WASTE TREATMENT AND IMMOBILIZATION PLANT
CHAPTER 4G
DIRECT-FEED LOW-ACTIVITY WASTE (EFFLUENT MANAGEMENT FACILITY)
CHANGE CONTROL LOG

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

Modification History Table

Modification Date	Modification Number
05/17/2018	8C.2018.2F
09/05/2017	8C.2017.6F
12/15/2016	8C.2016.Q3

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CHAPTER 4G
DIRECT FEED LOW-ACTIVITY WASTE (EFFLUENT MANAGEMENT FACILITY)

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4G.0 Direct Feed Low-Activity Waste (Effluent Management Facility)

The Direct Feed Low-Activity Waste (DFLAW) configuration allows for the operation of the Low-Activity Waste (LAW) Vitrification Facility and Analytical Laboratory (Lab) prior to operation of the Pretreatment (PT) Facility. In this configuration, pretreated low-activity waste is fed directly from the Hanford Tank Farms ~~LAW Pretreatment System (LAWPS)~~ to the LAW Vitrification Facility. ~~The LAWPS is permitted as a separate Treatment, Storage, and Disposal Facility under the Hanford Dangerous Waste Permit. The DFLAW configuration differs from the baseline configuration. In the baseline configuration, low-activity waste and high-activity waste is transferred directly from the Hanford Tank Farms to the Pretreatment Facility and treated by ultrafiltration and cesium ion exchange before transfer to the LAW Vitrification Facility or High-Level Waste (HLW) Vitrification Facility; in addition, the generated off-gas effluents from the LAW Vitrification Facility and HLW Vitrification Facility processes are returned to the Pretreatment Facility. In the DFLAW configuration, low-activity waste bypasses the Pretreatment Facility and feeds directly into the LAW Vitrification Facility. As such, the replication of some functions of the Pretreatment Facility is required.~~ The Effluent Management Facility (EMF) is in place to ~~replicate activities conducted in the baseline configuration, including the~~ manage~~ment~~ and treat~~ment of~~ the liquid effluent from the LAW Vitrification Facility Radioactive Liquid Waste Disposal (RLD) System and the Lab RLD System, and manage~~ment of~~ the effluent from the LAW Secondary Offgas/Vessel Vent Process (LVP) System. Waste received at the LAW Vitrification Facility from the Tank Operations Contractor (TOC)~~LAWPS~~ will not be characterized as ignitable (D001) or reactive (D003); therefore, tanks/vessels associated with the DFLAW configuration are not required to be designed to manage reactive or ignitable wastes.

Permitted processes involved with the DFLAW configuration include the Direct Feed LAW EMF Process (DEP) System, the Direct Feed LAW EMF Vessel Vent Process (DVP) System, and the underground waste transfer lines.

Process Flow

The primary function of the EMF is to house the DEP and DVP systems and their supporting utility systems, which allow for the treatment of radioactive, dangerous liquid effluent derived from secondary waste streams resulting from glass production in the LAW Facility. The sources of the secondary effluents that are sent to the EMF for treatment are the LAW and Lab RLD systems, the LAW LVP system~~s~~, and the transfer line flushes and drains associated with the feed and secondary effluent transfers. The EMF will operate up to and during the commissioning of the PT and High-Level Waste (HLW) Facilities. Once the HLW Facility and the PT Facility begin hot commissioning, the EMF will be placed into lay-up and maintained in the event that the PT Facility is unavailable.

The effluents from LAW Facility and Lab operations are collected in the EMF and blended together for evaporation, with the exception of the caustic scrubber effluent received from the LVP system. The EMF concentrates the blended effluent to reduce the total volume to be returned to the LAW Concentrate Receipt Process (LCP) system. The caustic scrubber effluent is combined with the evaporator condensate and is sent to the Liquid Effluent Retention Facility or Effluent Treatment Facility (LERF/ETF) for disposal.

The DEP system includes the equipment necessary to concentrate the liquid effluent from the LAW Facility and Lab, as well as transfer line drains and flushes, via evaporation. Recycling some concentrated effluent causes build-up in the evaporator recycle loop until steady state conditions are achieved. This approach is consistent with the baseline design, in which LAW Facility effluent is recycled to the PT Facility through the Treated LAW Evaporation System (TLP).

Internal areas of the EMF are provided with conditioned air and ventilation capability by the EMF heating, ventilation, and air conditioning (HVAC) systems. The EMF Active Confinement Ventilation System (ACV) serves the process and utility areas of the EMF, while the C1V system serves the C1 areas

that do not interface with the ACV system. The ACV system uses a cascading ventilation system that maintains airflow from areas of less potential for contamination to areas of greater potential for contamination to provide confinement of contamination at or near the source. Exhaust from the ACV system is monitored to ensure compliance with permit requirements.

Figure 4G-1, EMF Process Flow, presents a simplified process flow diagram of the EMF Process.

Direct Feed Low-Activity Waste Effluent Management Facility Process System

The DEP System allows the EMF to collect, process, recycle, and dispose of the liquid effluent from the Lab, LAW Vitrification Facility, and underground waste transfer line flushes. The DEP System performs the following functions:

- Receipt of liquid effluent.
- Liquid effluent volume reduction.
- Process stream sampling.
- Waste conditioning.

The DEP System includes the following major components:

- An evaporator system consisting of an evaporator separator vessel (DEP-EVAP-00001), evaporator reboiler (DEP-RBLR-00001), evaporator condensers (DEP-COND-0001/2/3), recirculation pump, and ~~vacuum~~ steam ejectors.
- Low-Point Drain Vessel (DEP-VSL-00001).
- Evaporator Feed Vessel (DEP-VSL-00002).
- Evaporator Concentrate Vessels (DEP-VSL-00003A/B/C).
- Overhead Sampling Vessels (DEP-VSL-00004A/B).
- Process Condensate Lag Storage Vessels (DEP-VSL-00005A/B).
- Other equipment, including pumps, filters, and associated piping and valves.

The DEP System evaporator loop functions to reduce the volume of liquid effluent ~~that is received from the LAW Vitrification Facility, Lab and underground waste transfer line flushes, and recycle the concentrate back to the LAW Vitrification Facility.~~sent to the LERF/ETF, reduce the amount of the effluent recycled, and concentrate the recycles by separating the effluents into a recycle stream and a waste stream. The design also supports the transfer of the concentrate to the Hanford Tank Farms and to the tanker truck load out area. Condensate from the DEP System process can be ~~disposed~~treated ~~of~~ at the ~~Liquid Effluent Retention Facility (~~LERF~~)/Effluent Treatment Facility (~~ETF~~)~~.

~~The evaporator loop consists of the evaporator separator vessel, reboiler, condensers, and the recirculation piping. As the liquid effluent circulates through the reboiler, the temperature rises. Then, the liquid rises into the separator vessel, the hydrostatic head diminishes, and flash evaporation occurs near the liquid surface. The liquid stream recirculates in the closed loop while the vapor stream enters the evaporator overheads. The evaporator loop operates under a vacuum to reduce the boiling temperatures and minimize corrosion.~~

~~The reboiler is a tube-and-shell heat exchanger. High pressure steam, supplied from the Balance of Facilities (BOF), is used to heat a secondary steam loop that feeds the heat exchanger shell side, while the evaporator feed circulates through the heat exchanger tubes.~~

Direct Feed Low-Activity Waste Effluent Management Facility Vessel Vent Process System

The DVP System is comprised of two main parts, air inlet, and exhaust. The DVP System provides vessel ventilation for the DEP System vessels.~~,~~ ~~t~~The purpose of the DVP System is to direct vessel vent

gases to emission control systems, and purge hydrogen to maintain the vessel hydrogen concentration below dangerous levels.

The DVP System includes the following major components:

- Process Ventilation Preheaters (DVP-HTR-00001A/B).
- Process Ventilation Primary High Efficiency Particulate Air (HEPA) Filters (DVP-HEPA-00003A/B).
- Process Ventilation Secondary HEPA Filters (DVP-HEPA-00004A/B).
- Process Ventilation Exhausters (DVP-EXHR-00001A/B).

