242-A EVAPORATOR
CHAPTER 4.0
PROCESS INFORMATION

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
07/14/2022	8C.2022.2F
07/13/2021	PCN-242-A-2021-03 (8C.2021.Q3)
06/28/2021	8C.2021.5F
05/10/2021	8C.2021.4F
11/12/2019	8C.2019.4F
04/09/2018	PCN-242-A-2017-02
07/19/2017	8C.2017.Q2
04/26/2017	8C.2017.Q1
02/18/2016	8C.2015.Q4

This page intentionally left blank.

242-A EVAPORATOR
CHAPTER 4.0
PROCESS INFORMATION

This page intentionally left blank.

CHAPTER 4.0
PROCESS INFORMATION

TABLE OF CONTENTS

FIGURES

TABLES

4. PROCESS INFORMATION

The 242-A Evaporator receives mixed waste from the Double-Shell Tank (DST) System that contains inorganic and organic constituents and radionuclides. The 242-A Evaporator Treatment, Storage, and Disposal (TSD) unit group boundary for lines running between the 242-A Evaporator and the DST System end at the exterior wall of 242-A Building. At this point, these lines (e.g., feed and slurry line piping [SN-275, SL-170, and SL-171]) are DST System components. Additional requirements for secondary containment and 242-A Evaporator simplified process flow diagram is given in Figure 4-1. The 242-A Evaporator separates the mixed waste received from the DST System, generating the following waste streams:

- A concentrated aqueous waste stream (slurry) containing the nonvolatile components, including most of the radionuclides, inorganic constituents, and nonvolatile organics such as tri-butyl phosphate.
- A dilute aqueous waste stream (process condensate) containing the volatile components, primarily water with low concentrations of radionuclides, inorganic constituents, and volatile constituents such as ammonia and acetone.

The slurry is routed back to the DST System pending further treatment. The process condensate is transferred to Liquid Effluent Retention Facility (LERF) through the PC-5000 transfer line for storage until processed through the 200 Area Effluent Treatment Facility (ETF). The 242-A Evaporator TSD unit group boundary for the PC-5000 transfer line running between the 242-A Evaporator and LERF end at the LERF TSD unit group boundary.

The 242-A Evaporator process employs a conventional forced circulation, vacuum evaporation system to concentrate the DST System waste solution. The major components of this system include the reboiler (E-A-1), vapor-liquid separator (C-A-1), recirculation pump (P-B-1) and pipe loop, slurry product pump, condenser, jet vacuum system, and condensate collection tank (TK-C-100).

The vapor-liquid separator (C-A-1) also called the evaporator vessel, and the condensate collection tank (TK-C-100), meet the definition of a tank in Washington Administrative Code (WAC) 173-303-040. Other process equipment associated with these tank systems is considered ancillary equipment. Drawings that aid in understanding the systems are provided in Section 4.3.

The 242-A Evaporator receives waste from DST System tank 241-AW-102 that serves as the 242-A Evaporator feed tank. The feed enters the recirculation line and blends with the main process slurry stream, which is pumped to the reboiler.

In the reboiler, the mixture is heated to the specified operating temperature, normally 100 to 155°F, using 3 to 10 pounds per square inch gauge (psig) pressure steam. The low-pressure steam provides adequate heat input, and the resulting low-temperature differential across the reboiler minimizes scale formation on the heat transfer surfaces. The static liquid head of the waste in the reboiler is sufficient to suppress the boiling point so the waste does not boil in the reboiler tubes. Boiling occurs only near or at the liquid surface in the vapor liquid separator (C-A-1), where the static liquid head is zero and the heated waste is at the reduced pressure of the vapor-liquid separator (C-A-1). Slurry may be transferred back to the 242-A Evaporator feed tank through the DST System for one or more passes through the 242-A Evaporator to achieve desired waste volume reduction.

The heated slurry stream is discharged from the reboiler (E-A-1) to the vapor-liquid separator (C-A-1). The vapor-liquid separator (C-A-1) is typically maintained at an absolute pressure of 0.77 to 1.55 psig absolute. Under this reduced pressure, a fraction of the water in the heated slurry flashes to steam and the steam is drawn through two, wire mesh deentrainer pads into a 42-inch diameter vapor line that leads to the primary condenser, leaving behind a more concentrated slurry solution in the vapor-liquid separator (C-A-1).

After a brief residence time in the vapor-liquid separator (C-A-1), the slurry exits from the bottom through the lower portion of the recirculation line and is recirculated by the recirculation pump (P-B-1). The pump discharges the slurry back to the reboiler via the upper portion of the recirculation line, thus completing the recirculation loop.

Operations monitors the specific gravity of the waste liquid, and adjusts process variables to stay within an acceptable range of the target specific gravity. As part of the campaign planning process, a process control plan is developed to identify the campaign objectives and process controls, including the target specific gravity that is determined before the campaign begins. Slurry is removed from the upper portion of the recirculation line and transferred using slurry pump (P-B-2) or gravity drained through an encased underground pipeline (pipe-within-a-pipe) to a designated slurry receiver tank in the DST System.

The vapors are drawn from the vapor-liquid separator (C-A-1), through a 42-inch diameter vapor line and enter a series of three condensers, where the vapors are condensed using raw water. The condensed vapors, called process condensate, are collected in the condensate collection tank (TK-C-100). Steam jets are used to create a vacuum on the vapor liquid separator drawing the process vapors into and through the condensers. Noncondensable vapors are drawn from the condensers, then through a series of particulate filters and vented to the atmosphere. The air discharges are monitored when the 242-A Evaporator is operating to verify that radionuclide and ammonia emissions standards are met.

The process condensate, a mixed waste, is a dilute aqueous solution with ammonia, volatile organics, and trace quantities of non-volatile constituents. The process condensate is pumped from the condensate collection tank (TK-C-100) through the PC-5000 encased underground pipeline (pipe-within-a-pipe) to the LERF.

During a campaign, the evaporation process is continuous, except when waste is recirculated when new feed is not being received. Typical feed flow rates of 69 to 119 gallons per minute (gpm), process condensate flow rates of 39 to 61 gpm, and slurry flow rates of 29 to 61 gpm. The evaporator process is shutdown when the desired endpoint concentration of the feed is met. Endpoints are established at the beginning of the campaign, based on the target specific gravity of the waste, or allowable waste volume reduction and defined operating limits. If the evaporation rate cannot achieve the desired endpoint, slurry in the DST System serving as the slurry receiver is transferred to the feed tank for one or more passes through the 242-A Evaporator. At the end of processing, the vapor-liquid separator (C-A-1) and recirculation loop are drained, flushed with raw water, and shutdown. The majority of maintenance activities are performed during this shutdown period when waste is not present in the processing equipment with the exception of the condensate collection tank (TK-C-100). The condensate collection tank (TK-C-100) continues to store process condensate from the last campaign.

Other discharges during 242-A Evaporator processing include condensate from the steam used to heat the waste and cooling water used to condense the vapors. The 242-A Evaporator is designed to prevent contamination of these streams, as such the cooling water and steam condensate waste streams do not designate as dangerous waste. The fluids on the uncontaminated side of the heat exchangers are maintained at a higher pressure than the waste stream so that uncontaminated fluid migrates toward the contaminated waste if a leak were to occur. The steam condensate and the cooling water are monitored continuously for radiation, pH, conductivity, and discharged to the Treated Effluent Disposal Facility (TEDF) as long as none of the discharge limits are exceeded. The steam condensate and cooling water streams were assessed in the stream specific reports (WHC-EP-0342-21 [1990], *242-A Evaporator Cooling Water Stream Specific Report*, *Addendum 21*, and WHC-EP-0342-26 [1996], *242-A Evaporator Steam Condensate Stream Specific Report*, *Addendum 26*), and are not dangerous waste in accordance with WAC 173-303. The steam condensate and the used raw water waste streams are discharged to the TEDF, under the authority of State Waste Discharge Permit ST0004502.

The 242-A Evaporator process is controlled by operators using the Monitoring Control System (MCS). The MCS computer monitors process parameters and controls the parameters where required. The MCS provides the capability to operate some components (e.g., pumps, valves) in a manual mode. Operations personnel monitor the function of the MCS and process equipment, and operate equipment in a manual mode when required to maintain safe facility operations. Once the configuration parameters and other process control inputs are set, the MCS maintains the process parameters within specified ranges by sending output signals that operate specific pieces of equipment (e.g., control valves). There are redundant MCS components in place that are not used to maintain the integrity of the mixed waste handling system and are not addressed in further detail in this permit.

4.1 Tank Systems

This section discusses information associated with design requirements, integrity assessments, and any additional requirements for tanks used to treat and store mixed waste in the 242-A Evaporator.

The 242-A Evaporator is divided into three major systems that manage mixed wastes. The systems are listed below:

- Transfer lines (PC-5000 and Waste Treatment and Immobilization Plant [WTP] backup transfer line [3"-WTP-002-M17]).
- Vapor-liquid separator (C-A-1) and ancillary equipment.
- Condensate collection tank (TK-C-100) and ancillary equipment.

4.1.1 Design Requirements

The following design requirements were addressed in the 242-A Evaporator/Crystallizer Tank System Integrity Assessment Reports (IARs), which are identified in Section 4.1.5:

- Minimum design wall thicknesses and measured wall thicknesses at various points throughout the tank systems.
- Design standards used in construction, including references.
- Waste characteristics.
- Materials of construction and compatibility of materials with the waste being processed.
- Corrosion protection.
- Seismic design basis evaluation.

The conclusion of the latest IARs are that the 242-A Evaporator system and associated PC-5000 transfer line is not leaking and is fit for use. The inspections, tests, and analyses performed provide assurance that the tank system has adequate design, sufficient structural strength, and sufficient compatibility with the waste to not collapse, rupture, or fail during operation. The report also states that a review of construction files indicates that the building structure was designed and constructed to withstand a design-basis earthquake and recommends a frequency of future integrity assessments. The codes and standards applicable to the design, construction, and testing of the 242-A Evaporator tank system are evaluated as part of the fit for use determination [WAC 173-303-640(2)(d)] reached by the latest IARs for the 242-A Evaporator and associated PC-5000 transfer line.

4.1.2 Transfer Lines

This permit includes the PC-5000 transfer line (3"-EVAP_COND-PC5000-M17) leaving the 242-A Evaporator and ending at LERF Catch Basins 242AL-41 and 242AL-43 (TSD unit group boundary between 242-A Evaporator and LERF and 200 Area ETF); and the WTP backup transfer line (3"-WTP-002-M17) leaving WTP and merging with the PC-5000 transfer line at caisson MH-WTP-01 (TSD unit group boundary between 242-A Evaporator and WTP is the WTP fence line). Addendum A, "Part A Form," topographic map depicts these TSD unit group boundaries. Leak detection for PC-5000 transfer line (3”-EVAP_COND-PC5000-M17), and WTP backup transfer line (3”-WTP-002-M17) are discussed in Section 4.1.7.3. Chapter 6.0, “Procedures to Prevent Hazards,” has additional information on transfer line leak detection.

Caisson MH-WTP-01, is a flat-bottomed fiberglass tank that contains valves for the isolation of either PC-5000 (3”-PC-5000-M17) or WTP backup transfer line (3”-WTP-002-M17) carrier pipes. All containment pipes open into caisson MH-WTP-01 allowing any leaks to transfer through the caisson to LERF Basin 43. The containment pipe lower internal surfaces are flush with the inside bottom surface of the caisson. The caisson has a 48-inch inside diameter, an overall length of 98 inches and a nominal wall thickness of ½ inch. There are four isolation valves inside the caisson that are controlled by 242-A Evaporator for transfer line use. The valves are 3-inch valves fabricated with stainless steel bodies and pipe extensions.

