1 and HLW Melter Cave No. 2 Containment Buildings

Prior to initial receipt of dangerous and mixed waste, certification by a qualified registered professional engineer that the HLW melter containment building meets the design requirements of 40 CFR 264.1101(a) and (c) will be obtained. The requirements of 40 CFR 264.1101(b) do not apply to this design because liquid dangerous wastes present in the containment building will be managed in tank systems with secondary containment systems, as presented in section 4.2.2.

Operation of the HLW Melter Cave No. 1 and HLW Melter Cave No. 2 Containment Buildings

Operational and maintenance controls and practices will be established and followed to ensure containment of the wastes within the HLW melter containment building, as required by 40 CFR 264.1101(c)(1).

Maintenance of the HLW Melter Cave No. 1 and HLW Melter Cave No. 2 Containment Buildings

The partial stainless steel lining of the containment building will be designed and constructed in a manner that will be free of significant cracks, gaps, corrosion, or other deterioration. The liner will be welded at each seam. The stainless steel liner will be free of corrosion or other deterioration because it will be compatible with materials that will be managed in the containment building, which will include spent melters and spent equipment. Only decontamination chemicals that are compatible with the liner will be used.

Wastes managed in the containment building will not be stacked. In general, waste will be placed in containers and removed from the containment building.

Measures to Prevent Tracking Wastes from the HLW Melter Cave No. 1 and HLW Melter Cave No. 2 Containment Building

The HLW melter cave no. 1 and 2 containment building design and operating methods include several measures that will prevent wastes from being tracked from the unit. Measures that will be implemented include:

- Limiting the movement of personnel and material from the C3/C5 airlock
- Using shield doors to prevent the inadvertent spread of contamination
- Decontaminating materials or containers before they are released from the unit
- Using C5 ventilation as a primary containment method

Personnel access to the HLW melter caves, which are classified as a C5 contamination area, will be restricted. Personnel operating in melter cave C3/C5 airlocks will not be in contact with spent melters because they will be encased in overpack containers.

Export of equipment from the melter caves will be kept to a minimum by performing in-cave maintenance to the maximum extent possible. The design of the cave and equipment includes master-slave manipulators, special tools, and a tool import port that will enable maintenance operations to be conducted remotely without removing the equipment from the cave. When equipment must be removed for hands-on maintenance, it will be transferred through shield doors into the Decontamination Tank (HSH-TK-00001/2) or the crane decontamination area (C3/C5) above the C3/C5 airlock. The equipment will be transferred to the maintenance room only after it has been decontaminated in Decontamination Tank HSH-TK-00001/2, and in the equipment decontamination area, if needed.

Spent consumables and wastes will be size-reduced in the cave and exported to drums through an air lock, which is designed to provide containment of contamination between the C5 melter cave and the C3 drum transfer tunnel. Export of spent Melters will be controlled to prevent the spread of contamination. Melters will be transferred into overpack containers that are docked with the shield doors to the C3/C5 airlock.

Procedures in the Event of Release or Potential for Release from the HLW Melter Cave No. 1 and HLW Melter Cave No. 2 Containment Buildings

Conditions that could lead to a release from the HLW melter cave no. 1 and HLW melter cave no. 2 containment buildings will be corrected as soon as possible after they are identified.

In the unlikely event of a release of dangerous wastes from either containment building, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Specific administrative and operating methods to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste.

Inspections of the HLW Melter Cave No. 1 and HLW Melter Cave No. 2 Containment Buildings
An inspection program will be established as required under WAC 173-303-695 to detect conditions that could lead to the release of wastes from the HLW melter cave no. 1 and HLW melter cave no. 2 containment buildings. The inspection and monitoring schedule and methods that will be used to detect a release from the unit are included in DWP Attachment 51, Chapter 6.

### 4.2.4.12 IHLW Canister Handling Cave Containment Building (H-0136)

The HLW canister handling cave containment building will be located in the southern portion of the HLW vitrification plant. Typical waste management activities performed within this containment building include the storage of waste canisters and containerized secondary waste. Located within the containment building will be two cooling and buffer storage areas and two container welding and rework stations. IHLW canisters that have cooled enough to leave the pour areas will be transported to the canister handling cave containment building by means of an overhead crane. The IHLW glass waste will continue to cool in the buffer storage areas. When adequately cooled, canisters will be moved to one of the two weld and rework stations, where the lid will be welded onto the canister. The IHLW canister will then be transported to the IHLW canister swabbing and monitoring cave containment building. Container management practices are discussed in section 4.2.1.

IHLW Canister Handling Cave Containment Building Design
The IHLW canister handling cave containment building will be completely enclosed within the HLW vitrification plant. The design and construction of the HLW vitrification plant exterior will prevent water from running into the plant. The roof of the HLW vitrification plant will be metal. Run-off will be collected by roof drains and a drainage system with overflow roof drains. The unit is designed to prevent the release and exposure of dangerous constituents to the outside environment. Its approximate dimensions are summarized in Table 4-12.

