U.S. Department of Energy
Hanford Site

September 11, 2023

23-ECD-0056

Mr. David Bowen, Program Manager
Nuclear Waste Program
Washington State Department of Ecology
3100 Port of Benton Boulevard
Richland, Washington 99354

Dear Mr. Bowen:

SUBMITTAL OF SUPPLEMENTAL INFORMATION TO THE HANFORD FACILITY RESOURCE CONSERVATION AND RECOVERY ACT PERMIT RENEWAL, REVISION 9, APPLICATION FOR DOUBLE-SHELL TANK SYSTEM, ADDENDUM C, PROCESS INFORMATION

The U.S. Department of Energy (herein after referred to as the Permittee) submits the supplemental information for the Double-Shell Tank System, Addendum C, "Process Information" with a certification statement for the document, pursuant to the Washington Administrative Code (WAC) 173-303-840 (1)(b) to support the Hanford Facility Resource Conservation Recovery Act (RCRA) Permit, Revision 9, renewal. The purpose of this action is to clarify, modify, or supplement information previously submitted.

The Permittee has worked with your office on the content of the Attachments to this letter, which represent the Permittee's intent to operate pursuant to Revision 9 of the Hanford Facility RCRA Permit upon the effective date of the permit. This supplemental information may not reflect current facility configurations and/or applicable permit conditions enforceable under the Hanford Facility RCRA Permit Revisions 8C. In accordance with WAC 173-303-806 (7), the Permittees will comply with the Revision 8C of the Hanford Facility RCRA Permit until the effective date of Revision 9.

If you have any questions, please contact me, or you may contact Glyn D. Trenchard, Assistant Manager for Safety and Environment, at (509) 373-4016.

Sincerely,

Brian T. Vance

Digitally signed by Brian T. Vance
Date: 2023.09.11 15:17:23 -07'00'

Brian T. Vance
Manager

ECD:DBC

Attachments and cc: See page 2

Attachments:
1. Certifications
2. DSTS Process Information

cc w/attachs:
D. J. Alexander, Ecology
J. Bell, NPT
C. Buck, Wanapum
L. C. Buelow, EPA
C. E. Cameron, EPA
J. L. Cantu, Ecology
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S. L. Dahl-Crumpler, Ecology
D. R. Einan, EPA
J. J. Lyon, Ecology
M. R. Mullin, EPA
M. Murphy, CTUIR
S. N. Schleif, Ecology
M. Woods, ODOE
Administrative Record (TSD: S-2-3)
Ecology NWP Library
Environmental Portal
HF Operating Record (J. K. Perry, HMIS)

Attachment 1
23-ECD-0056

Certification for Double-Shell Tank
System Addendum C, Process Information

(3 pages including cover sheet)

U.S. Department of Energy Certification

In accordance with WAC 173-303-810, the following certification statement is provided for the submittal of the Hanford Facility Resource Conservation and Recovery Act Permit, Revision 9, Addendum C, Process Information, for the Double-Shell Tank System (Operating Unit Group 12).

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Brian T. Vance Digitally signed by Brian T. Vance Date: 2023.09.11 15:17:51 -07'00'

Brian T. Vance, Manager
Department of Energy

Date

Washington River Protection Solutions LLC Certification

In accordance with Washington Administrative Code 173-303-810, the following certification statement is provided for the submittal of the Hanford Facility Resource, Conservation, and Recovery Act Permit (WA 7890008967), Revision 9, Addendum C, Process Information, for the Double-Shell Tank System (Operating Unit Group 12).

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

8.28.2023

Wes H. Bryan
President and Project Manager
Washington River Protection Solutions LLC

Date

Attachment 2
23-ECD-0056

Double-Shell Tank system Addendum C
Process Information
Part III Operating Unit Group 12

(73 pages including cover sheet)

DOUBLE-SHELL TANK SYSTEM
ADDENDUM C
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 tracing the different versions of the permit. The log will serve as an up-to-date record of modifications and version history of the unit.

Modification History Table

Modification Date	Modification Number

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DOUBLE-SHELL TANK SYSTEM
ADDENDUM C
PROCESS INFORMATION

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ADDENDUM C
PROCESS INFORMATION

TABLE OF CONTENTS

FIGURES

TABLES

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C. PROCESS INFORMATION

The Double-Shell Tank (DST) System is located on the 200 Area Plateau of the Hanford Site. The DST System consists of 28 DSTs, four catch tanks, and ancillary equipment (e.g., transfer piping, fittings, flanges, valves, and pumps used to distribute`, meter, or control the flow of dangerous waste) organized into six tank farms. The 241-SY Tank Farm is in 200 West Area, while the 241-AN, 241-AP, 241-AW, 241-AY, and 241-AZ Tank Farms are in the 200 East Area.

The DSTs provide long-term storage of radioactive dangerous waste produced at the Hanford Site. Each DST has a primary tank that contains the waste, and an outer tank that provides secondary containment. The secondary containment provides sufficient capacity to hold the waste from the primary tank, comprising a double-walled tank system under WAC 173-303-640(4)(d)(iii). An integrity assessment of the DST System in 2016 determined 27 of the 28 DSTs were fit for use. Tank 241-AY-102 was declared a leaker, and in 2018 the decision was made to close Tank 241-AY-102.[1] See Addendum H, "Closure Plan," for additional information on closure of Tank 241-AY-102.

Where information regarding treatment, management, and disposal of the radioactive source byproduct material and/or special nuclear components of mixed waste (as defined by the *Atomic Energy Act of 1954*, as amended [AEA]) has been incorporated into this permit, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit or RCW 70.105, "Hazardous Waste Management." The radioactive component of mixed waste is interpreted to be regulated under the AEA; the nonradioactive dangerous component of mixed waste is interpreted to be regulated under the *Resource Conservation and Recovery Act of 1976* (RCRA) and WAC 173-303, "Dangerous Waste Regulations."

C.1 Unit Group Description

The DST System is a network of waste storage tanks, arranged in tank farms, interconnected by a system of piping, "boxes," and "pits" that provide access to ancillary equipment. The DSTs contain a mixture of liquid, saltcake, and sludge waste types, though not all waste types are stored in all DSTs. Liquids exist as supernatant (liquid above solids) and interstitial liquid (liquid filling the void between solids) in the tanks. Saltcake, generally between the supernatant and sludge, consists of the various salts formed by the evaporation of water from the waste. Sludge consists primarily of solids. Some sludges and saltcake contain interstitial liquids and are relatively soft; others are drier and harder. These types of waste do not necessarily exist as distinct layers, but rather are intermingled to differing degrees. Some tanks are equipped with mixer pumps for blending wastes and mixing with added chemicals to adjust corrosion properties or meet the needs of downstream treatment facilities. Many of the DSTs are not equipped with pumps for removing waste. Pumps are installed as needed and are manufactured to suit the specific location of installation and properties of the waste to be pumped. Factors that affect pump design include requirements for handling, storage, installation, preventive maintenance, corrective maintenance, operation, item/component/system design, and testing.

The DSTs were constructed between 1968 and 1986. The first DST, Tank 241-AY-101, began operation in 1971, and the last tanks in the 241-AP Tank Farm, began operation in 1986. Addendum A, "Part A Form," provides the capacity of each tank.

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[1] 17-TF-0119, 2017, "The U.S. Department of Energy, Office of River Protection Transmittal of RPP-RPT-60320, Leak Inspection Report for Tank 241-A Y-102, Rev. 00, in Response to Section II.B.5 .c of the 241-AY-102 Settlement Agreement," letter to A.K. Smith, Washington State Department of Ecology, from M.A. Lindholm, Washington River Protection Solutions LLC, and B.T. Vance, U.S. Department of Energy, Office of River Protection, Richland, Washington, December 19.

The DST System treatment, storage, and disposal unit boundary starts at the first diversion box/valve pit leaving the interfacing generating unit. A generating unit is defined as any facility or tank system that manages or has managed mixed or dangerous waste [e.g., single-shell tank (SST), B Plant.] The piping from the generating unit to the first diversion box/valve pit belongs to the generating unit. Exceptions to this rule include those lines associated with the 219-S/222 S Laboratory, 242-A Evaporator, Plutonium Uranium Extraction Plant (PUREX), and the Plutonium Finishing Plant, whereby operational boundaries have been defined to start with the pipe as it exits those facilities. DST System interfaces are shown in Table C.1.

The DST System also includes ancillary equipment and secondary containment:

- Encased pipelines for transferring waste between the DSTs and to and from other Unit Groups.
- Cross-Site Transfer System between the 241-SY Tank Farm and the 241-AN Tank Farm to transfer supernatant waste between the 200 East and 200 West Area tank farms.
- Pumps, installed to transfer liquids or solids from tank to tank, to mix or recirculate waste within a tank, or transfer waste to other Unit Groups.
- Valves to direct the flow of waste from one location to another.
- Jumpers, which are removable sections of waste transfer piping, that connect waste transfer lines inside secondary containment pits.
- Nozzles used as termination or connection points for waste transfer lines/piping.
- Lined concrete structures, called “pits,” that provide secondary containment and leak detection for ancillary equipment.

The DST System Routing Board is an engineering drawing portraying the tanks and ancillary equipment of the DST System and the interfaces with other dangerous waste management units. The Routing Board drawing is updated as needed to reflect the status of the DST System as described in Section C.6.10.5.

Table C.1 Double-Shell Tank System Interfaces

Dangerous Waste Management Unit	Boundary/Interface	Waste Management Function
242-A Evaporator	Exterior wall of 242-A Evaporator building where transfer and drain lines penetrate the wall	Provide waste feed to 242-A Evaporator, and receive treatment residues
222-S Dangerous & Mixed Waste TSD Unit	Exterior wall of 219-S Building where transfer lines SNL-5350 and SNL-5351 penetrate the wall	Receive waste transfers from the 219-S tank system
Single-Shell Tank System	Numerous interface points–the boundary is depicted on the Routing Board	Provide DST supernate for waste retrieval, and receive waste retrieved from the SSTs
Low-Activity Waste Pretreatment Facility	Nozzles C and D in the AP-07F pit Nozzles U and V in the AP-02D pit Nozzle K in the AP-06A pit 241-AP-106 Riser 002 drop-leg Drop-legs 008 and -008A on Riser 15 of 241-AP-108	Provide waste feed to LAWPS, and receive LAWPS treatment residues
Waste Treatment and Immobilization Plant	The waste transfer lines between WTP and the 241-AP Tank Farm are addressed in the LAWPS permit	Provide waste feed to WTP, and receive WTP treatment residues

LAWPS = Low-Activity Waste Pretreatment System.
SST = single-shell tank.
TSD = treatment, storage, and disposal.
WTP = Waste Treatment and Immobilization Plant.

C.2 Catch Tanks

Catch tanks are smaller steel tanks, usually inside a concrete vault, that collect miscellaneous aqueous wastes produced during operation of the DST System. These wastes consist primarily of non-contact steam condensate, condensate generated in tank ventilation systems, and intrusion stormwater.

C.2.1 204-AR-TK-1 Catch Tank

Catch Tank 204-AR-TK-1 (204-AR-TK-1) is a 1,500-gallon stainless-steel tank inside a stainless-steel-lined concrete vault that collected miscellaneous spill washdowns, steam condensate, sample jet discharges, seal water, and chemical waste. Collected wastes were discharged through transfer line LIQW-702 to the 241-A-A valve pit, then routed to the 241-AN Tank Farm. In 2000, a backflow preventer on the raw water line failed, spilling water into the catch tank until it overflowed into the sump. The tank was subsequently pumped out and rinsed. In 2005, the last transfer occurred from 204-AR-TK-1 to Tank 241-AP-107, followed by a raw water flush. After 204-AR-TK-1 was emptied, periodic additions of water to the seal loops and weekly eyewash and safety shower inspections continued to add liquids to this catch tank until 204-AR was isolated from raw water sources. The contents of the tank were sampled in 2016 and all constituents were below regulated thresholds; however, the waste is derived from F001-F005 wastewater, and is managed as listed waste.

C.2.2 241-AZ-301 Catch Tank

Catch Tank 241-AZ-301 (241-AZ-301) was constructed and placed in service in 2005 under Project E-525, DST Transfer System Modifications. This tank was installed as a replacement for Catch Tank 241-AZ-151 (241-AZ-151); however, its mission is slightly different. Whereas 241-AZ-151 collected drainage from other pits and condensate, 241-AZ-301 is only used to collect condensate from the primary tank exhaust system from waste tanks in the 241-AZ and 241-AY tank farms. This condensate is potentially contaminated through migration of radioactively contaminated material into the exhaust system. The condensate collected in 241-AZ-301 is shipped by tanker to the Liquid Effluent Retention Facility (LERF) or is returned to a DST if LERF is not available.

C.2.3 241-AZ-151 Catch Tank

Catch Tank 241-AZ-151 is a 12,000-gallon carbon steel tank situated in a concrete vault in the 241-AZ Tank Farm. 241-AZ-151 received drainage from DST 241-AZ-101 and 241-AZ -102 vent header seal loops, 241-AZ Tank Farm leak-detection pits, the floor drain in Instrument Building 241-AZ-801A, the 241-AZ-702 ventilation system, 241-AZ-152 sluicing transfer box floor drain, and stormwater. The inside dimensions of the catch tank are 24 feet long by 6 feet wide by 11 feet deep. The catch tank is constructed of reinforced concrete and is lined with ASTM A569, 10-gauge sheets of carbon steel. The catch tank's walls and top slab are 1 foot thick. The catch tank floor is 1 foot, 6 inches thick, and tapers towards a 10-inch-deep sump located at one end. There is 8 inches of concrete below the sump. Although the catch tank has a maximum capacity of 12,000 gallons, it is administratively controlled at 9,630 gallons. Monitoring instrumentation within 241-AZ-151 consists of the following: one leak-detection probe (LDE 151-1); one thermocouple box; and one portable liquid level (Food Instrument Corporation) that was replaced with an Enraf Series 854 ATG (Advanced Technology Servo Tank Gauge) in 2000.

HFFACO Milestone M-48-07A was established to complete construction of the 241-AZ-301 condensate return system and remove 241-AZ-151 from service by October 31, 2005. This was completed on October 24, 2005, when 241-AZ-151 was removed from service by welding a cap on the connecting pipe and the 241-AZ-301 lines were connected for the new condensate return system.

C.2.4 241-AZ-154 Catch Tank

Catch Tank 241-AZ-154 (241-AZ-154) is an 872-gallon carbon steel catch tank situated in a concrete vault in the 241-AZ Tank Farm. The tank measures 5 feet long, 5 feet wide, and 4 feet 6 inches deep. This catch tank was used to collect condensate from DST 241-AZ-101 and 241-AZ -102 in-tank steam heating coils. This catch tank did not manage dangerous waste and is not a dangerous waste management unit; however, it is included for completeness and will be dispositioned at the time of closure for the 241-AZ Tank Farm.

C.3 Double-Shell Tank Design

The DSTs are 75 feet internal diameter with operating volumes of approximately 1 million gallons each; the specific capacities are as listed in Addendum A, "Part A Form." The tanks are cylindrical with domed roofs (Figure C.1), and the top of the dome is several feet below the ground surface. Risers of varying diameter extend from the dome to above the ground surface, providing access into the inside of the tank for placement of instruments and/or equipment. Cross-sectional drawings and design details are provided in design drawings listed in Table C.3, Engineering Drawings.

The DSTs are constructed with these common components:

- Foundation concrete pad
- Secondary steel tank
- Insulation concrete pad
- Annulus space
- Primary steel tank
- Concrete shell

- Supporting pits.

Concrete foundation. The round foundation concrete pad is constructed to distribute evenly the weight of the filled DST. On top of the pad is a "checkerboard" pattern of drain slots to direct any possible waste leakage from the secondary tank to the leak-detection well. This pad is about 2 feet thick and 90 feet in diameter. The foundation concrete pad and the leak-detection well are not part of secondary containment system; its description is provided for completeness and is not subject to WAC 173-303.

Secondary steel tank. The secondary tank, which provides the secondary containment, sits on top of the concrete foundation pad and is made of carbon steel. It is 80 feet in diameter, which is 5 feet wider than the primary tank. This creates an air space, or an annulus space (30 inches), between the two tanks which serves as a first defense in the event the primary tank leaks. The secondary tank also provides structural strength for the primary tank. The secondary tank and the primary tank walls meet in the dome space at 38 feet. Any waste above this point would not be double-walled protected.

Refractory slab (i.e., insulation or concrete pad). Sitting below the primary tank and above the secondary tank is an 8-inch-thick pad of cast refractory material with axial slots for air and gravity drainage. These slots drain leakage from the primary tank to the annulus space where the leak detectors are located. The insulating pad works in conjunction with the annulus space to maintain a uniform tank bottom temperature, provide a means of heat removal, and provide a means for detecting leaks from the primary tank.

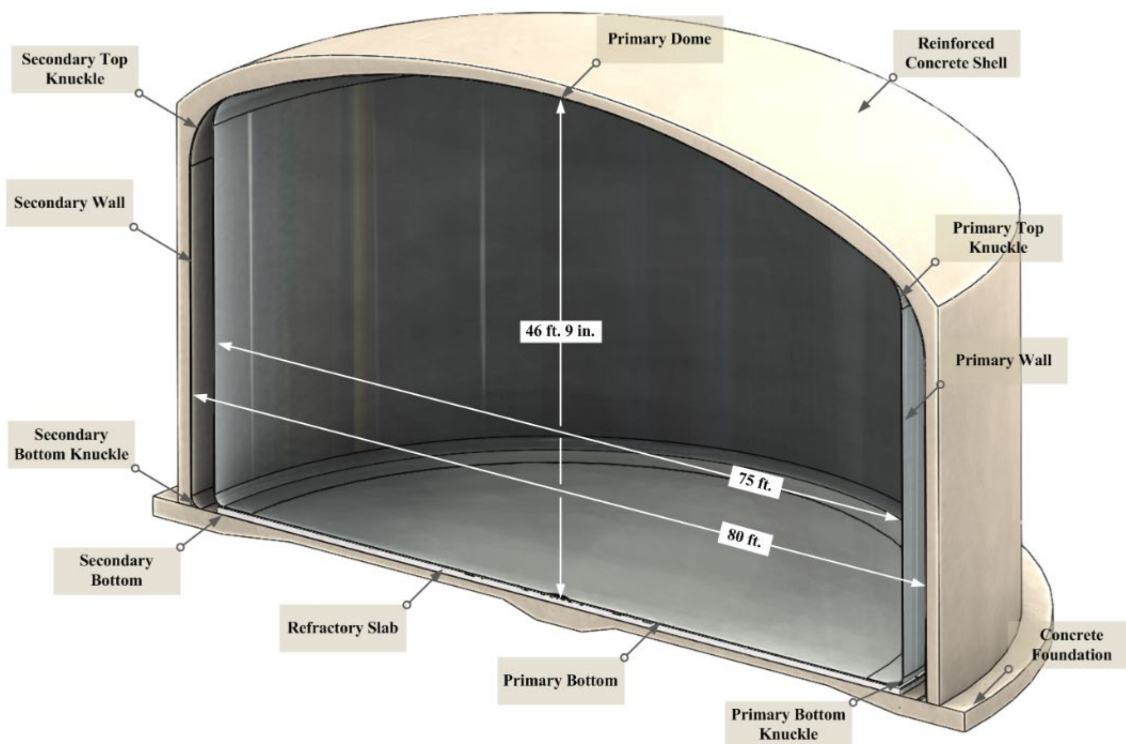


Figure C.1 Typical Double-Shell Tank

Note: The DSTs may differ slightly due to design improvements and accommodations or variations of waste composition for each farm.

Annulus space. The 30-inch annulus space between the primary and secondary tank walls provides secondary containment. This space can be monitored for primary tank leakage, structural integrity, and is where leak-detection instruments are located. The space also allows the annulus ventilation system to circulate air around both the outside and the bottom of the primary tank and the inside of the secondary tank, which removes heat and minimizes condensate from collecting on the outside of the primary tank. This helps minimize corrosion of the steel tank.

Primary steel tank. The primary tank contains the radioactive liquid and/or solid waste and rests upon the insulating concrete pad. It is 75 feet in diameter and made of carbon steel. The heights of the tanks are close to 50 feet. With this diameter, each inch of waste (up to the top knuckle) equals 2,750 gallons. If the waste were filled above that point, the value would be less for each inch due to the curve of the dome in the primary tank.