The PC-5000 transfer line has limited capacity, and cannot be used by both the 242-A Evaporator and WTP at the same time due to valve alignment. The use of the PC-5000 transfer line to transfer liquid effluent from WTP to LERF will be controlled by the 242-A Evaporator. The WTP process condensate transfer to LERF will satisfy the waste acceptance criteria identified in the LERF and 200 Area ETF Permit, Addendum B, “Waste Analysis Plan.”

4.1.2.1 PC-5000 Transfer Line (3”-EVAP_COND-PC5000-M17)

The PC-5000 primary pipeline (3”-EVAP_COND-PC5000-M17) leaves the 242-A Evaporator and ends at LERF Catch Basins 242AL-41 (valve 60M-41-2) and 242AL-43 (valve 60M-43-P). Valve 60M-41-2 and valve 60M-43-P are controlled by LERF and 200 Area ETF for transfers to LERF. The PC-5000 encasement line (6”-ENC-M17) includes in-line and end-of-line electronic leak detection elements, and sight glass at LERF Catch Basins 242AL-41 and 242AL-43 (refer to Section 4.1.7.3.3). Process condensate from the 242-A Evaporator is transferred to the LERF using a pump located in the 242-A Evaporator and approximately 5,000 feet of pipe, consisting of a 3-inch carrier pipe within a 6-inch outer containment pipeline. Flow through the pump is controlled through a valve at approximate flow rates from 40 to 80 gpm.

The encased fiberglass transfer line (PC-5000) exits the 242-A Evaporator below grade and remains below grade at a minimum 4-feet depth for freeze protection, until the pipeline emerges at the LERF Catch Basins 242AL-41 and 242AL-43. All piping at the catch basin that is above grade is wrapped with electric heat tracing tape and insulated for protection from freezing. Additional detail including information on secondary containment, leak detection and integrity assessment for this line is provided in Sections 4.1.7.3.3 and 4.1.5.1. The PC-5000 transfer line leaving the 242-A Evaporator is considered ancillary equipment to the 242-A Evaporator up to LERF Catch Basins 242AL-41 and 242AL-43.

4.1.2.2 Waste Treatment and Immobilization Plant Backup Transfer Line (3”-WTP-002-M17)

The process condensate from WTP can be transferred to LERF Basins 41 or 43, by using a pump located at WTP, and approximately 2,380 feet of pipe, consisting of a 3-inch carrier pipe within a 6-inch outer containment pipeline that merges with the PC-5000 transfer line at caisson MH-WTP-001. Valves located at LERF Catch Basin 242AL-41 (valve 60M-41-2) and Catch Basin 242AL-43 (valve 60M-43-P) are controlled by LERF and 200 Area ETF for transfers to LERF. The combined PC-5000 encasement line (6”-ENC-M17) and WTP backup transfer line (3”-WTP-002-M17) includes in-line and end-of-line electronic leak detection elements and sight glass at LERF Catch Basins 242AL-41 and 242AL-43 (refer to Section 4.1.7.3.4).

The encased fiberglass backup transfer line (3”-WTP-002-M17) exits the WTP and runs below grade, and merges with the PC-5000 transfer line at caisson MH-WTP-01, for transferring process condensate to LERF. The WTP backup transfer line (3”-WTP-002-M17) leaving the WTP is considered ancillary equipment to the 242-A Evaporator from caisson MH-WTP-01 up to the WTP fence line.

4.1.3 Vapor-Liquid Separator (C-A-1) and Ancillary Equipment

The following sections describe the vapor-liquid separator (C-A-1) and ancillary equipment.

Waste Feed System. Feed to the 242-A Evaporator is supplied via a pump located in the DST System 241-AW-102 feed tank. The feed pump transfers the waste to the 242-A Evaporator through a 3-inch diameter transfer pipeline encased in a 6-inch diameter pipe to provide secondary containment or a 2-inch diameter transfer pipeline encased in a 4-inch diameter pipe to provide secondary containment. The DST pits are equipped with leak detectors that are part of the DST System.

Waste feed will be sampled from 241-AW-102 or identified candidate feed tanks as described in the "Waste Analysis Plan" (Chapter 3.0). The feed sampler (SAMP-F-1) located in a sample enclosure located in the hot equipment storage room has been isolated and blanked, and will be closed in accordance with the approved Closure Plan.

Evaporator Process Loop. The 242-A Evaporator process loop equipment components are as follows:

- Reboiler (E-A-1).
- Vapor-liquid separator (C-A-1).
- Recirculation pump (P-B-1).
- Recirculation loop.

Figure 4-2 is a simplified process flow diagram showing the major components of the process loop.

Reboiler (E-A-1). Waste is heated as the waste passes through the reboiler before entering the vapor-liquid separator (C-A-1). The reboiler (E-A-1) is a vertical tube unit with steam on the shell-side and process solution on the tube-side. The 364 tubes in the reboiler (E-A-1) are enclosed in an approximately 40-inch-outside diameter, 15-feet-long stainless steel shell. Both the reboiler shell and tubes are constructed of 304L stainless steel. The shell is 1/4-inch thick and the tubes are 14-gauge steel. The reboiler is designed to distribute steam evenly and to prevent tube damage from water droplets that may be present in the steam.

Vapor-Liquid Separator (C-A-1). Process solution from the reboiler enters the vapor-liquid separator (C-A-1) via the upper recirculation line. Some of the solution flashes into vapor, which exits through a vapor line at the top of the vapor-liquid separator (C-A-1). The remaining solution (slurry) exits through the recirculation line at the bottom.

The vapor-liquid separator (C-A-1) consists of a lower and upper section. The lower (liquid) section is a stainless steel shell 14 feet in diameter having a 22,500 to 26,000 gallon normal operating capacity (including recirculation loop and reboiler). The maximum design capacity is 35,600 gallons. The upper (vapor) section is a stainless steel shell is 11.5 feet in diameter containing two deentrainment pads. These wire mesh pads remove liquids and solids that entrain into the vapor section of the vessel. Spray nozzles, using recycled process condensate or filtered raw water, wash collected solids from the deentrainment pads and vessel walls; or raw water is used to flush the vapor-liquid separator (C-A-1) vessel. Both sections of the vapor-liquid separator (C-A-1) are constructed of 3/8-inch-thick stainless steel.

Operating parameters in the vapor-liquid separator (C-A-1) are monitored to provide an indication of process problems such as slurry foaming, deentrainer flooding, or excessive vapor temperatures. Instrumentation also is available to monitor the liquid levels in the vapor-liquid separator (C-A-1). Interlocks are activated when high pressures or high- or low-liquid levels are detected, shutting down the evaporation process and placing the facility in a safe configuration. Three configurations can be achieved during operation of the 242-A Evaporator:

- Recirculation with vacuum.
- Recirculation without vacuum.

- Waste in vapor-liquid separator (C-A-1) with no recirculation.

The vapor-liquid separator (C-A-1) and recirculation loop can be drained and flushed to remove any residual solids from the system and/or to reduce radiation levels. The most common flush solution is water, but dilute nitric or citric acid solutions could be used. All acidic flush solutions are chemically adjusted to meet DST acceptance criteria before transfer to the DST System. Antifoam solution is added (at very low flow rates - approximately 0.01 to 0.1 gpm) to the vessel to prevent foaming. The antifoam solution is a noncorrosive, nonregulated silicone-based solution that is compatible with the evaporator components.

242-A Evaporator shutdown is accomplished by performing manual, localized actions such as system isolation, equipment shutdown, etc. The system is designed to drain so that normal practices effectively drain the system. After shutdown, a small volume of liquid may be present in the vapor-liquid separator (C-A-1).

Recirculation Pump. The stainless steel recirculation pump (P-B-1), is constructed as part of the recirculation loop to the reboiler. The 28-inch diameter axial flow pump has nominal flow rate of 13,000 to 16,000 gpm output. The recirculation pump is designed to handle slurry up to 30 percent undissolved solids by volume at specific gravities up to 1.8. The recirculation pump moves waste at high velocities through the reboiler to improve heat transfer, keep solids in suspension, and reduce fouling of the heat transfer surfaces.

The recirculation pump is equipped with shaft seals with high-pressure recycled process condensate (or water) introduced between the seals to prevent the waste solution from leaking out of the system. Seal water pressure and flow are monitored and controlled to shut down the recirculation pump if conditions are not adequate to prevent waste liquid from migrating into the seal water. The used seal water is routed to the feed tank.

Recirculation Loop. The recirculation loop consists of a 28-inch diameter stainless steel pipe that connects the vapor-liquid separator (C-A-1) to the recirculation pump and reboiler. The lower loop runs from the bottom of the vapor-liquid separator (C-A-1) to the recirculation pump inlet. The upper loop connects the pump discharge to the reboiler and the reboiler to the vapor-liquid separator (C-A-1). The feed line from the DST System feed tank and the slurry line to underground storage tanks are connected to the upper recirculation line.

Slurry System. The slurry system draws a portion of the concentrated waste from the upper recirculation loop and transfers it to the DST System.

The major components of the slurry system are the slurry pump and the slurry transfer pipelines. Figure 4-3 shows a simplified flow diagram of the slurry system. These components are described in the following paragraphs.

The slurry pump (P-B-2) is used to transfer slurry from the recirculation loop to the designated DST System tank. The pump is driven by a variable speed motor and is constructed of 304L stainless steel. The slurry pump is designed to generate high pressures to alleviate the possibility of a transfer line plugging.

Interlocks control the operation of the slurry pump. The slurry pump (P-B-2) is shutdown if any of the following occur:

- Excessive pressure is detected in the slurry lines to 241-AW Tank Farm.
- A leak is detected in the slurry transfer lines secondary containment.
- A leak is detected in the 241-AW Tank Farm valve pits (see Section 4.1.7.3.2).

The slurry pump uses a shaft seal with recycled process condensate (or water) and pressure and flow controls similar to the system described above for the recirculation pump.

Compliant transfer pipelines route slurry to a designated DST System tank within the 200 East Area. The detection of any leak by the DST System automated leak detection system is used to shut off the slurry pump. In lieu of the MCS automated shutdown, the slurry pump (P-B-2) can be manually shutdown at the direction of the shift manager or 242-A Evaporator control room operator if a leak occurs.

The flow rate of the slurry transfer to the DST System is monitored and a decrease in flow below a specified value automatically will shut down the slurry pump (P-B-2) and initiate a line flush with water. The objective of flushing the transfer line is to prevent settling of solids, which precludes plugging the slurry transfer lines.

Slurry samples can be taken from the recirculation loop when needed via a sampler (SAMP-F-2) that is located near the feed sampler in the load out and hot equipment storage room.

4.1.4 Condensate Collection Tank (TK-C-100) and Ancillary Equipment

The following section discusses the condensate collection tank (TK-C-100) and ancillary equipment. This equipment collects process condensate via the condensers in the vacuum condenser system, filters the condensate, and pumps the process condensate to LERF. Figure 4-4 provides a simplified process flow diagram showing the major components of the process condensate system. The following major components make up the process condensate system:

- Vacuum condenser system.
- Condensate collection tank (TK-C-100).
- Process condensate pump (P-C-100).
- Condensate filters (F-C-1 and F-C-3).
- Process condensate radiation monitoring, sampling system and diversion system (RC3).
- Seal pot.
- Process condensate recycle system.
- Vessel vent system.

Vacuum Condenser System. Vapors removed from the vapor-liquid separator (C-A-1) flow to a series of three condensers where the vapors are condensed using raw water. Condensate drains to the condensate collection tank (TK-C-100). The vacuum condenser system consists of the following major components:

- Primary condenser (E-C-1).
- Intercondenser (E-C-2).
- Aftercondenser (E-C-3).
- Steam jet ejectors (J-EC1-1 and J-EC2-2).

Figure 4-5 provides a simplified process flow diagram showing the major components of the vacuum condenser system. These system components are discussed in the following sections.