IHLW Canister Handling Cave Containment Building Structure
Because the IHLW canister handling cave containment building will be a concrete-walled structure fully enclosed within the HLW vitrification plant, its structural requirements will be met by the design standards of the HLW vitrification plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the HLW vitrification plant meet or exceed the Uniform Building Code Seismic Design Requirements.

IHLW Canister Handling Cave Containment Building Unit Materials
The IHLW canister handling cave containment building will be constructed of steel-reinforced concrete. The interior floor and a portion of the walls of the unit will be lined with stainless steel. The height of the lining will be a minimum of 0.5 feet.

Use of Incompatible Materials for the IHLW Canister Handling Cave Containment Building

The partial stainless steel liner will be provided for the IHLW containment building that will be compatible with the steel canisters that will be managed. Treatment reagents that could cause the liner to leak, corrode, or otherwise fail will not be used in the unit.

Primary Barrier Integrity in the IHLW Canister Handling Cave Containment Building

The HLW vitrification plant is designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the IHLW Canister Handling Cave Containment Building

Prior to initial receipt of dangerous and mixed waste, certification by a qualified registered professional engineer that the IHLW canister handling cave containment building meets the design requirements of 40 CFR 264.1101(a) and (c) will be obtained. The requirements of 40 CFR 264.1101(b) do not apply to this design because waste containing free liquid will not be managed in the containment building and the waste will not be treated with free liquids.

Operation of the IHLW Canister Handling Cave Containment Building

Operational and maintenance controls and practices will be established to ensure containment of the wastes within the IHLW canister handling cave containment building, as required by 40 CFR 264.1101(c)(1).

Maintenance of the IHLW Canister Handling Cave Containment Building

The partial stainless steel lining of the containment building will be constructed and maintained in a manner that will be free of significant cracks, gaps, corrosion, or other deterioration. The stainless steel liner will be welded at each seam, and will be free of corrosion or other deterioration because it will be compatible with materials that will be managed in the containment building, including the stainless steel containers. Only decontamination chemicals that are compatible with the liner will be used.

Wastes that will be managed in the containment building will not be stacked higher than the unit wall; however, wastes are not anticipated to be stacked.

Measures to Prevent Tracking Wastes from the IHLW Canister Handling Cave Containment Building

The IHLW canister handling cave containment building is designed to store cooling IHLW glass waste containers and weld the lids onto the containers.

The outside of the canister will be inspected to see whether glass is present on the container. If glass is found, it will be removed using a needle gun or other mechanical method. The glass shards will be collected for disposal in a shop-type vacuum and disposed of as a secondary waste. The containment building will be classified as a C5 contamination area, and therefore personnel access will be restricted. Wastes leaving the unit will be within containers.

Procedures in the Event of Release or Potential for Release from the IHLW Canister Handling Cave Containment Building

Conditions that could lead to a release from the IHLW canister handling cave containment building will be corrected as soon as possible after they are identified.

In the unlikely event of a release of dangerous wastes from the containment building, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Specific administrative and operating methods to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste.

Inspections of the IHLW Canister Handling Cave Containment Building
An inspection program will be established as required under WAC 173-303-695 to detect conditions that could lead to the release of wastes from the IHLW canister handling cave containment building. The inspection and monitoring schedule and methods that will be used to detect a release from the unit are included in DWP Attachment 51, Chapter 6.

#### 4.2.4.13 IHLW Canister Swab and Monitoring Cave Containment Building (H-0133)

The IHLW canister swab and monitoring cave containment building is located in the southeast portion of the HLW vitrification plant (room H-0133). The systems associated with the swabbing and monitoring activities in the cave include overhead crane, grapples, power manipulator, swabbing turntable, and swabbing waste storage container.

After decontamination in the Canister Decon Vessels (HDH-VSL-00002/4), the canister is moved to the canister swab and monitoring building and placed on the turntable. The turntable provides a base on which the canister is set and rotated while the surface swabbing is performed. When surface cleanliness has been verified, the canister is placed in the canister storage bogie and transferred to the canister storage cave.

IHLW Canister Swab and Monitoring Cave Containment Building Design
The IHLW canister swab and monitoring cave containment building will be completely enclosed within the HLW vitrification plant, and will be designed to prevent the release of dangerous constituents and their exposure to the outside environment. The design and construction of the HLW vitrification plant exterior will prevent water from running into the plant. The roof of the HLW vitrification plant will consist of metal roofing, roof insulation, and a vapor barrier. Run-off will be collected by roof drains and a drainage system with overflow roof drains. Unit dimensions are summarized in Table 4-12.

The containment building design requirements of 40 CFR 264.1101(b) do not apply because there are no liquid wastes managed in the IHLW canister swab and monitoring cave containment building.

IHLW Canister Swab and Monitoring Cave Containment Building Structure
Because the IHLW canister swab and monitoring cave building will be a concrete-walled structure fully enclosed within the HLW vitrification plant, its structural requirements will be met by the design standards of the HLW vitrification plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the HLW vitrification plant meet or exceed the Uniform Building Code Seismic Design Requirements.

IHLW Canister Swab and Monitoring Cave Containment Building Unit Materials

The IHLW canister swab and monitoring cave containment building will be constructed of steel-reinforced concrete. The interior floor and a portion of the walls of the unit will be covered with protective coating.