~~For the DEP System vessels in the LAW Effluent Process Building, a purge air inbleed is used to meet the very low required flow rates. The vessel vent is the exhaust portion of the DVP System and provides suction pressure on the vessel headspace, to draw in the purge air, and mitigate hydrogen accumulation. The discharged air is sent through a preheater, two-stage HEPA filters, and through an exhaust fan to discharge out of the EMF stack. The DVP exhaust fans control and maintain the suction pressure inside the various process vessels, maintaining the continuous purge air inbleed.~~

Underground Waste Transfer Lines

The underground waste transfer lines installed to support the DFLAW configuration are coaxial lines that are constructed of stainless steel primary pipe, with a carbon steel encasement pipe that is coated with fusion bonded epoxy (FBE). ~~The coating system and water barrier consist of the FBE, polyurethane insulation, and a jacket or thermoplastic outer water barrier made of high density polyethylene (HDPE).~~ Cathodic protection is not needed for the underground waste transfer lines installed to support the DFLAW configuration as the pipe system is made of corrosion resistant materials, providing water resistant construction to isolate the underground waste transfer lines from the soil and moisture.

The underground waste transfer lines transfer waste from various areas to support the DFLAW configuration. Underground waste transfer lines support the receipt of the treated low-activity waste ~~from LAWPS~~ to the LAW Vitrification Facility, as well as effluent transfers from LAW Vitrification Facility and Lab~~,~~ to ~~the~~ EMF and from the EMF to ~~the~~ LERF/ETF. Evaporator concentrate is sent back to the LAW Vitrification Facility through the ~~LAWPS~~ underground waste transfer line. In addition, liquid effluent can be transferred underground from the DEP System to the Hanford Tank Farms. After every waste transfer ~~from the LAWPS to LAW Vitrification Facility~~, the underground waste transfer lines are flushed and drained to the EMF low-point drain vessel (DEP-VSL-00001); the effluent is collected and processed at the EMF. ~~The effluent is monitored for flow and density to minimize the volume of flush liquid that is transferred to the LAW concentrate receipt vessel.~~

~~There are eight major Waste Treatment and Immobilization Plant (WTP) underground waste transfer lines that support the EMF process. Line DEP-PB-00009-S32B-03 transfers LAWPS feed from the WTP property boundary to the low-point drain vessel. Line LCP-PB-03368-S32B-03 transfers LAWPS feed and EMF concentrate from the low-point drain vessel to the LAW Vitrification Facility. LAW LVP process effluent and LAW RLD process effluent are transferred from the LAW Vitrification Facility to the EMF through line LVP-ZY-00171-W31A-03. Lab RLD process effluent is transferred from the Lab to the EMF through line RLD-WU-22142-S32B-03. Line DEP-ZS-00069-W31A-03 returns EMF concentrate from the EMF to the WTP property boundary, with transfer to the Hanford Tank Farms. EMF effluent is transferred to the existing LERF/ETF transfer line that connects in between the Pretreatment Facility and the WTP property boundary through lines RLD-ZS-66989-W31A-04 and RLD-ZS-66991-W31A-03.~~

Effluent Management Facility Buildings

The EMF, located north of the Lab, is comprised of four buildings, the LAW effluent process building, the LAW effluent drain tank building, the LAW effluent electrical building, and the LAW effluent utility building. ~~The EMF contains an evaporator system, nine major process vessels, three supporting reagent product storage tanks, heating, ventilation and air conditioning (HVAC) equipment, and electrical utilities. The buildings are described in more detail below.~~ The following is a list of the EMF Buildings:

- Building 25 – LAW Effluent Process Building.
- Building 25A – LAW Effluent Drain Tank Building.
- Building 26 – LAW Effluent Utility Building.
- Building 27 – LAW Effluent Electrical Building.

~~Building 25 – LAW Effluent Process Building~~

~~The LAW effluent process building houses the DEP System and DVP System. The DEP System is the main process system for the EMF and consists of vessels and ancillary equipment used to support the collection, processing, and disposal of the mixed waste effluent from the LAW and Lab Facilities; a more detailed discussion of the processes contained in this building are located in Section 4G.2 and 4G.3. The DVP System provides vessel ventilation for the DEP System vessels. A more detailed discussion of this system can be found in Section 4G.5.~~

~~Building 25A – LAW Effluent Drain Tank Building~~

~~The LAW effluent drain tank building consists of the low-point drain vessel (DEP-VSL-00001) and the drain tank maintenance area. The low-point drain vessel is sized to handle flushing of the DFLAW underground waste transfer lines, between the LAWPS and the LAW Vitrification Facility and the effluent lines between the LAW Vitrification Facility, the Lab and the EMF. A more detailed discussion of the processes contained in this building are located in Section 4G.2.~~

~~Building 26 – LAW Effluent Utility Building~~

~~The LAW effluent utility building contains the building ventilation HVAC HEPA filters and fans, and the BOF utility pumps and storage vessels. The LAW effluent utility building shares a ventilation system with the LAW effluent process building. The treated DVP offgas from the LAW effluent process building ties into the exhaust duct in the LAW effluent utility building and is discharged to the atmosphere through the 150-foot-high stack. A more detailed discussion of this process can be found in Section 4G.5.1. The building does not contain equipment that manages dangerous or mixed waste.~~

~~Building 27 – LAW Effluent Electrical Building~~

~~The LAW effluent electrical building houses most of the EMF electrical equipment, which includes electrical batteries and control/instrumentation equipment. It has a separate power supply and exhaust system. The building does not contain equipment that manages dangerous or mixed waste.~~

~~Figure 4G-1, EMF Process Flow, presents a simplified process flow diagram of the EMF Process.~~

4G.1 Containers

The dangerous and mixed waste generated at the EMF is managed in 90-day accumulation areas and satellite accumulation areas pursuant to the requirements in Washington Administrative Code (WAC) 173-303-200, generating dangerous waste on-site. All waste anticipated to be dangerous or mixed waste is managed in accordance with WAC 173-303-170, *Requirements for Generators of Dangerous Waste*, through WAC 173-303-230, *Special Conditions*. The dangerous and mixed waste is labeled and characterized in accordance with requirements in WAC 173-303-070, *Designation of Dangerous Waste.* ~~Information on all 90-day accumulation areas and satellite accumulation areas is maintained as required in the Hanford Dangerous Waste Permit, Part II General Facility Conditions, permit condition II.I.1.a.~~

The following are examples of secondary dangerous and mixed waste generated at the EMF:~~The dangerous and mixed waste generated at the EMF is containerized secondary waste. The following are examples of the generated secondary waste:~~

- Spent or failed equipment.
- Offgas HEPA filters.
- Personal Protective Equipment.
- Spent maintenance materials.

4G.2 Tank Systems

Permitted tank systems are designed to comply with bounding design criteria, such as pH, temperature, and pressure conditions. ~~The EMF evaporator feed vessel (DEP-VSL-00002), the overhead sampling vessels (DEP-VSL-00004A/B), evaporator concentrate vessels (DEP-VSL-00003A/B/C), and the process condensate lag storage vessels (DEP-VSL-00005A/B) are located outside in secondary containment areas. The remaining EMF process vessel, the low-point drain vessel (DEP-VSL-00001), is located indoors, in a below-grade process area. All tank systems are located within process areas with controlled access.~~

~~In general, overflows are prevented by inventory controls in conjunction with level monitoring. The fluid level in a vessel is maintained within low- and high-level ranges. Appropriate alarm settings are used to note deviations from the designed settings.~~ Vessel overflow is prevented by continuous level monitoring in conjunction with inventory controls. Automatic and operator alarm responses are designed to shut down feed to the vessel when the high-level settings are exceeded.

A list of all EMF tank systems can be found in Table 4G-1, EMF Tank Systems.

4G.2.1 Low-Point Drain Vessel (DEP-VSL-00001)

The low-point drain vessel (DEP-VSL-00001) is located below grade, within an enclosed room (ED-B001), in the LAW effluent drain tank building. The lower elevation of Room ED-B001 is designated as a routinely non-accessible area. The low-point drain vessel collects effluent ~~from underground waste transfer line flushes, including effluent~~ from flushes of the underground waste transfer lines.

The low-point drain vessel also collects effluent from the ~~DEP System concentrate transfer line relief valve;~~ west process area sumps (DEP-SUMP-00002A/B), feed vessel area sumps (DEP-SUMP-00004A/B), and tanker truck loadout sump (DEP-SUMP-00008)~~; and the drains from the evaporator concentrate/feed vessels LAW effluent cooler (DEP-HX-00001)~~. In addition, the low-point drain vessel collects overflow from several DEP System process vessels, including the evaporator feed vessel (DEP-VSL-00002), evaporator concentrate vessels (DEP-VSL-00003A/B/C), overhead sampling vessels (DEP-VSL-00004A/B), and process condensate lag storage vessels (DEP-VSL-00005A/B), as well as effluent from the ~~sampler return line,~~ evaporator drain line, fume hood drain line, and off-specification evaporator concentrate drain line.

The vessel drain line, overflow pipe, and the low-point drain sump (DEP-SUMP-00001) are decontaminated with demineralized water. The demineralized water used for decontamination is ultimately sent to LERF/ETF.