Primary Condenser (E-C-1). Vapors drawn from the vapor-liquid separator flow through the 42-inch vapor line, into the E-C-1 condenser where the majority of the condensation takes place. Noncondensed vapors exit to the intercondenser (E-C-2) while the condensed vapors (process condensate) drain to the condensate collection tank (TK-C-100). Cooling water passes through the cooling tubes and exits to TEDF.

The carbon steel condenser shell measures approximately 17.5 feet long with an 85-inch inside diameter. The condenser consists of 2,950 equally spaced carbon steel tubes that are 11 feet long with a 0.75-inch outside diameter.

Intercondenser (E-C-2). Noncondensed vapors from E-C-1 enter the intercondenser. The vapor stream contacts the cooling tubes in the condenser where cooling water provides additional condensation. The condensate drains to the condensate collection tank (TK-C-100). Noncondensed vapors and cooling water are routed to the after condenser.

The carbon steel intercondenser measures 7.25 feet long with a 15.4-inch inside diameter. This heat exchanger contains 144 tubes that are 66 inches long with a 0.75-inch outside diameter.

After Condenser (E-C-3). Vapor discharged from the intercondenser enters the after condenser. Cooling is supplied to the after condenser by the cooling water from the intercondenser. Condensate is routed to the condensate collection tank (TK-C-100), while the noncondensed vapors are filtered, monitored, and discharged to the atmosphere through the vessel ventilation system. The cooling water is discharged to TEDF.

The carbon steel after condenser measures 7.4 feet long and has an 8-inch inside diameter. This heat exchanger contains 45 tubes that are 6 feet long with a 0.75-inch outside diameter.

Steam Jet Ejectors. The vacuum that draws the vapors from vapor-liquid separator (C-A-1) into the condensers is created by a two-stage steam jet ejector system. The first-stage jet ejector (J-EC1-1) maintains a vacuum on the primary condenser, which in turn creates a vacuum on the vapor-liquid separator. The ejector consists of a steam jet, pressure controller, and air bleed-in valve. Steam and noncondensed vapors from the primary condenser are ejected from J-EC1-1 into the intercondenser. The desired vacuum is obtained by controlling steam pressure and bleeding ambient air as necessary into the vapor header through an air intake filter. The second-stage jet ejector (J-EC2-1) creates the vacuum that moves vapors from the intercondenser through the after condenser.

Condensate Collection Tank (TK-C-100). Process condensate from the primary condenser, intercondenser, after condenser, and the vessel ventilation system drain to the condensate collection tank (TK-C-100). The tank is 14 feet in diameter, 19 feet high, and is constructed of 5/16-inch-thick stainless steel. The tank has a maximum design capacity of 17,800 gallons. Normal operating volume is approximately 50 percent of the tank capacity. A carbon steel base supports the tank. An agitator is installed but not used.

In the event of a tank overflow, the solution is routed through an overflow line to the drain system, which returns waste to the feed tank (241-AW-102). Overflow occurs when the volume exceeds about 16,000 gallons. The overflow line is equipped with a liquid filled trap to isolate the drain system from the tank.

Candidate feed tank waste samples are evaluated for the presence of a separate organic layer as described in the “Waste Analysis Plan” (Chapter 3.0) and process controls are used to reduce the risk of the condensate collection tank (TK-C-100) to receive small amounts of immiscible organics with the condensed waste. If detected, the organic layer is removed by overflowing the condensate collection tank (TK-C-100) back to the feed tank 241-AW-102. The liquid level in the tank is controlled well above the discharge pump intake point and a controlled overflow is conducted upon completion of each processing cycle (campaign or campaigns) to ensure that an organic layer does not accumulate and cannot be pumped to LERF.

Process Condensate Pump. A pump (P-C-100) moves the process condensate from the condensate collection tank (TK-C-100) through the condensate filter to LERF. The process condensate pump is a centrifugal pump constructed of 316 stainless steel.

Condensate Filters. After leaving the condensate collection tank (TK-C-100), the process condensate is filtered to remove solids. The primary condensate filter (F-C-1) has a welded steel housing. A second filter system (F-C-3), installed downstream is also used to filter the process condensate.

This system has duplex in-line filters in cast iron housing. Both filters employ a filter material that is compatible with the process condensate.

Process Condensate Radiation Monitoring, Sampling, and Diversion System. The process condensate is monitored for radiation during transfer to LERF. If radiation levels exceed established limits, an alarm is received and interlocks immediately divert the stream back to the condensate collection tank (TK-C-100) (or the feed tank) and shut off the process condensate pump. This ensures process condensate containing excessive radionuclides due to an accidental carryover from the vapor-liquid separator (C-A-1) is not transferred to LERF.

Seal Pot. The condensate collection tank (TK-C-100) receives condensed liquids from the vessel ventilation system. A seal pot collects the drainage before discharge into the condensate collection tank (TK-C-100) and isolates the tank from the vessel ventilation system.

Condensate Recycle System. For waste minimization, a portion of the process condensate from the condensate collection tank (TK-C-100) is recycled for deentrainment pad sprays and seal water for the recirculation pump (P-B-1) and slurry pump (P-B-2). Use of process condensate instead of raw water results in approximately 10 percent reduction in waste volume generated during continuous operation of the 242-A Evaporator. Filtered raw water also is available as a backup for sprays and seal water. A 2-inch diameter carbon steel line, stainless steel centrifugal pump (P-C-106), and filters (F-C-5 and F-C-4) supply process condensate from condensate collection tank (TK-C-100) to the pad sprays and pump seals. The filters are disposable cartridge filters in carbon steel housings arranged in parallel with one filter in service while the other is in standby.

4.1.5 Integrity Assessments

The IARs are maintained in the Hanford Facility Operating Record, 242-A Evaporator unit-specific portion and discuss:

- The standards used during design and construction of the 242-A Evaporator and the adequacy of those standards.
- The characteristics of the DST System waste processed.
- The adequacy of the materials of construction to provide corrosion protection from the waste processed.
- The age of the tanks and the effect of age on tank integrity.
- The results of the leak tests, visual inspections, and tank wall thickness inspections.
- The frequency and scope of future integrity assessments.
- Deficiencies in secondary containment design. These deficiencies are discussed in the IARs.

An Independent, Qualified, Registered Professional Engineer (IQRPE) certified the integrity assessment.

The inspections, tests, and analyses performed provide assurance that the 242-A Evaporator tank system has adequate design, sufficient structural strength, and sufficient compatibility with the waste to not collapse, rupture, or fail during operation. No evidence of degradation was noted during the visual test, ultrasonic test, or leak test. Both the condensate collection tank (TK-C-100) and the vapor-liquid separator (C-A-1)/reboiler loop passed leak tests. The frequency of subsequent integrity assessments has been established at every 10 years. This frequency is based on the results of the 2008 IARs transmitted to Washington State Department of Ecology (Ecology) on May 27, 2008, which include:

- *IQRPE Integrity Assessment Report for the 242-A Evaporator Tank System*, RPP-RPT-33306, Revision 0, 2007.
- *Integrity Assessment Report for the 242-A PC-5000 Transfer Pipeline*, RPP-RPT-33307, Revision 0, 2007.
- *IQRPE Integrity Assessment Report for the 242-A Evaporator Tank System*, RPP-RPT-33306, Revision 0-A, IQRPE, 2008.

4.1.5.1 Transfer Line (PC-5000)

An integrity assessment for the PC-5000 transfer line was performed, including a hydrostatic leak/pressure test at 150 psig. A statement by an IQRPE attesting to the integrity of the piping system is included in the latest IAR, along with the results of the leak/pressure test. The next integrity assessment for the PC-5000 transfer line will be completed on or before May 27, 2018, in accordance with the 2008 IARs. The schedule for conducting integrity assessments will be at a frequency of every 10 years unless otherwise required by an IQRPE or as required for system repairs and upgrades. All integrity assessments will be conducted in accordance with WAC 173-303-640.

4.1.6 Additional Requirements for Existing Tanks

Refer to information in Section 4.1.1 and the IARs, which includes measuring tank wall thicknesses, evaluating corrosion protection, and performing leak tests.

4.1.7 Secondary Containment and Release Detection for Tank Systems

This section describes the design and operation of secondary containment sumps, drain lines, and leak detection systems for the 242-A Evaporator.

4.1.7.1 Requirements for All Tank Systems

The Construction Specification for 242-A Evaporator-Crystallizer Facilities Project B-100 (*Construction Specification for 242-A Evaporator-Crystallizer Facilities Project B-100, B-100-C1, Automated Industries, Vitro Engineering Division, Richland Washington*, Vitro 1974) was used during preparation, design, and construction of the tank and secondary containment systems. The 2008 IARs detail how the construction specification relates to the national codes and standards.

Constructing the building and vessels per this specification ensures that foundations are capable of supporting tank and secondary containment systems and that uneven settling and failures from pressure gradients do not occur. The 2008 IARs state that the "242-A Evaporator has adequate design, sufficient structural strength, and sufficient compatibility with the wastes to not collapse, rupture, or fail during service loads associated with normal operations and that the building structure was designed and constructed to withstand a design basis earthquake."

The 2008 IARs describe the building and secondary containment system. This system is designed to ensure any release is detected within 24 hours.

The secondary containment system also is designed to contain 100 percent of the maximum operating capacity of the vapor-liquid separator (C-A-1)/reboiler loop, and the drain systems are sloped to allow collection of solution and have sufficient capacity to drain this volume in less than the required 24 hours.

The IAR describes the protective coating material and sealant used to protect concrete and joints from attack by leaks to the secondary containment. The materials of construction for the sump and drain lines are also compatible with the waste processed at the 242-A Evaporator.

For new dangerous waste tank systems or components, the Permittee must obtain a written assessment, reviewed and certified by an IQRPE, in accordance with WAC 173-303-810(13)(a), attesting that the tank system has sufficient structural integrity and is acceptable for the storing and treating of dangerous waste. The assessment must show that the foundation, structural support, seams, connections, and pressure controls (if applicable) are adequately designed and that the tank system has sufficient structural strength, compatibility with the waste(s) to be stored or treated, and corrosion protection to ensure that it will not collapse, rupture, or fail. [WAC 173-303-640(3)(a)]

During installation of new dangerous waste tank systems or components, the Permittees will ensure that proper handling procedures are adhered to in order to prevent damage to the new tank systems or components. Prior to covering, enclosing, or placing a new tank system or component in use, an independent, qualified installation inspector, or an IQRPE, either of whom is trained and experienced in the proper installation of tank systems or components, must inspect the system for the presence of weld breaks, punctures, scrapes of protective coatings, cracks, corrosion, structural damage, and inadequate construction/installation. [WAC 173-303-640(3)(c)(i-vi)]

The Permittees will test for tightness, all new dangerous waste tanks and ancillary equipment prior to being covered, enclosed, or placed in use. If a tank system is found not to be tight, all repairs necessary to remedy the leak(s) in the system must be performed prior to the tank system being covered, enclosed, or placed into use. [WAC 173-303-640(3)(e)]

For existing tank system integrity, for each existing tank system, the Permittees must determine that the tank system is not leaking or is fit for use. The permittees must obtain and keep on file at the facility a written assessment reviewed and certified by an IQRPE that attests to the tank system's integrity. This assessment must determine that the tank system is adequately designed and has sufficient structural strength and compatibility with the waste(s) to be stored or treated, to ensure that it will not collapse, rupture, or fail. [WAC 173-303-640(2)(a)]

At a minimum, this assessment must consider the following:

- Design standard(s), if available, according to which the tank system was constructed;
- Dangerous characteristics of the waste(s) that have been and will be handled;
- Existing corrosion protection measures;
- Documented age of the tank system, if available (otherwise, an estimate of the age); and
- Results of a leak test, internal inspection, or other tank system integrity examination such that for other than nonenterable underground tanks and for ancillary equipment, this assessment must include either a leak test, as described above, or other integrity examination, that is certified by an IQRPE, in accordance with WAC 173-303-810(13)(a), that addresses cracks, leaks, corrosion, and erosion.