Use of Incompatible Materials for the IHLW Canister Swab and Monitoring Cave Containment Building

Treatment reagents that could cause the protective coating to leak, corrode, or otherwise fail will not be used within the unit.

Primary Barrier Integrity in the IHLW Canister Swab and Monitoring Cave Containment Building

The IHLW canister swab and monitoring cave building is designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the IHLW Canister Swab and Monitoring Cave Containment Building

Prior to initial receipt of dangerous and mixed waste, certification by a qualified registered professional engineer that the IHLW canister swab and monitoring cave containment building meets the design requirements of 40 CFR 264.1101(a) and (c) will be obtained. The requirements of 40 CFR 264.1101(b) do not apply to this design because there are no free liquids managed in the unit.

Operation of the IHLW Canister Swab and Monitoring Cave Containment Building

Operational and maintenance controls and practices will be established to ensure containment of the wastes within the IHLW canister swab and monitoring cave containment building, as required by 40 CFR 264.1101(c)(1).

Maintenance of the IHLW Canister Swab and Monitoring Cave Containment Building

The protective coating of the containment building will be maintained in a manner that will be free of significant cracks, gaps, corrosion, or other deterioration. Only decontamination chemicals that are compatible with the protective coating will be used. Wastes are not expected to be stacked within the unit.

Measures to Prevent Tracking Wastes from the IHLW Canister Swab and Monitoring Cave Containment Building

The IHLW canister swab and monitoring cave containment building is designed to manage canisters that are swabbed to determine whether they meet the surface radiological requirements. The containment building will be a C3 area. The air from the unit passes through HEPA filtration prior to discharge out of the plant stack.

Personnel access to the canister swab and monitoring cave containment building, which is classified as a C3 area, will be limited. Therefore, personnel moving into and out of the unit will not track contamination out of the unit.

Procedures in the Event of Release or Potential for Release from the IHLW Canister Swab and Monitoring Cave Containment Building
Conditions that could lead to a release from the IHLW canister swab and monitoring cave containment building will be corrected as soon as possible after they are identified.

In the unlikely event of a release of dangerous wastes from the containment building, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Administrative and operating methods to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste.

Inspections of the IHLW Canister Swab and Monitoring Cave Containment Building
An inspection program will be established as required under WAC 173-303-695 to detect conditions that could lead to release of wastes from the IHLW canister swab and monitoring cave containment building. The inspection and monitoring schedule and methods that will be used to detect a release are included in DWP Attachment 51, Chapter 6.

#### 4.2.4.14 C3 Workshop Containment Building (H-0311A, H-0311B)

The C3 workshop containment building will be located in the northeast side of the HLW vitrification plant at elevation 37 ft.

Typical waste management activities performed in this containment building include decontamination, size reduction, and packaging of spent equipment. Equipment will be transported to the unit contained in shielded casks, drums, or in a standard waste box. In the workshop, the equipment will be decontaminated to enable hands-on maintenance. Spent equipment parts will be bagged and placed in standard waste containers or boxes for disposal. Size reduction may be performed to facilitate packaging. Other spent equipment will be packaged in drums or standard waste boxes.

C3 Workshop Containment Building Design
The C3 workshop containment building will be designed as a completely enclosed area within the HLW vitrification plant. It will be designed to prevent the release of dangerous waste and their exposure to the outside environment. The design and construction of the HLW vitrification plant exterior will prevent water from running into the plant. The roof of the HLW vitrification plant will consist of metal roofing, roof insulation, and vapor barrier. Rainwater run-off will be collected by roof drains and drainage systems with overflow roof drains. The approximate dimensions of the unit are summarized in Table 4-12.

C3 Workshop Containment Building Structure
The C3 workshop containment building will be a concrete-walled structure fully enclosed within the HLW vitrification plant. Therefore, structural requirements for the containment building will be met by the design standards of the HLW vitrification plant. The design will ensure that the

unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the HLW vitrification plant meet or exceed the Uniform Building Code Seismic Design Requirements.

C3 Workshop Containment Building Materials
The C3 workshop containment building will be constructed of steel-reinforced concrete. The interior floor and a portion of the walls of the unit will be lined with stainless steel or protective coating.

Use of Incompatible Materials in the C3 Workshop Containment Building
A partial stainless steel liner or protective coating will be provided for this unit. Stainless steel or the protective coating will be compatible with the equipment wastes that will be managed. Activities in the unit will be limited to decontamination, size reduction, and packaging the waste components into drums or waste boxes. Treatment reagents that could cause the liner or coating to leak, corrode, or otherwise fail will not be used within the unit.

Primary Barrier Integrity in the C3 Workshop Containment Building
The C3 workshop containment building is designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the C3 Workshop Containment Building
Prior to initial receipt of dangerous and mixed waste, a certification by a qualified registered professional engineer that the C3 workshop containment building meets the design requirements of 40 CFR 264.1101(a) and (c) will be obtained. The requirements of 40 CFR 264.1101(b) do not apply to this design because the waste managed in the unit will not contain free liquids or be treated with free liquids.