The low-point drain vessel is equipped with a vessel agitator (DEP-AGT-00001) to help prevent buildup of settled solids in the waste. The agitator ~~has a manual start and~~ operates when transferring or sampling liquid. ~~The low-point drain vessel is vented to the vessel vent header and overflows to the low-point drain area sump through a loop seal. This sump effluent is transferred to the evaporator feed prefilter (DEP-FILT-00003) and then to the evaporator feed vessel by the low-point drain vessel area sump pump. In-vessel pumps (DEP-PMP-00001A/B) are used to transfer the low-point drain vessel contents to the~~

~~evaporator feed vessel through the evaporator feed prefilter. The evaporator feed prefilter is used to keep any solids larger than 5 microns from entering the evaporator process.~~

4G.2.2 Evaporator Feed Vessel (DEP-VSL-00002)

The evaporator feed vessel (DEP-VSL-00002) receives filtered effluent from multiple sources and caustic solution from the caustic tank (SHR-TK-00013) for pH adjustment. Effluent is received in the evaporator feed vessel (DEP-VSL-00002) from the following systems:

- LAW plant wash vessel (RLD-VSL-00003).
- RLD submerged bed scrubber condensate collection vessel (RLD-VSL-00005).
- Lab RLD vessel (RLD-VSL-00164).
- Low-point drain vessel (DEP-VSL-00001).
- Overhead sampling vessels (DEP-VSL-00004A/B).
- Low-point drain sump (DEP-SUMP-00001).
- Off-specification concentrate (DEP-VSL-00003A/B/C).
- Contaminated steam condensate (DEP-VSL-00008).
- Evaporator Feed Prefilter (DEP-FILT-00003).

~~Effluent from the LAW plant wash vessel (RLD-VSL-00003), the RLD submerged bed scrubber condensate collection vessel (RLD-VSL-00005), the Lab RLD vessel (RLD-VSL-00164), and the low-point drain vessel (DEP-VSL-00001) are collected in the evaporator feed vessel prior to transfer to the evaporator separator vessel (DEP-EVAP-00001).~~

~~The evaporator feed vessel also receives off-specification effluent from the overhead sampling vessels (DEP-VSL-00004A/B), off-specification concentrate from the evaporator separator vessel (DEP-EVAP-00001), and sump effluent from the low-point drain sump (DEP-SUMP-00001).~~

~~The evaporator system concentrates the feed from the evaporator feed vessel to reduce the overall effluent volume for recycle to the LAW Vitrification Facility, or for transfer to the Hanford Tank Farms and the tanker truck load out area. In addition, the evaporator system provides an overhead condensate that can be processed by LERF/ETF.~~

The evaporator feed vessel recirculation pumps (DEP-PMP-00012A/B/C) are used to recirculate the evaporator feed vessel contents to a sample connection, where samples are collected, and fluid is returned to the evaporator feed vessel through the eductors. After passing through the evaporator feed prefilter (DEP-FILT-00003), effluent from the evaporator feed vessel (DEP-VSL-00002) is transferred to the evaporator separator vessel (DEP-EVAP-00001).

~~The evaporator feed vessel is equipped with eductors to mix vessel contents to support sampling. The eductors circulate fluid from the evaporator feed vessel using recirculation pumps and operate while the pumps are running.~~ In the event of an off-normal condition within the EMF, the evaporator feed vessel recirculation pumps can bypass the evaporator separator vessel and transfer effluent to the Hanford Tank Farms after passing through the evaporator concentrate/feed vessels LAW effluent cooler (DEP-HX-00001). The evaporator feed vessel (DEP-VSL-00002) is located in Room E-0105 which has been designated as a routinely non-accessible tank system room. The evaporator feed prefilter (DEP-FILT-00003) is used to keep any solids larger than 5 microns from entering the evaporator process.

4G.2.3 Evaporator Concentrate Vessels (DEP-VSL-00003A/B/C)

The evaporator concentrate vessels (DEP-VSL-00003A/B/C) are used to accumulate concentrated effluent from the evaporator separator vessel (DEP-EVAP-00001). In addition, the evaporator concentrate vessels may receive filter backflush from the evaporator feed prefilter (DEP-FILT-00003) and caustic solution from the caustic tank (SHR-TK-00013). The concentrate effluent can either be recycled

back to the LAW LCP vessels (LCP-VSL-00001/2), to the Hanford Tank Farms, or to the tanker truck load out area. In the event of an overflow, the liquid flows by gravity into the low-point drain vessel (DEP-VSL-00001). Each batch is sampled ~~in the evaporator concentrate vessels~~ and characterized before it is sent to the LAW Vitrification Facility or the Hanford Tank Farms. The evaporator concentrate vessels (DEP-VSL-00003A/B/C) are also located in Room E-0105 which is designated as a routinely non-accessible tank system room.

The evaporator concentrate transfer pumps (DEP-PMP-00003A/B) are used to circulate fluid from the evaporator concentrate vessels via eductors. The evaporator concentrate pumps also transfer the evaporator concentrate vessels' contents to LAW LCP vessels, the Hanford Tank Farms, or the tanker truck load out area.

When transferring concentrate to the Hanford Tank Farms, the effluent stream must comply with the ~~Hanford~~ Tank Farms Waste Transfer Compatibility Program ~~waste acceptance criteria~~. The evaporator concentrate transfer pumps transfer the effluent through the evaporator feed prefilter (DEP-FILT-00003) to remove solids, the filtered effluent is mixed with process condensate and sodium nitrite, as necessary, and then the effluent is sent through the evaporator concentrate/feed vessel LAW effluent cooler (DEP-HX-00001) before being sent to the Hanford Tank Farms.

4G.2.4 Overhead Sampling Vessels (DEP-VSL-00004A/B)

The overhead sampling vessels (DEP-VSL-00004A/B) receive ~~inter and after condenser~~ condensate from:

- ~~the e~~Evaporator primary condenser (DEP-COND-00001).
- ~~,i~~Inter-condenser (DEP-COND-00002). ~~and the~~
- ~~a~~After-condenser (DEP-COND-00003).~~,~~
- ~~c~~Caustic scrubber fluids from the LVP system (LVP-TK-00001).~~,~~
- Process condensate lag storage vessels (DEP-VSL-00005A/B).
- West process area sumps (DEP-SUMP-00002A/B).
- Feed vessel area sumps (DEP-SUMP-00004A/B).
- Non-radioactive liquid waste disposal system (NLD) sumps (NLD-SUMP-00031/32).

~~off-specification condensate from the process condensate lag storage vessels (DEP-VSL-00005A/B), effluent from west process area sumps (DEP-SUMP-00002A/B), effluent from the feed vessel area sumps (DEP-SUMP-00004A/B) and liquid from the non-radioactive liquid waste disposal system (NLD) sumps (NLD-SUMP-00031/32). Only qualified effluent is transferred to the overhead sampling vessels. Effluent in the west process area sumps and the feed vessel area sumps is also characterized using sampling or process knowledge prior to transfer to the overhead sampling vessels. Each process batch is sampled in the concentrate vessels and characterized before it is sent to the LAW facility or to the Hanford tank farms. Similarly, each batch is sampled in the overhead sampling vessels and characterized before it is sent to the process condensate lag storage vessels.~~

Samples are collected from the concentrate vessels in DEP-HOOD-0001 and characterized before being sent to the LAW Facility or being returned to the Hanford tank farms. Similarly, each batch is sampled in the overhead sampling vessels and characterized before transfer to the process condensate lag storage vessels (DEP-VSL-00005A/B). If the waste does not meet LERF/ETF requirements (i.e., off-specification), it can be blended in the other overhead sampling vessel in attempt to meet the LERF/ETF requirements. ~~If required, the liquid effluent can be transferred to the evaporator feed vessel (DEP-VSL-00002).~~

The overhead sampling vessel transfer/recirculation pumps (DEP-PMP-00004A/B/C) are used to recirculate the overhead sampling vessels contents to a sample connection, where samples are collected and fluid is returned to the overhead sampling vessels through the eductors. After the content quality has been verified through laboratory testing, pumps are used to transfer the contents to the process condensate lag storage vessels. If the waste does not meet LERF/ETF requirements (i.e., off-specification), it can be blended with the other overhead sampling vessel in attempt to meet the LERF/ETF requirements. If required, the liquid effluent can be transferred to the evaporator feed vessel (DEP-VSL-00002) for reprocessing, if necessary. ~~In the event of an overflow, the liquid gravity drains to the low-point drain vessel (DEP-VSL-00001).~~

4G.2.5 Process Condensate Lag Storage Vessels (DEP-VSL-00005A/B)

The process condensate lag storage vessels (DEP-VSL-00005A/B) receive batches of process condensate from:

- ~~the o~~Overhead sampling vessels (DEP-VSL-00004A/B)~~,~~
- ~~s~~Secondary steam blowdown (SCW-VSL-00054)~~, and~~
- ~~e~~Effluent from the east process area sumps (DEP-SUMP-00003A/B)~~, and the~~
- ~~p~~Process condensate vessel area sumps (DEP-SUMP-00005A/B)~~,~~

The vessels allow for lag storage before sending the process condensate to the LERF/ETF. In the event of an overflow, the liquid will flow by gravity into the low-point drain vessel (DEP-VSL-00001). While sampling normally occurs in the overhead sampling vessels, ~~the process condensate vessel can also be sampled prior to transfer to LERF/ETF~~periodic sampling of the process condensate vessel area sumps is out-sourced for permit compliance and LERF/ETF acceptance.