4.1.7.2 242-A Building Secondary Containment

The 242-A Building serves as a secondary containment vault for the vapor-liquid separator (C-A-1), condensate collection tank (TK-C-100), and ancillary equipment used for transferring mixed waste at the 242-A Evaporator. The concrete for the operating area was poured to form a monolithic structure. Where needed, joints in the concrete were fabricated with preformed filler conforming to the standards of the American Society for Testing and Materials (ASTM). Joint filler is sealed with a polysulfide sealant per the requirements of the construction specifications (*Construction Specification for 242-A Evaporator-Crystallizer Facilities Project B-100, B-100-C1, Automated Industries, Vitro Engineering Division, Richland Washington*, Vitro 1974).

Before restart in 1994, a new acrylic special protective coating was applied to the concrete in the pump, evaporator, and condenser rooms. The coating meets the requirements of the construction specifications (*Construction Specification for 242-A Evaporator-Crystallizer Facilities Project B-100, B-100-C1, Automated Industries, Vitro Engineering Division*, *Richland Washington*, Vitro 1974), including resistance to very high radiation doses, temperatures of 170°F, and spills of 25 percent caustic solution. The protective coating is maintained.

The following six rooms contain equipment used to process or store* mixed waste:

- Pump room.
- Evaporator room.
- Condenser room.
- Ion exchange room.
- Loading room* (used for temporary storage of mixed waste).
- Loadout and hot equipment storage room.

4.1.7.2.1 Pump Room

The pump room contains the process recirculation loop, recirculation pump (P-B-1), and slurry pump (P-B-2), and jumpers that transfer feed and slurry solutions between the vapor liquid separator (C-A-1) and the DST System.

The pump room secondary containment walls are 12- to 22-inch-thick reinforced concrete. The secondary containment floor is 20-inch-thick reinforced concrete. The pump room floor is lined with 0.25-inch stainless steel and the concrete walls and ceiling cover blocks are painted with a special protective coating. The pump room contains pipe jumpers used to transfer feed and slurry solutions between the vapor-liquid separator and the DST System, and the process recirculation loop, recirculation pump (P-B-1), and slurry pump (P-B-2).

Leaks in the pump room collect in the pump room sump, a 5 x 5 x 6-feet deep sump with a 0.25-inch stainless steel liner. The pump room sump collects spills from various sources for transfer to the feed tank, 241-AW-102. Figure 4-6 provides a simplified process flow schematic of sources, which drain to the pump room sump. Drainage to the sump includes:

- Leaks to the pump room floor from equipment in the pump room.
- Evaporator room floor drain.
- Loadout and hot equipment storage room floor drain.
- Loading room floor drain.
- Raw water backflow preventer drain.

Solution in the pump room sump is transferred to the feed tank (241-AW-102) using a steam jet. A 10-inch secondary containment overflow line is provided for draining large volumes of solution should a catastrophic tank failure occur. Because the overflow line provides a direct path between the air space of feed tank 241-AW-102 and the pump room, a minimum level of water must be maintained in the sump to prevent cross ventilation. A leak into the pump room sump would be detected by a rise in the sump level. Leaks in the pump room are detected by:

- A rise in the sump level resulting in instrumentation alarms on high sump level.
- Inspections of the ancillary equipment and floor in the pump room identified in Chapter 6.0, "Procedures to Prevent Hazards."
- Unexplained level increases in feed tank 241-AW-102 because of liquid entering the 242-A Evaporator sump overflow drain line.

The recirculation and slurry pumps in the pump room are equipped with mechanical seals having pressurized water introduced between the seals. The seal water is maintained at a pressure that exceeds the process pressure at the seal to ensure water leaks into the process solution, but waste solution does not leak out. Water from seal leakage is collected in funnels in the pump room and routed to feed tank 241-AW-102 via the 10-inch overflow line described previously.

4.1.7.2.2 Evaporator Room

The evaporator room contains the vapor-liquid separator vessel (C-A-1), part of the recirculation loop, the reboiler, the 42-inch vapor line, and line used to empty the vapor-liquid separator to feed tank 241-AW-102.

The evaporator room secondary containment walls are 22-inch-thick reinforced concrete. The secondary containment floor is 20-inch-thick reinforced concrete. Leaks in the evaporator room flow to a floor drain that routes through a 3-inch line to the pump room sump described in Section 4.1.7.2.1. A leak in the evaporator room would be detected by a rise in the pump room sump level. The floor of the evaporator room and a portion of the pump room floor are 10 feet below grade to contain the entire contents of the vapor-liquid separator, reboiler, and recirculation loop in the event of a catastrophic failure. The floor and walls of the evaporator room up to an elevation of 6 feet are painted with a special protective coating.

4.1.7.2.3 Condenser Room

The condenser room contains the components of the process condensate system described in Section 4.1.4 (refer Figure 4-4), including the condensate collection tank TK-C-100.

The condenser room secondary containment walls are 12- to 22-inch-thick reinforced concrete. The secondary containment floor is 20-inch-thick reinforced concrete. Leaks in the condenser room flow to two floor drains that join and route through a 6-inch line to feed tank 241-AW-102. Leaks in the condenser room are detected by the following:

- Unexpected changes in liquid level in the condensate collection tank (TK-C-100). Instrumentation is provided to monitor liquid level in the tank, including high- and low-level alarms.
- Daily visual inspections of process condensate system components and piping.
- Unexplained level increases in feed tank 241-AW-102 because of liquid entering the common drain line from 242-A Evaporator.

The floor and walls of the condenser room up to an elevation of 4 feet are painted with a special protective coating.

4.1.7.2.4 Ion Exchange Room

The ion exchange room is a small room connected to the condenser room. This room previously contained an ion exchange column that has since been removed from the processing unit in 2003. The ion exchange room walls are 12-inch-thick reinforced concrete. The floor is 20-inch-thick reinforced concrete. The room contains a single pipeline used to transfer process condensate during a campaign if the process condensate is diverted to feed tank 241-AW-102. The pipeline within the ion exchange room does not contain valves or other components that could release waste into the ion exchange room other than by a rupture of the line.

Surveillance of the ion exchange room is only required if the piping is returned to service and dangerous waste is reintroduced to the piping as would be the case for diverting process condensate to feed tank 241-AW-102.

4.1.7.2.5 Loading Room and Loadout and Hot Equipment Storage Rooms

The loading room and the loadout and hot equipment storage rooms are used to support maintenance of pump room equipment and store contaminated reusable equipment. Movement of equipment, waste, personnel and other items in and out of the unit as necessary to support ongoing operations and maintenance activities in contaminated zones can occur in these rooms. A contamination control curtain may also be closed in support of evolutions conducted in the load-out and hot equipment storage room to control the spread of contamination. The loadout and hot equipment storage room contains a slurry sampling system.

The loadout and hot equipment storage rooms walls are 12- to 22-inch thick reinforced concrete. The floors are 6-inch-thick reinforced concrete. The room contains two recirculation lines and samplers used to sample the feed and slurry streams. The feed sampler has been isolated and is no longer capable of sampling feed. The lines and samplers are located in a shielded enclosure adjacent to the pump room wall.

The loadout and hot equipment storage room contains two sumps: the drain sump and decontamination sump. The sumps are approximately 3 feet in diameter, about 4 feet deep, and lined with stainless steel.

Both sumps drain via a 3-inch drain line to the pump room sump described in Section 4.1.7.2.1. The sumps, floor, and walls of the load out and hot equipment storage room up to an elevation of 12 feet are painted with a special protective coating.

Leaks in the sampler piping, flow into two drains in the sample enclosure that drain via a 2-inch line to the decontamination sump, which drains to the pump room sump (described in Section 4.1.7.2.1). Leak detectors in the sampler enclosures or a rise in the pump room sump level detects leaks in the sampler piping.

4.1.7.2.6 242-A Building Drain Lines

Figure 4-6 provides a simplified process flow schematic of sources routed to the 242-A Building drain lines. The 242-A Evaporator TSD unit group boundary includes these lines up until they exit the 242-A Building. At this point, the lines are considered DST System components. Four lines serve to drain the 242-A Building and equipment to feed tank 241-AW-102:

- Pump room sump drain line (DR-334): 10-inch carbon steel line that transfers process condensate overflow/diverted liquids and empty out of the pump room sump to the feed tank.
- Vapor-liquid separator vessel drain line (DR-335): 10-inch carbon steel line that allows gravity drain of the vessel to the DST feed tank 241-AW-102.
- Condenser room drain line (DR-343): 6-inch carbon steel line that drains potential leakage from the condenser room.
- Diverted process condensate drain line (DR-338): Process condensate liquid drains through DR-338 into sump drain line (DR-334) which drains to feed tank 241-AW-102.

The four lines are sloped to drain about 560 feet to feed tank 241-AW-102 via the drain pit (241-AW-02D). Although WAC 173-303-640(1)(c) exempts systems that serve as secondary containment from requiring secondary containment, drain lines DR-334, DR-335, and DR-338 have outer encasement piping and are part of the DST System.

4.1.7.3 Transfer Line Secondary Containment and Leak Detection

This section describes the design and operation of secondary containment and leak detection systems for transfer lines between the DST System and the 242-A Evaporator, from 242-A Evaporator to LERF, and from WTP to PC-5000 transfer line. The 242-A Evaporator TSD unit group boundary for lines running between the 242-A Evaporator and the DST System ends at the exterior wall of 242-A Building. At this point, these lines (e.g., feed and slurry line piping [SN-275, SL-170, SL-171]) are DST System components.

The PC-5000 transfer line transfers process condensate (Section 4.1.2) from the 242-A Building to LERF. The 242-A Evaporator TSD unit boundary includes the PC-5000 transfer line up to the LERF TSD unit group boundary ("Part A Form," Chapter 1.0, and Section 4.1.2). This transfer line is equipped with the following in-line leak detectors in order of direction of flow; LDE-049, LDE-044 (in caisson MH-WTP-01), LDE-031, LDE-015. LDS-41-5 is the end-of-line leak detector at Catch Basin 41. LDE-43-2 is the end-of-line leak detector at Catch Basin 43. Refer to Chapter 6.0, “Procedures to Prevent Hazards,” for additional leak detector information.

The WTP backup transfer line to the PC-5000 transfer line (ends within caisson WTP-MH-01) transfers effluent from the WTP Effluent Management Facility (EMF) (“Part A Form,” Chapter 1.0, and Section 4.1.2). This transfer line is equipped with the following in-line leak detectors in order of direction of flow; LDE-006 and LDE-001 (in caisson MH-WTP-01). Refer to Chapter 6.0, “Procedures to Prevent Hazards,” for additional leak detector information.

The Permittees must maintain and operate the in-line leak detectors for the PC-5000 and WTP backup transfer lines continuously during transfers, except during conditions outlined below.