Operation of the C3 Workshop Containment Building
Operational and maintenance controls and practices will be established and followed to ensure containment of the dangerous wastes within the C3 workshop containment building unit as required by 40 CFR 264.1101(c)(1).

Maintenance of the C3 Workshop Containment Building
The concrete and protective coating, where used, will be constructed and maintained in a manner that will be free of significant cracks, gaps, corrosion, or other deterioration. The concrete and protective coating, where used, will remain free of corrosion or other deterioration because it is compatible with materials that will be managed in the containment building. The failed equipment that will be managed in the containment building unit will be compatible with the concrete or protective coating, where used. Only decontamination chemicals that are compatible with the concrete or protective, where used, will be applied.

Measures to Prevent Tracking Wastes from the C3 Workshop Containment Building

The C3 workshop containment building will be designed to isolate failed equipment from the accessible environment and to prevent the spread of contaminated materials. Very little dust is expected to be generated in the unit.

The containment building will be classified as a C3 contamination area, which allows only limited access by personnel. Personnel access will be via a C2/C3 subchange room. Equipment will enter and exit the workshop via a C2/C3 airlock. Wastes leaving the unit will be enclosed within containers. If necessary, the containers will be decontaminated in the unit prior to transportation to a permitted storage area. Equipment leaving the unit will be decontaminated, when necessary, before being released for removal from the cells.

Procedures in the Event of Release or Potential for Release from the C3 Workshop Containment Building

The design and operation of the unit makes it very unlikely that releases will occur. The design and operational measures will minimize the generation of dust and contain it within the unit. In the unlikely event that a release of dangerous wastes from the containment building is detected, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Specific administrative and operating methods that will be used to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste These methods will be followed to repair conditions that could lead to a release.

Inspections of the C3 Workshop Containment Building

An inspection program will be established to detect conditions that could lead to a release of wastes from the C3 workshop containment building. The inspection and monitoring schedule and methods that will be used to detect releases from the unit are included in DWP Attachment 51, Chapter 6.

#### 4.2.4.15 Filter Cave Containment Building (H-0104)

The filter cave containment building is located in the northwest portion of the plant. The filter cave containment building will manage spent HEPA filters via an overhead crane. The crane transports the spent filters to a disposal container. The disposal container is then transported via cart, through an air lock and shield doors and to a load-out area for storage pending final disposal. The containment building also houses a hands-on crane decontamination and repair area.

Filter Cave Containment Building Design

The filter cave containment building will be completely enclosed within the HLW vitrification plant, and will be designed to prevent the release and exposure of dangerous constituents to the outside environment. The design and construction of the HLW vitrification plant exterior will prevent water from running into the plant. The roof of the HLW vitrification plant will consist of metal roofing, roof insulation, and a vapor barrier. Run-on will be collected by roof drains and a drainage system with overflow drains. The approximate dimensions of the containment building are summarized in Table 4-12.

Filter Cave Containment Building Structure

Because the filter cave containment building will be a concrete-walled structure fully enclosed within the HLW vitrification plant, its requirements will be met by the design standards of the HLW vitrification plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the HLW vitrification plant meet or exceed the Uniform Building Code Seismic Design Requirements.

Filter Cave Containment Building Materials

The Filter Cave containment building will be constructed of steel-reinforced concrete. The interior floor and a portion of the walls will be lined with a protective coating.

Use of Incompatible Materials for the Filter Cave Containment Building

The concrete structure and protective coating, where used, will be compatible with the wastes that will be managed in the unit, which will include spent HEPA filters. Activities in the unit will be limited to HEPA filter change out and waste packaging. Treatment reagents that could cause concrete or protective coating, where used, to leak, corrode, or otherwise fail will not be used within the unit.

Primary Barrier Integrity in the Filter Cave Containment Building

The filter cave containment building will be designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the Filter Cave Containment Building

Prior to initial receipt of dangerous and mixed waste, certification by a qualified registered professional engineer that the filter cave containment building meets the design requirements of 40 CFR 264.1101(a) and (c) will be obtained. The requirements of 40 CFR 264.1101(b) do not apply to this design because dangerous waste containing free liquids will not be managed in the unit and waste will not be treated with free liquids.

Operation of the Filter Cave Containment Building

Operational and maintenance controls and practices will be established to ensure containment of the waste within the filter cave containment building, as required by 40 CFR 264.1101(c)(1).

Maintenance of the Filter Cave Containment Building

The concrete floor and walls of the unit will be constructed and maintained in a manner that will be free of significant cracks, gaps, corrosion, or other deterioration. The concrete structure will be compatible with materials that will be managed in the containment building, which will include spent HEPA filters. No decontamination chemicals that are incompatible with the concrete will be used.

Measures to Prevent Tracking Wastes from the Filter Cave Containment Building

The filter cave containment building is designed to manage spent HEPA filters. Conducting these activities in a C5 zone will prevent the spread of contaminated materials. Controlled movement of equipment into and out of the unit will decrease the possibility that waste will be tracked from the unit.

Personnel access to the filter cave containment building, which is classified as a C5 contamination area, will be restricted.