Concrete shell. The exterior concrete shell comprises a foundation, walls, and dome that completely enclose the secondary tank and primary tank dome. The concrete shell is reinforced with steel for additional containment, radiation shielding, and structural support. The concrete is 18 inches thick on the sides and 15 inches thick on top. This shell is designed to support soil loading, dead loads, live loads (e.g., equipment, personnel), and seismic loads.

DST risers. Each tank is equipped with riser pipes that penetrate the concrete dome and the top of the primary and/or secondary tanks. The risers provide access to the annulus and to the primary tank for waste transfer operations and equipment monitoring. Primary tank risers allow for waste level measurement, physical access, mixing (airlift circulator), observation/inspection, and waste sampling and waste additions and drainage return. Annulus space risers allow for physical access and air flow, observation/inspection, emergency pumping, and leak detection.

Central pump pits. The central pump pit, which has the letter "A" at the end of its label, provides a safe and convenient space for installing a waste transfer pump and allows connections to the buried waste transfer piping entering or exiting the pit. The central pump pit is usually located above the center of the tank.

Annulus pump pits. These pits are located over an annulus riser to provide a means for pumping out any liquids that have accumulated in the annular space in the event of a primary tank leak. Annulus pump pits are covered with a concrete cover block.

Valve pits. These pits contain valves and jumper assemblies to route the liquid waste through the connected pipelines within the tank farms. The tops of the pits have removable cover blocks.
When several tanks are pumped to a single receiver tank, the flow is routed to a valve pit. In the valve pit, the transfer lines of the sending tank are connected to the receiver tank line by means of a series of valves and jumper connections. Each valve pit is equipped with leak detection. A typical valve pit is shown in Figure C.2.

Other waste process pits include the following.

Feed pump pits. Feed pump pits are located off center on some tanks to provide another means of transferring the tank contents.

Drain pits. Drain pits are located over off-center tank risers on some tanks to provide a means for returning liquids to the tank.

Sluice pits. Sluice pits are located over off-center tank risers on some tanks to provide a means for injecting a high-pressure liquid stream directly into the sludge so that it may be broken up, removed, and transferred to another tank.

Flush pits. Flush pits are provided for most valve pits so that transfer lines can be purged with water. This flush can run back to the sending tank or forward to the receiving tank when transfer operations are complete. Cold water is normally used, but hot water can also be used in conjunction with a hot water truck. Flow direction is controlled by two- and three-way valves so that different lines can be flushed.

Pit cover blocks. There is typically a cover block, constructed of reinforced concrete, on top of each process pit. In most cases, there are at least two sections, but some pits have six or more sections to each cover block. They may be removed to allow for configuration changes or equipment installation or removal. In addition, some of the pit cover blocks have valve handles extending through them. The blocks are several feet thick (a crane is used to remove or install them) and they provide protection from high radiation. Valve pit cover blocks may have transfer routes painted on them. On top of each pit there will always be "key block"; this block is the first one removed and the last one replaced, due to its overlapping edges (Figure C.3). Cover blocks are not considered components of the tank system; their inclusion in this application is for completeness.

Pit floor drains. Pits equipped with floor drains that drain into a DST by gravity are designed with a seal to prevent radioactive emissions and odors from the tank headspace. Similar to modern plumbing practices used to prevent sewer gas emissions through sink drains, the DST pit floor drains use a column of water or a plumber's plug to prevent unfiltered emissions through the drain. Some water columns are provided by a seal pot, which are described in C.4.3.

Figure C.2. Typical Valve Pits

Figure C.3 Typical Pit Cover Blocks

C.4 Ancillary Equipment

Ancillary equipment in the DST System consists of any devices including, but not limited to, piping, fittings, flanges, valves, and pumps, that are used to distribute, meter, or control the flow of dangerous waste (WAC 173-303-040). The following sections describe the ancillary equipment that is common to all tank farms. The DST farm-specific sections describe differences, where they exist.

C.4.1 Piping

Most dangerous waste pipes in the DST System are located below ground and consist of double-walled pipes or single-wall piping in lined concrete structures called pits. The reinforced concrete pits were constructed as the top of the tanks were backfilled to provide access to some of the risers and equipment. Pits have heavy covers made of concrete and/or steel, which are normally in place during waste transfers to protect workers from radiological exposure and reduce the consequences of a release.

The waste transfer lines are designed with a minimum 3-inch in 100 feet (0.25 percent) slope between valve pits to ensure gravity free-drainage of the waste and post-transfer flush water (TFC-ENG-STD-22, *Piping, Jumpers, and Valves*). Some waste transfer lines have minimum slope exceptions due to construction and post-construction anomalies that resulted in unintentional low spots: SL-167 from the 242-A Evaporator to the 241-AW-B valve pit; cross-site lines SNL-3150 and SLL-3160 from the 6241-V Vent Station to the 241-AN-01A and 241-AN-04A pump pits, respectively; and lines SNL-5350 and SNL-5351 from 222-S Laboratory 219-S tanks to 241-SY-01A and 241-SY-03A, respectively.

Other lines, that by design should be gravity free draining, are suspected of holding up water flushes when significant differences between water density and the waste density are present in the receiving tank. If the water flush is drained into the receiving tank through equipment terminating below the liquid waste surface, then the water will be held up in the transfer line back to a distance where the water column's hydraulic head exceeds the waste column's hydraulic head in the submerged portion of the equipment.

In other cases, the low point of a waste transfer route is a dead leg terminated with a PUREX connector blank. In 241-AN Tank Farm, ten transfer lines are terminated in this manner to prevent drainage into the DSTs. After transfers involving these dead legs complete, the lines remain filled with a mixture of waste and flush water up to the next available higher hydraulic drainage location. When transfer routes are made up with multiple lines using jumpers to connect the lines, the jumpers can become hydraulic low points, and termination of a transfer can leave waste or flush solution standing in some fraction of the transfer lines and jumpers until the jumpers are drained or removed.

Aboveground piping (i.e., temporary transfer lines) are discussed in Section C.4.1.3. Aboveground pits are limited to temporary waste pipelines are used for the following:

- Internal waste transfers between individual DSTs.
- Recirculation of waste within a tank for mixing
- Sending flush water, or chemicals, to DSTs
- Receiving new and returned waste into the DST System or transferring waste to other Unit Groups for treatment.
- Secondary containment drains that remove accumulated liquids from encasement pipes, pits, and valve boxes.

Drain lines are extensions of a secondary containment system that drain liquid by gravity or by pumping into a connected DST. Drain lines are part of the secondary containment system; they do not require secondary containment themselves [WAC 173-303-640(1)(c)].

There are two types of pipe jumpers that are used to transport the waste within a pit:

- Rigid jumpers are built of solid stainless-steel pipe designed to specific dimensions to fit a specific wall nozzle configuration within a valve pit or diversion box and usually have valves installed (Figure C.4).
- Flexible jumpers are built of flexible braided stainless-steel pipe to allow for multiple connections or make-up configurations within a valve pit and would have no valves installed (Figure C.5).

There are two types of wall nozzle-jumper head connectors, which are attached to the nozzles within the pit on the sides or walls (Figure C.6). On one end of the connector, there is a jumper connected to another nozzle to support a transfer.

- Hanford head connectors are larger in diameter than PUREX type with a flat nozzle flange gasket.
- PUREX head connectors are smaller in diameter with a radius-faced beveled flange gasket and are generally used in the newer Tank Farm valve pits.

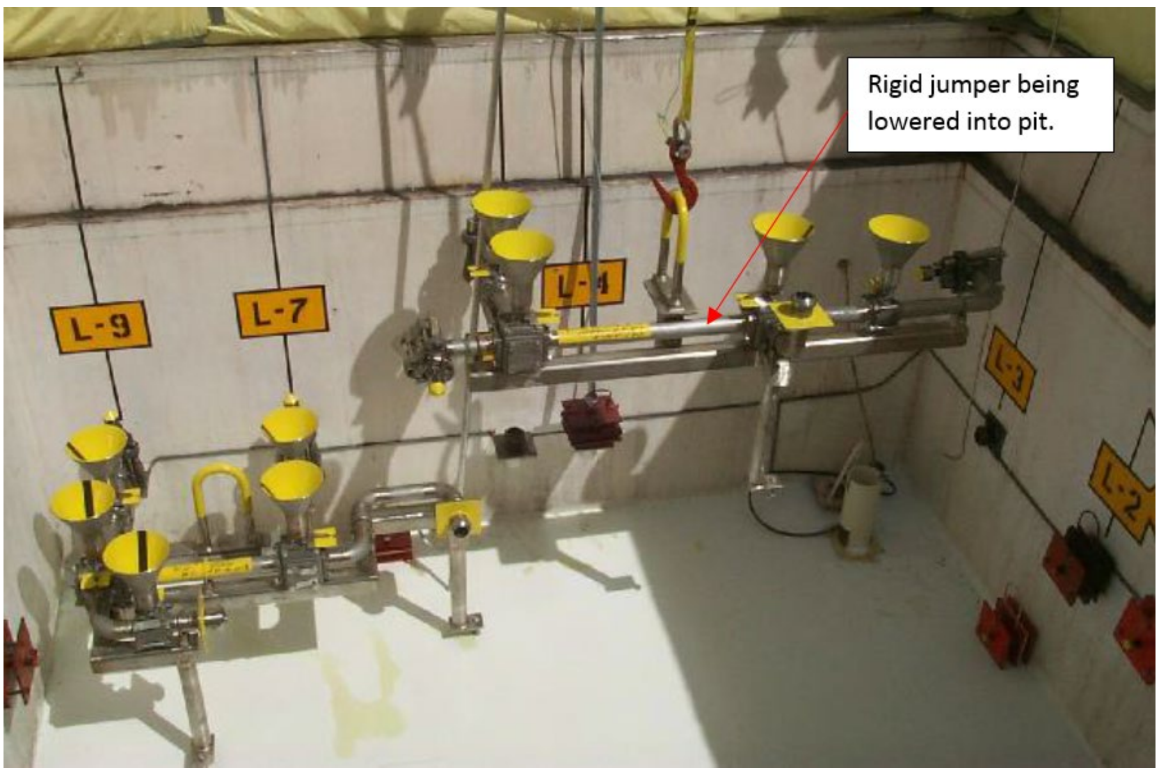


Figure C.4 Rigid Jumper

Figure C.5 Flexible Jumper

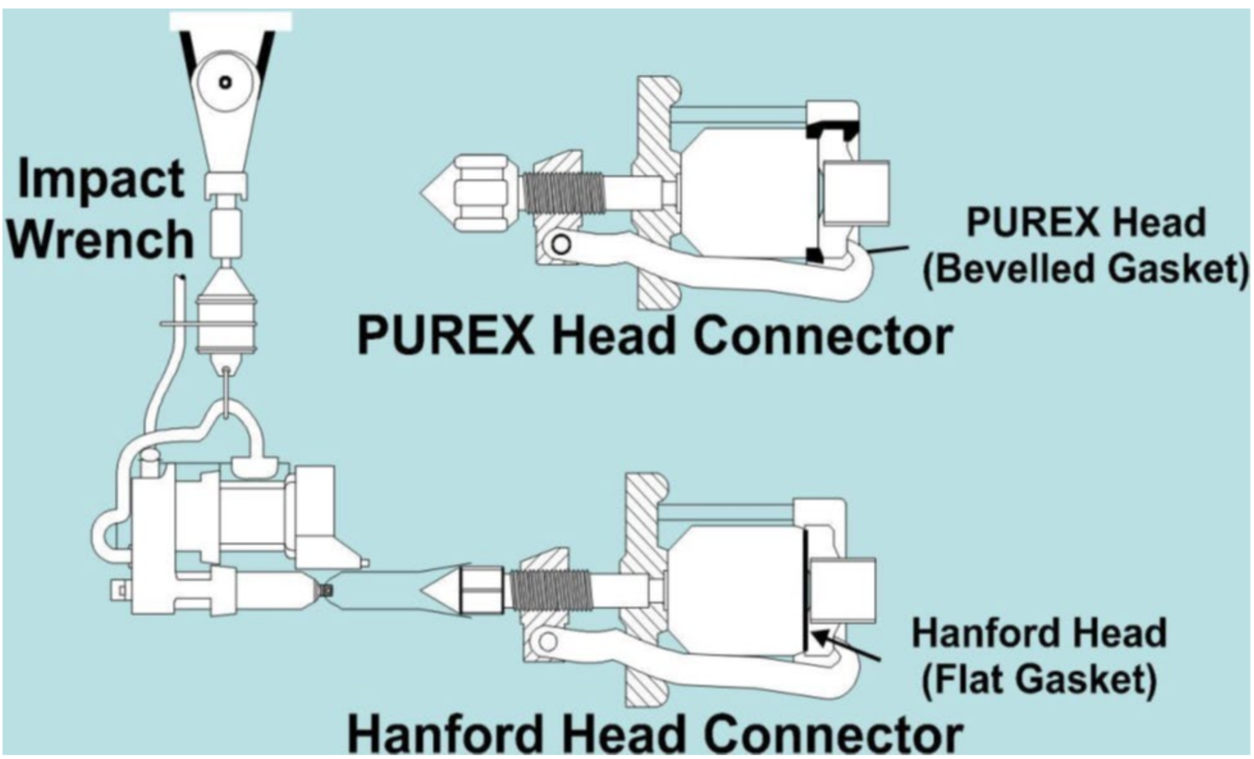


Figure C.6 Jumper Connectors

C.4.1.1 Cross-Site Transfer Line

There are underground transfer lines running approximately 7.5 miles between the 200 West and 200 East Area tank farms through the 600 Area known as the Cross-Site Transfer System (CSTS). The CSTS includes two support buildings situated along the route (Figure C.7 and Figure C.8). Only one of the pipelines, SN-3150 has been used. The second line, SNN-3160 was installed but remains unused. The control station for the CSTS was in the 242-S Evaporator building in the 200 West Area but has been deactivated. A future project will replace the control and monitoring equipment in a different location.

The in-service CSTS pipeline, SNL-3150, begins at the SY-A valve pit in the 241-SY Tank Farm and terminates in the 241-AN-01A pump pit. The other CSTS pipeline, SNN-3160, begins in the SY-B valve pit and ends in the 241-AN-04D pit. Both pipelines pass through the Diversion Box 6241-A, which houses booster pumps for increasing the flow of waste in the SNN-3160 pipeline.

From the diversion box, the buried pipelines travel to their high point at Vent Station 6241-V, located between the 200 East and 200 West Areas. Inside Vent Station 6241-V, valves connect the transfer lines to a vent line that introduces air to facilitate pipeline drainage after transfer and flushing. Connections inside Vent Station 6241-V allow connection of a sump pump to remove accumulated liquids from secondary containment in Vent Station 6241-V.

From Vent Station 6241-V, the pipelines continue to the 241-AN Tank Farm. Refer to Addendum A, “Part A Form,” for layout and location of the CSTS, including the waste pipeline and related structures.

The underground portions of the CSTS are double-wall piping (Figure C.9). The design provides for corrosion protection and secondary containment in accordance with WAC 173-303-640(4)(f). The metal pipelines are protected from contact with bare soil by design and construction. The stainless-steel primary pipe is supported with non-conductive spacers inside the carbon steel encasement. The steel encasement pipe is epoxy coated on the outside, insulated with closed-cell foam insulation, and wrapped in a fiberglass jacket. This method of construction insulates the metal components from contact with bare soil. A continuous leak-detection cable lies in the annulus space between the primary pipe and the encasement pipe of the buried pipelines.

Accessible portions of the CSTS are inside the Diversion Box 6241-A and Vent Station 6241-V buildings where the single-wall pipe is provided with secondary containment by concrete structures with a stainless-steel liner, and under by heavy concrete cover blocks that provide shielding. The Diversion Box 6241-A, and the Vent Station 6241-V each contain a sump for collecting liquids. Leak detectors are installed in the low point of these sumps. Relays that transmit the leak-detection signal are in the Vent Station 6241-V and in the Diversion Box 6241-A and in the 241-SY-271 Instrument Control Building for the leak detectors. Should a leak occur in Diversion Box 6241-A, or Vent Station 6241-V; the liquid would accumulate in the sump, which can be pumped into the waste transfer line.

The maximum gravity drain-back head is approximately 91 feet and occurs in the segment of the CSTS between Vent Station 6241-V and the 241-AN Tank Farm. A portion of the CSTS piping has a negative slope that will result in a hold-up of liquid. To mitigate this condition, the stainless-steel primary line is drained and flushed after use to remove the waste and maintain corrosion control. The conditions for waste transfer line flushes are specified in each waste transfer control plan.

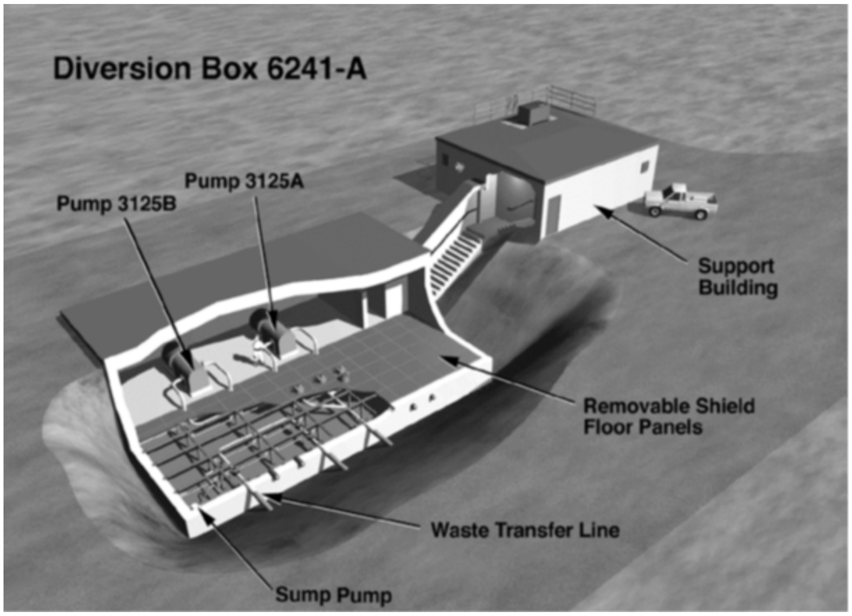


Figure C.7 Cutaway View of Diversion Box

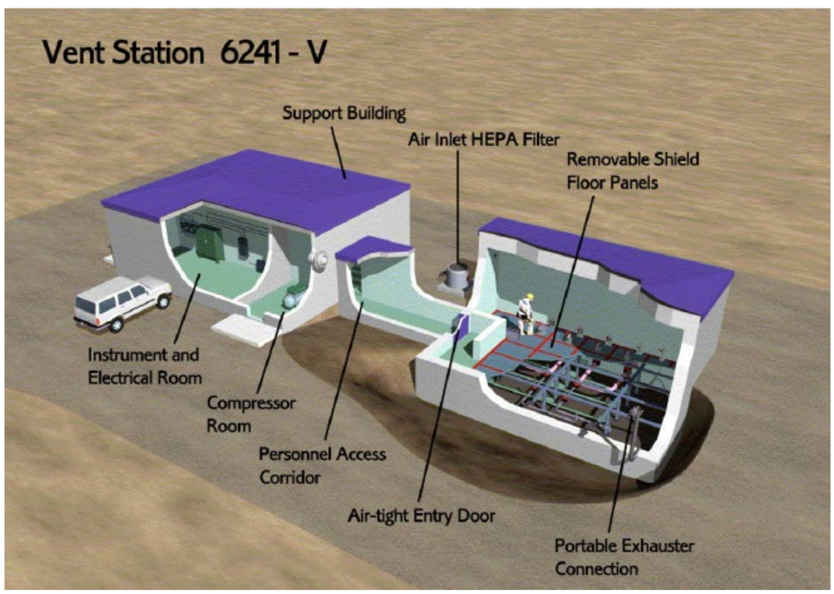


Figure C.8 Cutaway View of Vent Station 6241-V

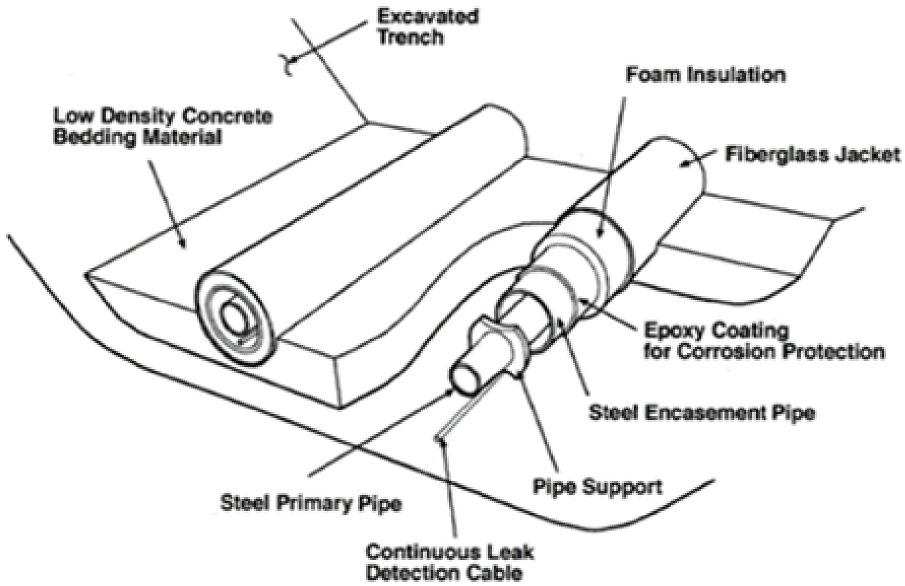


Figure C.9 Design of Cross-Site Waste Transfer System

C.4.1.2 Permanent Pipelines

Pipelines in the DST System consist of a steel pipe encased in a larger diameter steel or fiberglass pipe, and meet the requirements of WAC 173-303-640(4)(f). The primary and encasement pipes are isolated from each other using non-conductive supports. The pipelines between the 219-S tank system and the 241-SY Tank Farm consist of fiberglass pipe inside a fiberglass encasement pipe.