~~Recirculation pumps are used to circulate fluid in the process condensate lag storage via eductors.~~ The ~~recirculation pumps are~~ process condensate may be~~also~~ used to flush the transfer line from the low-point drain vessel to the evaporator feed prefilter (DEP-FILT-00003), flush the transfer line from the evaporator concentrate vessels to LCP-VSL-00001/2 ~~low-point drank vessel transfer pumps, flush the pump suction lines of the three evaporator concentrate vessels~~, as well as dilute evaporator concentrate prior to transfer back to the Hanford Tank Farms to meet the acceptance criteria. ~~The condensate is added to the evaporator concentrate in a tee prior to the evaporator concentrate/feed vessel LAW effluent cooler (DEP-HX-00001). The flow ratios, based upon sampling before the transfer, are recorded and a sample is taken for post transfer confirmation to verify that the transfer meets the Hanford Tank Farms waste acceptance criteria. The effluent is then transferred to the Hanford Tank Farms.~~

4G.3 Miscellaneous Units

The following miscellaneous units are part of the DEP System and are managed under this permit as tanks and tank systems. Table 4G-2 EMF Miscellaneous Units (Systems and Sub-Systems) summarizes the miscellaneous units within the EMF.

4G.3.1 Evaporator Separator Vessel (DEP-EVAP-00001)

The evaporator separator vessel (DEP-EVAP-00001) receives feed from the evaporator feed vessel (DEP-VSL-00002 via DEP-PMP-00002A/B). Feed from DEP-VSL-00002 is combined with evaporator concentrate recycles, heated in the reboiler, and introduced into the lowest portion on the evaporator. Additionally, evaporator concentrates can be recycled without going through the reboiler.~~The evaporator separator vessel also receives recirculated evaporator concentrate effluent from DEP-PMP-00007A/B and recirculates concentrate from the evaporator reboiler (DEP-RBLR-00001). Recirculated concentrate effluent from the evaporator reboiler is introduced below the liquid level and flashes to steam in the vacuum atmosphere at the liquid surface. The overhead vapors, consisting mainly of water, pass through an impingment plate tray and demister pads to remove entrained liquid, with the overhead vapor~~

~~continuing on to the evaporator primary condenser (DEP-COND-00001). Overhead vapors from the evaporator are condensed through a series of condensers (DEP-COND-00001/2/3) before the condensate is pumped to the DEP overhead sampling vessels (DEP-VSL-00004A/B) by the DEP evaporator condensate pumps (DEP-PMP-00006A/B). The majority of the bottom liquid is recycled through the evaporator reboiler with a small amount sent to the evaporator concentrate vessels (DEP-VSL-00003A/B/C) via the evaporator concentrate discharge pumps (DEP-PMP-00007A/B.~~

The evaporator circulation pump (DEP-PMP-00017) is used to provide a continuous flow of recirculated concentrate effluent to the evaporator reboiler (DEP-RBLR-00001). ~~The evaporator reboiler adds heat to the contents of evaporator to causing evaporation in the evaporator separator vessel (DEP-EVAP-0001).~~ Multiple transfer options are considered depending on the density, flow, and radiation levels of the concentrate; and the effluent may be discharged to the evaporator concentrate vessels (DEP-VSL-00003A/B/C), recirculated back to the evaporator separator vessel, or if off-specification, transferred to the evaporator feed vessel (DEP-VSL-00002). In addition, a drain line is provided from the evaporator separator vessel to the low-point drain vessel (DEP-VSL-00001) to drain the evaporator during maintenance.

The evaporator separator vessel (DEP-EVAP-00001) is fitted with level, temperature, pressure, and differential pressure instrumentation that interfaces with the Process Control System (PCJ) for remote monitoring of evaporator separator vessel conditions. ~~The evaporator separator vessel is equipped with nozzles in the vessel to spray evaporator condensate on the demister pads and impingement plate tray to keep them clean. The evaporator separator vessel also has a nozzle for injection of anti-foam reagent. Feed streams to the~~ Anti-foam reagent is added to the evaporator separator vessel ~~are combined with anti-foam reagent~~ that is supplied by the anti-foam metering pumps (AFR-PMP-00014A/B) to reduce foam generation and minimize entrainment of aerosols with overhead vapor during the evaporation process.

4G.3.2 Evaporator Primary Condenser (DEP-COND-00001)

The vapors from the evaporator separator vessel enter the primary condenser (DEP-COND-00001). The vapor is cooled, allowing liquids to condense out and collect in the boot of DEP-COND-00001. The liquids from DEP-COND-00002 and DEP-COND-00003 also collect in the boot of DEP-COND-00001. ~~The evaporator primary condenser (DEP-COND-00001) is the primary condenser for the evaporator separator vessel (DEP-EVAP-00001). The overhead vapors from the top of the evaporator separator vessel are condensed in the shell and tube condenser using a secondary cooling water loop.~~ The condensate is pumped to the overhead sampling vessels (DEP-VSL-00004A/B) by evaporator condensate pumps (DEP-PMP-00006A/B), or sent back to the evaporator separator vessel (DEP-EVAP-00001) for reprocessing. A portion of the condensate is also filtered via the condensate duplex cartridge filters (DEP-FILT-00004A/B) and used to spray the demister pads and for intermittent wash down of the evaporator separator vessel.

The vacuum for the evaporator separator vessel is established and maintained through condensing the vapor into liquid in the evaporator primary condenser. The first stage ejector (DEP-EJCTR-00001A/B) is used for additional pressure control in the evaporator separator vessel.

4G.3.3 Evaporator Inter-Condenser (DEP-COND-00002)

Non-condensable overhead vapor is moved from the evaporator separator vessel (DEP-EVAP-00001) and evaporator primary condenser (DEP-COND-00001) via the first stage ejector and discharged to the evaporator inter-condenser (DEP-COND-00002). The evaporator inter-condenser and evaporator after-condenser (DEP-COND-00003) work with the steam ejectors to create a vacuum in the evaporator separator vessel (DEP-EVAP-00001). The first stage ejector (DEP-EJCTR-00001A/B) is used to draw vapor from the evaporator primary condenser (DEP-COND-00001).

4G.3.4 Evaporator After-Condenser (DEP-COND-00003)

The second stage ejector (DEP-EJCTR-00002) pulls vapor from evaporator inter-condenser (DEP-COND-00002) and discharges into the evaporator after-condenser (DEP-COND-00003), where the steam is condensed and the remaining vapor is drawn into the vessel vent header. The condensate ~~from the condensers flows to a drain pot on the boot of the primary condenser, from there it~~ is pumped by evaporator condensate pumps (DEP-PMP-00006A/B) to the overhead sampling vessels (DEP-VSL-00004A/B), and/or back to the evaporator separator vessel (DEP-EVAP-00001)~~. to be used as continuous mesh wash spray or intermittent wash down, or sent back to the evaporator for reprocessing.~~

4G.3.5 Process Condensate Filter (DEP-FILT-00002)

Prior to transfer to LERF/ETF, effluent is filtered through a 5-micron process condensate filter (DEP-FILT-00002) downstream of the process condensate lag storage transfer pumps (DEP-PMP-00005A/B).