Procedures in the Event of Release or Potential for Release from the Filter Cave Containment Building

Conditions that could lead to a release from the filter cave containment building will be corrected as soon as possible after they are identified. In the unlikely event of a release of dangerous wastes from the containment building, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Specific administrative and operating methods that will be used to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste.

Inspections of the Filter Cave Containment Building

An inspection program will be established to detect conditions that could lead to a release of wastes from the filter cave containment building. The inspection and monitoring schedule and methods that will be used to detect releases from the unit are included in DWP Attachment 51, Chapter 6.

An inspection program will be established to detect conditions that could lead to a release of wastes from the HLW vitrification plant drum transfer tunnel containment building. The inspection and monitoring schedule, and methods that will be used to detect releases from the unit, are included in Chapter 6.

#### 4.2.4.16 HLW Pour Tunnel No. 1 Containment Building (H-B032) and HLW Pour Tunnel No. 2 Containment Building (H-B005A)

HLW pour tunnels No. 1 and No. 2 containment building contain bogies that transport empty canisters to the melter pour spout. Each of the two pour tunnels are 11 ft wide by 85 ft 2 in. long extending from the south end of the melter caves in a north-south direction to an area below the canister handling cave. The glass pouring into canisters takes place in the north half of the HLW pour tunnels No.1 and No. 2 containment buildings. After filling with glass, the canisters are allowed to cool down prior to being transported to the south portion of the HLW pour tunnels No.1 and No. 2 containment buildings and transferred through the hatch to the canister handling cave located above. The south portion of the HLW pour tunnels No.1 and No. 2 containment buildings can be used for bogie decontamination, if required, prior to handling in the bogie maintenance area. The bogie maintenance area is segregated from HLW pour tunnels No.1 and No. 2 containment buildings by a shield door. Bogie decontamination is not considered a dangerous waste management activity performed within the boundary of the HLW pour tunnels No.1 and No.2 containment buildings. Contaminated liquids which accumulate in the sumps located in the pour tunnels will be sent to RLD-VSL-00008.

HLW Pour Tunnel No. 1 and HLW Pour Tunnel No. 2 Containment Building Design

The HLW pour tunnels No.1 and No. 2 containment buildings will be completely enclosed within the HLW vitrification plant, and will be designed to prevent the release of dangerous constituents and their exposure to the outside environment. The design and construction of the HLW vitrification plant exterior will prevent water from running into the facility. The roof of the HLW vitrification plant will consist of metal roofing, roof insulation, and a vapor barrier. Runoff will be collected by roof drains and a drainage system with overflow roof drains. Unit dimensions are summarized in Table 4-12.

The containment buildings' design requirements of 40 CFR 264.1101(b) do not apply because there are no liquid dangerous wastes managed in the pour tunnels.

HLW Pour Tunnel No. 1 and HLW Pour Tunnel No. 2 Containment Building Structure

Because the HLW pour tunnels No.1 and No. 2 containment buildings will be concrete-walled structures fully enclosed within the HLW vitrification plant, their structural requirements will be met by the design standards of the HLW vitrification plant. The design will ensure that the units have sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the HLW vitrification plant meet or exceed the Uniform Building Code Seismic Design Requirements.

HLW Pour Tunnel No. 1 and HLW Pour Tunnel No. 2 Containment Building Unit Materials

The HLW pour tunnels No.1 and No. 2 containment buildings will be constructed of steel-reinforced concrete. The interior floors and a portion of the walls of the units will be lined with stainless steel to protect the insulation and concrete from the effects of high temperatures.

Use of Incompatible Materials for the HLW Pour Tunnel No. 1 and HLW Pour Tunnel No. 2 Containment Buildings

There are no liquid dangerous wastes managed within the HLW pour tunnels No.1 and No. 2 containment buildings.

Primary Barrier Integrity in the HLW Pour Tunnel No. 1 and HLW Pour Tunnel No. 2 Containment Buildings

The HLW pour tunnels No.1 and No. 2 containment buildings are designed to withstand loads from the movement of wastes and handling equipment. The seismic design criteria found in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the HLW Pour Tunnel No. 1 and HLW Pour Tunnel No. 2 Containment Buildings

Prior to initial receipt of dangerous and mixed waste, certification by a qualified registered professional engineer that the HLW pour tunnels No.1 and No. 2 containment buildings meet the design requirements of 40 CFR 264.1101(a) and (c) will be obtained. The requirements of 40 CFR 264.1101(b) do not apply to this design because no free liquids are managed in the unit.

Operation of the HLW Pour Tunnel No. 1 and HLW Pour Tunnel No. 2 Containment Buildings
Operational and maintenance controls and practices will be established to ensure containment of the wastes within the HLW pour tunnels No.1 and No. 2 containment buildings, as required by 40 CFR 264.1101(c)(1).

Maintenance of the HLW Pour Tunnel No. 1 and HLW Pour Tunnel No. 2 Containment Buildings
The partial stainless-steel liner will be installed in the HLW pour tunnels No.1 and No. 2 containment buildings to protect insulation and concrete from the effects of high temperatures. Waste canisters will not be stacked within the unit.