Waste transfer lines design varies; however, all transfer lines have common features. Transfer lines employ a pipe-in-pipe encasement (Figure C.9). Waste transfer pipelines are sloped so liquid collected in the encasement will drain to a pit or encasement leak detector. The primary pipe is made of steel and in some cases is isolated from the steel encasement pipe with non-conductive supports. Alternately, the primary pipe can be supported within the encasement by one of two methods. In one method, the primary pipe rests on a flat bar. This bar is welded to the encasement and primary pipe. This encasement type anchors the primary pipe to the encasement. The other method of support involves welding two bars to the primary pipe only, which allows the primary pipe to expand relative to its encasement. Buried waste transfer line encasements that are bare steel in direct contact with soil are cathodically protected, as discussed in Section C.6.1.4.2.

Concrete valve pits located above the concrete tank dome provide access to the waste transfer lines and assist in transferring waste between tanks. Underground waste transfer lines enter the lined concrete pits and terminate inside the pits at wall- or floor-mounted nozzles. Within the pits, nozzles can be connected to one another via a jumper, which is a detachable section of the waste transfer line that can be rigid or flexible. Rigid jumpers fit a specific nozzle configuration, whereas flexible jumpers will fit a variety of nozzle combinations. Operations that occur in process pits are performed remotely using overhead cranes or similar lifting equipment.

The piping system for the DSTs is sloped to route any spilled waste to a collection point with leak detection equipment. Sloping also minimizes pooling of liquids that could result in excessive corrosion. The transfer of compliant waste further reduces the propensity for corrosion in a piping system and as such, raw water flushes are sufficiently protective of the piping system. To ensure the protection of the piping, each transfer of waste that doesn't meet corrosion control parameters is evaluated for the need for a chemical flush. If a chemical flush is required, the following compositions can be used:

- For carbon steel piping, chemical flushes consist of inhibited water, which contains at least 0.01 moles/l (M) hydroxide (pH>12) and 0.011 M (500ppm) nitrite. Water that is treated to prevent corrosion of metal piping.
- For stainless steel piping, chemical flushes consist of raw water, de-ionized water, or ionic species that promote the formation of an oxide layer on the pipe surface (e.g., nitrate, phosphate, aluminate, etc.). If an ionic solution is used, the species should have a concentration of 0.1 M.
- Due to the aggressive ions (e.g., chloride) present in potable water, the use of potable water for a waste transfer line flush is not allowed except for TSCR.
- A flush from TSCR may use water (e.g., potable water, TSCR treated water, TSCR ion exchange column rinse water, raw water, or inhibited water) or a sodium hydroxide solution.
- Deep flush water from the 242-A Evaporator can also be used for connected transfer lines that do not have the ability to receive inhibited water additions.
- 222-S Lab waste transfers use a dedicated waste transfer route that has no provision for a flush. Lab waste transfers use either SNL-5350 or SNL-5351, which are 2-inch fiberglass transfer lines. Corrosion control is not applicable to fiberglass transfer lines. No flush is required following a lab waste transfer.

The DST transfer piping is designed to slope continuously, but some low spots were found while using a borescope inserted in the encasement pipe or through other means such as measuring pipe elevations with precision measuring equipment. Condensation occurs in the annular space between the primary and secondary pipes, and if there is a low spot the condensation can pool instead of draining properly. When these low spots are identified that have standing condensate, the encasement pipe is dried with a stream of forced air, if needed, a corrosion evaluation is performed, and the transfer line is pressure tested before it is returned to service. Pressure testing consists of pneumatic testing of the encasement pipe, or hydrostatic testing of the primary pipe, or both.

Another method to prevent excessive corrosion in low spots in the primary piping is using a heated flush solution, called inhibited water, that contains low concentrations of caustic and nitrite, if it is possible to introduce the inhibited water into the primary pipe. The temperature of flush water or chemicals is less than 180˚F. The standard transfer line flush volume is at least 1.5 times the transfer line volume.

Waste transfer pipes known to have the potential for hold up are identified to the IQRPE along with data on any corrosion measurements and compensatory measures that have been implemented.

C.4.1.3 Temporary Transfer Lines

Temporary transfer lines are used when compliant permanent pipelines are not available to transfer waste. The two types of temporary lines are hose-in-hose transfer lines (HIHTL) and hose-in-sleeve (HIS). The HIHTLs are manufactured hoses with secondary containment meeting the requirements of WAC 173-303-640(4)(f) built into the design. Leak detection is provided for all HIHTL, either within the encasement to detect leaks from the primary hose, or the HIHTL is installed on a slope so any leaks collected in the encasement will drain to a structure (e.g., a pit) with leak-detection capability. Installation and management of HIHTLs is performed in accordance with RPP-12711, *Temporary Waste Transfer Line Management Program Plan*, a HFFACO primary document. Revisions to RPP-12711 are subject to the HFFACO primary document modification process and are not subject to the RCRA permit modification provisions.

When a HIHTL is needed for DST operations, the HIHTL will be installed and managed under RPP-12711, and will not be subject to the permit modification procedures of WAC 173-303-830. HIHTLs are displayed on the DST Routing Board.

The HIS is a transfer hose with a transparent sleeve surrounding the hose so that visual inspection can detect the presence of a leak. An HIS is usually used for unloading of tankers or other containers into a tank riser. A reinforced flexible hose with leak-proof fittings is used for tanker offloading. The contents of smaller, portable containers are usually pumped out using a peristaltic pump and tubing.

C.4.2 Valves

Two-way and three-way valves are primarily used in both T-port and L-port valve configurations. Valve positioning is achieved by valve stops, T-handle, or gear actuator.

C.4.3 Seal Pots

Seal pots are small steel vessels that utilize a column of water to maintain a pressure seal to prevent air from inside the tanks from bypassing the filtration system (e.g., air escaping through the ventilation system drain lines). Seal pots are used to control radionuclide releases; they do not manage dangerous waste and are not regulated under RCRA. Their inclusion in this document is for completeness and to aid in understanding a source of tank additions.

The tank exhaust system has condensate drain lines that gravity flow to a seal pot. In addition, when a portion of the air filtration system needs flushing, the flush water also drains to the seal pot by design, which drains into a DST. Condensate drains into the seal pot below the liquid level in the seal pot. The liquid seals the drain lines to prevent airflow.

C.4.4 Pumps

Permanently installed waste transfer pumps are generally used when it is necessary to remove waste from primary tanks. As a practice, waste pumps are not installed in the DSTs until it is necessary to remove waste from the primary tank. Temporary pumps would be installed to remove liquid from a tank annulus. Spare pumps can be used for either purpose. Pumps used for waste transfers may remain permanently installed in the pit.

Waste transfer pumps are procured, designed, and constructed using the guidance of nationally recognized pump standards, as applicable. Factors specific to the tank that will receive the transfer pump are considered in pump selection. Transfer pumps need to be capable of being internally flushed with water to reduce contamination levels prior to and during pump removal, and to assure there is a clear path through the pump to allow drainage of free liquids. For positive displacement pumps, the pump needs to be capable of being flushed by reverse rotation or other means. Transfer pumps are designed to require no routine “hands-on” maintenance requiring entry into secondary containment structures. Pumps that require external lubrication are seldom used.

C.5 Tank Farm Descriptions

The design requirements for tanks that store mixed waste in the DST System are outlined in this section and are detailed in the Independent Qualified Registered Professional Engineer (IQRPE) integrity assessment reports for the DST System. In accordance with WAC 173-303-640(2), the IQRPE reports attest to the tank systems’ integrity, including ancillary equipment and secondary containment systems

The six DST System tank farms are described in the following sections. Descriptions for catch tanks 204-AR-TK-1 and 241-AZ-151 are found Section C.2 and Addendum H, “Closure Plan.”

C.5.1 241-AN Tank Farm

The 241-AN Tank Farm is in the 200 East Area and consists of seven tanks, numbered 241-AN-101 through 241-AN-107. The primary steel tank rests inside the secondary steel tank, supported by an insulating concrete pad on the floor of the secondary tank. The secondary steel tank surrounds the primary tank, forming an annular space between the primary and secondary tanks. Figures C.10 through C.13 show the configurations of 241-AN tank risers and pits located over the tanks.

The seven DSTs are similar in design except for Tank 241-AN-101, which has two additional structural pits, and Tank 241-AN-107, which has 21 airlift circulator assemblies. Addendum A, “Part A Form,” provides tank design and capacity information. Additional design information is contained in the integrity assessment reports for the DST System.

C.5.1.1 Permanent Lines

The 241-AN process pipelines are constructed of steel pipe and are encased in steel secondary pipe. The pipe encasements consist of steel pipe of a larger diameter than the primary pipe. The primary pipe is supported within the encasement using one of several configurations. The pipelines, direction of slope, and other information are identified on the DST System Routing Board.

C.5.1.2 Valve Pits (241-AN-A and 241-AN-B)

The 241-AN-A and 241-AN-B valve pits are located north of Tanks 241-AN-102, and 241-AN-103, and south of Tanks 241-AN-105 and 241-AN-106. The valve pits route waste to and from the 241-AN DSTs and other DSTs.

C.5.1.3 Central Pump Pits (241-AN-01A, -02A, -03A, -04A, -05A, -06A, and -07A)

The central pump pit is located over the top of the center of the tank, accommodates three risers, and has pipe and conduit penetrations (Figure C.14). The central pump pits provide a safe and convenient space for installing a waste transfer pump and/or mixer pump and provides connections to the waste transfer piping entering the pit. The risers are capped using devices such as flanged cover plates, shield plugs, or dummy pump heads, vapor seals, or blank connectors unless pumps or other equipment are installed in the risers. Each 241-AN central pump pit is connected with the 241-AN valve pits allowing waste to be directed to other DSTs. The Cross-Site Transfer Line SNL-3150 connects to the 241-AN-01A. Pumps and a leak-detection system are installed in the central pump pits when it is necessary to remove waste from a DST.