If a leak or spill of dangerous and/or mixed waste is detected in the secondary containment for PC-5000 transfer line (3”-EVAP_COND-PC5000-M17) during a transfer from the 242-A Building, the following actions will be taken:

- For any leak detection alarm, immediately and safely stop the flow of dangerous waste into the tank or secondary containment.
- For in-line leak detection alarms along the active transfer route, the transfer will be stopped and the riser containing the leak detection element in alarm will be swabbed and checked for pH. If the pH is ≤ 9.0, the leak detector will be declared Out of Service (OOS) and the transfer will be allowed to continue. The OOS leak detector is to be returned to service within 90 days to allow for troubleshooting and repair. If the pH of the swab is above 9.0, the system will be secured, and notifications will be made in accordance with Permit Condition I.E.15.
- No two adjacent leak detectors may be OOS, and not more than two leak detectors along a transfer route may be OOS at any time during a transfer.
- Notes: If system is not transferring dangerous waste at the time of alarm, system may be operated with an acceptable pH test riser swab. At all times, the end-of-line (wired) leak detector shall be operational, or the sight glass shall be used.
- Determine the source of the dangerous waste.
- Remove the dangerous waste from secondary containment pursuant to WAC 173-303-640(7)(b). The waste removed from secondary containment areas will be managed as dangerous and/or mixed waste.
- If the cause of the release has not damaged the integrity of the tank system, the Permittee may return the tank system to service pursuant to WAC 173-303-640(7)(e)(ii). In such a case, the Permittee will take action to ensure the incident that caused liquid to enter the secondary containment will not reoccur.
- If the source of the dangerous waste and/or mixed waste is determined to be a leak from the primary containment, or the tank system is unfit for use as determined through an integrity assessment or other inspection, the Permittee must comply with the requirements of WAC 173-303-640(7) and take the following actions [WAC 173-303-640(5)(c)]:
    - Close the tank system according to procedures in WAC 173-303-640(7)(e)(i); or
    - Repair and re-certify [in accordance with WAC 173-303-810(13)(a)] the tank system before the tank system is placed back into service [WAC 173-303-640(7)(e) and (f) and WAC 173-303-806(4)(c)(vii)].
- The Permittees will notify and report to Ecology any releases to the environment in accordance with WAC 173-303-640(7)(d).

- If liquids (e.g., dangerous and/or mixed waste, leaks and spills, precipitation, fire water, liquids from damaged or broken pipes) cannot be removed from the secondary containment system within 24-hours, Ecology will be verbally notified within 24-hours of determination that the liquid cannot be removed.
- If the liquids cannot be removed with 24-hours, the Permittees will provide Ecology with a written demonstration within seven (7) business days, in accordance with WAC 173-303-640(4)(c)(iv), WAC 173-303-640(7)(b)(ii), and WAC 173-303-806(4)(c)(vii). The written demonstration will identify at a minimum:
    - Reasons for delayed removal.
    - Measures implemented to ensure continued protection of human health and the environment.
    - Current actions being taken to remove liquids from secondary containment.
- The Permittees will document in the operating record the actions/procedures taken to comply with the above conditions in accordance with WAC 173-303-640(6)(d).

If a leak or spill of dangerous and/or mixed waste is detected in the secondary containment for PC-5000 transfer line or WTP backup transfer line (3”-WTP-002-M17) during a transfer from the WTP EMF, the following actions will be taken:

- For any leak detection alarm, immediately and safely stop the flow of dangerous waste into the tank, surface impoundment, or secondary containment.
- For in-line leak detection alarms along the active transfer route, the transfer will be stopped and the riser containing the leak detection element in alarm will be swabbed and checked for radiological contamination. If no radiological contamination is found, the leak detector will be declared OOS and the transfer will be allowed to continue. The OOS leak detector is to be returned to service within 90 days to allow for troubleshooting and repair. If swab comes back with contamination, the system will be secured and notifications will be made in accordance with Permit Condition I.E.15.
- No two adjacent leak detectors may be OOS, and not more than two leak detectors along a transfer route may be OOS at any time during a transfer.
- Notes: If system is not transferring dangerous waste at the time of alarm, system may be operated with an acceptable radiological test riser swab. At all times the end-of-line (wired) leak detector shall be operational, or the sight glass shall be used.
- Determine the source of the dangerous waste.
- Remove the dangerous waste from secondary containment pursuant to WAC 173-303-640(7)(b). The waste removed from secondary containment areas will be managed as dangerous and/or mixed waste.
- If the cause of the release has not damaged the integrity of the tank system, the Permittee may return the tank system to service pursuant to WAC 173-303-640(7)(e)(ii). In such a case, the Permittee will take action to ensure the incident that caused liquid to enter the secondary containment will not reoccur.
- If the source of the dangerous waste and/or mixed waste is determined to be a leak from the primary containment, or the tank system is unfit for use as determined through an integrity assessment or other inspection, the Permittee must comply with the requirements of WAC 173-303-640(7) and take the following actions [WAC 173-303-640(5)(c)]:
    - Close the tank system according to procedures in WAC 173-303-640(7)(e)(i); or
    - Repair and re-certify [in accordance with WAC 173-303-810(13)(a)] the tank system before the tank system is placed back into service [WAC 173-303-640(7)(e) and (f) and WAC 173-303-806(4)(c)(vii)].

- The Permittees will notify and report to Ecology any releases to the environment in accordance with WAC 173-303-640(7)(d).
- If liquids (e.g., dangerous and/or mixed waste, leaks and spills, precipitation, fire water, liquids from damaged or broken pipes) cannot be removed from the secondary containment system within 24-hours, Ecology will be verbally notified within 24-hours of determination that the liquid cannot be removed.
- If the liquids cannot be removed within 24-hours, the Permittees will provide Ecology with a written demonstration within seven (7) business days, in accordance with WAC 173-303-640(4)(c)(iv), WAC 173-303-640(7)(b)(ii), and WAC 173-303-806(4)(c)(vii). The written demonstration will identify at a minimum:
    - Reasons for delayed removal.
    - Measures implemented to ensure continued protection of human health and the environment.
    - Current actions being taken to remove liquids from secondary containment.
- The Permittees will document in the operating record the actions/procedures taken to comply with the above conditions in accordance with WAC 173-303-640(6)(d).

4.1.7.3.1 Feed Line Piping

Waste feed is supplied to the 242-A Evaporator by DST System transfer line SN-275, for transfers from DST System valve pit 241-AW-02E. Transfer line SN-275 consists of 3-inch transfer piping within a 6-inch secondary containment encasement piping. In the event transfer line SN-275 is not available, the spare transfer line SL-171 would be used for transfers from DST System valve pit 241-AW-02A. Transfer line SL-171 consists of a 2-inch transfer piping within a 4-inch secondary containment encasement piping. The transfer piping is sloped to gravity drain to the DST System.

Wall nozzles act as a connection point to the DST System transfer piping, which provide secondary containment through the 242-A building wall. If a leak develops in the wall nozzle primary pipe, fluid will travel down the interior of the respective encasement line (SN-275 or SL-171) to the DST System valve pit leak detection system. If the DST System MCS annunciates a leak alarm associated with the DST System transfer, the transfer operator notifies the 242-A Evaporator control room operator of the appropriate action regarding processing operations.

DST System feed lines SN-269 and SN-270, will be physically isolated from potential sources of dangerous waste, by disconnecting jumpers from the wall nozzles and installing process blanks. These transfer lines do not have secondary containment for the sections that pass through 242-A building wall.

4.1.7.3.2 Slurry Line Piping

The slurry pump (P-B-2) transfers mixed waste through DST System transfer line SL-170, for transfers to DST System valve pit 241-AW-02A. In the event SL-170 is not available, the spare transfer line SL-171 would be used for transfers to DST System valve pit 241-AW-02A. Transfer lines SL-170 and SL-171, consist of a 2-inch transfer piping within a 4-inch secondary containment encasement piping. The transfer piping is sloped to gravity drain to the DST System.

Wall nozzles act as a connection point to the DST System transfer piping, which provide secondary containment through the 242-A building wall. If a leak develops in the wall nozzle primary pipe, fluid will travel down the interior of the respective encasement line (SL-170 or SL-171) to the DST System leak detection system. If the DST System MCS annunciates a leak alarm associated with the DST System transfer, the transfer operator notifies the 242-A Evaporator control room operator of the appropriate action regarding processing operations.

DST System slurry lines SL-167 and SL-168, will be physically isolated from potential sources of dangerous waste, by disconnecting jumpers from the wall nozzles and installing process blanks. These transfer lines do not have secondary containment for the sections that pass through the 242-A building wall.

4.1.7.3.3 PC-5000 Transfer Line (3”-EVAP_COND-PC5000-M17)

The process condensate transfer line (PC-5000) from the 242-A Evaporator is centrifugally cast, fiberglass-reinforced epoxy thermoset resin pressure pipe fabricated to meet the requirements of American Society of Mechanical Engineers (ASME) D2997 (ASME 1984). The 3-inch carrier piping is centered and supported within 6-inch containment piping. Pipe supports are fabricated of the same material as the pipe, and meet the strength requirements of American National Standards Institute (ANSI) B31.3 (ANSI 1987) for dead weight, thermal, and seismic loads. PC-5000 transfer line leaves the 242-A Evaporator and merges with the WTP backup transfer line (3”-WTP-002-M17) at caisson WTP-MH-01. At the intersection of the transfer lines (3”-EVAP_COND-PC5000-M17 and 3”-WTP-002-M17), caisson MH-WTP-01 provides secondary containment.

The PC-5000 primary pipe leaves the 242-A Evaporator and ends at valve 60M-43-P. The encasement line (6”-ENC-M17) and caisson MH-WTP-01 provide secondary containment. If a leak develops in the primary pipe, fluid will travel down the interior of the encasement line to a leak detection system that sounds an alarm in the 242-A Evaporator Control Room. In accordance with Permit Condition III.4.C.4.a, if the electronic end-of-line leak detection system is not available, once per shift visual inspection can be employed at the corresponding LERF Catch Basins 242AL-41 or 242AL-43 sight glass. For LERF Basin 41, the sight glass is FG-60M-002; for LERF Basin 43, the sight glass is FG-60M-001. Upon verification of a leak, the 242-A Evaporator shift manager will direct the shutdown of the aqueous waste through the transfer line(s) to immediately prevent addition of waste. To stop 242-A Evaporator waste through the PC-5000 transfer line, the condensate pump (P-C-100), located at the 242-A Evaporator is shutdown. Any leaked waste in the encasement line is gravity drained to the corresponding LERF basin.

Drawing H-2-88766, Sheets 1 and 3, provide details of the piping from the 242-A Evaporator to LERF.

4.1.7.3.4 Waste Treatment Plant Backup Transfer Line (3”-WTP-002-M17)

The process condensate transfer line (3”-WTP-02-M17) from WTP is constructed of fiberglass-reinforced plastic. The piping material specification is ASTM D2996, “Standard Specification for Filament-Wound ‘Fiberglass’ (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.” The 3-inch carrier piping is centered and supported within 6-inch containment piping. Pipe supports are fabricated of the same material as the pipe, and meet the strength requirements of ANSI B31.3 (ANSI 1987) for dead weight, thermal, and seismic loads. The backup transfer line leaves WTP and merges with PC-5000 transfer line at caisson WTP-MH-01. At the intersection of the transfer lines, the caisson (WTP-MH-01) provides secondary containment.

In accordance with Permit Condition III.4.C.4, if a leak develops in the primary pipe, fluid will travel down the interior of the secondary containment pipe to an end-of-line leak detection system, which sounds an alarm in the 242-A Evaporator control room or 200 Area ETF control room. If the end-of-line electronic leak detection system is not available, once per shift visual inspection can be employed at the corresponding LERF Catch Basins 242AL-41 or 242AL-43 sight glass. For LERF Basin 41, the sight glass is FG-60M-002; for LERF Basin 43, the sight glass is FG-60M-001. Upon verification of a leak, the shift manager notifies WTP to shut down the aqueous waste through the backup transfer line from WTP (3”-WTP-002-M17). Any leaked waste in the encasement line is gravity drained to the corresponding LERF basin.

Drawing H-2-88766, Sheet 5 provides details of the transfer line from WTP to 242-A Evaporator.

4.1.7.4 Additional Requirements for Specific Types of Systems

Addressed in this section are additional requirements in WAC 173-303-640 for vault systems like the 242-A Building to ensure neither buildup of ignitable vapors nor does infiltration of precipitation occur. This section also addresses secondary containment for ancillary equipment and piping associated with the tank systems.