Measures to Prevent Tracking Wastes from the HLW Pour Tunnel No. 1 and HLW Pour Tunnel No. 2 Containment Buildings
The HLW vitrification plant C5 HLW pour tunnels No.1 and No. 2 containment buildings will be designed to isolate failed equipment from the accessible environment and to prevent the spread of contaminated materials. Very little dust is expected to be generated in the unit.

Personnel access to the HLW pour tunnels No.1 and No. 2 containment buildings will not be allowed because of high radiation.

Control of Fugitive Dust from the HLW Pour Tunnel No. 1 and HLW Pour Tunnel No. 2 Containment Buildings
Operational controls of the HLW vitrification plant ventilation system will be used to control fugitive dust emissions from the units to meet the requirements of 40 CFR 264.1101(c)(1)(iv). The following measures will be used to prevent fugitive dust from escaping the HLW pour tunnels No.1 and No. 2 containment buildings:

- A cascading air flow from areas of least to greatest potential contamination (that is, C2 to C3 to C5)
- Greater negative air pressure in the unit, compared to adjacent C3 units, to pull air into the unit and prevent backflow
- Intake air through controlled air in-bleed units with backflow prevention dampers
- Safety interlocks to shut down C3 extract fans to prevent backflow if the C5 system shuts down
- Dual HEPA filtration of exhaust air before discharge to the atmosphere through a monitored stack
- A multiple fan extraction system, designed to maintain negative pressure and cascading air flow, even during fan maintenance and repair

Procedures in the Event of Release or Potential for Release from the HLW Pour Tunnel No. 1 and HLW Pour Tunnel No. 2 Containment Buildings
Conditions that could lead to a release from the HLW pour tunnels No.1 and No. 2 containment buildings will be corrected as soon as possible after they are identified. In the unlikely event of a release of dangerous wastes from the containment buildings, actions required by 40 CFR

264.1101(c)(3)(i) through (iii) will be taken. Administrative and operating methods to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste.

Inspections of the HLW Pour Tunnel No. 1 and HLW Pour Tunnel No. 2 Containment Buildings
An inspection program will be established as required under WAC 173-303-695 to detect conditions that could lead to the release of wastes from the HLW pour tunnel containment buildings. The inspection and monitoring schedule and methods that will be used to detect a release are included in DWP Attachment 51, Chapter 6.

#### 4.2.4.17 HLW Drum Swabbing and Monitoring Area Containment Building (H-0126A, H-0126B, and H-B028)

The HLW drum swabbing and monitoring area containment building is located in the northeast section of the HLW vitrification plant. Typical waste management activities performed in this containment building include the remote handling of 55 US gallon drums. The drums will be swabbed for surface contamination and decontaminated if needed.

Upon arrival in the HLW drum swabbing and monitoring area, the 55 US gallon drums are weighed, monitored, and then transferred through a hatch and placed into a shielded cask in the cask handling area.

In the cask handling area, drum transport casks are remotely lidded and moved to the truck loading bay for removal from the facility.

Drum Swabbing and Monitoring Area Containment Building Design
The drum swabbing and monitoring area containment building will be completely enclosed within the HLW vitrification plant, and will be designed to prevent the release of dangerous constituents and their exposure to the outside environment. The design and construction of the HLW vitrification plant exterior will prevent water from running into the plant. The roof of the HLW vitrification plant will consist of metal roofing, roof insulation, and a vapor barrier. Runoff will be collected by roof drains and a drainage system with overflow roof drains. Unit dimensions are summarized in Table 4-12.

The containment building design requirements of 40 CFR 264.1101(b) do not apply because the liquid dangerous wastes will not be managed in the drum swabbing and monitoring area. If liquid dangerous wastes are stored in 55 US gallon drums, the drums will be provided with portable secondary containment.

HLW Drum Swabbing and Monitoring Area Containment Building Structure
Because the HLW drum swabbing and monitoring area will be a concrete-walled structure fully enclosed within the HLW vitrification plant, its structural requirements will be met by the design standards of the HLW vitrification plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the HLW vitrification plant meet or exceed the Uniform Building Code Seismic Design Requirements.

HLW Drum Swabbing and Monitoring Area Containment Building Unit Materials

The HLW drum swabbing and monitoring area containment building will be constructed of steel-reinforced concrete. The interior floor and a portion of the walls of the unit will be covered with special protective coating to protect the concrete from mixed waste contamination.

Use of Incompatible Materials for the HLW Drum Swabbing and Monitoring Area Containment Building

There are no liquid dangerous wastes managed within the HLW drum swabbing and monitoring containment building.

Primary Barrier Integrity in the HLW Drum Swabbing and Monitoring Area Containment Building

The HLW drum swabbing and monitoring area containment building is designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the HLW Drum Swabbing and Monitoring Area Containment Building

Prior to initial receipt of dangerous and mixed waste, certification by a qualified registered professional engineer that the HLW drum swabbing and monitoring area containment building meets the design requirements of 40 CFR 264.1101(a) and (c) will be obtained. The requirements of 40 CFR 264.1101(b) do not apply to this design because free liquids managed in the unit are addressed under tank systems in section 4.2.2.