4G.3.6 Evaporator Feed Prefilter (DEP-FILT-00003)

The evaporator feed prefilter (DEP-FILT-00003) is used to remove solids ~~larger than 5 microns~~ from the effluent entering the evaporator feed vessel (DEP-VSL-00002). It filters all effluent except for off-specification recycled condensate from overhead sampling vessels (DEP-VSL-00004A/B), contaminated secondary condensate (off normal condition in closed-loop system) from reboiler condensate collection vessel (DEP-VSL-00008), and off-specification concentrate from evaporator separator vessel (DEP-EVAP-00001). Filtered solids do not enter the evaporator feed vessel and are flushed to the evaporator concentrate vessels (DEP-VSL-00003A/B/C), where the solids are mixed with the evaporator concentrate for transfer back to the LAW Vitrification Facility~~. or filtered through the evaporator feed prefilter and sent the Hanford Tank Farms. Filtered solids do not enter the evaporator feed vessel.~~

4G.3.7 Condensate Duplex Cartridge Filters (DEP-FILT-00004A/B)

A portion of the condensate from the evaporator primary condenser (DEP-COND-00001) is also filtered via the condensate duplex cartridge filters (DEP-FILT-00004A/B) and used to spray off the demister pads or for intermittent wash down of the evaporator separator vessel (DEP-EVAP-00001).

4G.3.8 Evaporator Concentrate/Feed Vessels Low-Activity Waste Effluent Cooler (DEP-HX-00001)

The evaporator concentrate/feed vessels LAW effluent cooler (DEP-HX-00001) uses plant cooling water to cool the effluent stream prior to return to Hanford Tank Farms per the Tank Farms Waste Transfer Compatibility Program.~~acceptance criteria; it is a plate and frame heat exchanger, where metal plates are used to transfer heat between the effluent and the plant cooling water.~~ The effluent stream may be mixed with sodium nitrite and/or process condensate, as necessary.

4G.3.9 Evaporator Reboiler (DEP-RBLR-00001)

The evaporator reboiler (DEP-RBLR-00001) reheats the ~~is a forced flow shell and tube reboiler that heats the high flow rate bottom stream (~~recirculating~~d~~ concentrate~~)~~ and the feed before it enters into ~~from~~ the evaporator separator vessel (DEP-EVAP-00001). The process fluid is on the tube side, with saturated steam on the shell side. The evaporator circulation pump (DEP-PMP-00017) is used to circulate evaporator separator vessel concentrate through the evaporator reboiler and back to the evaporator separator vessel. ~~The heat input from the stream is adjusted depending on the temperature, level, and vaporization rate in the evaporator separator vessel.~~ The evaporator reboiler has temperature and level sensing capabilities on the utility outlet piping, which interfaces with the PCJ to remotely monitor temperature and level on the process fluid side. ~~Also, the evaporator reboiler has conductivity sensing capability for the utility side of the reboiler, which interfaces with the PCJ to remotely monitor the evaporator reboiler for tube leaks.~~ The reboiler condensate collection vessel (DEP-VSL-00008) manages clean steam condensate as part of a closed loop system, and any contaminated steam condensate is

transferred to DEP-VSL-00002 and processed through the evaporator. ~~During normal operations, it does not handle dangerous waste or mixed waste.~~

4G.4 Secondary Containment and Release Detection for Effluent Management Facility

The EMF is constructed of steel reinforced concrete. The design ensures that the containment units have sufficient structural strength to prevent collapse or failure. The primary barriers of the EMF containment units are designed to withstand loads from the movement of personnel, wastes, and equipment handling. Stainless steel liners are provided on the interior floors, and a portion of the walls, for the areas containing the low-point drain vessel (DEP-VSL-00001), the evaporator feed vessel (DEP-VSL-00002), and the evaporator concentrate vessels (DEP-VSL-00003A/B/C). The remaining containment areas are provided with special protective coatings that are constructed with chemical-resistant water stops and compatible with the stored waste.

The specifications for the preparation, design, and construction of the secondary containment systems are documented in Operating Unit Group 10, Appendix 13.7~~, and designed to applicable national codes and standards~~. Construction of tank systems to required specifications ensures that foundations are capable of supporting tank and secondary containment systems and that uneven settling and failures from pressure gradients will not occur.

Table 4G-3, EMF Secondary Containment Rooms/Areas and Table 4G-4, EMF Sumps, Leak Detection Boxes (LDB), Drain Lines and Floor Drains, summarizes the EMF secondary containment systems.

4G.4.1 Low-Point Drain Sump (DEP-SUMP-00001)

The low-point drain sump (DEP-SUMP-00001) is used to capture overflow effluent from the low-point drain vessel (DEP-VSL-00001). In addition, underground waste transfer line leak detection box drain headers discharge to the low-point drain sump. The low-point drain sump discharges to the evaporator feed vessel (DEP-VSL-00002) via DEP-FILT-00003. The liquid level in the low-point drain sump is monitored with transmitters that communicate with the PCJ and provide control room alarm indication.

4G.4.2 Pipeline Containment and Leak Detection

The DEP System has LDBs on the headers of the coaxial underground waste transfer piping. Leak detection boxes are provided for the underground transfer lines ~~from LAWPS~~ to LAW Vitrification Facility. Leak detection boxes are also provided on underground transfer lines between EMF, LAW, Lab, and Hanford treatment, storage, and/or disposal (TSD).~~EMF and LAW Vitrification Facility, between EMF and Lab, between EMF and the Hanford Tank Farms, and between EMF and the LERF/ETF.~~ The WTP underground transfer lines are equipped with LDBs ~~are located in the LAW effluent drain tank building (Room ED-B001) with the exception of the LERF/ETF transfer line LDBs which are located at the interface point on the WTP property line. The LDBs are designed~~ to detect a leak within the annular space of the coaxial piping. The liquid level in the sumps is monitored with transmitters that communicate with the PCJ and provide control room alarm indication.

Within EMF, the pipelines associated with the tank systems/miscellaneous units are primarily single-walled. Secondary containment is provided for piping within the plant through the use of special protective coatings and waterstops or stainless liners in process areas and process rooms. ~~A short section of process piping is located in a pipe chase in Room ED-CH01, between the west process area and the low-point drain tank area, where coaxial piping is used.~~ The leak detection equipment located within the process areas and process rooms sumps alert operators of a piping leak through the use of level detection instrument alarms. The west process area and the low-point drain area are connected by a pipe chase with coaxial piping that drains to the low-point drain sump (DEP-SUMP-00001).

For all secondary containment area sumps, residual liquids may be present after the sump has been flushed and pumped using the large transfer pump. When residual liquid is detected in sumps ~~in readily accessible areas~~, excluding the low point drain sump (DEP-SUMP-00001) and the feed vessel area sumps

(DEP-SUMP-00004A/B), an entry will occur to remove the residual liquid using a portable sump pump or absorbent device. ~~An exception to this process is in place for t~~The feed vessel area sumps (DEP-SUMP-00004A/B) in room E-0105~~. These sumps~~ include designated sample pumps (DEP-PMP-00042A/B). ~~located~~ Samples are collected in the EMF Sampling Fume Hood (DEP-HOOD-00001). The pumps are designed to support sampling of the sumps as well as the removal of small volumes of precipitation or residual liquids after the large transfer pump has completed the transfer.

The leak detection instrumentation for all secondary containment area sumps include a Level Computation Relay (LKY) function. The LKY function indicates an increase in fluid levels in the sump, even when residual liquid is present.

~~Design details for EMF Sumps, LDBs, drain lines and floor drains are included in Table 4G-4, and are shown on the process and instrumentation diagrams for DEP systems located in Operating Unit Group 10, Appendix 13.2.~~

4G.4.3 Evaporator Secondary Containment System

The secondary containment system and associated ancillary equipment for the evaporator separator vessel (DEP-EVAP-00001) is located in the ~~area known as the~~ west process area, located in the LAW effluent process building. The west process area sumps (DEP-SUMP-00002A/B) are located in Room E-0103. The west process area sumps and level detection instruments detect leakage from the evaporator separator vessel, evaporator feed prefilter (DEP-FILT-00003), and the additional ancillary equipment associated with the evaporator separator vessel. The west process area is sloped to the room sumps and is provided with a special protective coating and waterstops as part of secondary containment.

Fluid contained in the west process area sumps is transferred to the overhead sampling vessels (DEP-VSL-00004A/B) or the low-point drain vessel (DEP-VSL-00001) by sump pumps (DEP-PMP-00032A/B). The liquid level in the west process area sumps is monitored with transmitters that communicate with the PCJ and provide control room alarm indication.

4G.4.4 Evaporator Condenser Secondary Containment System

The secondary containment system for the evaporator condensers (DEP-COND-00001/2/3) and associated ancillary equipment is located in the ~~area known as the~~ east process area. The east process area sumps (DEP-SUMP-00003A/B) are located in Room E-0102. The east process area sumps and level detection instruments detect leakage from the evaporator condensers, the evaporator reboiler (DEP-RBLR-00001), the evaporator concentrate/feed vessels LAW effluent cooler (DEP-HX-00001), and the ancillary equipment associated with the evaporator condensers and evaporator reboiler. The east process area is sloped to the ~~east process area~~ sumps and is provided with a special protective coating and waterstops as part of secondary containment.