4.1.7.4.1 Vault Systems

The 242-A Building is a vault constructed partially below ground, providing secondary containment for the tank systems. The 242-A Evaporator "Part A Form" (Chapter 1) contains the ignitable waste number because of the presence of nitrite and nitrate salts, which in sufficient concentrations are considered oxidizers per WAC 173-303-090(5)(a)(iv). Because of their low volatility, these compounds are unlikely to be present in the vapor phase of the tank systems at the 242-A Evaporator. However, to prevent the spread of contamination, the vapor-liquid separator (C-A-1) is ventilated and maintained at lower air pressure than the building air space during operation. This ensures air leakage is from uncontaminated building air space into the tank vapor space. Vapors from the vapor-liquid separator (C-A-1) flow to the vacuum condenser system described in Section 4.0.

The condensate collection tank (TK-C-100), collects process condensate that is not designated ignitable or reactive. The tank systems and ancillary equipment are located within the 242-A Building, which is completely enclosed to prevent run-on and infiltration of precipitation into the secondary containment system.

4.1.7.4.2 Ancillary Equipment

The 242-A Building provides secondary containment for ancillary equipment. Double containment is provided for the feed and slurry transfer lines between the 242-A Building and the AW Tank Farm by pipe-in-pipe arrangements. Since the ancillary equipment has compliant secondary containment the daily inspection requirements in WAC 173-303-640(4)(f) are not applicable.

4.1.8 Variances from Secondary Containment Requirements

The IARs identified in Section 4.1.5 discuss the following three deficiencies associated with the secondary containment system:

Pump Room Sump. The pump room sump does not comply with secondary containment requirements because liquid must be kept in the sump to provide a seal to prevent airflow between the pump room and feed tank 241-AW-102. Although the sump has a 0.25-inch-thick stainless steel liner to prevent corrosion of the concrete floor, the sump does not have secondary containment.

Routine Discharges through Secondary Containment. The configuration of the 242-A Evaporator process requires routine, batch discharges of dangerous waste through secondary containment drain lines. These routine discharges include the following.

- Steam condensate, cooling water, process condensate sample stations, and safety shower testing drain to the DST feed tank, 241-AW-102, through drain line DR-343. Total discharge is about 10 gallons per month during operation.
- Sample bottle water sprays down in the slurry sample station drains to the decontamination sump in the load out and hot equipment storage room. The decontamination sump then drains to the pump room sump. Total discharge is about 20 gallons per month during operation.
- Vapor-liquid separator (C-A-1) and recirculation loop gravity drain to DST feed tank 241-AW-102, through DR-335. During operations (end of campaigns/shutdown), the waste in the vapor-liquid separator (C-A-1) and recirculation loop can be emptied using the slurry or feed lines; however, this does not fully empty the vapor-liquid separator (C-A-1) and recirculation loop. To ensure that waste is not stored when the 242-A Evaporator is in the shutdown mode,

dump valves (HV-CA1-7 and HV-CA1-9) are opened to gravity drain the vapor-liquid separator (C-A-1) and recirculation loop to DST feed tank 241-AW-102 via drain line DR-335. The dump valves may also open to drain the system in the event of equipment failure, interlocks, or power outage.

Transfer Piping Wall Penetrations. Two dangerous waste transfer line piping sections (DR-335 and DR-338) passing through the 242-A Building wall are single-walled, i.e., no secondary confinement in the wall.

The deficiency for DR-335 was identified to Ecology, October 28, 1993. Ecology's response stated:

- "No physical revision of the pipe wall penetrations or the floor drains in the evaporator pump room will be required prior to evaporator restart."
- "If at any time leakage is seen or detected from these installations, or if for any reason these installations are repaired or rebuilt, they will be rebuilt or repaired in accordance with regulations."
- "Should a spill occur in the evaporator pump room, the sump and the piping shall be rinsed three times as required in WAC 173-303-160, as appropriate. 'Appropriate' in this case means that the original regulation was written for a free container, not a sump, so that judgment will have to be used in the application of the regulation. The rinsate shall be transferred to the double-shell tanks."

4.1.9 Tank Management Practices

All waste to be processed at the 242-A Evaporator must be sampled to determine if the waste is compatible with the materials of construction at the 242-A Evaporator. Before each campaign, candidate feed tanks are sampled per the requirements of the "Waste Analysis Plan" (Chapter 3.0). Based on the results, three possible options are implemented.

- The waste is acceptable for processing without further actions.
- The waste is unacceptable for processing as a single batch, but is acceptable if blended with other waste that is going to be processed.
- The waste is unacceptable for processing.

The 242-A Evaporator process is controlled by operators using the MCS. The MCS computer monitors liquid levels in the vapor-liquid separator (C-A-1) and condensate collection tank (TK-C-100). The MCS system manages liquid levels in the vapor-liquid separator (C-A-1) using a control function that controls feed delivery to the vapor-liquid separator (C-A-1). The MCS system also manages liquid levels in the condensate collection tank (TK-C-100) using a control function to maintain the tank level at approximately 50 percent under normal conditions. The MCS has alarms that annunciate on high-liquid levels for both the vapor-liquid separator (C-A-1) and condensate collection tank (TK-C-100) to notify operators that actions must be taken to prevent overfilling of these vessels.

An interlock is activated when high-liquid level in the vapor-liquid separator (C-A-1) is detected, automatically shutting down the feed transfer pump at feed tank 241-AW-102, thereby preventing overfilling of the vessel and carryover of slurry into the process condensate system. The condensate collection tank (TK-C-100) has an overflow line that routes solution to feed tank 241-AW-102 in case of overfilling.

Process and instrumentation drawings are listed in Section 4.3.

The process condensate pump (P-C-100), recirculation pump (P-B-1), and slurry pump (P-B-2) can be shutdown using the MCS or manually at the direction of the Shift Manager or 242-A Evaporator Control Room Operator if a leak occurs.

4.1.10 Labels or Signs

This section identifies how tank labeling practices will be implemented to meet the requirements of WAC 173-303-640(5)(d). Both the condensate collection tank TK-C-100 and ancillary piping is labeled "Process Condensate" to alert trained personnel which pipes in the condenser room contain dangerous waste.

The vapor-liquid separator (C-A-1) is located in the evaporator room, a normally unoccupied area. This area is posted as a radiological area based on current conditions. Access is controlled using As Low as Reasonably Achievable (ALARA) principles and limited to personnel in accordance with "Personnel Training" (Chapter 8.0). The tank labels are visible from the walls of the tank enclosure rooms, which are less than 50 feet from the tank systems; therefore, label visibility requirements are met.

4.1.11 Air Emissions

Tank systems that contain acutely or chronically toxic waste, by inhalation must be designed to prevent the escape of such vapors as required by WAC 173-303-640(5)(e). For the DST System waste in the vapor-liquid separator (C-A-1), no determination has been performed to determine if the waste is acutely or chronically toxic by inhalation. Most of the toxic compounds in the DST waste are not volatile, but because of the high radioactivity of the waste, controls are included to prevent or mitigate the release of tank vapors. During operation, the vapor-liquid separator (C-A-1) is maintained under vacuum to ensure air leakage is from uncontaminated building air space into the tank vapor space. The vapor in the vapor-liquid separator (C-A-1) then passes through deentrainment pads to prevent liquid and solid carryover into condensers (E-C-1, E-C-2, and E-C-3). The vapor stream passes through the three condensers that remove the condensable components. The noncondensable vapors pass through High Efficiency Particulate Air (HEPA) filters before being discharged to the environment.

4.1.12 Management of Ignitable or Reactive Wastes in Tank Systems

The 242-A Evaporator "Part A Form" (Chapter 1.0) contains the ignitable waste number because of the presence of oxidizers (nitrates and nitrites). Waste accepted at the 242-A Evaporator does not meet the definition of a combustible or flammable liquid given in National Fire Protection Association (NFPA) code number 30 (NFPA 1996). The buffer zone requirements in NFPA-30, which require tanks containing combustible or flammable solutions be a safe distance from each other and from public way, are not applicable.

Testing is performed on the DST System candidate feed tank waste to be processed to verify the waste does not react exothermically at the elevated temperatures at the 242-A Evaporator. The "Waste Analysis Plan" (Chapter 3.0) discusses waste acceptance requirements due to the reactive waste number contained on the 242-A Evaporator "Part A Form" (Chapter 1.0).

4.1.13 Management of Incompatible Wastes in Tank Systems

Waste transferred to the 242-A Evaporator must be compatible before mixing. The "Waste Analysis Plan" (Chapter 3.0) includes waste compatibility requirements; including waste-to-waste compatibility of multiple candidate feed tanks. Waste stored in the condensate collection tank (TK-C-100) contains low quantities of constituents where compatibility from batch to batch is not a concern.

4.2 Air Emissions Control

This section addresses the requirements of Air Emission Standards for Process Vents, under 40 Code of Federal Regulations (CFR) 264 Subpart AA (incorporated by reference in WAC 173-303-690).

4.2.1 Applicability of Subpart AA Standards

The 242-A Evaporator performs distillation that specifically requires evaluation of process vents for the applicability of 40 CFR 264 Subpart AA.

Waste processed at the 242-A Evaporator routinely contains greater than 10 parts per million organic concentrations; therefore, organic air emissions are subject to 40 CFR 264.1032, which requires organic emissions from all affected vents at the Hanford Facility be less than 3 pounds per hour and 3.1 tons per year, or control devices be installed to reduce organic emissions by 95%.

The 242-A Evaporator has one process ventilation system that vents both the vapor-liquid separator (C-A-1) and the condensate collection tank (TK-C-100). The vent lines from both tanks combine before entering an off-gas system consisting of a deentrainer, a prefilter/demister, HEPA filters, and an exhaust fan. The vessel vent off-gas system is located on the third floor of the condenser room, with the exhaust stack extending horizontally through the east wall of the building at an elevation of approximately 48 feet above ground level. The exhaust stack bends to run vertically with the discharge point approximately 111 feet above ground level.

During waste processing, the airflow is about 720 cubic feet per minute, with about 150 cubic feet per minute ventilated from the condensate collection tank (TK-C-100) and the remainder from the vapor-liquid separator (C-A-1) and air in leakage.

Organic emissions occur during waste processing, which is less than 6 months (182 days) each year. This is the maximum annual operating time for the 242-A Evaporator, as shutdowns are required during the year for maintenance outages, candidate feed tank analysis, and establishing transfer routes for staging waste in the DST System.

4.2.2 Process Vents - Demonstrating Compliance

This section outlines how the 242-A Evaporator complies with the requirements of 40 CFR 264, Subpart AA, including a discussion of the basis for meeting the organic emission limits, calculations demonstrating compliance, and conditions for reevaluating compliance.

4.2.2.1 Basis for Meeting Limits/Reductions

The TSD units at the Hanford Facility subject to 40 CFR 264, Subpart AA meet the organic air emission limits of 3 pounds per hour and 3.1 tons per year, established in 40 CFR 264.1032, by the design of the facility. The 242-A Evaporator and the other TSD units collectively can meet these standards without the use of air pollution control devices.

4.2.2.2 Demonstrating Compliance

Process vent organic air emissions are controlled by establishing limits for acceptance of waste at the 242-A Evaporator. Before startup of each campaign, the waste to be processed is sampled in the DST System to determine the organic content. If the concentrations of organic constituents are less than the limits in the “Waste Analysis Plan” (Chapter 3.0), the waste can be processed, provided the Hanford Facility will not exceed 3 pounds per hour and 3.1 tons per year. The waste acceptance limits in the “Waste Analysis Plan” (Chapter 3.0) are based on equilibrium calculations and assumptions given in *Organic Emission Calculations for the 242-A Evaporator Vessel Vent System* (WHC-SD-WM-ES-380, 1996). The calculation to determine organic emissions consists of the following steps:

1. Determine the emission rate of each candidate feed tank organic constituent by multiplying the constituent concentration by the corresponding partition factor in *Organic Emission Calculations for the 242-A Evaporator Vessel Vent System* (WHC-SD-WM-ES-380, 1996).
2. Sum the emission rates of all organic constituents to determine the emission rate for the candidate feed tank. The maximum emission rate for the campaign is the rate from the candidate tank with the greatest emission rate.
3. Determine the total amount of emission during the campaign by using operating time and a weighted average emission rate, based on the volume of each candidate feed tank processed.