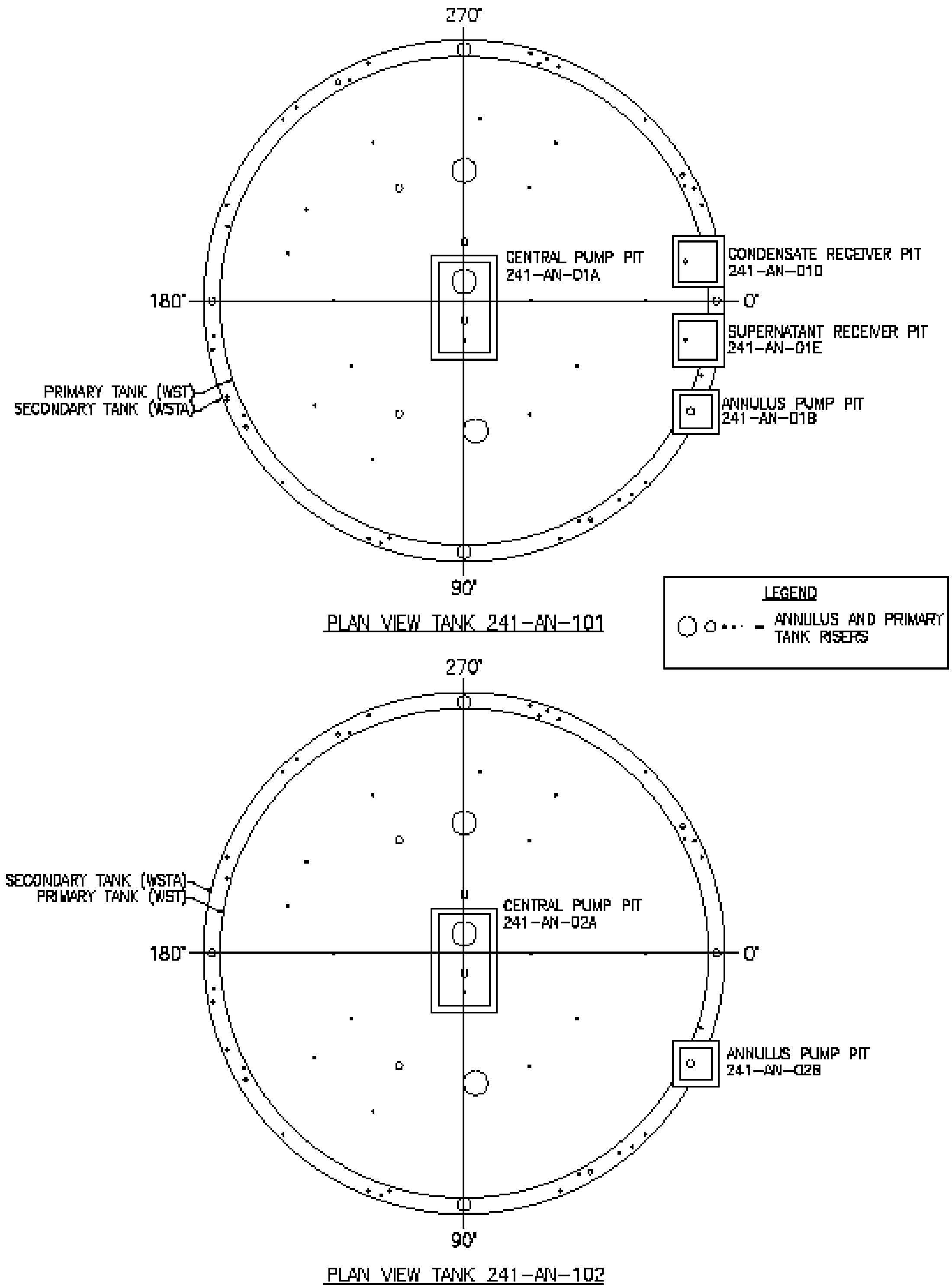


Figure C.10 Plan View Double-Shell Tanks 241-AN-101 and 241-AN-102

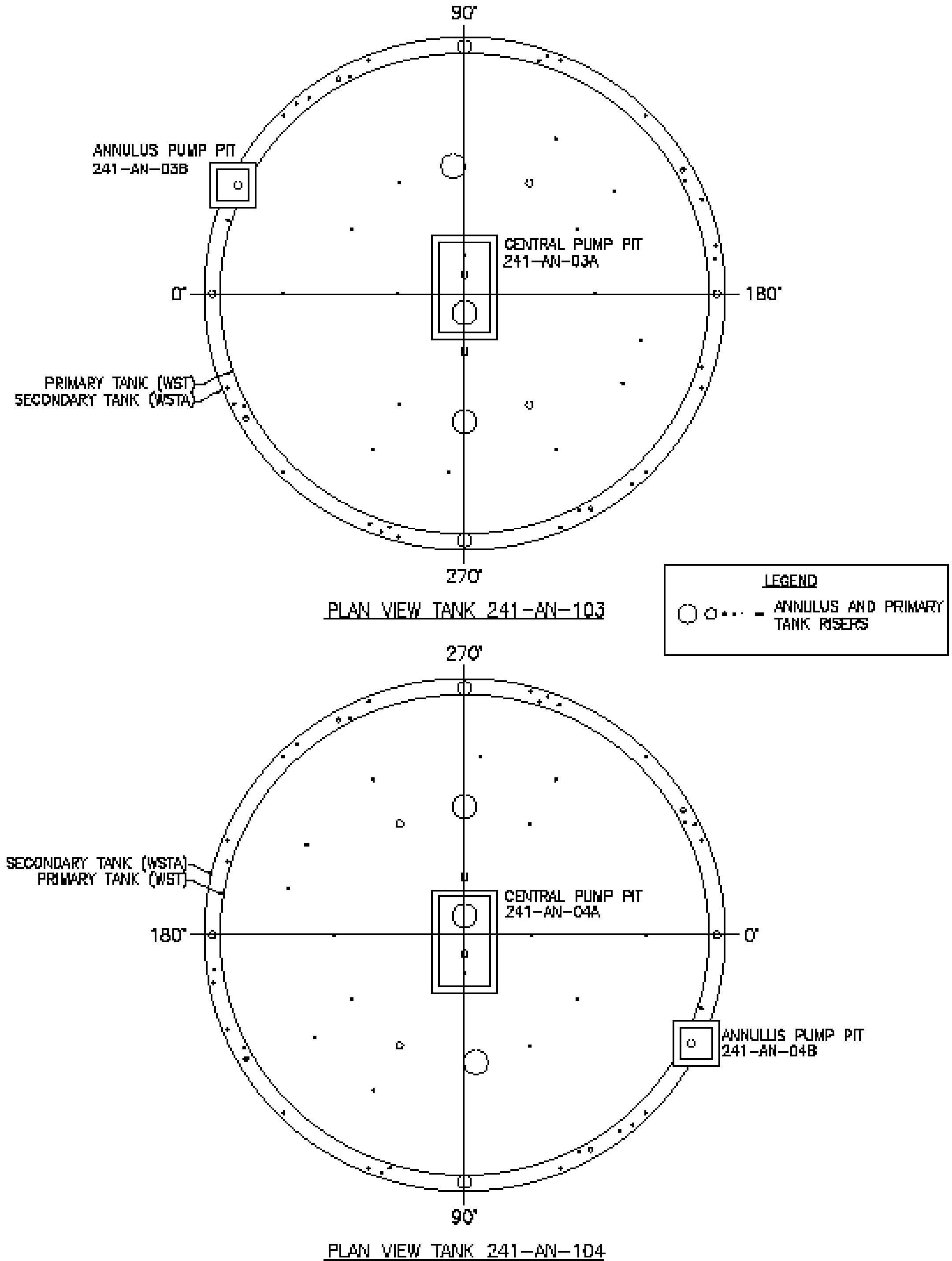


Figure C.11 Plan View Double-Shell Tanks 241-AN-103 and 241-AN-104

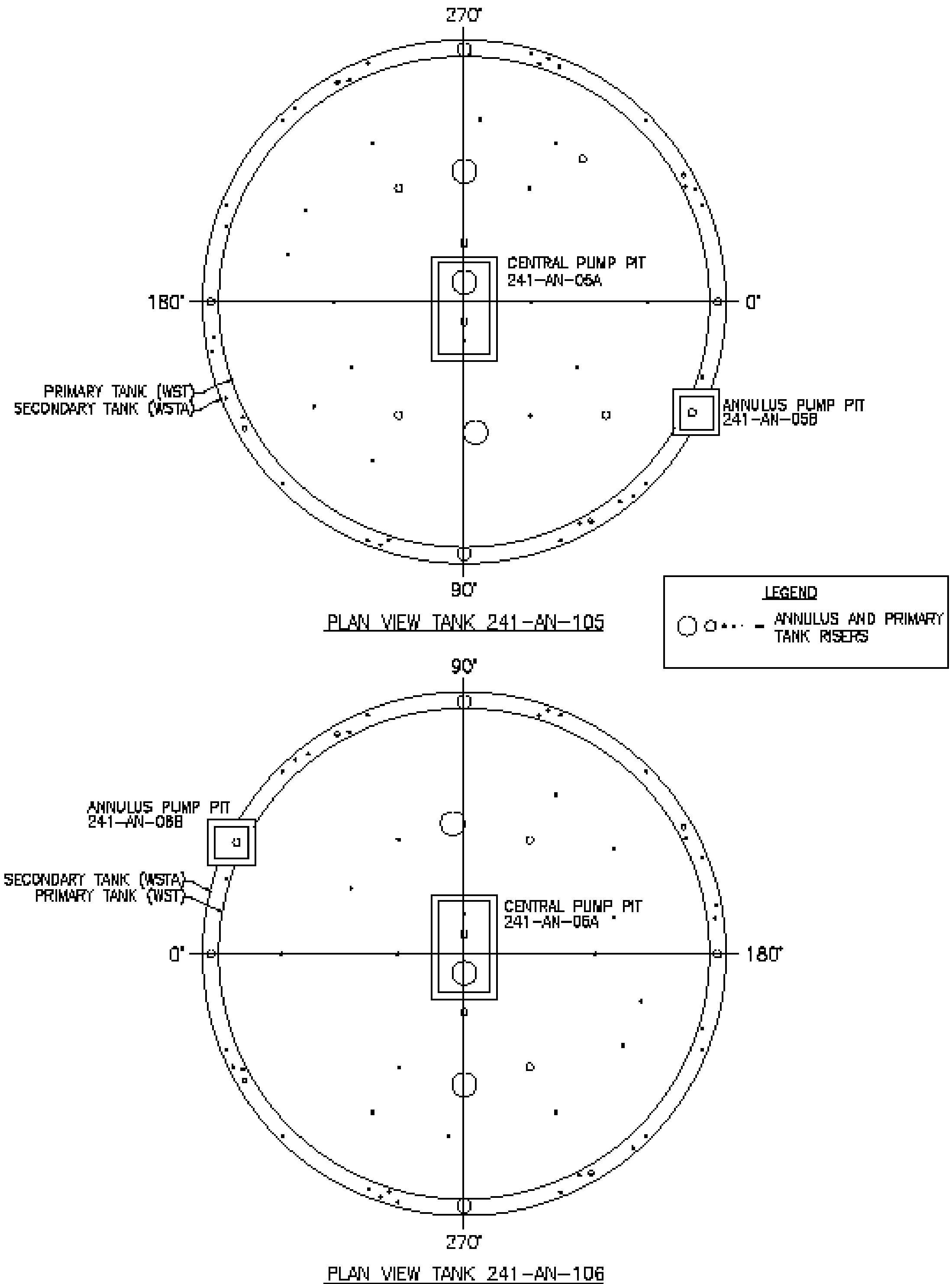


Figure C.12 Plan View Double-Shell Tanks 241-AN-105 and 241-AN-106

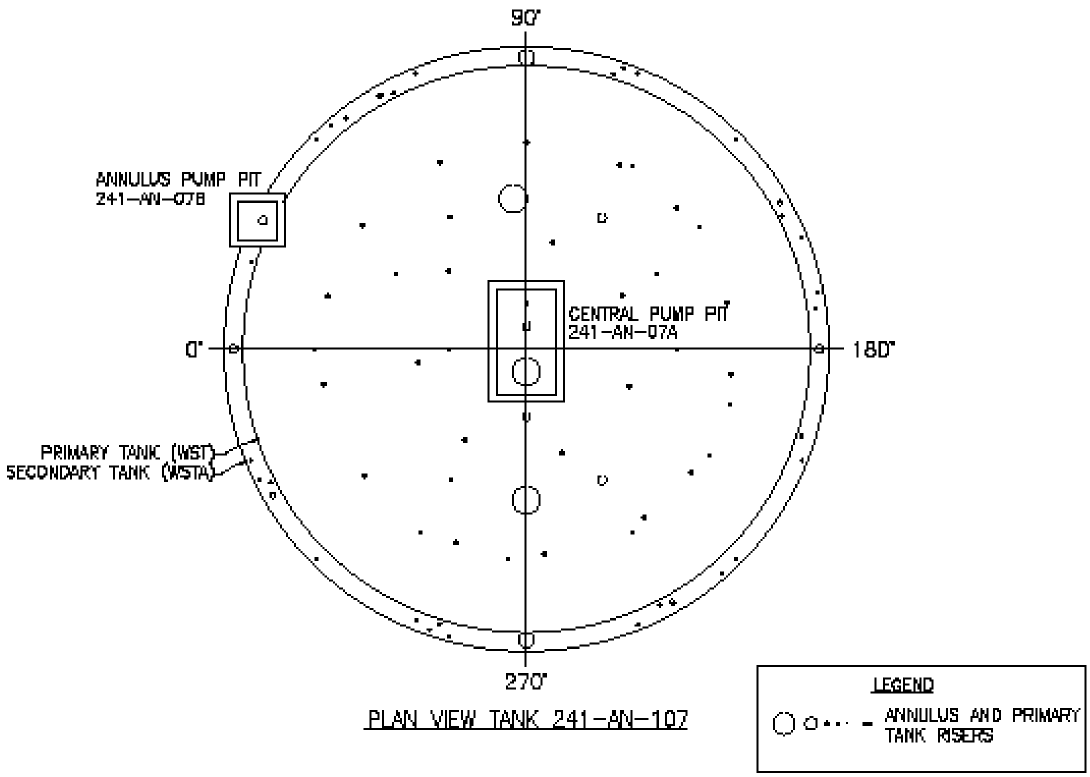


Figure C.13 Plan View Double-Shell Tank 241-AN-107

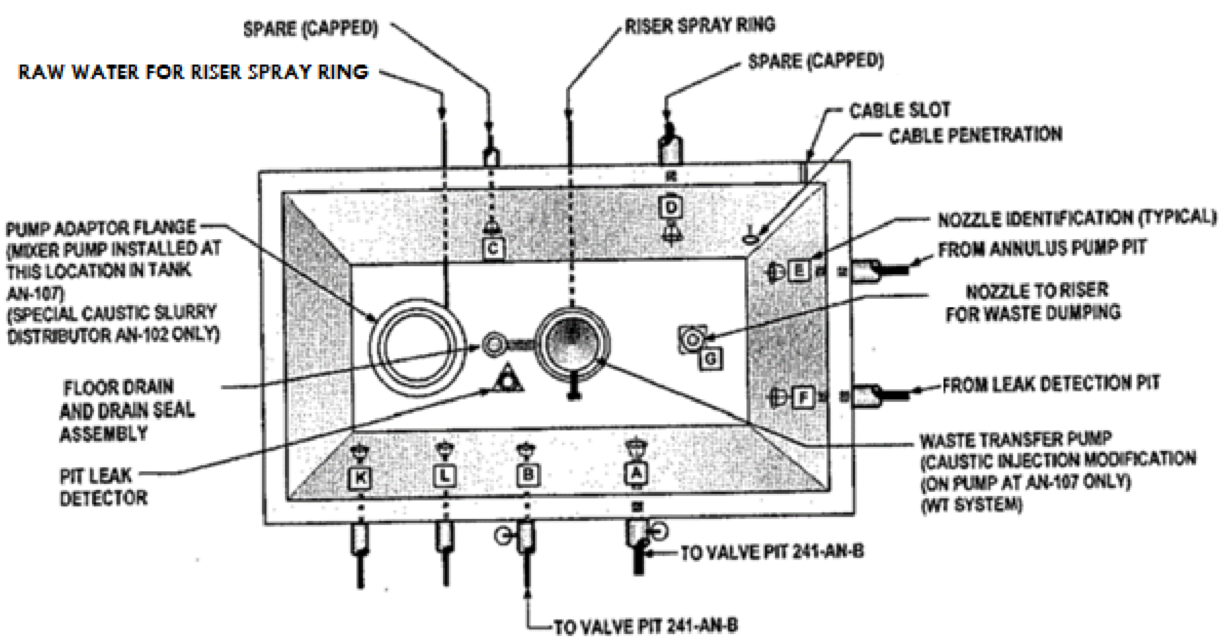


Figure C.14 Central Pump Pit Three-Dimensional Plan View (Typical for 241-AN Tank Farm)

C.5.1.4 Annulus Pump Pits (241-AN-01B, -02B, -03B, -04B, -05B, -06B, and -07B)

Each annulus pump pit is located over a riser above the tank annulus. There are pipe and conduit penetrations in the pit walls (Figure C.15). The riser from the tank is capped with a pump adaptor plate. A double-encased pipeline connects each annulus pump pit with that tank's central pump pit. Under normal conditions, a blank flange is installed over the riser unless a pump-out system is in place. The 241-AN annulus pump pits and associated drains and transfer lines have never been used for managing dangerous waste. If there were a need to pump accumulated liquid from the annulus, these annulus pump pits would serve as the access point to insert a pumping system.

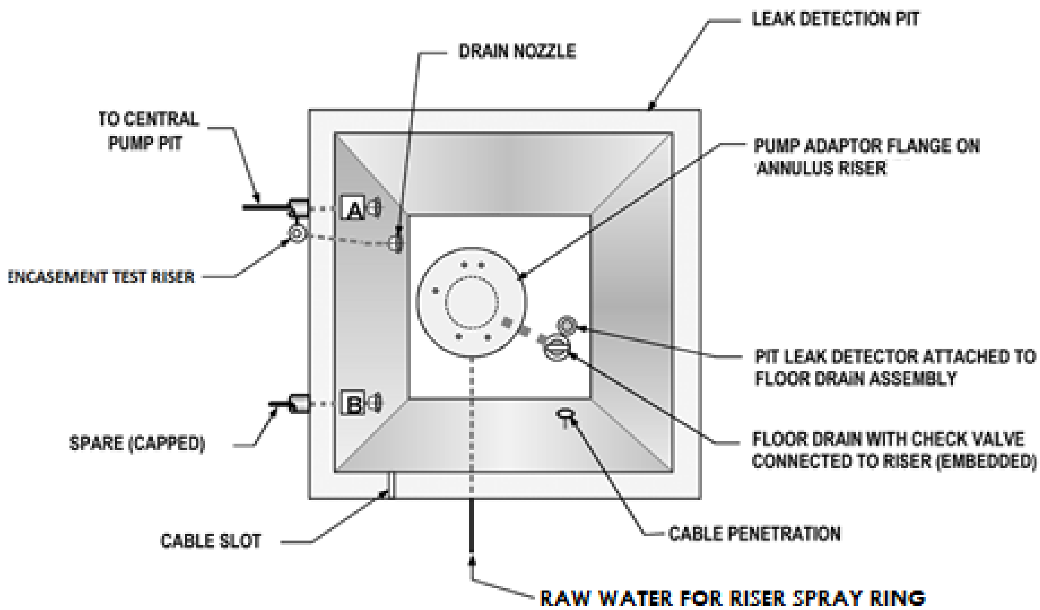


Figure C.15 Annulus Pump Pit Three-Dimensional Plan View (Typical for 241-AN Tank Farm)

C.5.2 241-AP Tank Farm

The 241-AP Tank Farm, located in the 200 East Area, consists of eight tanks, numbered 241-AP-101 through 241-AP-108. The primary steel tank rests inside the secondary steel tank, supported by an insulating concrete pad on the floor of the secondary tank. The secondary steel tank surrounds the primary tank, forming an annular space between the primary and secondary tanks.

The eight 241-AP tanks are essentially identical in design except for Tank 241-AP-102, which has an additional transfer pump pit and Tank 241-AP-107 has three mixer pump pits. Addendum A, "Part A Form," provides tank design and capacity information. Figures C.16 through C.19 show the configuration of 241-AP tank risers and pits located over the tanks.

A manometer effect is created in some 241-AP tanks that contain a high waste level of high-density liquid waste. Following a transfer, flush water is used to remove waste from the transfer system. The tank fill line is below the surface of the waste and the low-density flush water is unable to drain from the system because it cannot displace the higher-density waste in the tank.