Operation of the HLW Drum Swabbing and Monitoring Area Containment Building

Operational and maintenance controls and practices will be established to ensure containment of the wastes within the HLW drum swabbing and monitoring area containment building, as required by 40 CFR 264.1101(c)(1).

Maintenance of the HLW Drum Swabbing and Monitoring Area Containment Building

Personnel access to the containment building will not be allowed because of high radiation. Drums are not normally expected to be stacked within the unit.

Measures to Prevent Tracking Wastes from the HLW Drum Swabbing and Monitoring Area Containment Building

The HLW vitrification plant C5 HLW drum swabbing and monitoring containment building will be designed to isolate failed equipment from the accessible environment and to prevent the spread of contaminated materials. Very little dust is expected to be generated in the unit.

Control of Fugitive Dust from the HLW Drum Swabbing and Monitoring Area Containment Building

Operational controls of the HLW vitrification plant ventilation system will be used to control fugitive dust emissions from the unit to meet the requirements of 40 CFR 264.1001(c)(1)(iv).

The following measures will be used to prevent fugitive dust from escaping the HLW drum swabbing and monitoring area containment building:

- A cascading air flow from areas of least to greatest potential contamination (that is, C2 to C3 to C5)
- Greater negative air pressure in the unit, compared to adjacent C3 units, to pull air into the unit and prevent backflow
- Intake air through controlled air in-bleed units with backflow prevention dampers
- Safety interlocks to shut down C3 extraction fans to prevent backflow, if the C5 system shuts down
- Dual HEPA filtration of exhaust air before discharge to the atmosphere through a monitored stack
- A multiple fan extraction system, designed to maintain negative pressure and cascading air flow, even during fan maintenance and repair

Procedures in the Event of Release or Potential for Release from HLW Drum Swabbing and Monitoring Area Containment Building
Conditions that could lead to a release from the HLW drum swabbing and monitoring area containment building will be corrected as soon as possible after they are identified. In the unlikely event of a release of mixed or dangerous wastes from the containment building, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Administrative and operating methods to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste.

Inspections of the HLW Drum Swabbing and Monitoring Area Containment Building
An inspection program will be established as required under WAC 173-303-695 to detect conditions that could lead to the release of wastes from the HLW drum swabbing and monitoring area containment building. The inspection and monitoring schedule and methods that will be used to detect a release are include in DWP Attachment 51, Chapter 6.

#### 4.2.4.18 HLW Waste Handling Area Containment Building (H-410B, H-411)

The HLW waste handling area containment building consists of rooms H-410B, and H-411 on the 58 ft elevation of the HLW vitrification plant. Typical waste management activities performed in this containment building include waste sorting, segregation, and providing temporary storage of mixed waste containers (e.g. spent silver mordenite). The HLW waste handling area containment building will contain floor space for segregated storage of empty and full containers, typically 55 gallon waste drums. Tools and equipment will also be stored in this containment building.

HLW Waste Handling Area Containment Building Design
The HLW waste handling area containment building will be completely enclosed within the HLW vitrification plant, and will be designed to prevent the release of dangerous constituents

and their exposure to the outside environment. The design and construction of the HLW vitrification plant exterior will prevent water from running into the plant. The roof of the HLW vitrification plant will consist of metal roofing, roof insulation, and a vapor barrier. Runoff will be collected by roof drains and a drainage system with overflow roof drains. Unit dimensions are summarized in Table 4-12.

The containment building design requirements of 40 CFR 264.1101(b) do not apply because the liquid dangerous wastes will not be managed in the waste handling area. If liquid wastes are stored in 55 US gallon drums, the drums will be provided with portable secondary containment.

HLW Waste Handling Area Containment Building Structure
Because the HLW waste handling area containment building will be a concrete-walled structure fully enclosed within the HLW vitrification plant, its structural requirements will be met by the design standards of the HLW vitrification plant. The design will ensure that the unit has sufficient structural strength to prevent collapse or failure. DWP Attachment 51, Supplement 1 provides documentation that the seismic requirements for the HLW vitrification plant meet or exceed the Uniform Building Code Seismic Design Requirements.

HLW Waste Handling Area Containment Building Unit Materials
The HLW waste handling area containment building will be constructed of steel-reinforced concrete. The interior floor and a portion of the walls of the unit will be covered with special protective coatings to protect the concrete from mixed waste contamination.

Use of Incompatible Materials for the HLW Waste Handling Area Containment Building
There are no liquid dangerous wastes managed within the HLW waste handling area containment building.

Primary Barrier Integrity in the HLW Waste Handling Area Containment Building
The HLW waste handling area containment building is designed to withstand loads from the movement of personnel, wastes, and handling equipment. The seismic design criteria found in DWP Attachment 51, Supplement 1 ensures that appropriate design loads, load combinations, and structural acceptance criteria are employed at the WTP.

Certification of Design for the HLW Waste Handling Area Containment Building
Prior to initial receipt of dangerous and mixed waste, certification by a qualified registered professional engineer that the HLW waste handling area containment building meets the design requirements of 40 CFR 264.1101(a) and (c) will be obtained. The requirements of 40 CFR 264.1101(b) do not apply to this design because free liquids will not be managed in the unit.