Fluid contained in the east process area sumps is transferred to the process condensate lag storage vessels (DEP-VSL-00005A/B) by sump pumps (DEP-PMP-00033A/B). The liquid level in sumps is monitored with transmitters that communicate with the PCJ and provide control room alarm indication.

4G.4.5 Process Condensate Vessel Area Sumps (DEP-SUMP-00005A/B)

The process condensate vessel area sumps (DEP-SUMP-00005A/B) are located in Room E-0106. The process condensate vessel area sumps are equipped with level detection instruments to detect precipitation or leakage from the overhead sampling vessels (DEP-VSL-00004A/B) and the process condensate lag storage vessels (DEP-VSL-00005A/B). The process condensate vessel area sumps also collect leakage from ancillary equipment located in this room. Room E-0106 is sloped to the sumps and is provided with a special protective coating and waterstops as part of secondary containment.

Fluid contained in the process condensate vessel area sumps is transferred to the process condensate lag storage vessels (DEP-VSL-00005A/B) by sump pumps (DEP-PMP-00035A/B). ~~Room E-0106 is an easily accessible area, and s~~Sump liquid will be transferred to the lag storage vessels after an operator

verifies that the source of the sump effluent did not originate in either of the lag storage vessels. ~~When effluent is transferred from a sump to a vessel in a shared secondary containment area, the effluent will only be transferred to a non-leaking vessel.~~

Any accumulation of precipitation can be transferred to a container and managed as non-dangerous waste. Large volumes can be transferred to the process condensate lag storage vessels (DEP-VSL-00005A/B). ~~If sampling verifies that the source of liquid in the overhead sampling vessel area sumps is precipitation, large volumes of precipitation can be transferred to the process condensate lag storage vessels (DEP-VSL-00005A/B) to be treated and disposed at the LERF/ETF. If small volumes of precipitation are accumulated, the liquid from the sumps can be manually transferred to a container and managed as non-dangerous waste. The effluent in the sumps will be removed within 24 hours or as practicable after receipt of the sample results.~~

A small volume of residual liquids may be present after the sump has been flushed and pumped using the large transfer pump. When residual liquid is detected in Room E-0106 sumps, an entry will occur to remove the residual liquid using a portable pump or absorbent spill devices.

The liquid level in the sump is monitored and the sump is equipped with level transmitters that communicate with the PCJ and provide a control room alarm indication. The leak detection instrumentation for all secondary containment area sumps include a LKY function. The LKY function indicates an increase in fluid levels in the sump, even when residual liquid is present.

4G.4.6 Feed Vessel Area Sumps (DEP-SUMP-00004A/B)

The feed vessel area sumps (DEP-SUMP-00004A/B) are located in Room E-0105 and provide leak detection for the evaporator feed vessel (DEP-VSL-00002) and the evaporator concentrate vessels (DEP-VSL-00003A/B/C). The sumps also collect leakage from ancillary equipment or precipitation collected in Room E-0105. The room is sloped to the feed vessel area sumps. The secondary containment area located in the room is provided with a stainless steel liner. The liquid level in the feed vessel area sumps is monitored with transmitters that communicate with the PCJ and provide control room alarm indication. Due to radiation dose rates there is limited access to Room E-0105.

Any accumulation of precipitation can be transferred to a container and managed as non-dangerous waste. Large volumes can be transferred to the process condensate lag storage vessels (DEP-VSL-00005A/B). ~~If sampling verifies that source of liquid in the feed vessel area sumps is precipitation, large volumes of precipitation can be transferred to the overhead sampling vessels to be returned to the process. If small volumes of precipitation are accumulated, the liquid from the sample pumps (DEP-PMP-00042A/B) will be discharged to the DEP-HOOD-00001 drain that discharges to the low-point drain vessel (DEP-VSL-00001). Alternately, precipitation can be discharged to a container and managed as non-dangerous waste. The effluent in the sumps will be removed within 24 hours or as practicable after receipt of the sample results.~~

A small volume of residual liquids may be present after the sump has been flushed and pumped using the large transfer pump. When residual liquid is detected the sample pumps (DEP-PMP-00042A/B) can be used to remove the residual liquids after the large transfer pump has completed the transfer.

~~The leak detection instrumentation for all secondary containment area sumps include a LKY function.~~ The LKY function indicates an increase in fluid levels in the sump, even when residual liquid is present. The feed vessel area sumps are equipped with pumps that transfer the liquid to the appropriate vessel; the liquid is transferred after sampling occurs to characterize the liquid. Precipitation collected in the feed vessel area sumps can be transferred by sump pumps (DEP-PMP-00034A/B) to the overhead sampling vessels (DEP-VSL-00004A/B). Effluent from a spill is transferred to the low-point drain vessel (DEP-VSL-00001) by sump pumps (DEP-PMP-00034A/B) and recycled back into the process.

4G.5 Air Emission Control

4G.5.1 Direct Feed Low-Activity Waste Effluent Management Facility Vessel Vent Process System

The DVP System is comprised of two main parts, air intake and exhaust. The DVP is designed to ~~maintain hydrogen levels below dangerous levels and~~ remove mixed waste particulates that may be present in the gases that fill the headspace of select DEP System process vessels. The DEP System process vessels and condenser that directly interface with the DVP are the low-point drain vessel (DEP-VSL-00001), evaporator feed vessel (DEP-VSL-00002), evaporator concentrate vessels (DEP-VSL-00003A/B/C), overhead sampling vessels (DEP-VSL-00004A/B), process condensate lag storage vessels (DEP-VSL-00005A/B) and the evaporator after condenser (DEP-COND-00003). The headspace in the evaporator separator vessel (DEP-EVAP-00001) is exhausted by the DVP through the evaporator condensers (DEP-COND-00001/2/3). The inlet air is taken from lower contamination areas throughout the building to provide purged air for maintaining the DEP System process vessels ~~below the lower flammability limit for hydrogen~~.

In the LAW effluent process building, the exhaust air is sent through a preheater (DVP-HTR-00001A/B), two-stages of HEPA filters (DVP-HEPA-00004A/B) and (DVP-HEPA-00003A/B), and an exhaust fan (DVP-EXHR-00001A/B). The exhaust fan is downstream of the DEP System process vessels, preheater and HEPA filters, to ensure that the DEP System vessel headspaces are at negative pressure.

Downstream of the EMF ACV HEPA filters and exhaust fans, the treated DVP offgas ties into the LAW effluent utility building exhaust duct, where it is discharged through the ~~150-foot high~~ EMF stack. ~~The tie-in point to the LAW effluent utility building exhaust duct is upstream of the stack monitoring systems, which monitor the exhaust air streams prior to discharge to the atmosphere.~~

4G.6 Effluent Management Facility Process Sampling

~~A liquid s~~Sampling station (DEP-HOOD-00001) ~~is provided for the manual sampling of seven unique EMF process fluid streams, while maintaining the safety of the operator/worker. The sampling station~~ consists of a standard fume hood, the low-point drain vessel (DEP-VSL-00001) process pipelines, manual sampling collection points, utilities systems and a drain system. The ~~seven~~ EMF process sample streams include ~~samples from~~:

- DEP-VSL-00001.
- DEP-VSL-00002.
- DEP-VSL-00003A/B/C.
- DEP-VSL-00004 A/B.
- DEP-VSL-00005A/B.
- DEP-EVAP-00001.
- DEP-HX-00001.

~~The fume hood functions to capture, confine, and exhaust fumes, vapors, and particulate matter produced or generated within the enclosure. The process pipelines provide primary containment for the radioactive process fluid to be sampled, and the hood is located within the east process area (Room E-0102).~~ Process pipelines bring the process fluids to the sampling station, recirculate the stream before the sample is collected to ensure the sample is representative for the batch, and provide the means to collect the sample into a sampling bottle. A system of valves ~~is installed~~ on the pipelines are~~and~~ used to control the flow during ~~the~~ sampling. ~~The manual sampling collection points are individual points for each process vessel and are designed to hold and secure the sampling bottle during collection.~~

The utility systems are provided in the sampling station to allow for flushing and cleanup of the ~~sampling~~ lines at completion of the sampling campaign, and cleanup of the sampling station work area~~, whenever~~

needed. The drain system collects the liquid waste resulting from the line flushing process and from the hood cleanup. The drain system connects the liquid sampling station and drains to the low-point drain vessel (DEP-VSL-00001).