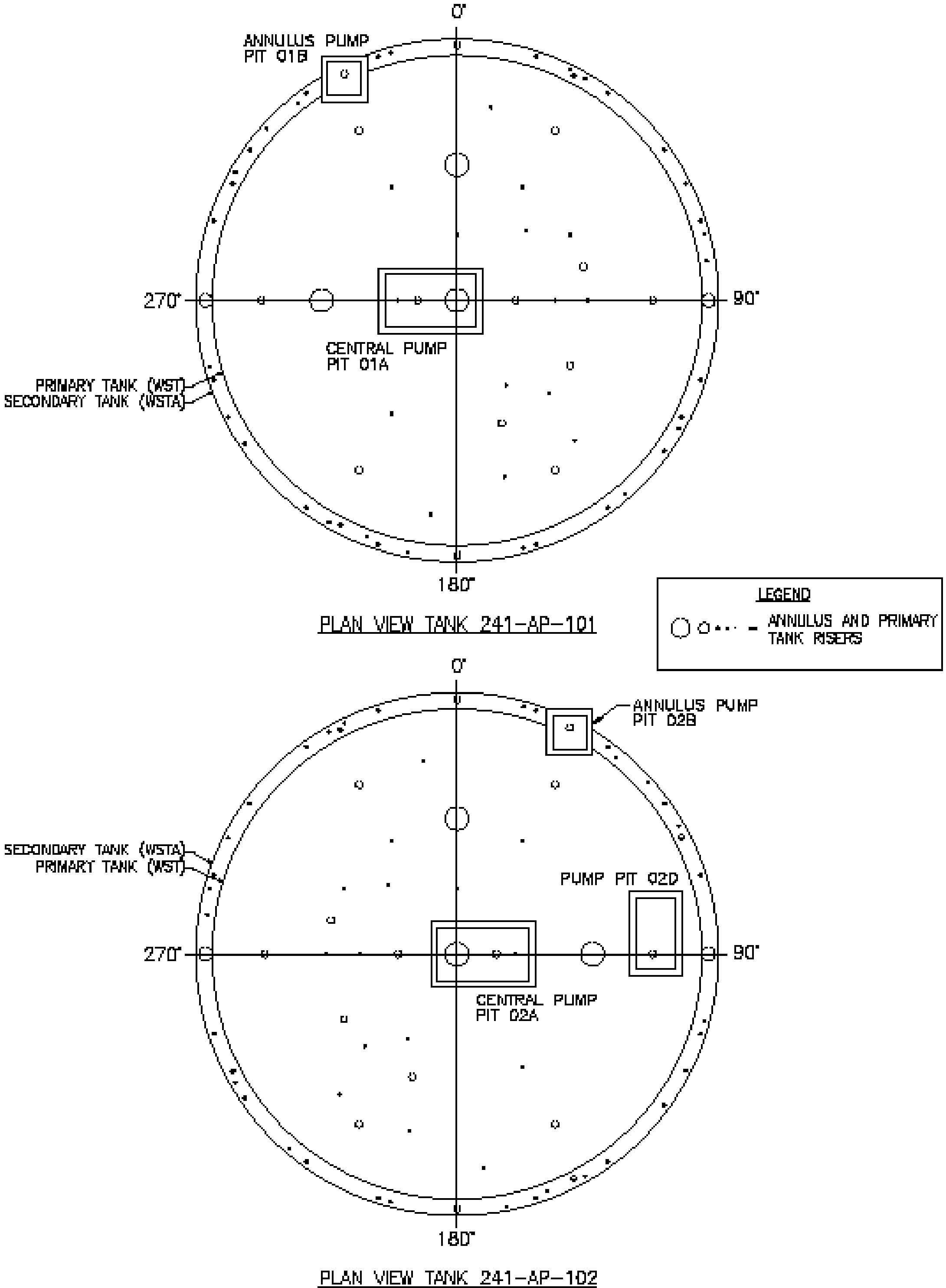


Figure C.16 Plan View Double-Shell Tanks 241-AP-101 and 241-AP-102

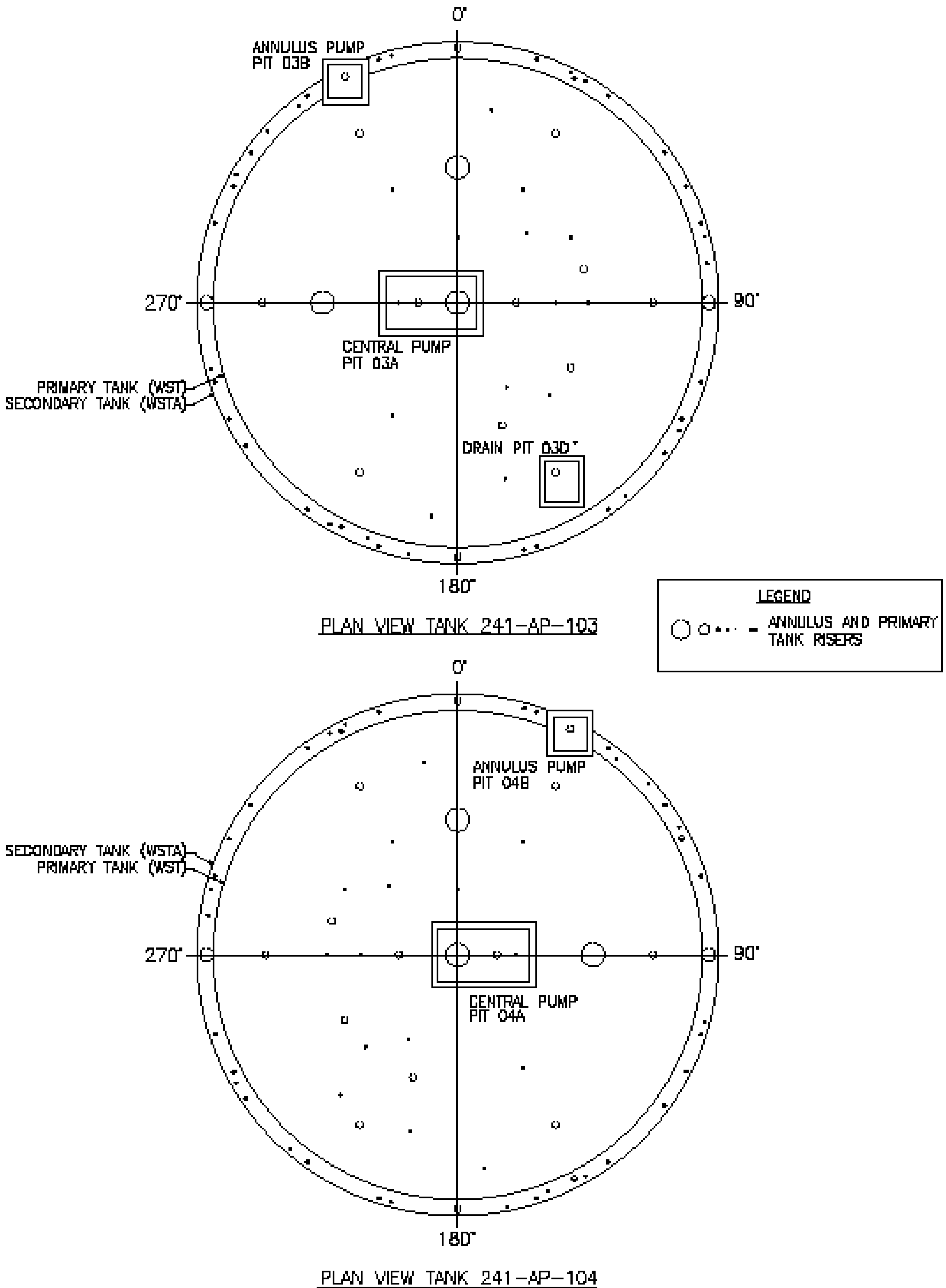


Figure C.17 Plan View Double-Shell Tanks 241-AP-103 and 241-AP-104

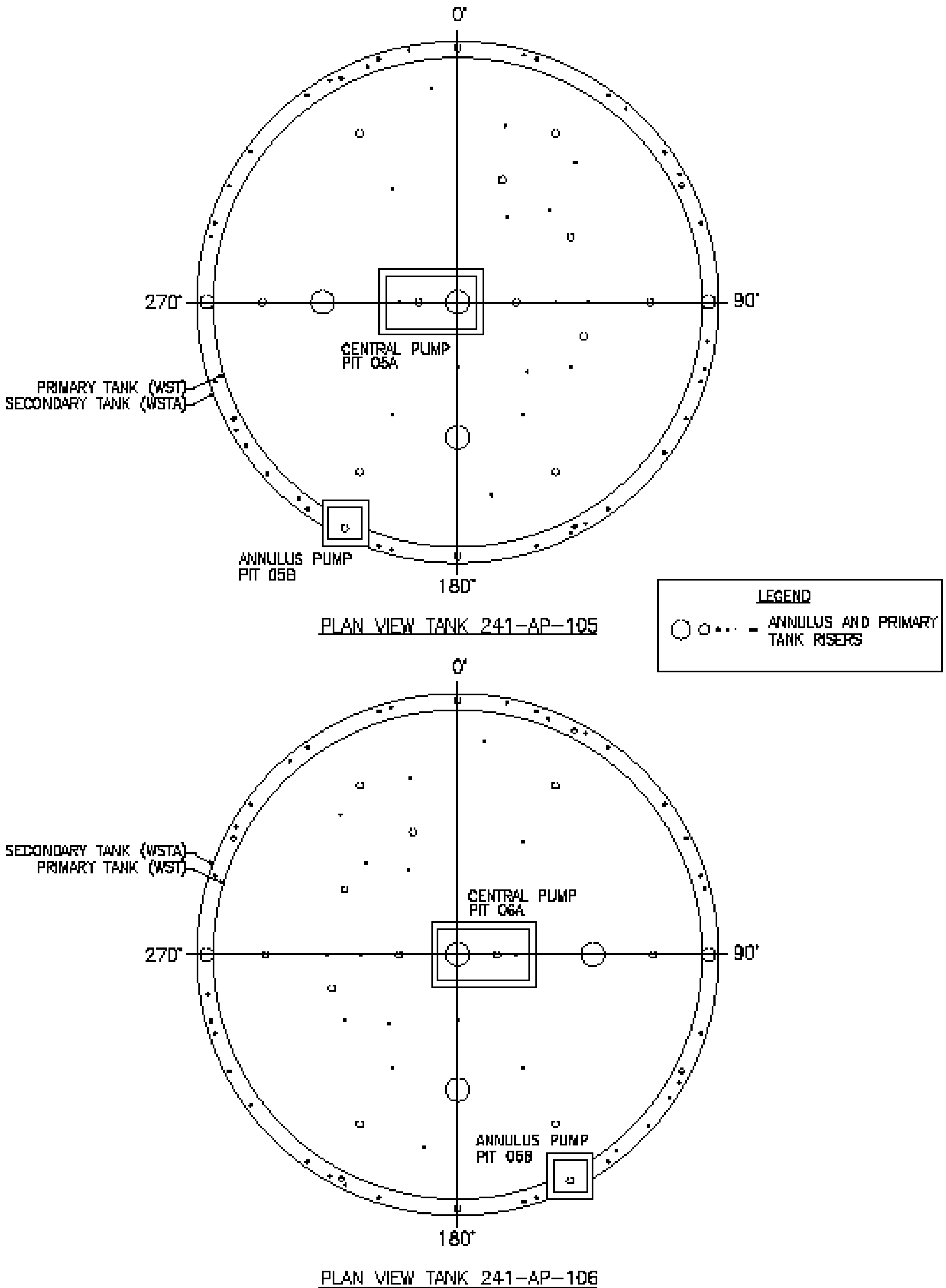


Figure C.18 Plan View Double-Shell Tanks 241-AP-105 and 241-AP-106

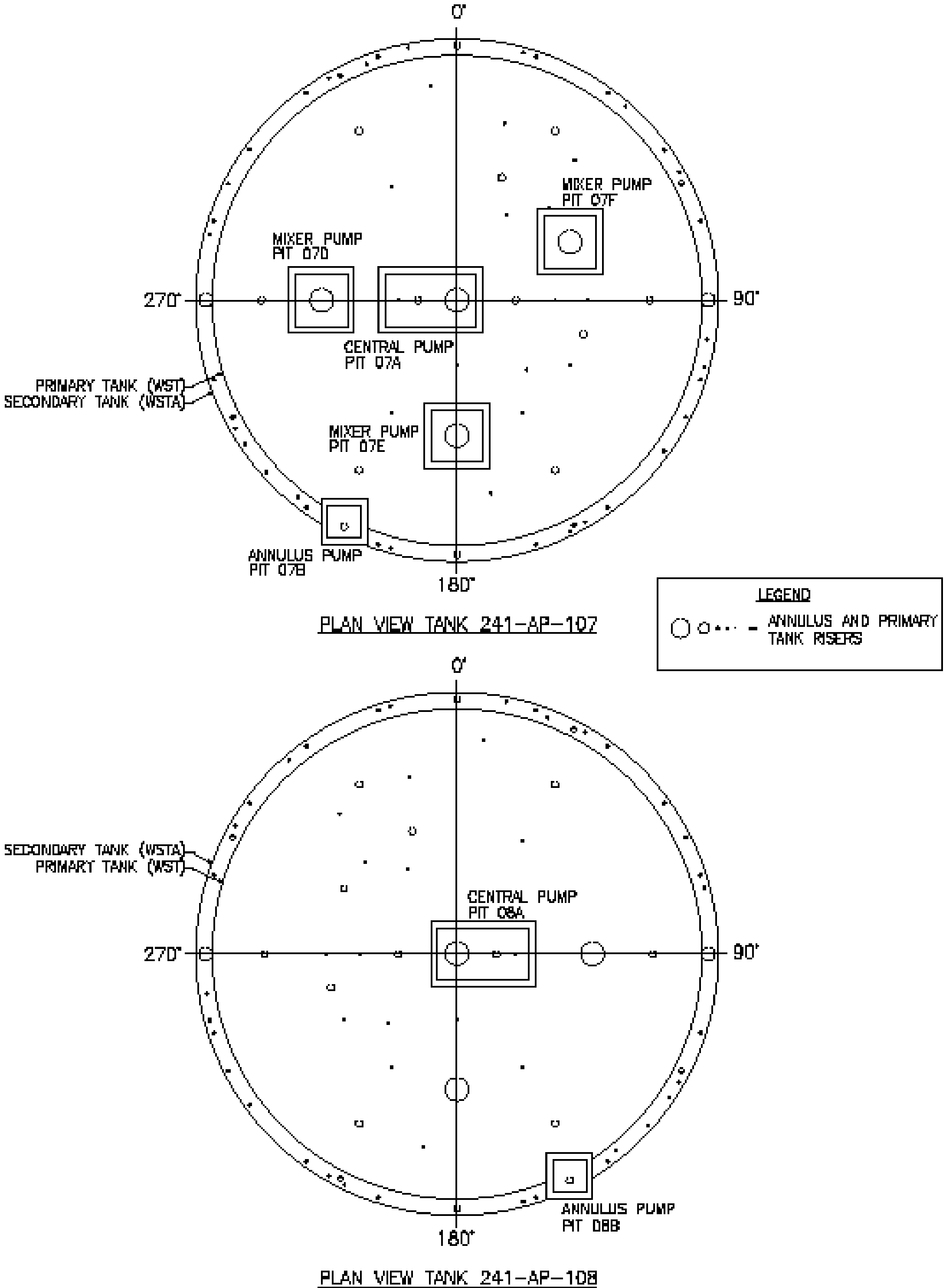


Figure C.19 Plan View Double-Shell Tanks 241-AP-107 and 241-AP-108

C.5.2.1 Permanent Lines

The 241-AP process pipelines are constructed of steel pipe and encased in steel pipes of larger diameter. Two lines connect to the 241-AW Tank Farm. Each 241-AP central pump pit is connected with the 241-AP valve pit by a waste transfer line. These lines are sloped toward the respective central pump pit so that waste drains back to the DST.

The transfer line secondary containment system in the 241-AP Tank Farm provides for automatic drainage to a detection point within secondary containment pits or back to the primary tanks. The process piping is constructed of steel pipes encased in secondary steel pipes. Both the primary line and its encasement are equipped to be hydrostatic pressure tested. If leakage is detected during a transfer, the transfer pump(s) are shut down.

C.5.2.2 Valve Pit

The valve pit is located in the center area between Tanks 241-AP-103 and 241-AP-105 on the west side of the 241-AP Tank Farm. The 241-AP valve pit consists of two sections: the valve pit and the jumper storage area. The jumper storage area is lined with stainless-steel on the floor and walls.

The process pipelines from 241-AW Tank Farm to 241-AP Tank Farm and the process pipelines to the central pump pits in the 241-AP Tank Farm terminate in the 241-AP valve pit. The routing of waste in these pipelines is determined by the jumper configuration and positioning of valves in the 241-AP valve pit.

The floors on the process side and the jumper storage side of the 241-AP valve pit are sloped toward drains that flow by gravity to the 241-AP-03D drain pit through drain line DR-713. The seals on these drains are designed to release liquid to the drain at a preset level. The seals also can be opened manually with a drain seal assembly installed through the access hole in the pit cover block.

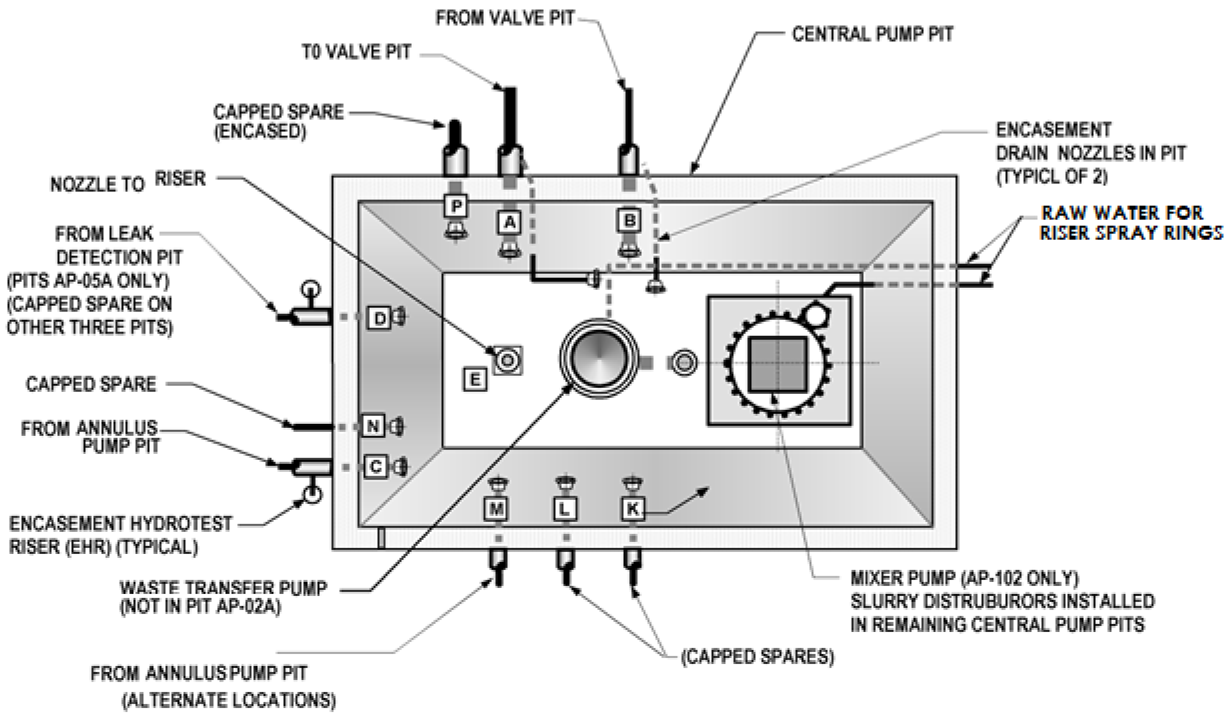
A leak detector is mounted on the floor of the process side of the 241-AP valve pit adjacent to the drain. Detection of a leak activates an alarm on the Tank Farm Monitoring and Control System (TFMCS). Failure of the leak detector also activates an alarm.

C.5.2.3 Central Pump Pits (241-AP-01A, -02A, -03A, -04A, -05A, -06A, -07A, and -08A)

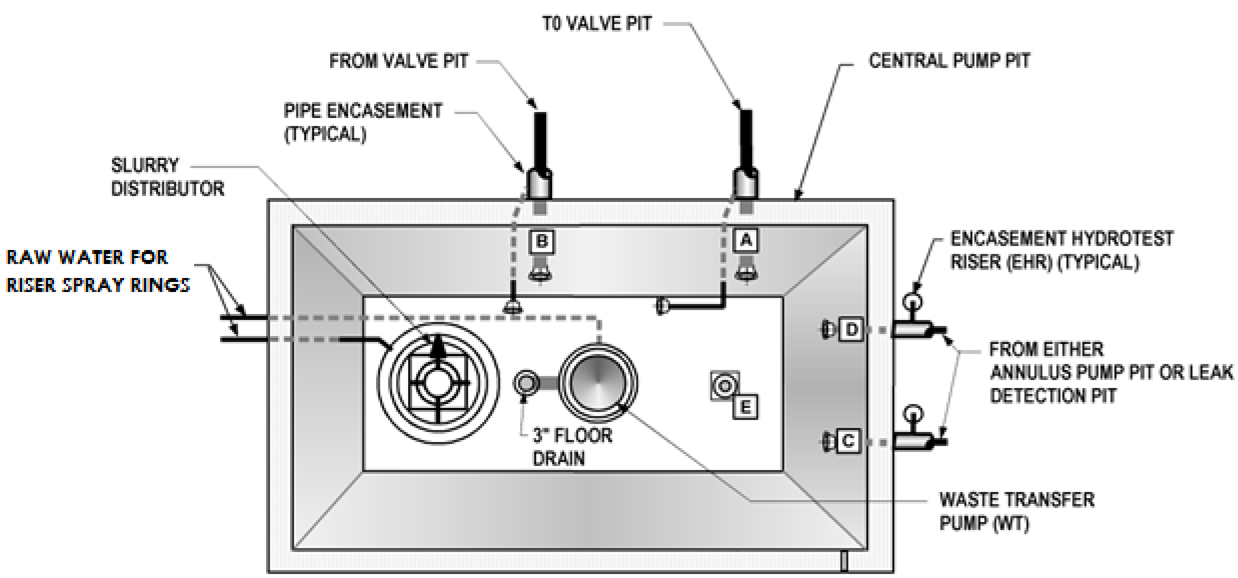
The function of the central pump pits is to provide a safe and convenient space for installing a waste transfer pump and to allow connections to the buried waste transfer piping entering the pit. Pumps are installed in the central pump pits when it is necessary to remove waste.

Each central pump pit is located over the center of the tank and accommodates three risers (Figure C.20). Waste is routed to the 241-AP tanks through the central pump pits. The pit wall has approximately eight pipe and conduit penetrations, except for pit 241-AP-02A, which has approximately 16 pipe and conduit penetrations. A riser from the tank is capped with a cover at or just above the pit floor unless a pump is installed on the riser. When the pump is not installed, a closure flange caps the riser. Waste being removed from the 241-AP tanks is routed through the central pump pit or can be routed directly from 241-AP-02D to the 241-AZ valve pit through a jumper. Each 241-AP central pump pit is connected with the valve pit by two pipelines that allow waste to be directed to other tanks as well as to other tank farms, the 242-A Evaporator, the LAWPS, or the WTP when it becomes operational.

Detection of a leak in a 241-AP central pump pit activates an alarm. Failure of the leak detector also activates an alarm.



CENTRAL PUMP PIT 3D PLAN VIEW - ARRANGEMENT I
(PITS AP-02A, 04A, 05A & 07A)
NOT TO SCALE



CENTRAL PUMP PIT 3D PLAN VIEW - ARRANGEMENT II
(PITS AP-01A, 03A, 06A & 08A)
NOT TO SCALE

Figure C.20 Central Pump Pit Three-Dimensional Plan View

C.5.2.4 Annulus Pump Pits (241-AP-01B, -02B, -03B, -04B, -05B, -06B, -07B, and -08B)

The annulus pump pits are located over a riser from the tank annulus. The riser from the tank is capped with a pump adaptor plate at the pit floor. Under normal conditions, a blank flange is installed over the riser unless a pump is in place (Figure C.21). The 241-AP annulus pump pits, associated drains, and transfer lines have never been used for managing dangerous waste. If there were a need to pump accumulated liquid from the annulus, these annulus pump pits could serve as an access point to insert a pumping system.

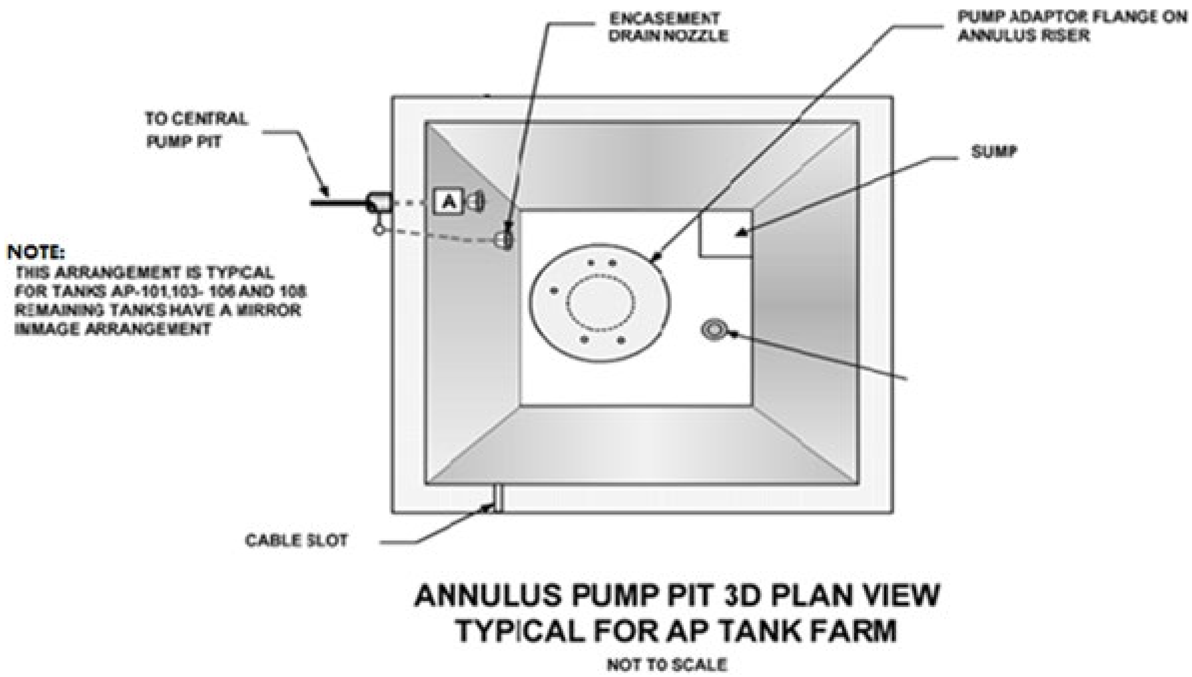


Figure C.21 Annulus Pump Pit Three-Dimensional Plan View (241-AP Tank Farm)

C.5.2.5 Drain Pit (241-AP-03D)

The drain pit is located on Tank 241-AP-103 over a riser from the primary tank (Figure C.22). The drain pit receives drainage from the 241-AP Tank Farm valve pit, floor drain, and seal pots. The floor of this drain pit is sloped toward a drain that routes liquid back to Tank 241-AP-103 through a riser. The drain seal assemblies are set to open at a nominal liquid depth corresponding to a preset limit. The leak detector is mounted on the pit floor adjacent to the drain.