The organic emission rates and quantity of organics emitted during the campaign are determined using these calculations and are included in the operating record for each campaign, as required by 40 CFR 264.1035. The Hanford Facility has a system to ensure organic emissions from units subject to 40 CFR 264, Subpart AA are less than the limits of 3 pounds per hour and 3.1 tons per year. Records documenting total organic emissions are available for Ecology review on request.

4.2.2.3 Reevaluating Compliance with Subpart AA Standards

Calculations to determine compliance with Subpart AA will be reviewed when any of the following conditions occur at the 242-A Evaporator:

- Changes in the configuration or operation that affect the assumptions in the *Organic Emission Calculations for the 242-A Evaporator Vessel Vent System* (WHC-SD-WM-ES-380, 1996).
- Annual operating time exceeds 182 days.

4.3 Engineering Drawings

The drawings in Table 4-1 are Process and Instrumentation Diagrams (P&IDs) for the systems at the 242-A Evaporator that contact mixed waste. These drawings are provided for general information, and demonstrate adequacy of the tank systems design.

Table 4-1 Process and Instrumentation Diagrams

System	Drawing Number	Drawing Title
Vapor-Liquid Separator (C-A-1)	H-2-98988 Sheet 1	P&ID Evaporator Recirc System
Reboiler (E-A-1)/Recirculation Line	H-2-98988 Sheet 2	P&ID Evaporator Recirc System
Slurry System	H-2-98989 Sheet 1	P&ID Slurry System
Condensate Collection Tank (TK-C-100)	H-2-98990 Sheet 1	P&ID Process Condensate System
Secondary Containment Drain System	H-2-98995 Sheet 1	P&ID Drain System
Secondary Containment Drain System	H-2-98995 Sheet 2	P&ID Drain System
Condensers	H-2-98999 Sheet 1	P&ID Vacuum Condenser System
Pump Room Sump	H-2-99002 Sheet 1	P&ID Jet Gang Valve System
Condensate Recycle System	H-2-99003 Sheet 1	P&ID Filtered Raw Water System
PC-5000 Transfer Line (3”-EVAP_COND-PC5000-M17)	H-2-88766, Sheets 1, 3, and 6	P&ID LERF Basin & ETF Influent Evaporator
WTP backup transfer line (3”-WTP-002-M17)	H-2-88766, Sheet 5	P&ID LERF WTP Interface

The drawings in Table 4-2 are for secondary containment systems for the 242-A Evaporator. Because secondary containment systems are the final barrier for preventing the release of dangerous waste into the environment, modifications that affect the secondary containment systems will be submitted to Ecology as a Class 1, 2, or 3 Permit Modifications, as required by WAC 173-303-830.

Table 4-2 242-A Evaporator Secondary Containment Systems Drawings

System	Drawing Number	Drawing Title
242-A Building	H-2-69277 Sheet 1	Structural Foundation Plan Sections & General Notes - Areas 1 & 2
	H-2-69278 Sheet 1	Structural Foundation Elevations & Details - Areas 1 & 2
	H-2-69279 Sheet 1	Structural First Floor Plan & AMU - Areas 1 & 2
Pump Room Sump Drainage	H-2-69352 Sheet 1	Sections Process Waste Drainage
242-A Building Drainage	H-2-69354 Sheet 1	Plan Process Waste Drainage
Pump Room Sump	H-2-69369 Sheet 1	Pump Room Sump Assembly & Details

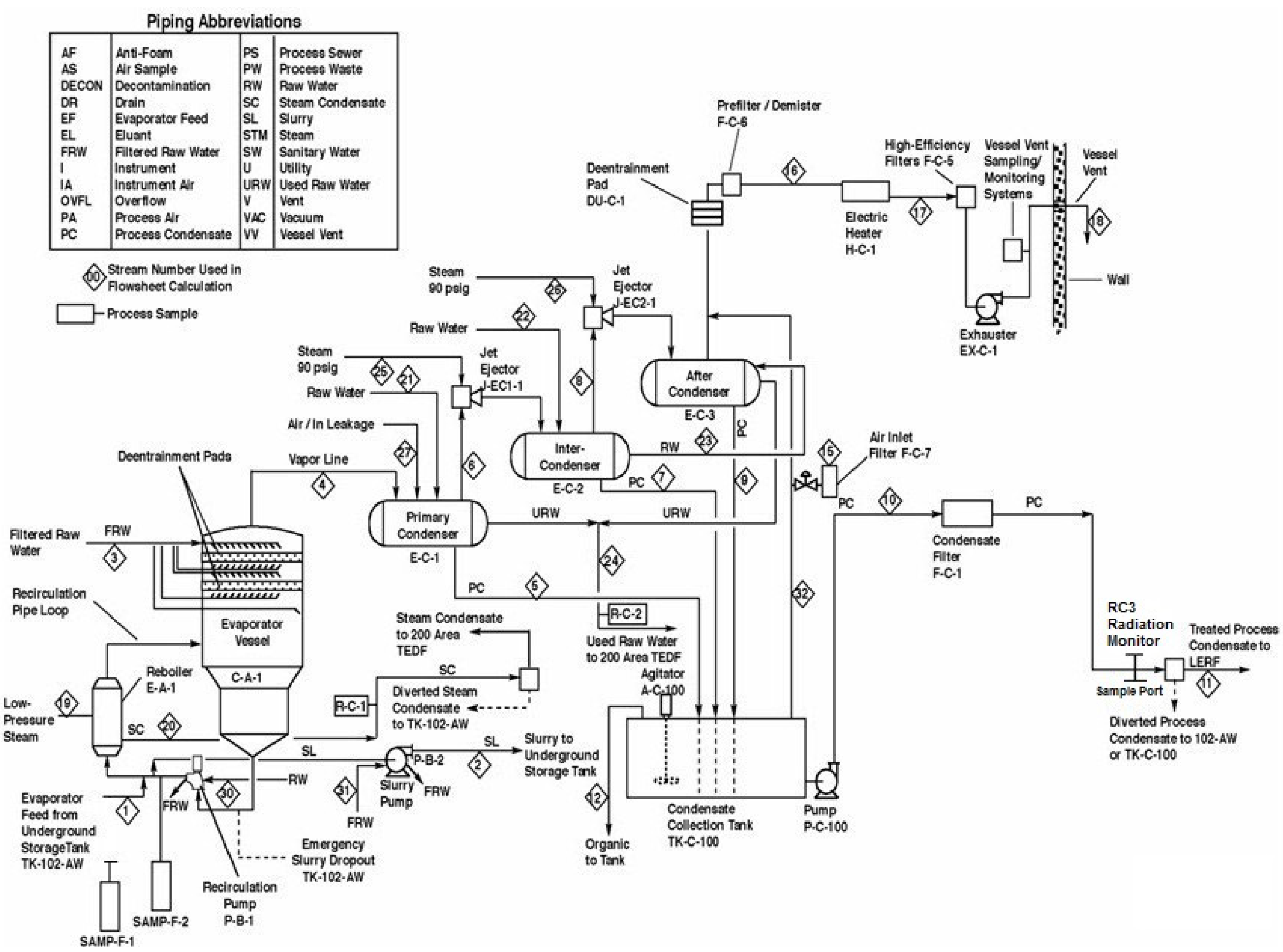
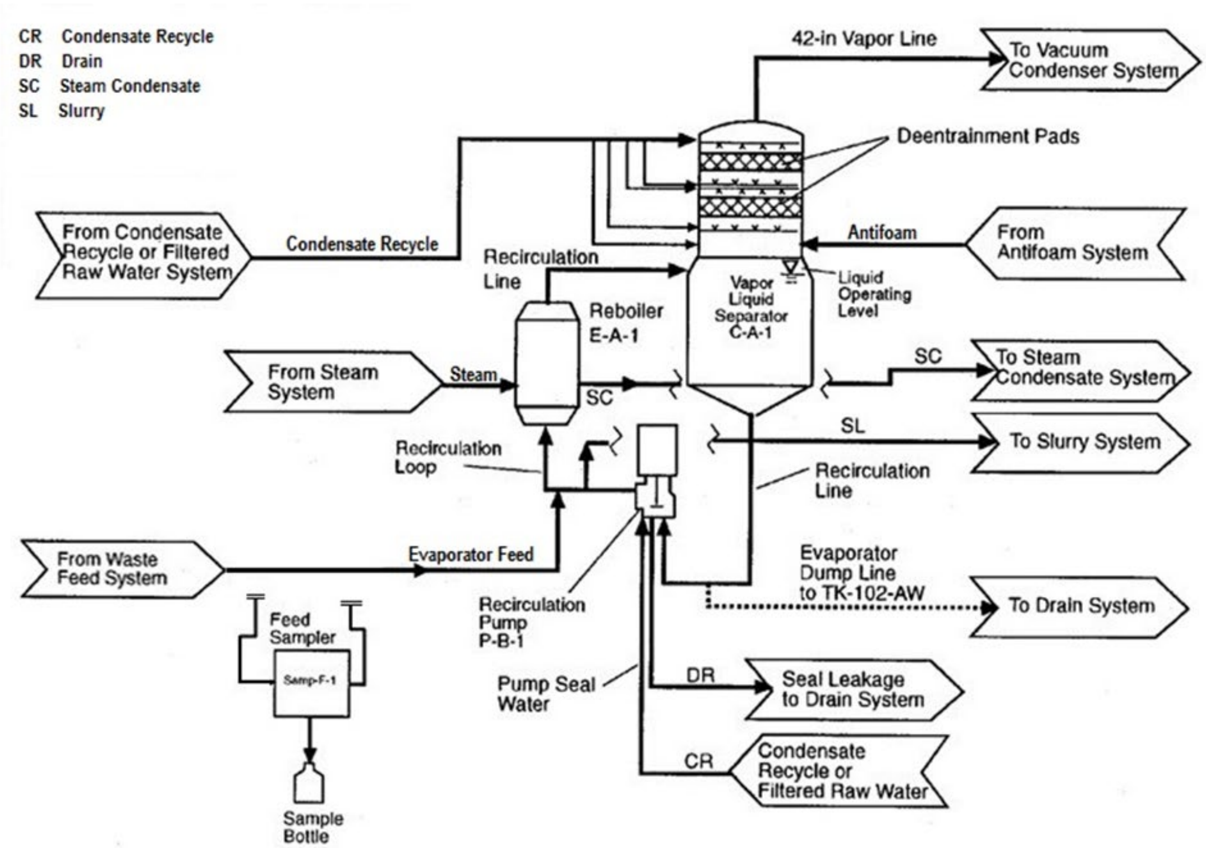