Operation of the HLW Waste Handling Area Containment Building
Operational and maintenance controls and practices will be established to ensure containment of the wastes within the HLW waste handling area containment building, as required by 40 CFR 264.1101(c)(1).

Maintenance of the HLW Waste Handling Area Containment Building

Wastes are not normally expected to be stacked within the unit.

Measures to Prevent Tracking Wastes from the HLW Waste Handling Area Containment Building

Wastes leaving the HLW waste handling area containment building will be enclosed within containers. If necessary, these containers will be decontaminated in the unit prior to transportation to another permitted TSD facility.

Control of Fugitive Dust from the HLW Waste Handling Area Containment Building

Operational controls of the HLW vitrification plant ventilation system will be used to control fugitive dust emissions from the unit to meet the requirements of 40 CFR 264.1101(c)(1)(iv). The following measures will be used to prevent fugitive dust from escaping the waste handling area containment building:

- A cascading air flow from areas of least to greatest potential contamination (that is, C2 to C3 to C5)
- Greater negative air pressure in the unit, compared to adjacent C2 units, to pull air into the unit and prevent backflow
- Intake air through controlled air in-bleed units with backflow prevention dampers
- Safety interlocks to shut down C3 extraction fans to prevent backflow if the C5 system shuts down
- HEPA filtration of exhaust air before discharge to the atmosphere through a monitored stack
- A multiple fan extraction system, designed to maintain negative pressure and cascading air flow, even during fan maintenance and repair
- Personnel ingress and egress through airlocks and subchange rooms

Procedures in the Event of Release or Potential for Release from HLW Waste Handling Area Containment Building

Conditions that could lead to a release from the HLW waste handling area containment building will be corrected as soon as possible after they are identified. In the unlikely event of a release of dangerous wastes from the containment building, actions required by 40 CFR 264.1101(c)(3)(i) through (iii) will be taken. Administrative and operating methods to satisfy this requirement will be developed prior to initial receipt of dangerous and mixed waste.

Inspections of the HLW Waste Handling Area Containment Building

An inspection program will be established as required under WAC 173-303-695 to detect conditions that could lead to the release of wastes from the HLW waste handling area containment building. The inspection and monitoring schedule and methods that will be used to detect a release are included in DWP Attachment 51, Chapter 6.

## 4.3 OTHER WASTE MANAGEMENT UNITS

Sections 4.3.1 through 4.3.5 discuss the applicability of the requirements for waste management units that have not been discussed up to this point in the permit. Sections 4.3.6 through 4.3.9 describe the applicability of air emission controls, waste minimization, groundwater monitoring, and functional design requirements to the WTP. References to other sections of the permit are provided as appropriate.

### 4.3.1 Waste Piles [D-3]

The operation of the WTP does not involve the placement of dangerous waste in waste piles. Therefore, the requirements of WAC 173-303-660, "Waste Piles", do not apply to the WTP.

### 4.3.2 Surface Impoundments [D-4]

The operation of the WTP does not involve the placement of dangerous waste in surface impoundments. Therefore, the requirements of WAC 173-303-650, "Surface Impoundments", do not apply to the WTP.

### 4.3.3 Incinerators [D-5]

The WTP does not include a dangerous waste incinerator. Therefore, the requirements of WAC 173-303-670, "Incinerators", do not apply to the WTP.

### 4.3.4 Landfills [D-6]

The operation of the WTP does not involve the placement of dangerous waste in landfills. Therefore, the requirements of WAC 173-303-665, "Landfills", do not apply to the WTP.

### 4.3.5 Land Treatment [D-7]

The operation of the WTP does not involve the land treatment of dangerous waste. Therefore, the requirements of WAC 173-303-655, "Land Treatment", do not apply to the WTP.

### 4.3.6 Air Emissions Control [D-8]

Information regarding air emissions control is provided in the following sections:

- Pretreatment plant vessel vent process and exhaust system (PVP/PVV) - section 4.1.2.17
- LAW vitrification offgas treatment system description - section 4.1.3.3
- HLW vitrification offgas treatment system description - section 4.1.4.3
- Process vents (40 CFR 264 Subpart AA) - section 4.2.2.10.2
- Equipment leaks (40 CFR 264 Subpart BB) - section 4.2.2.10.3
- Tanks and containers (40 CFR 264 Subpart CC) - section 4.2.2.10.4

### 4.3.7 Waste Minimization [D-9]

Waste minimization information is presented in Chapter 10 of the permit.

### 4.3.8 Groundwater Monitoring for Land-Based Units [D-10]

The groundwater monitoring requirements found in WAC 173-303-645, "Releases from regulated units", do not apply to the WTP, since it is not operated as a regulated dangerous waste surface impoundment, landfill, land treatment area or waste pile, as defined in WAC 173-303-040. Therefore, groundwater monitoring is not required.

### 4.3.9 Functional Design Requirements

The WTP will be designed to comply with applicable design codes and specifications. The documents referenced in this chapter and contained in DWP Attachment 51 identify the codes and standards to which the WTP system, structures, and components are being constructed.