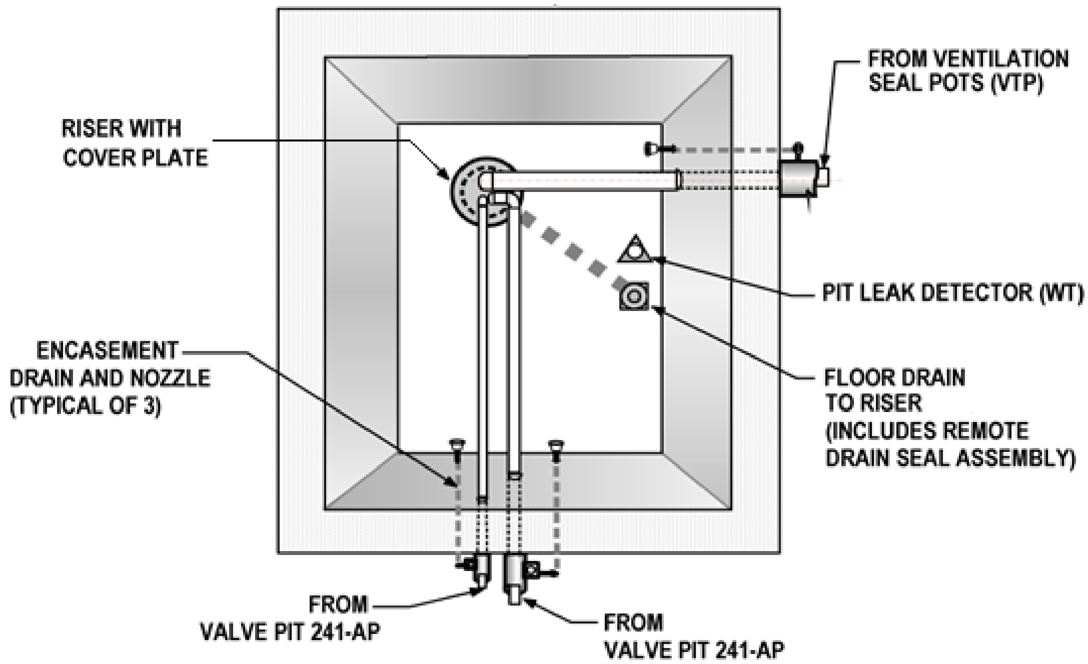


Figure C.22 Drain Pit Three-Dimensional Plan View (Tank 241-AP-103)

C.5.2.6 Transfer Pump Pit (241-AP-02D)

The 241-AP-02D transfer pump pit exists only at Tank 241-AP-102. The pit is located on top of the tank over a riser from the primary tank (Figure C.23). The pit wall has six transfer lines and five spares that entail eleven pipe penetrations. At the pit floor, a water spray ring encircles the riser for washing down equipment removed from the riser. The pit floor is sloped to a floor drain that connects to the tank riser, which is just below the pit floor for drainage back into the primary tank. A pipe with a nozzle located above the floor that connects to the riser below the pit floor and provides a bypass connection to allow the pump to discharge back to the primary tank. A pipe with a floor nozzle provides an additional bypass and route to the riser.

The floor of the 241-AP-02D pump pit is sloped toward a drain that routes liquid through a riser back to Tank 241-AP-102. A plumber's plug is installed over the floor drain. The plug opens to allow flow into the tank drain when the liquid level in the pit is at a depth corresponding to a preset limit. The capability exists to drain the entire floor by raising the check valve manually using a handle that extends through an access hole in the cover block.

A detection of a leak in the 241-AP-02D pump pit activates an alarm. Failure of the leak detector also activates an alarm.

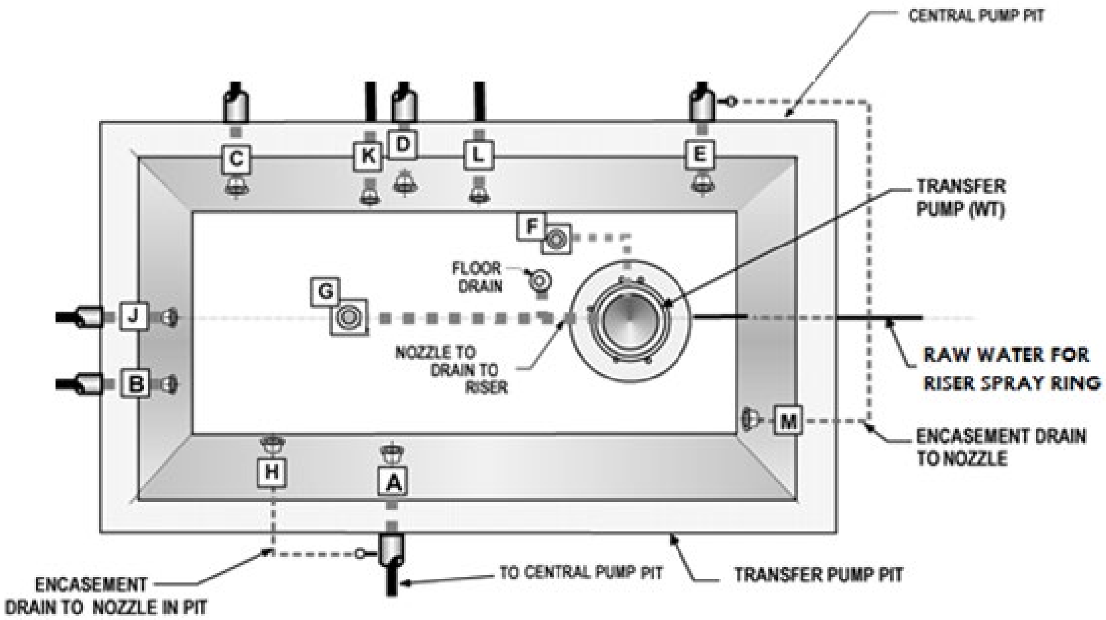


Figure C.23 Transfer Pump Pit Three-Dimensional Plan View (Tank 241-AP-102)

C.5.2.7 Mixer Pump Pits (241-AP-07D, -07E, and -07F)

Three mixer pump pits are located on top of Tank 241-AP-107 to provide future waste mixing capabilities. Each pit is located over a riser that accommodates a mixer pump. The bottom of each pit rests on the tank dome slab. Mixer pump pits 241-AP-07D and 241-AP-07E have a drain connection to the riser; pit 241-AP-07F has a floor drain connected to an adjacent riser. The floor is equipped with a pit drain seal to allow manual draining of any accumulated liquid.

C.5.3 241-AW Tank Farm

The 241-AW Tank Farm is located in the 200 East Area and consists of six tanks, numbered 241-AW-101 through 241-AW-106. The primary steel tank rests inside the secondary steel tank, supported by an insulating concrete pad on the floor of the secondary tank. The secondary steel tank surrounds the primary tank, forming an annular space between the primary and secondary tanks.

Tank 241-AW-102 is the feed tank for the 242-A Evaporator, and is outfitted with airlift circulators for mixing the contents to provide a consistent feed. Tank 241-AW-102 has two additional pits, a feed pump pit, and a drain pit. Addendum A, “Part A Form,” provides tank design and capacity information. Additional design information is contained in the integrity assessment reports for the DST System. Figures C.24 through C.26 show the configuration of 241-AW tank risers and pits located over the tanks.

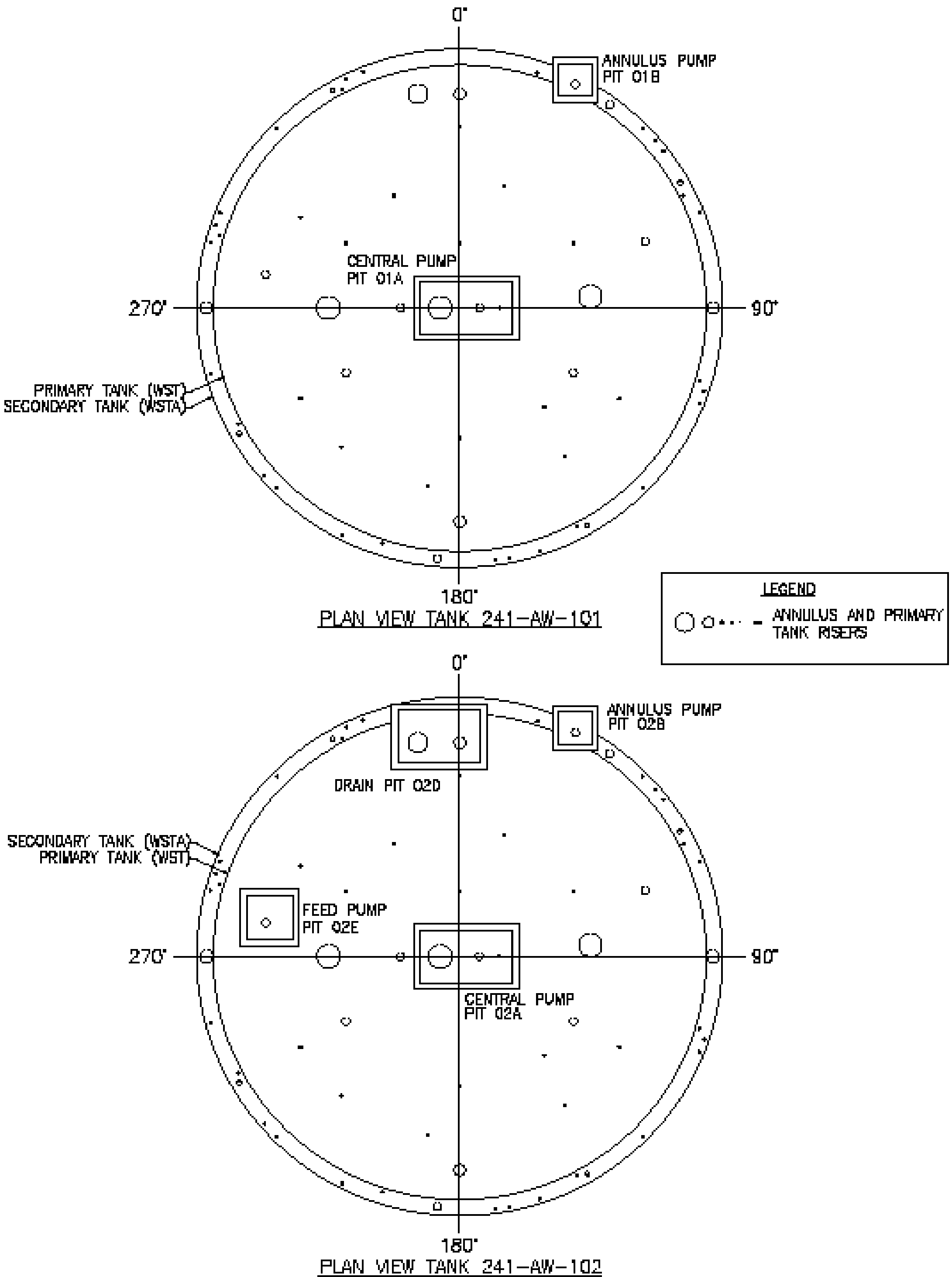


Figure C.24 Plan View Double-Shell Tanks 241-AW-101 and 241-AW-102

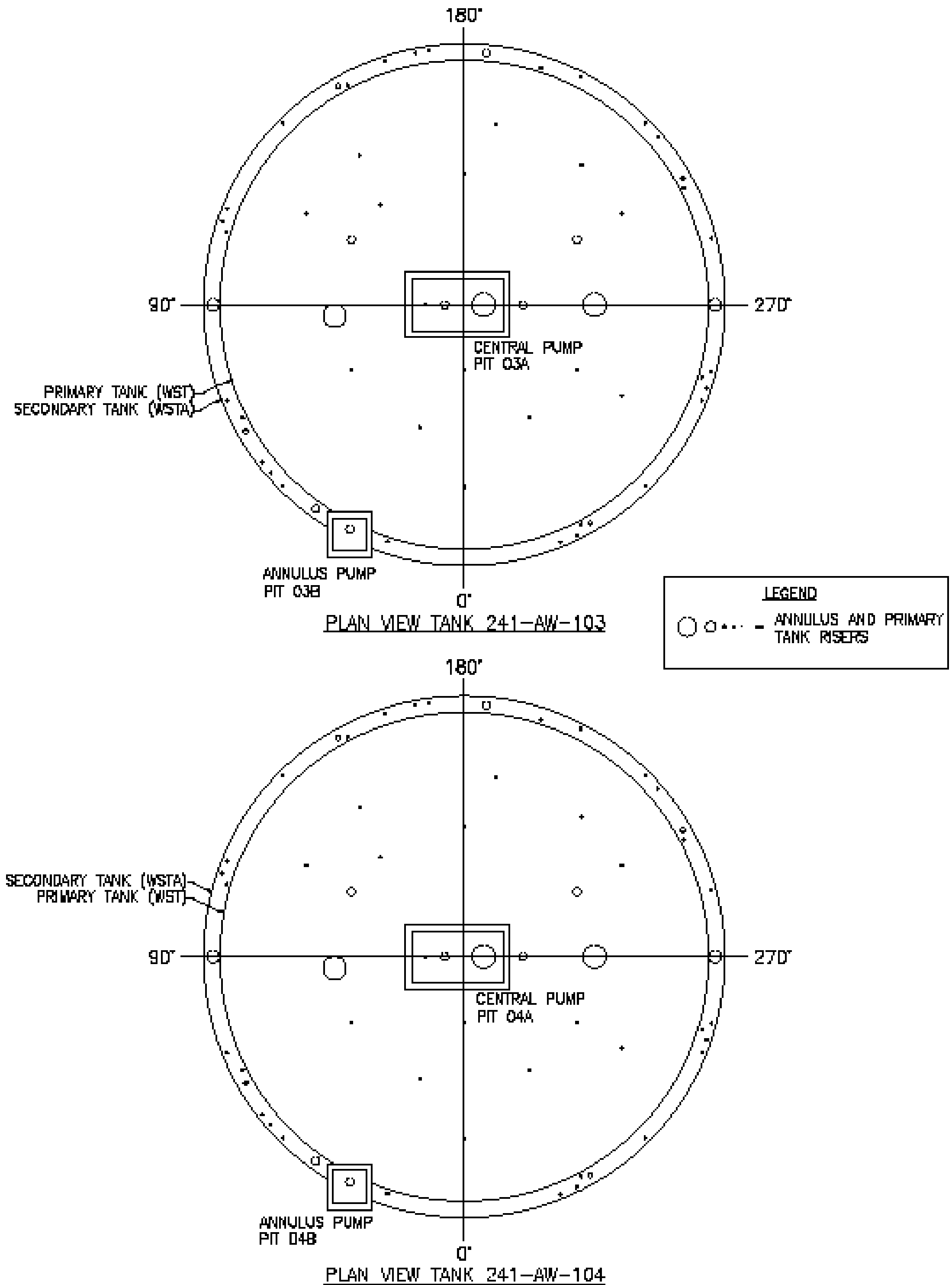


Figure C.25 Plan View Double-Shell Tanks 241-AW-103 and 241-AW-104

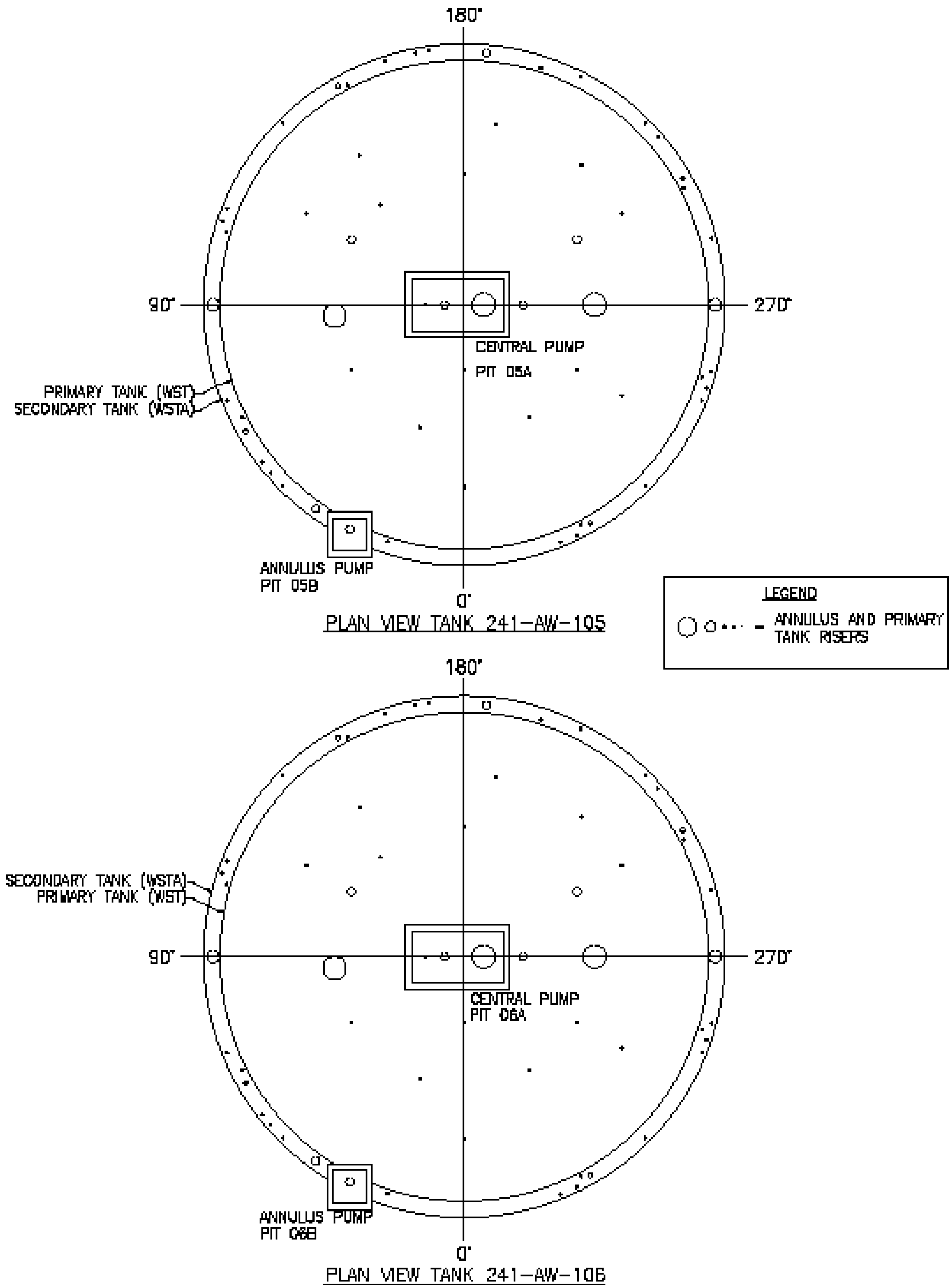


Figure C.26 Plan View Double-Shell Tanks 241-AW-105 and 241-AW-106

C.5.3.1 Permanent Transfer Pipelines

All 241-AW waste transfer pipelines are constructed of steel pipe in a larger-diameter steel encasement pipe. Waste can be transferred to the central pump pits from valve pits 241-AW-A or 241-AW-B, or can be routed to the 241-AP Tank Farm. Pipelines also connect the 241-AW-A and 241-AW-B valve pits with the 241-A-A and 241-A-B valve pits.

C.5.3.2 Primary Tank Ventilation Seal Pots

Condensate and moisture (radioactive non-dangerous waste) removed from the ventilation system is routed to seal pots by a network of drain lines. The seal pots return the condensate to Tank 241-AW-102.

C.5.3.3 Valve Pits (241-AW-A and -B)

The 241-AW-A and 241-AW-B valve pits have several functions, including to route waste from the 242-A Evaporator to designated DSTs and to route waste among tanks. The 241-AW-A valve pit is essentially the same design as valve pit 241-AW-B. Waste transfer lines interconnect the valve pits. Two pipelines typically connect each 241-AW Tank with one of these two valve pits. Each valve pit has a floor drain that drains to 241-AW-102 via the 241-AW-02D drain pit. Leak detectors suspended from the cover blocks hang adjacent to the drains to provide leak detection.

C.5.3.4 Central Pump Pits (241-AW-01A, -02A, -03A, -04A, -05A, and -06A)

Each central pump pit is located over the top of the center of the tank. The pit wall has multiple pipe and conduit penetrations. When not in use, nozzles and risers are capped in various ways such as a vapor seal, process blank, a flanged cover plate, dummy pump head, shield collar, or a shield plug. Pumps are installed in the central pump pits when it is necessary to remove waste. In all 241-AW tanks except Tank 241-AW-102, waste being removed from the tank is routed through the tank-specific central pump pit to the 241-AW-A or 241-AW-B valve pit. Tank 241-AW-102 uses a feed pump pit. Each 241-AW central pump pit is connected with the 241-AW valve pits by transfer lines that allow waste to be directed to other tanks as well as to other tank farms.