Table 4G-1 Effluent Management Facility Tank Systems

No.	System	Vessel Number/Location	Description	Material	Approximate Total Volume (US Gallons)	Approximate Dimensions (Inside Diameter × Height or Length in feet) (tangent line/tangent line)
1	DEP	DEP-VSL-00001 ED-B001	Low-point drain vessel	Stainless Steel	18,000	14 ft x 12.75 ft
2	DEP	DEP-VSL-00002 E-0105	Evaporator feed vessel	6% Mo	42,300	14 ft x 32 ft
3	DEP	DEP-VSL-00003A E-0105	Evaporator concentrate vessel	6% Mo	14,900	12 ft x 13.5 ft
4	DEP	DEP-VSL-00003B E-0105	Evaporator concentrate vessel	6% Mo	14,900	12 ft x 13.5 ft
5	DEP	DEP-VSL-00003C E-0105	Evaporator concentrate vessel	6% Mo	14,900	12 ft x 13.5 ft
6	DEP	DEP-VSL-00004A E-0106	Overhead sampling vessel	Stainless Steel ~~Reserved~~	40,800	14 ft x 30.75 ft
7	DEP	DEP-VSL-00004B E-0106	Overhead sampling vessel	Stainless Steel ~~Reserved~~	40,800	14 ft x 30.75 ft
8	DEP	DEP-VSL-00005A E-0106	Process condensate lag storage vessel	Stainless Steel ~~Reserved~~	127,260	25 ft x 29.5 ft
9	DEP	DEP-VSL-00005B E-0106	Process condensate lag storage vessel	Stainless Steel ~~Reserved~~	127,260	25 ft x 29.5 ft
~~10~~	~~DEP~~	~~DEP-FILT-00003 E-0103~~	~~DEP Evaporator Feed Prefilter~~	~~6% Mo~~	~~NA~~	~~NA~~

Table 4G-2 Effluent Management Facility Miscellaneous Units (Systems and Sub-Systems)

No.	System/ Subsystem	Component Number/Location	Description	Material	Total Volume (US gallons)
Effluent Management Facility					
1	DEP	DEP-COND-00001 E-0102	DEP Evaporator Primary Condenser	Stainless Steel	NA
2	DEP	DEP-COND-00002 E-0102	DEP Evaporator Inter-Condenser	Stainless Steel	NA
3	DEP	DEP-COND-00003 E-0102	DEP Evaporator After-Condenser	Stainless Steel	NA
4	DEP	DEP-EVAP-00001 E-0103	DEP Evaporator Separator Vessel	Hastelloy	NA
5	DVP	DVP-HTR-00001A E-0102	Process Ventilation Preheater	Stainless Steel ~~Reserved~~	NA
6	DVP	DVP-HTR-00001B E-0102	Process Ventilation Preheater	Stainless Steel ~~Reserved~~	NA
7	DVP	DVP-HEPA-00003A E-0102A	Process Ventilation Primary HEPA Filter Housing	Stainless Steel ~~Reserved~~	NA
8	DVP	DVP-HEPA-00003B E-0102A	Process Ventilation Primary HEPA Filter~~s~~ Housing	Stainless Steel ~~Reserved~~	NA
9	DVP	DVP-HEPA-00004A E-0102A	Process Ventilation Secondary HEPA Filter~~s~~ Housing	Stainless Steel ~~Reserved~~	NA
10	DVP	DVP-HEPA-00004B E-0102A	Process Ventilation Secondary HEPA Filter~~s~~ Housing	Stainless Steel ~~Reserved~~	NA
11	DEP	DEP-HX-00001 E-0103	Evaporator Concentrate/Feed Vessels LAW Effluent Cooler	Stainless Steel	NA
12	DEP	DEP-RBLR-00001 E-0103	DEP Evaporator Reboiler	Hastelloy	NA
13	DVP	DVP-EXHR-00001A E-0102	Process Ventilation Exhausters	Stainless Steel ~~Reserved~~	NA
14	DVP	DVP-EXHR-00001B E-0102	Process Ventilation Exhausters	Stainless Steel ~~Reserved~~	NA
15	DEP	DEP-FILT-00002 E-0103	DEP Process Condensate Filter	6% Mo	NA
16	DEP	DEP-FILT-00003 E-0103	DEP Evaporator Feed Prefilter	6% Mo	NA
17	DEP	DEP-FILT-00004A E-0102	DEP Condensate Duplex Cartridge Filter	6% Mo	NA

Table 4G-2 Effluent Management Facility Miscellaneous Units (Systems and Sub-Systems)

No.	System/ Subsystem	Component Number/Location	Description	Material	Total Volume (US gallons)
Effluent Management Facility					
18	DEP	DEP-FILT-00004B E-0102	DEP Condensate Duplex Cartridge Filter	6% Mo	NA

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Table 4G-3 Effluent Management Facility Secondary Containment Rooms/Areas

Room/Area	Approximate Room/Area Dimensions (L×W, in feet)	Miscellaneous Treatment Units or Tanks in Room/Area (Largest Plant Item)	Volume of Largest Plant Item in Room/Area (US Gallons)	Minimum Secondary Containment Height (feet)
E-0102 east evaporator process area	62 ft x 94 ft 6 in.	Process condensate lag storage vessel	127,260	4 ft 6 in.
E-0103 west evaporator process area	62 ft x 56 ft 6 in.	Evaporator feed vessel	42,300	3 ft 5 in.
ED-B001 low-point drain vessel area	28 ft x 33 ft	Low-point drain vessel	18,000	4 ft 2 in.
E-0105-evaporator feed vessel area	45 ft 6 in. x 39 ft	Evaporator feed vessel	42,300	5 ft 2 in.
E-0106 process condensate lag storage vessel area	45 ft6 in. x 84 ft 4 in.	Process condensate lag storage vessel	127,260	6 ft 10 in.

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Table 4G-4 Effluent Management Facility Sumps, Leak Detection Boxes, Drain Lines/Floor Drains

Sump/Leak Detection Box, or Floor Drain/Line I.D.# and Room#	Maximum Sump/Leak Detection Box Capacity (gallons)	Sump/Leak Detection Box Level Detection Type	Sump, Leak Detection Box or Floor Drain/Line Dimensions (approximate) and Materials of Construction	Piping and Instrumentation Diagram Number
Effluent Management Facility				
Sumps				
DEP-SUMP-00001 ED-B001	~58	Radio Frequency (RF) Capacitance	24 in. Dia. x 30 in. Length 304L SS	**24590-BOF** -M6-DEP-00001002
DEP-SUMP-00002A E-0103	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS	**24590-BOF** -M6-DEP-00009001

Table 4G-4 Effluent Management Facility Sumps, Leak Detection Boxes, Drain Lines/Floor Drains

Sump/Leak Detection Box, or Floor Drain/Line I.D.# and Room#	Maximum Sump/Leak Detection Box Capacity (gallons)	Sump/Leak Detection Box Level Detection Type	Sump, Leak Detection Box or Floor Drain/Line Dimensions (approximate) and Materials of Construction		Piping and Instrumentation Diagram Number
DEP-SUMP-00002B E-0103	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS		**24590-BOF** -M6-DEP-00009001
DEP-SUMP-00003A E-0102	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS		**24590-BOF** -M6-DEP-00009004
DEP-SUMP-00003B E-0102	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS		**24590-BOF** -M6-DEP-00009004
DEP-SUMP-00004A E-0105	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS		**24590-BOF** -M6-DEP-00009002
DEP-SUMP-00004B E-0105	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS		**24590-BOF** -M6-DEP-00009002
DEP-SUMP-00005A E-0106	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS		**24590-BOF** -M6-DEP-00009005
DEP-SUMP-00005B E-0106	~58	RF Capacitance	24 in. Dia. x 30 in. Length 304L SS		**24590-BOF** -M6-DEP-00009005
Leak Detection Boxes					
DEP-LDB-00001 ED-B001	~7	Conductivity Switch	8 in. Dia. x 41 in. Length 316L SS		**24590-BOF** -M6-DEP-00011001
DEP-LDB-00002 ED-B001	~7	Conductivity Switch	8 in. Dia. x 41 in. Length 316L SS		**24590-BOF** -M6-DEP-00011001
DEP-LDB-00003 ED-B001	~7	Conductivity Switch	8 in. Dia. x 41 in. Length 316L SS		**24590-BOF** -M6-DEP-00011001
DEP-LDB-00004 ED-B001	~7	Conductivity Switch	8 in. Dia. x 41 in. Length 316L SS		**24590-BOF** -M6-DEP-00011001
DEP-LDB-00005 ED-B001	~7	Conductivity Switch	8 in. Dia. x 41 in. Length 316L SS		**24590-BOF** -M6-DEP-00011001
DEP-LDB-00006 ED-B001	~7	Conductivity Switch	8 in. Dia. x 41 in. Length 316L SS		**24590-BOF** -M6-DEP-00011001
Drain Lines					
BOF-DEP-ZS-20282-W11A-011/02-01 ED-CH01	NA	NA	4 in. Dia. 316L SS	Containment pipe	**24590-BOF** -M6-DEP-00001001
			1 ½ in. Dia. AL6XN	Process pipe	
BOF-DEP-ZS-20236-W31A-02-01 ED-CH01	NA	NA	4 in. Dia. Carbon Steel	Containment pipe	**24590-BOF** -M6-DEP-00001001
			2 in. Dia. 316L SS	Process pipe	