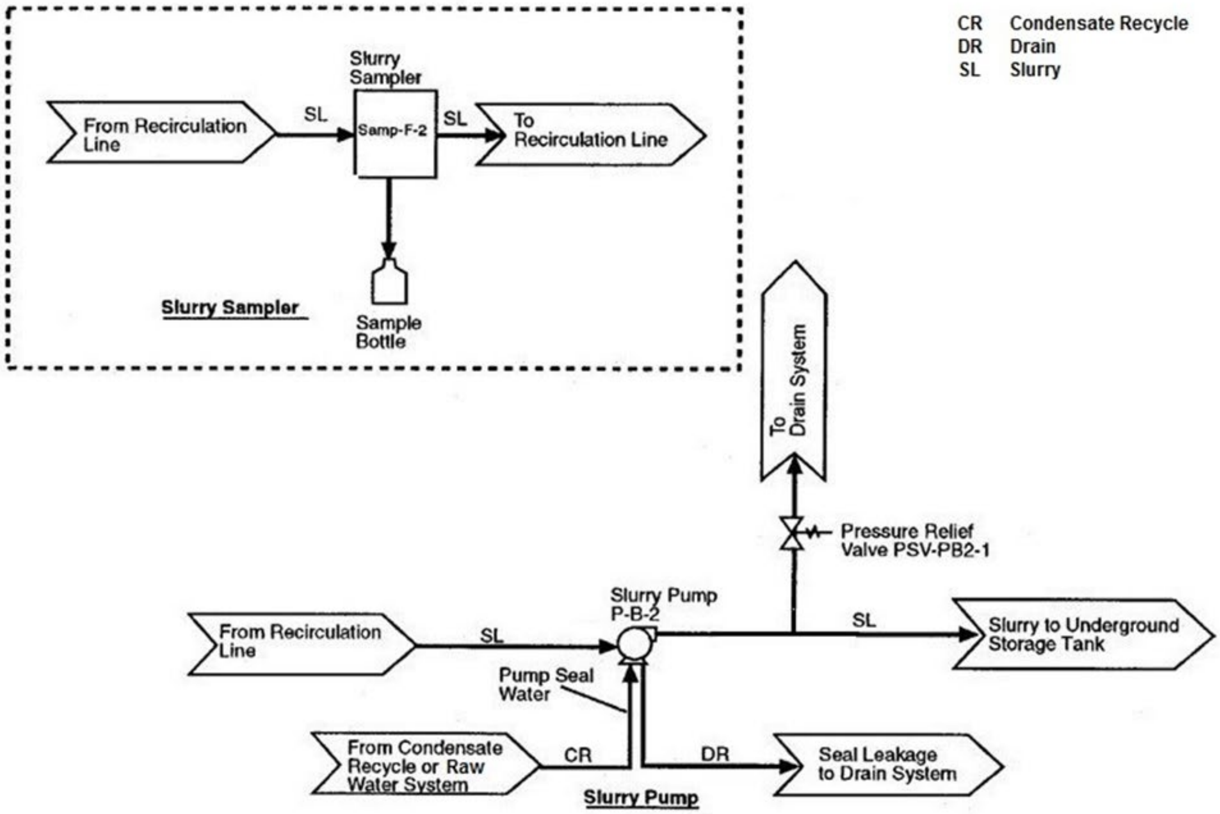
Figure 4-1 242-A Evaporator Simplified Process Flow Diagram

1



2 **Figure 4-2 242-A Evaporator Process Loop**

1



2 **Figure 4-3 242-A Evaporator Slurry System**

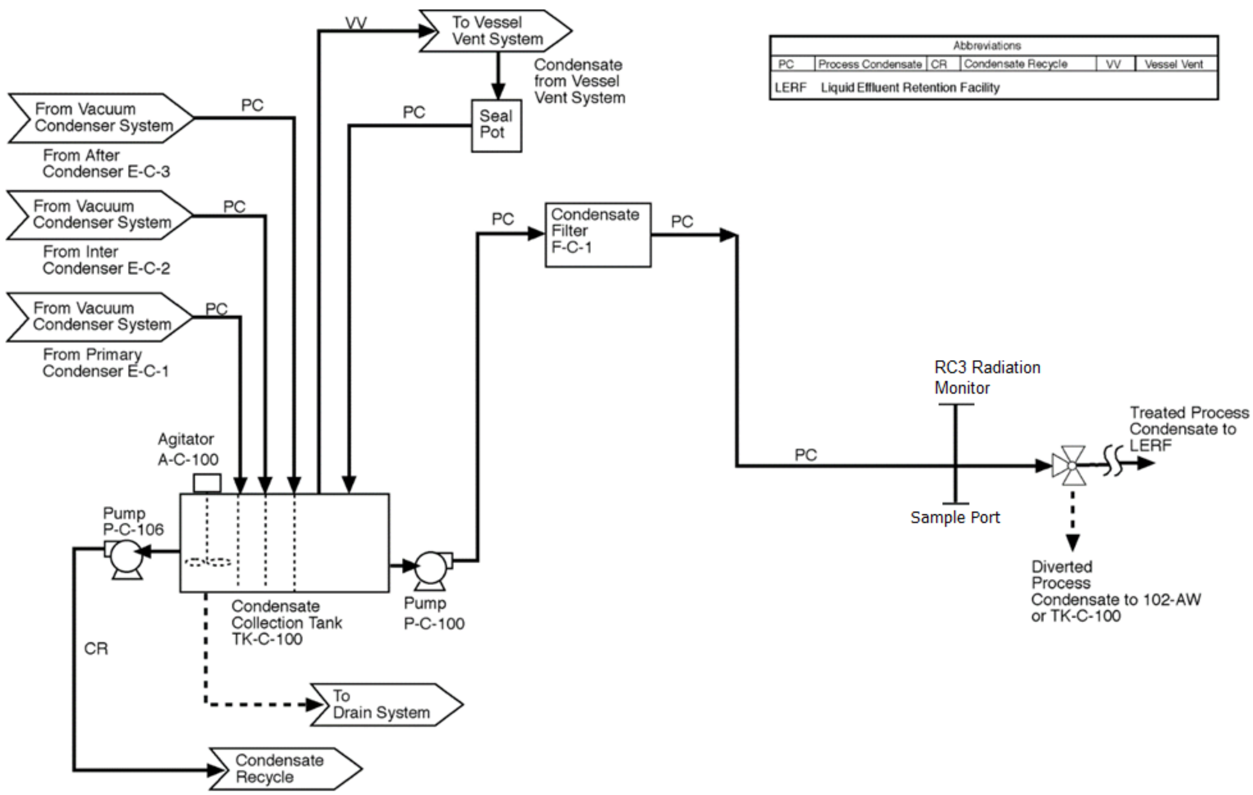


Figure 4-4 242-A Evaporator Process Condensate System

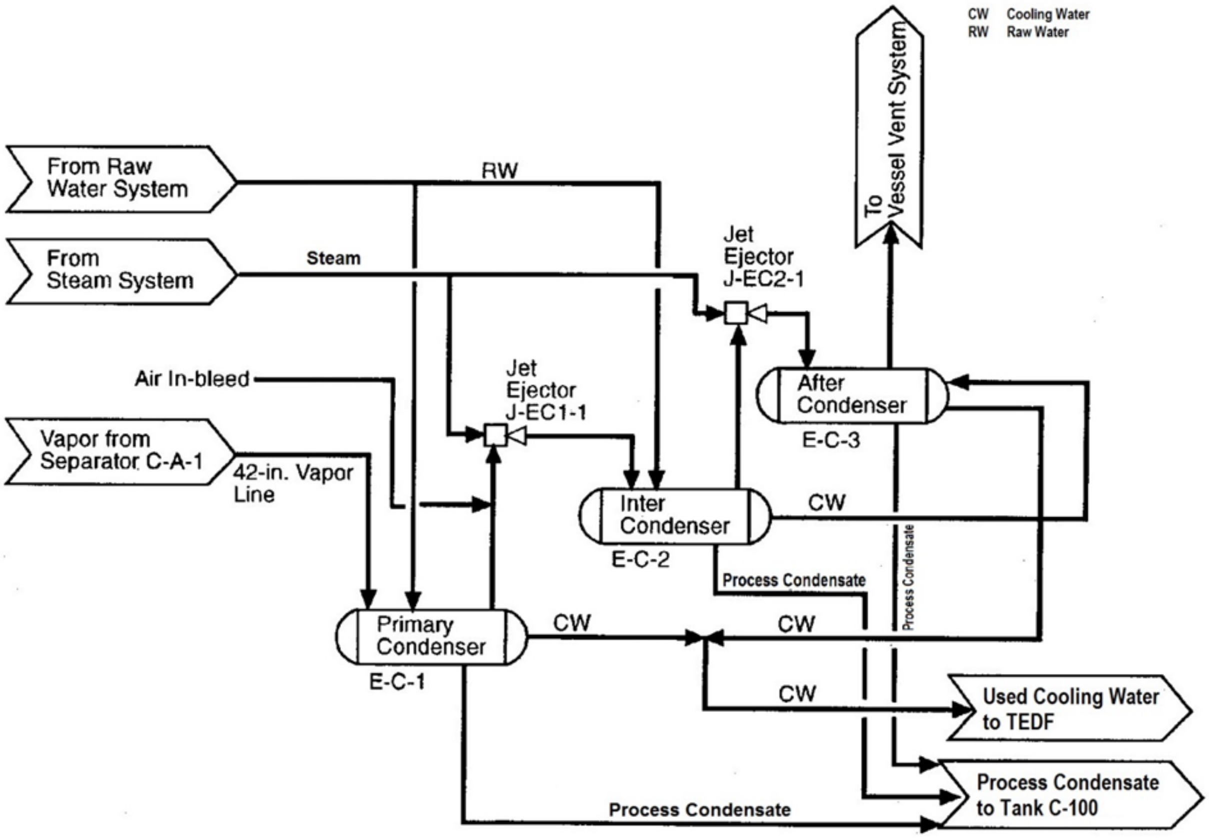


Figure 4-5 242-A Evaporator Vacuum Condenser System

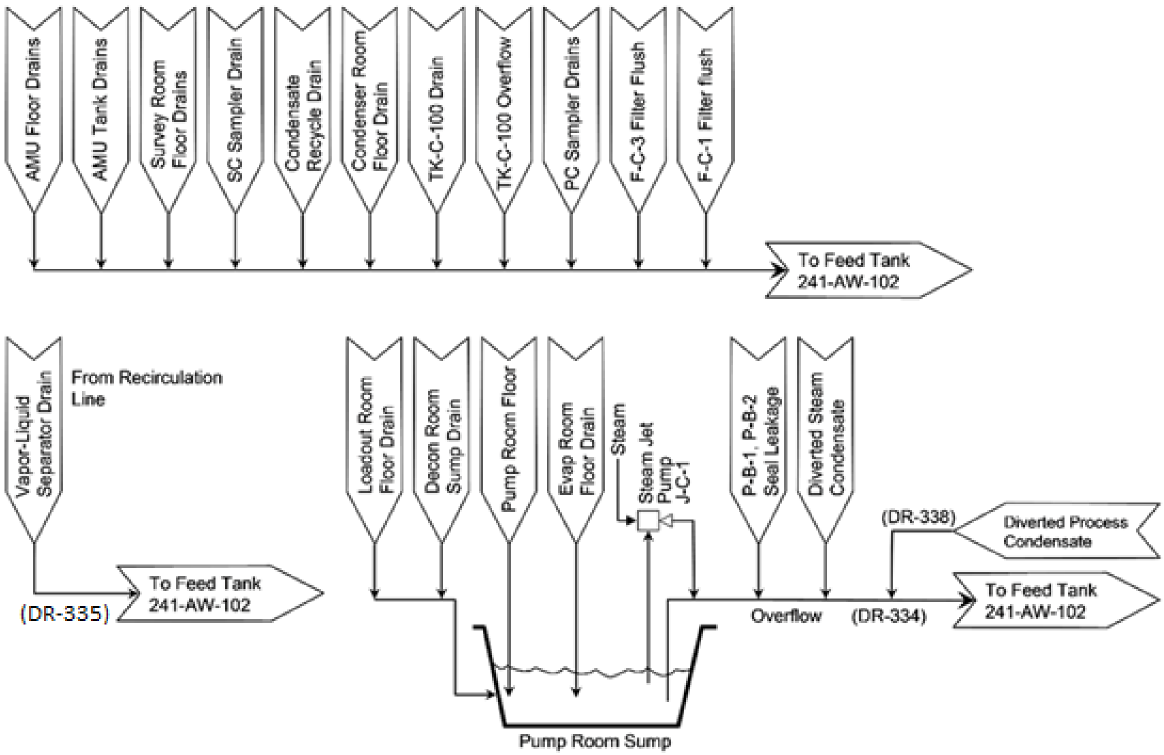


Figure 4-6 242-A Evaporator Drain System

This page intentionally left blank.