Risers from the primary tank are in the pit floor. Larger risers serve as the primary access for waste management activities such as waste mixing and slurry distribution. Smaller risers serve as primary access for waste management activities such as airlift circulators, mixer pump, or slurry distribution. Some risers are looped with a spray-ring header just under the adaptor flange. Nozzles from the spray-ring header extend into the riser to provide a water wash-down when equipment is being removed from the tank.

C.5.3.5 Drain Pit (241-AW-02D)

The 241-AW-02D drain pit is located only on top of Tank 241-AW-102 and provides drain access for placing waste into Tank 241-AW-102. The pit is located over two risers that accommodate waste additions. A floor drain in the center of the pit connects one of the risers just below the pit floor. The drain pit has spray nozzles recessed into its walls that provide pit wash-down capabilities. The water piping serving the pit spray nozzles is embedded in the pit walls. Embedded in the pit floor slab is a water spray ring encircling the riser for washing down equipment removed from the riser.

The drain pit holds lines that receive process waste drainage from the 242-A Evaporator, wastewater from the 272-AW Surveillance and Maintenance Building personnel decontamination shower, and the 241-AW-A and -B valve pit floor drains. Three drain lines connect with the 242-A Evaporator. Several encased spare nozzles are reserved for future use. A leak detector is positioned adjacent to the drain.

C.5.3.6 Annulus Pump Pits (241-AW-01B, -02B, -03B, -04B, -05B, and -06B)

The 241-AW annulus pump pits provide access to the annulus. The annulus pump pit is located over a riser from the tank annulus area at the perimeter of the tank.

Under normal conditions, a blank flange is installed over the riser. The 241-AW annulus pump pits, associated drains, and transfer lines have never been used for managing dangerous waste. If there were a need to pump accumulated liquid from the annulus, these annulus pump pits would serve as the access point to insert a pumping system.

C.5.3.7 Feed Pump Pit (241-AW-02E)

The 241-AW-02E feed pump pit, located on Tank 241-AW-102, is used to supply feed to the 242-A Evaporator. The pump pit has spray nozzles embedded into its walls to provide pit wash-down capabilities. Embedded in the pit floor slab is a water spray ring encircling the riser for washing down equipment removed from the riser. The pit floor is sloped to a floor drain that connects to the tank riser, located just below the pit floor for drainage back into the primary tank. Another pipe with a nozzle above the floor, also connecting to the riser below the pit floor, provides a bypass connection to allow the pump to discharge back into the primary tank. Encased waste lines connect the feed pump pit to the 242-A Evaporator and the central pump pit. A leak detector is mounted on the floor adjacent to the drain. A floor drain returns liquids to the primary riser.

C.5.3.8 Flush Pit

The flush pit provides raw water for flushing lines after a waste transfer is completed. The water supply system provides the water used.

C.5.4 241-AY and 241-AZ Tank Farms

The 241-AY and 241-AZ Tank Farms are in the 200 East Area and consists of four tanks, numbered 241-AY-101, 241-AY-102, 241-AZ-101, and 241-AZ-102. Each primary steel tank rests inside a secondary steel tank, supported by an insulating concrete pad on the floor of the secondary tank. The secondary steel tank surrounds the primary tank, forming an annular space between the primary and secondary tanks.

All 241-AY and 241-AZ tanks have pipe penetrations on the sides of the primary and secondary tanks just below the haunch and above the waste level. These penetrations provide for waste transfer into the primary tank. The liquid level in these tanks is maintained at a level that is lower than other DSTs to ensure waste does not back up into the fill lines. Addendum A, “Part A Form,” provides tank design and capacity information. Additional design information is contained in the integrity assessment reports for the DST System. Figures C.27 and C.28 show the configuration of 241-AY and 241-AZ tank risers and pits located over the tanks.

Tank 241-AY-102 was determined to be leaking into secondary containment in August 2012, and was isolated to prevent waste additions and declared unfit-for-use in accordance with WAC 173-303-640(7). Retrieval of the supernatant from Tank 241 AY-102 occurred in March 2016 and sludge retrieval was completed in April 2017.

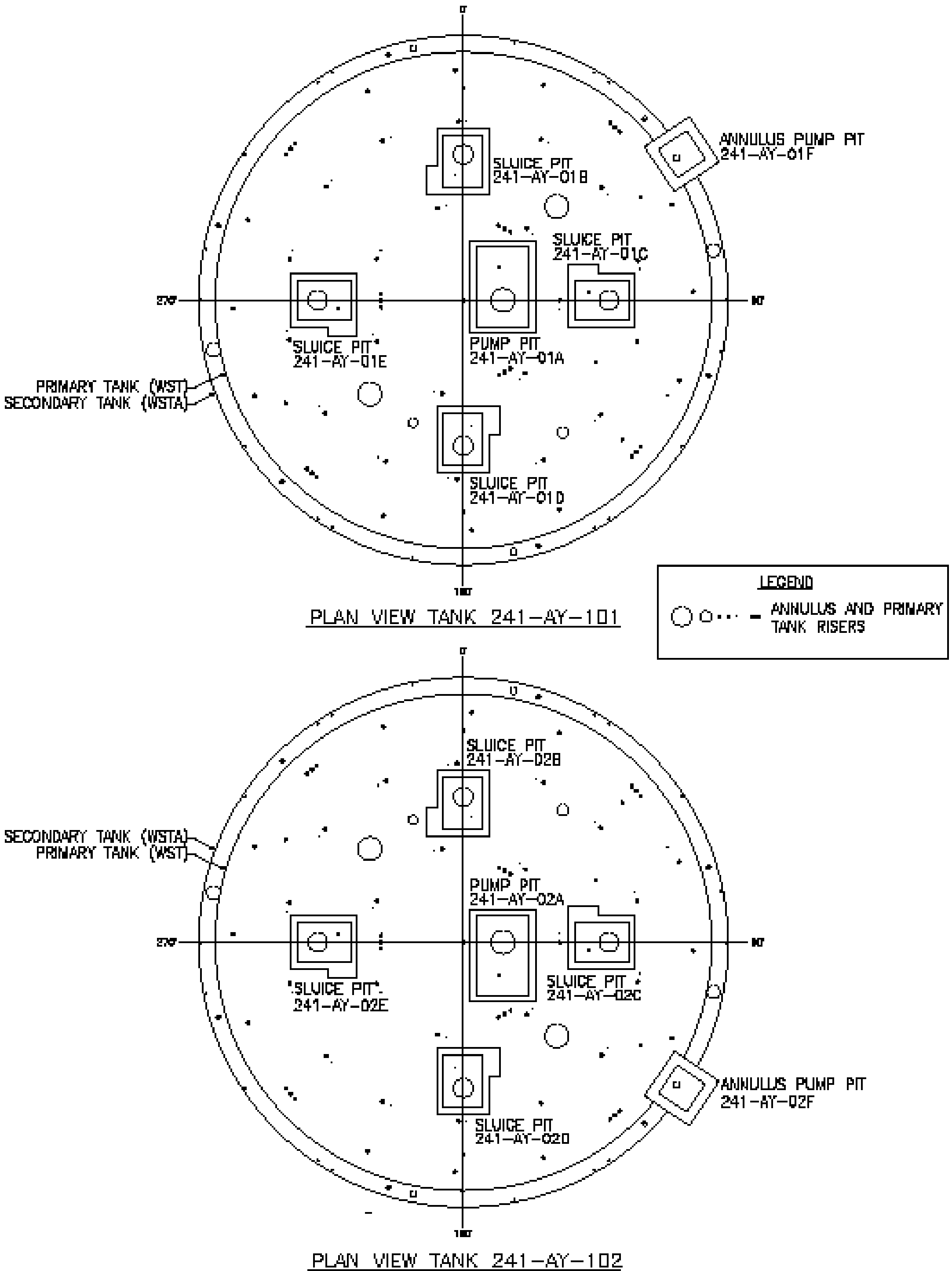


Figure C.27 Plan View Double-Shell Tanks 241-AY-101 and 241-AY-102

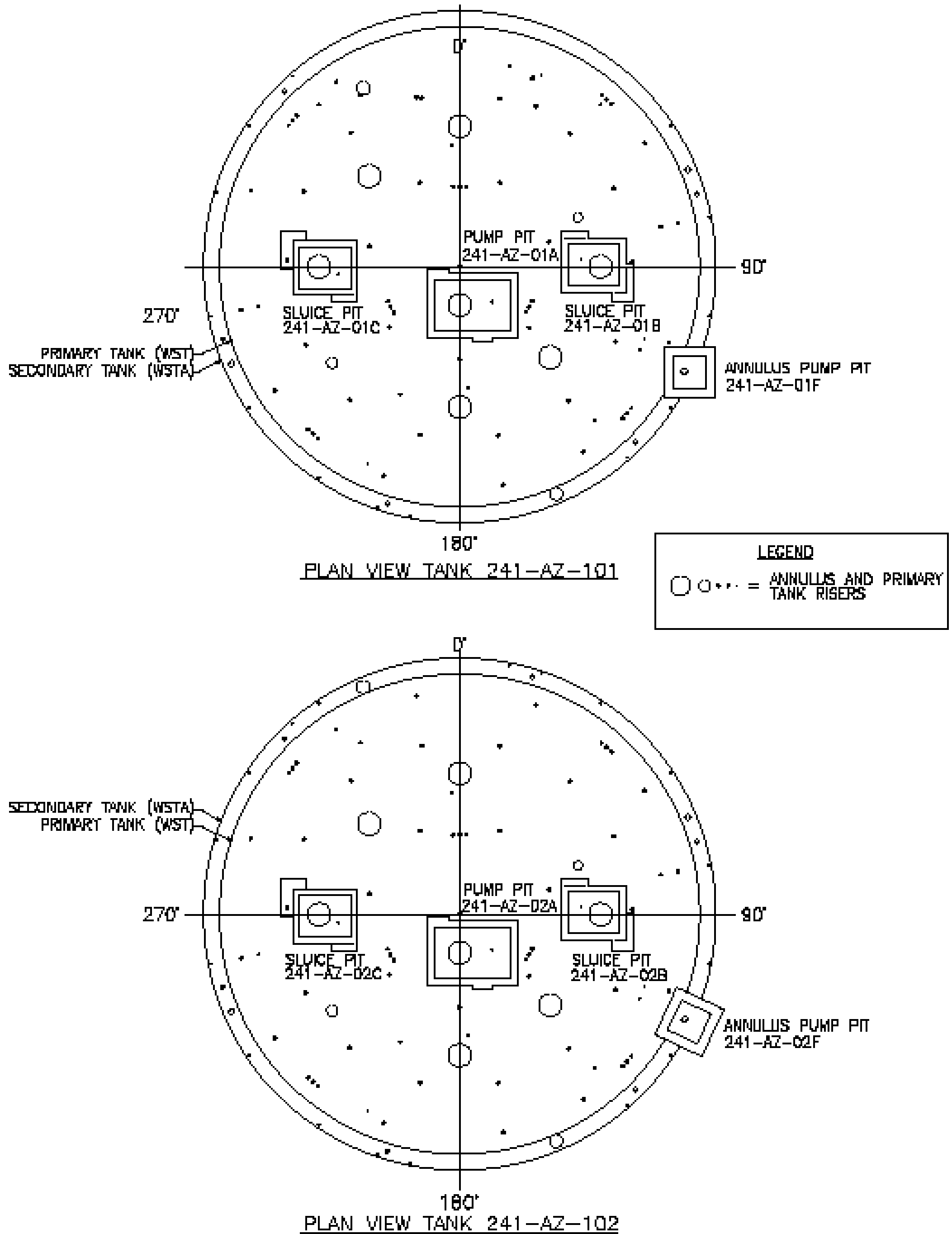


Figure C.28 Plan View Double-Shell Tanks 241-AZ-101 and 241-AZ-102

C.5.4.1 Permanent Pipelines

Process pipelines associated with the 241-AY/AZ Tank Farms are constructed of steel piping. The form of encasement consists of a secondary steel pipe of a larger diameter than the primary pipe. The primary pipe is supported inside the encasement.

Waste is transferred between the 241-AY and 241-AZ valve pits, pumps pits, and other 241-AY and 241-AZ tanks in underground transfer pipelines. The transfer line secondary containment system in the 241-AY and 241-AZ Tank Farms provides for automatic drainage to a detection point within secondary containment pits or back to the primary tanks.

C.5.4.2 Mixer Pumps

Two mixer pumps installed in Tank 241-AZ-101 are out of service and there are no plans to restore them to use.

C.5.4.3 Condensate Catch Tank (241-AZ-301)

The condensation from the primary condenser and condensed liquid removed by the ventilation system is drained to seal pot AZ-PC-SP-1 and then to tank 241-AZ-301, a catch tank that collects condensate, a radioactive, non-dangerous waste, from the 241-AY and 241-AZ Tank Farms. Catch tank 241-AZ-301 replaced catch tank 241-AZ-151 after the sources of dangerous waste that were previously collected in 241-Z-151 were isolated. Catch tank 241-AZ-301 does not manage dangerous waste but is included in this application for completeness. The condensate collected in Catch Tank 241-AZ-301 is shipped by tanker to LERF or can be returned to a DST.

C.5.4.4 Valve Pit (241-AZ-VP)

The valve pit is located southeast of Tank 241-AZ-101 and provides the capability for transfer routings to 241-AN, 241-AP, 241-AY, and 241-AZ Tank Farms and WTP. The pit contains a leak-detection probe.

C.5.4.5 Central Pump Pits (241-AY-01A and -02A, and 241-AZ-01A and -02A)

The central pump pits for 241-AY and 241-AZ Tank Farm tanks are located over the top of the center of the tank and accommodate two risers. The pit wall has numerous pipe and conduit penetrations. The risers from the tank are capped with flanged cover plates at or just above the pit floor unless pumps are installed on the risers. Waste can be routed to and from the 241-AY and 241-AZ Tank Farm tanks through the central pump pit. The central pump pits house large risers that provide access into the primary tank. The pits are made of concrete, and there is solid concrete from the pit floors to the concrete dome of the primary tanks below.

The risers from the primary tank are located in the pit floor. The larger riser serves as the primary access for waste management activities such as waste mixing and slurry distribution. The riser flange is flush with the bottom of the pit floor and is capped with an adaptor flange that will either receive a mixer pump or transfer pump. The riser is looped with a spray-ring header just under the adaptor flange. Nozzles from the spray-ring header extend into the riser to provide a water wash-down when equipment is removed from the tank. The smaller riser flange is flush with the bottom of the pit floor. It receives waste from other tanks or other sources and discharges it into the tank.

Central pump pits 241-AY-01A, 241-AY-02A, and 241-AZ-02A each accommodate service waste transfer pumps. Using jumpers, the waste can be routed through other central pump pits and 241-AZ valve pits to other DSTs. When in use, these pump pits are provided with a leak-detection system meeting the requirements of WAC 173-303-640(4).

C.5.4.6 Annulus Pump Pits (241-AY-01F and -02F, and 241-AZ-01F and -02F)

These annulus pump pits are designated emergency use only and are located over a riser from the tank annulus area at the perimeter of the tank. The pit wall contains pipe and conduit penetrations. The riser is covered by a shield plug when no process equipment is installed.

The 241-AY-02F annulus pump pit has a pit liner, line sleeve, and submersible pump attached to a HIHTL to assist with removal of accumulated liquid from the annulus.

The 241-AY-101 and 241-AZ annulus pump pits, associated drains, and transfer lines have never been used for managing dangerous waste. If there were a need to pump accumulated liquid from the annulus, these annulus pump pits would serve as the access point to insert a pumping system.

C.5.4.7 Sluice Pits (241-AY-01B, -01C, -01D, and 01E; 241-AY-02B, -02C, -02D, and -02E; 241-AZ-01B and -01C; and 241-AZ-02B and -02C)

The 241-AY Tank Farm tanks each have four sluice pits, and both 241-AZ Tank Farm tanks have two sluice pits each. All pits are located on top of the tank over a riser in 241-AZ Tank Farm and a riser in the 241-AY Tank Farm. Each sluice pit has wall penetrations for pipes and conduit (Figure C.29). The pit also has pit spray nozzles embedded into its walls to provide pit wash-down capabilities. The sluice pit floors are flat and have floor drains that extend above the bottom of the primary tank. Spray nozzles for decontamination are mounted in each of the four walls.

Mixer pumps may be installed in spare risers (currently buried underground) in 241-AZ Tank Farm and in spare risers in 241-AY Tank Farm.

Sluice pits 241-AY-01D, 241-AY-02D, and 241-AZ-01C each accommodate failed or permanently out of service waste transfer pumps. Each is mounted in a riser. Using jumpers, the waste can be routed through the central pump pit to other tanks or tank farms.

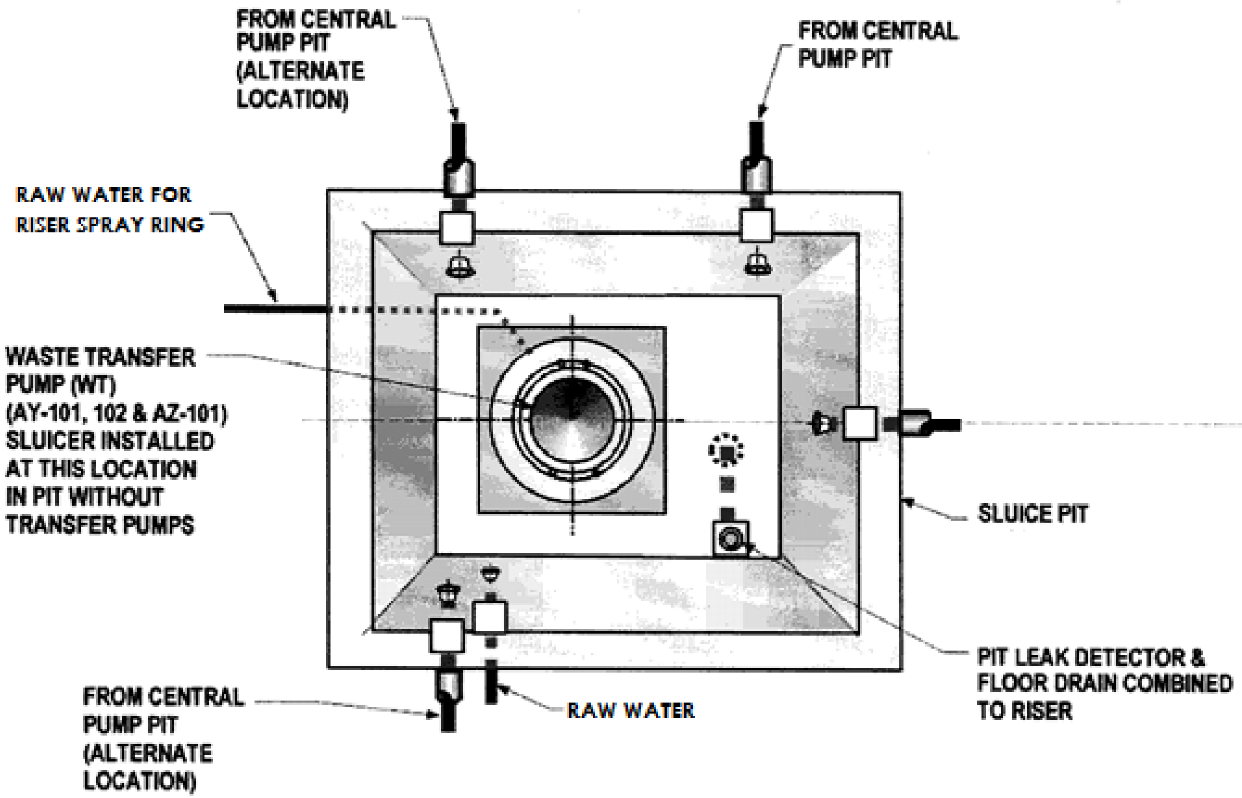


Figure C.29 Sluice Pit Three-Dimensional Plan View (241-AY/241-AZ Tank Farms)

C.5.5 241-SY Tank Farm

The 241-SY Tank Farm is located in the 200 West Area and consists of three tanks: 241-SY-101 through 241-SY-103. Each primary steel tank rests inside a secondary steel tank, supported by an insulating concrete pad on the floor of the secondary tank. The secondary steel tank surrounds the primary tank, forming an annular space between the primary and secondary tanks.