Table 4G-4 Effluent Management Facility Sumps, Leak Detection Boxes, Drain Lines/Floor Drains

Sump/Leak Detection Box, or Floor Drain/Line I.D.# and Room#	Maximum Sump/Leak Detection Box Capacity (gallons)	Sump/Leak Detection Box Level Detection Type	Sump, Leak Detection Box or Floor Drain/Line Dimensions (approximate) and Materials of Construction		Piping and Instrumentation Diagram Number
BOF-DEP-ZS-20245-W11A-04-01ED-CH01	NA	NA	6 in. Dia. 316 SS	Containment pipe	**24590-BOF** -M6-DEP-00001001
			4 in. Dia. AL6XN	Process pipe	
BOF-DEP-ZS-20231-W31A-03-01 ED-CH01	NA	NA	6 in. Dia. Carbon Steel	Containment pipe	**24590-BOF** -M6-DEP-00001001
			3 in. Dia. 316L SS	Process pipe	
BOF-DEP-ZS-20242-W31A-10-01 ED-CH01	NA	NA	14 in. Dia. Carbon Steel	Containment pipe	**24590-BOF** -M6-DEP-00001001
			10 in. Dia. 316L SS	Process pipe	
BOF-DEP-ZS-20249-W31A-03-01 ED-CH01	NA	NA	6 in. Dia. Carbon Steel	Containment pipe	**24590-BOF** -M6-DEP-00001001
			3 in. Dia. 316L SS	Process pipe	
BOF-DEP-ZS-20225-W31A-02-01 ED-CH01	NA	NA	4 in. Dia. Carbon steel	Containment pipe	**24590-BOF** -M6-DEP-00001002
			2 in. Dia. 316L SS	Process pipe	
BOF-DEP-ZS-20219-W31A-02-01 ED-CH01	NA	NA	4 in. Dia. Carbon steel	Containment pipe	**24590-BOF** -M6-DEP-00001002
			2 in. Dia. 316L SS	Process pipe	
BOF-DEP-ZS-20222-W31A-02-01 ED-CH01	NA	NA	4 in. Dia. Carbon Steel	Containment pipe	**24590-BOF** -M6-DEP-00001002
			2 in Dia 316L SS	Process pipe	
BOF-DEP-ZS-20252-W11A-03-01 ED-CH01	NA	NA	6 in. Dia. 316L SS	Containment pipe	**24590-BOF** -M6-DEP-00010001
			3 in. Dia. AL6XN	Process pipe	
BOF-DEP-ZS-20265-W31A-03-01 ED-CH01	NA	NA	6 in. Dia. Carbon Steel	Containment pipe	**24590-BOF** -M6-DEP-00002006
			3 in. Dia. 316L SS	Process pipe	

Table 4G-4 Effluent Management Facility Sumps, Leak Detection Boxes, Drain Lines/Floor Drains

Sump/Leak Detection Box, or Floor Drain/Line I.D.# and Room#	Maximum Sump/Leak Detection Box Capacity (gallons)	Sump/Leak Detection Box Level Detection Type	Sump, Leak Detection Box or Floor Drain/Line Dimensions (approximate) and Materials of Construction		Piping and Instrumentation Diagram Number
BOF-DEP-ZY-00181-W31A-03-01 ED-CH01	NA	NA	6 in. Dia. Carbon Steel	Containment pipe	**24590-BOF** -M6-DEP-00001001
			3 in. Dia. 316L SS	Process pipe	
BOF-DEP-WU-00008-W31A-03-01 ED-CH01	NA	NA	6 in. Dia. Carbon steel	Containment pipe	**24590-BOF** -M6-DEP-00001001
			3 in. Dia. 316L SS	Process pipe	
BOF-DVP-GV-00026-W31A-03-01 ED-CH01	NA	NA	6 in. Dia. Carbon steel	Containment pipe	**24590-BOF** -M6-DEP-00001001
			3 in. Dia. 316L SS	Process pipe	

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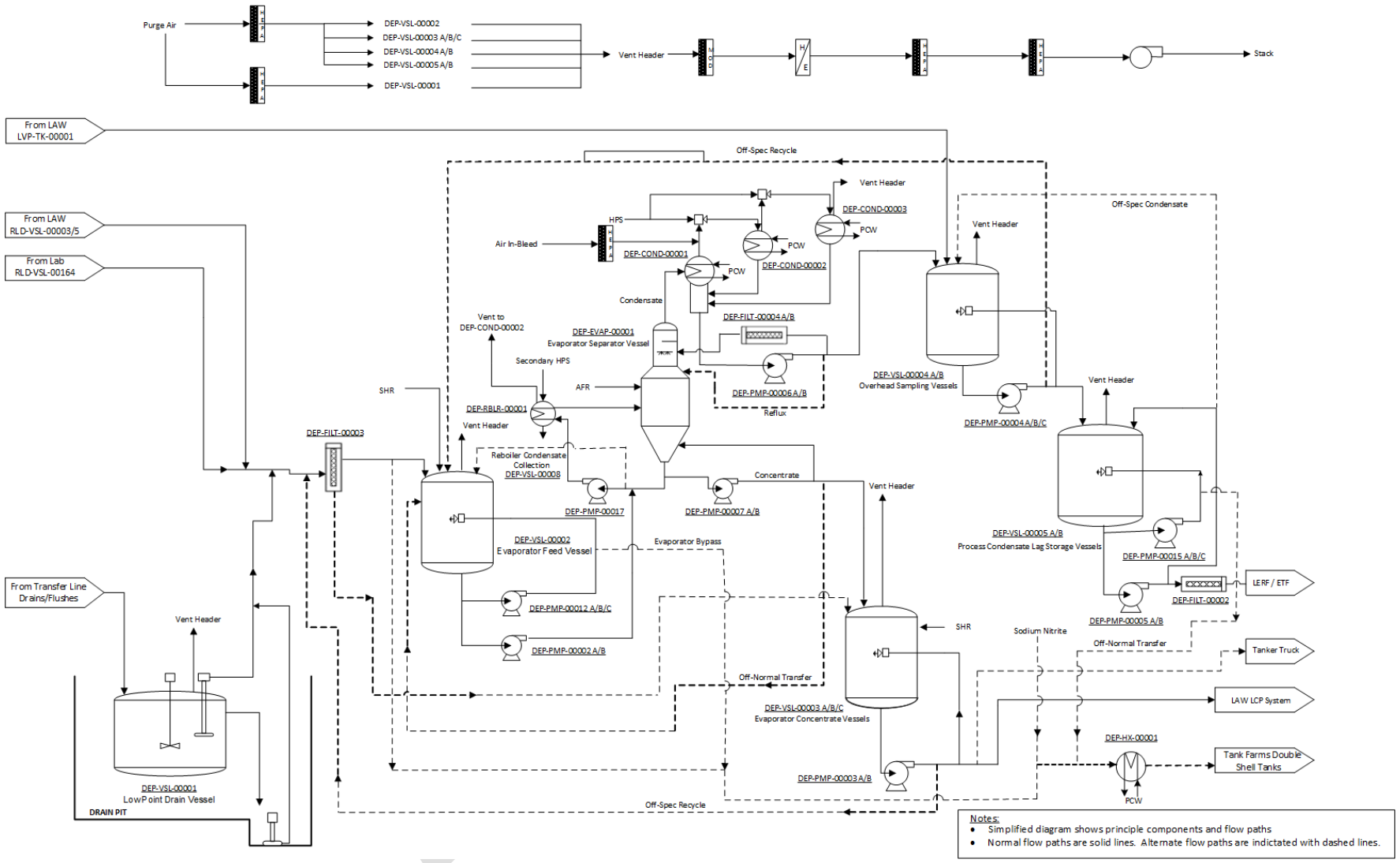

2 **Figure 4G-1 Effluent Management Facility Process Flow**

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