The three SY tanks essentially are identical in design. Tank 241-SY-102 has an additional riser for a supernate pump in the 241-SY-02E feed pit. Addendum A, "Part A Form," provides tank design and capacity information. Additional design information is contained in the integrity assessment reports for the DST System. Figures C.30 and C.31 show the configuration of 241-SY tank risers and pits located over the tanks.

C.5.5.1 Permanent Transfer Pipelines

Process pipelines in the 241-SY Tank Farm include lines designated for slurry or supernatant waste. Waste is transferred between the SY valve pits, pump pits, and other SY Tank Farm tanks in underground transfer pipelines. The permanent transfer lines are constructed of either carbon steel or stainless-steel piping.

The transfer line secondary containment system in the SY Tank Farm provides automatic drainage to a detection point within secondary containment pits or back to the primary tanks.

Two pipelines in the SY Tank Farm serve the 219-S tank system in the 222-S Facility. There is a siphon standpipe station at the low point in each of the lines to provide ability to drain waste from piping. Siphon standpipe stations provide secondary containment, leak detection, and a low-point sump pump for any collected waste leaks.

C.5.5.2 Valve Pits (241-SY-A and -B)

The 241-SY-A and 241-SY-B valve pits are connected by encased waste pipelines and have an encased floor drain that empties into the 241-SY-02D drain pit. Transfer lines SL-177, SL-180, SL-277, SN-280, SN-285, and SN-286 were removed and replaced with compliant transfer lines in SY-A pit. In addition, SL-180, SN-280, SN-278, and SN-279 transfer lines were removed and replaced with compliant transfer lines in SY-B pit. When in use, these pits are provided with a leak-detection system.

C.5.5.3 Central Pump Pits (241-SY-01A, -02A, and -03A)

The central pump pits provide safe and convenient space for installing a waste transfer pump and allow connections to the buried waste transfer piping entering the pit. The central pump pit is located over the top of the center of the tank. The top of the pit is above grade and the bottom slab of the pit rests on the top of the tank dome. Each central pump pit is connected with the valve pits by an encased pipeline that allows waste to be directed to other DSTs. Pumps are installed in the central pump pits when it is necessary to remove waste from a DST (Figure C.32).

The central pump pits are located near the center of each tank and contain three risers from the tank. The risers are located in the pit floor and are capped with an adaptor flange at or just above the pit floor unless pumps are installed on the risers. The adapter flange can receive a slurry distributor, airlift circulators, or a mixer pump. The largest riser serves as primary access for waste management activities such as waste mixing and slurry distribution.

C.5.5.4 Annulus Pump Pits (241-SY-01B, -02B, and -03B)

Annulus pump pits are designated as emergency use components and are located over a riser from the tank annulus area at the perimeter of the tank. Under normal conditions, a blank flange is installed over a riser. The 241-SY annulus pump pits, associated drains, and transfer lines have never been used for managing dangerous waste. If there were a need to pump accumulated liquid from the annulus, these annulus pump pits could serve as an access point to insert a pumping system.

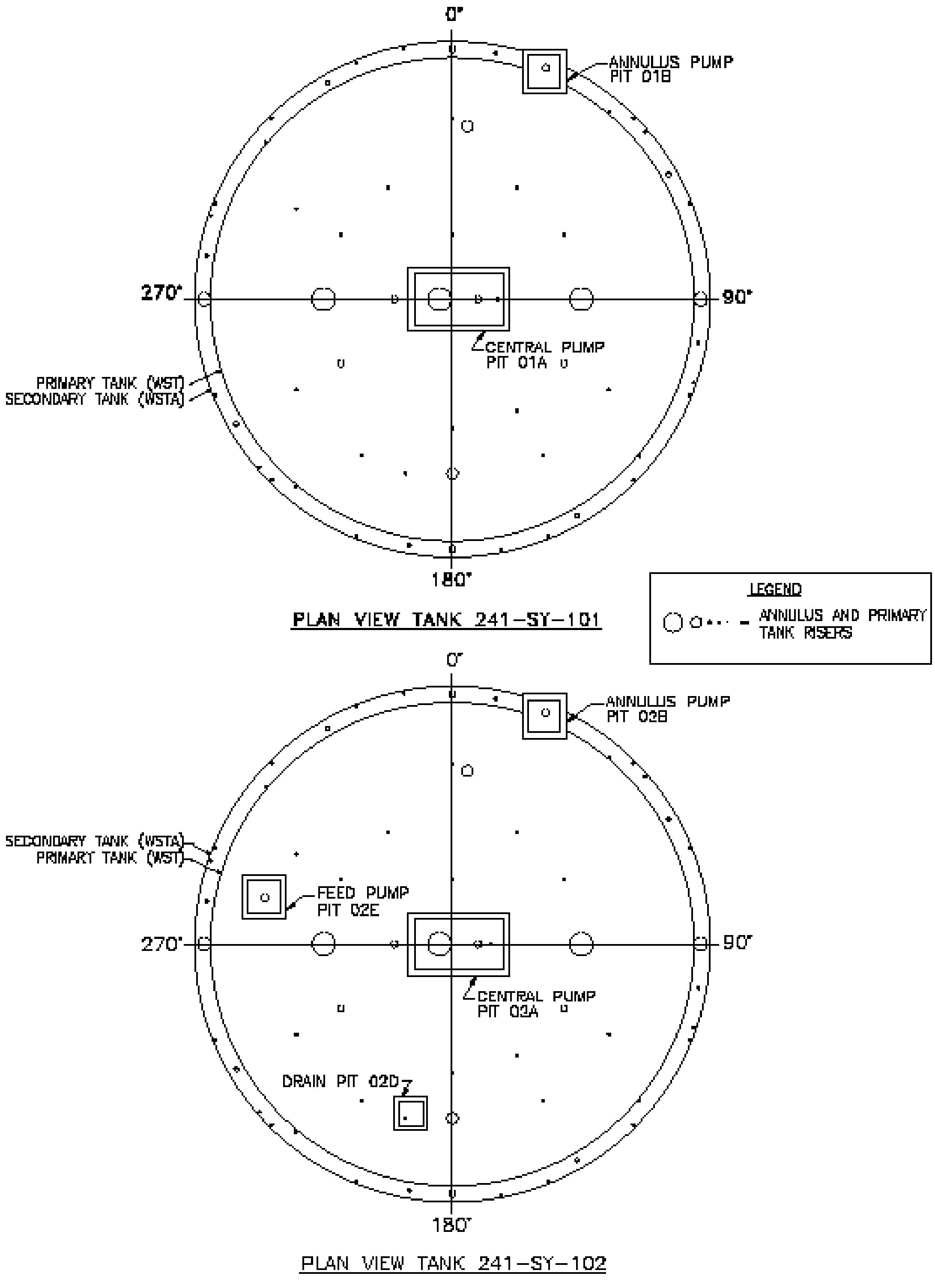


Figure C.30 Plan View Double-Shell Tanks 241-SY-101 and 241-SY-102

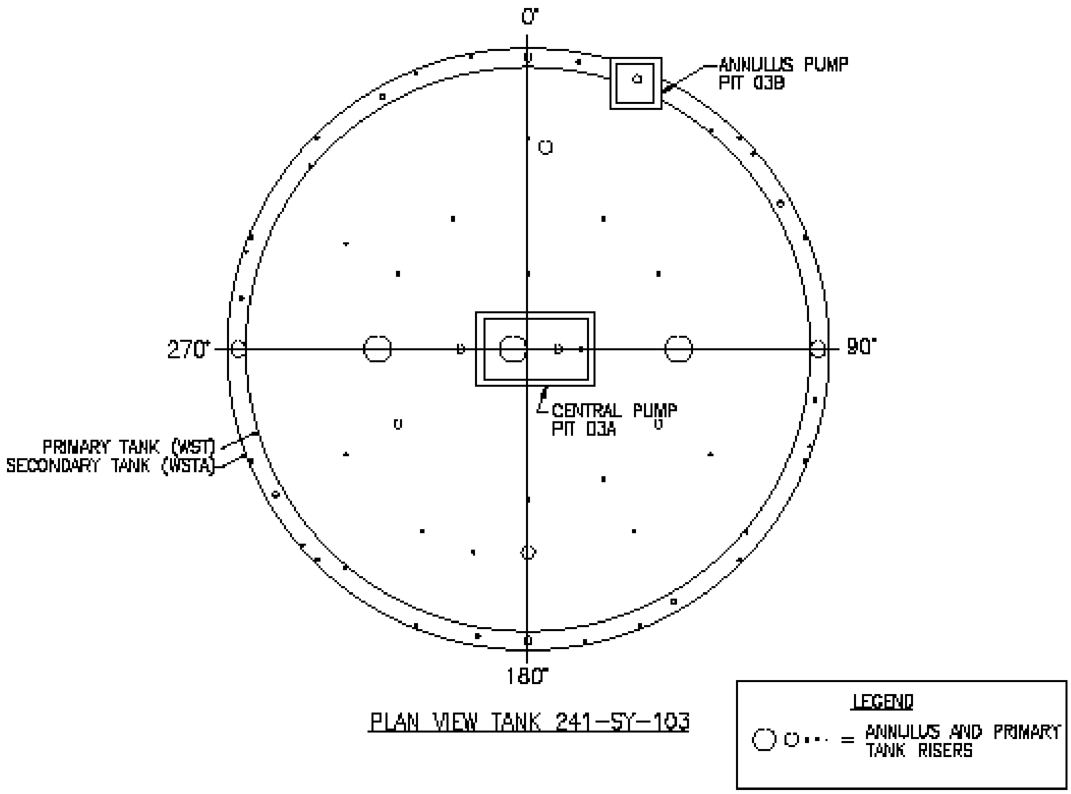


Figure C.31 Plan View Double-Shell Tank 241-SY-103

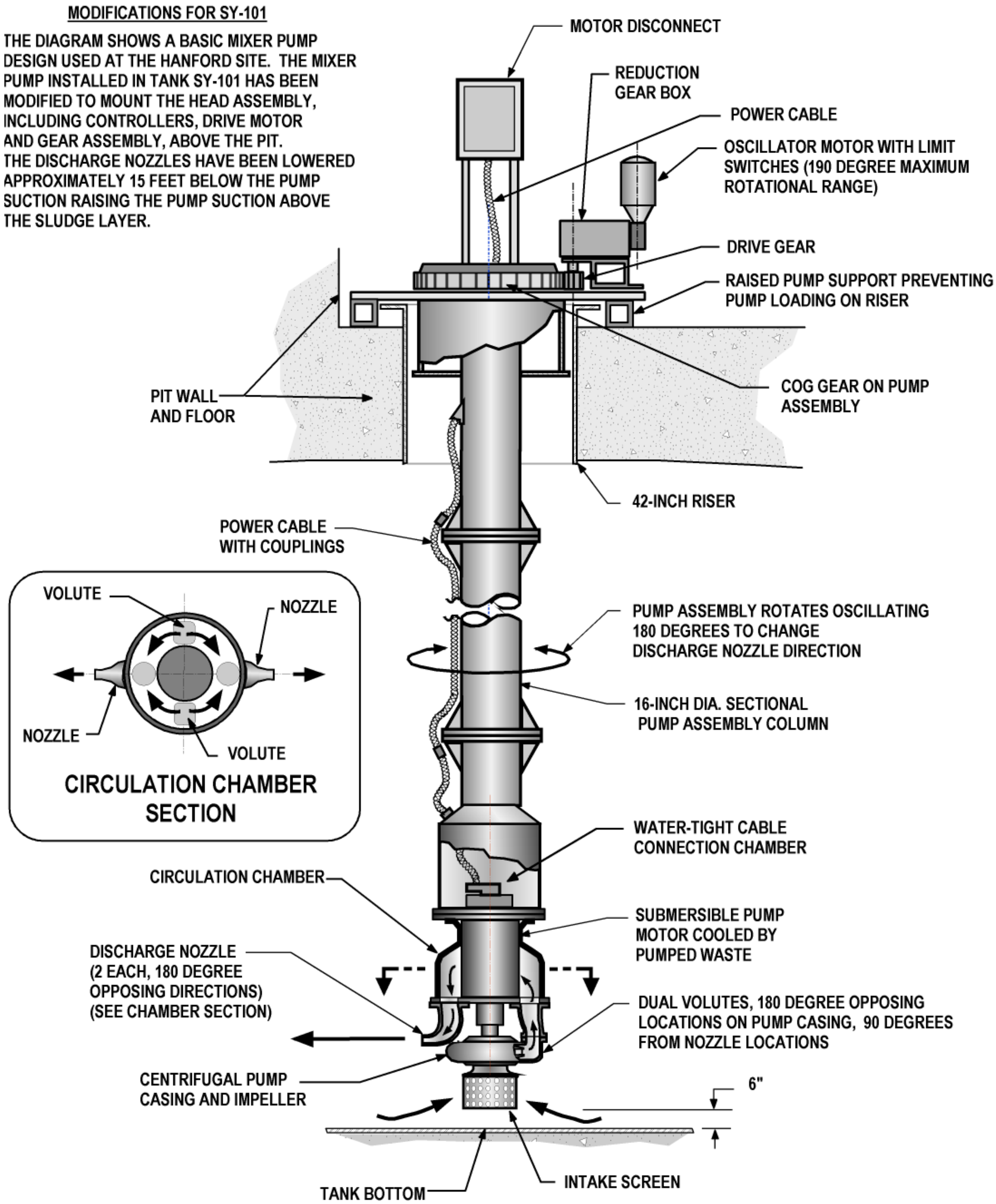


Figure C.32 Mixer Pump (Typical for Tank 241-SY-101)

C.5.5.5 Drain Pit (241-SY-02D)

The drain pit is located on Tank 241-SY-102 over a riser from the primary tank. The drain pit receives drainage from floor drains in valve pits 241-SY-A, and 241-SY–B. The pit walls contain pipe penetrations. Two are encased drain lines, and the third is from the valve pit floor drains. The encasement drains empty into the pit where leak detection is provided. The riser is equipped with a nozzle connection to accommodate jumper connections from the drain nozzles in the pit wall. The pit floor is sloped to a floor drain, which connects to the riser (connection embedded in the pit floor). When in use, these pits are provided with a leak-detection system. The floor drain has a lift-off cover that allows pit drainage and encasement drainage to collect and activate the pit leak detector.

C.5.5.6 Feed Pump Pit (241-SY-02E)

The 241-SY-02E feed pump pit is located on Tank 241-SY-102 over a riser. The pit wall has five pipe and conduit penetrations. The pit also has pit spray nozzles embedded in its walls to provide pit wash-down capabilities. Water spray rings are embedded in the pit floor slab. They encircle the riser for washing down any equipment removed from the riser. The pit floor is sloped to a floor drain that connects to the tank riser, just below the pit floor for drainage back into the primary tank. Another pipe with a nozzle located above the floor, also connecting to the riser below the pit floor, provides a bypass connection to allow the pump to discharge back to the primary tank. When in use, these pits are provided with a leak-detection system.

C.6 Management of Tank Systems

The operation and management of the DST System involves the implementation of controls, proper waste transfers, air monitoring, leak detection, and inspections to ensure that the DSTs and their ancillary equipment are being properly managed in accordance with WAC 173-303-640.

Tank System Inspections

Tank system inspections and instrument monitoring criteria and frequencies are provided in Table I.1 and Table I.2. Integrity assessments for the DST System are discussed in Addendum C and will continue over the life of the tank systems.

Security Equipment Inspections

Security equipment inspection criteria and frequencies are provided in Table I.1. The inspections include verifying required warning signs are posted and check the condition of security features described in Addendum E, Security.

Safety and Communication Equipment

Safety and communication equipment functional testing criteria and inspections are provided in Table I.3. The functional testing pertains to the telephones, 2-way portable radios, eyewash stations, and safety showers. The inspection criteria and frequency for spill response kits is provided in Table I.1. The safety and communication equipment locations are specified in Addendum J, Building Emergency Plan.

Storage of Ignitable or Reactive Wastes

Ignitable and reactive waste inspection criteria and frequencies are provided in Table I.1. Management of ignitable or reactive waste is discussed in Addendum C, Process Information.

C.6.1 Double-Shell Tank Activities

DST System activities include the following:

- Surveillance monitoring: leaks, security, hazards, abnormal events.
- Maintaining essential equipment.

- Facility modifications in support of the tank waste treatment and disposal mission.
- Decanting waste to optimize tank storage and for consolidating waste to feed to the 242-A Evaporator and other treatment facilities.
- Receipt and storage of miscellaneous waste streams from sumps, pits, etc., that have accumulated precipitation.
- Receipt of waste from SST retrievals, 222-S Laboratory, 242-A Evaporator, LAWPS, DFLAW, and WTP.
- Unloading of waste from trucks or containers.
- Performing DST waste corrosion optimization studies to quantify the parameters to minimize DST corrosion, while adding as few chemicals to the waste as possible.
- Developing and installing in-tank corrosion probes for DSTs with new or revised corrosion control limits.
- Conducting DST integrity assessments (e.g., ultrasonic and video examinations) and documenting results for use in subsequent inspections.
- Performing DST structural analysis and studies for thermal, operating, and seismic loads.
- Performing in-service leak testing which can be used to raise the maximum operating levels of DSTs.
- Conducting periodic testing, evaluation, and certification of DST ancillary equipment (e.g., waste transfer lines, valve pits, isolation valves, etc.).

C.6.1.1 Waste Inventory and Tracking

The Best-Basis Inventory (BBI) is the official database for tank waste inventory estimates. Estimates are based on the "best" available information to describe in-tank waste contents. This includes sample-based information (when available), process knowledge calculations, waste type templates based on sample data, and Hanford Defined Waste (HDW) Model estimates. The BBI process involves developing and maintaining waste tank inventories comprising 25 chemical and 46 radionuclide components for the DSTs. The BBI provides waste composition data for safety analyses, risk assessments, waste retrieval, waste treatment, and waste disposal. Inventories for other miscellaneous tanks may also be generated, as needed, to support customer needs.

Development and maintenance of the BBI is an ongoing effort. The tank waste inventories are updated because of new sample data, waste transfers into or out of tanks, and advances in process knowledge. The BBI is updated quarterly to reflect tank waste transfers in the previous quarter. Tank waste volumes and inventories are subtracted from the transfer tank and added to the receiver tank.

Sample data are not available for every constituent and for every tank. "Best available" information means process knowledge model estimates in these cases. Model-based results are the only available information for many of the standard radionuclide constituents. Model-based values for tank waste radionuclides are derived from fuel irradiation and plant process records. Inventory estimates are available for individual waste phases and for all the waste in a tank. For DSTs, separation into saltcake and sludge liquids and solids depends on the available data. Electronic reports containing BBI information are accessed through the Tank Waste Information Network System (TWINS).

C.6.1.2 Waste Transfers

Preparations for making a waste transfer include identifying the route the transfer will use, ensuring the needed transfer system components are available, and performing a waste compatibility assessment as described in Addendum B. A waste transfer procedure provides instructions for operation and monitoring of equipment for the purposes of DST waste volume management. Data sheets in the transfer procedure are used to document waste and flush volumes. Upon completion of a waste transfer, the transfer procedure and data sheets are placed in the DST System portion of the Operating Record.

C.6.1.3 Tank Integrity Program

The DST System implements controls and assessments that ensure integrity of the tank system is maintained throughout the mission life in accordance with WAC 173-303-640(3). These controls and assessments include the following.

Waste chemistry corrosion control. Waste chemistry corrosion control limits pitting corrosion and prevents cracking corrosion inside the DSTs by maintaining optimal pH and nitrite (NO_2-) concentrations. Waste chemistry corrosion control assessments are maintained in the DST System Operating Record.

In-tank corrosion monitoring. Collects corrosion data to refine and support the Waste Chemistry Corrosion Control program. Selected DSTs are currently fitted with corrosion monitoring systems and corrosion coupons. In-tank corrosion probes monitor the tank vapor space and waste corrosion potentials to confirm the results of laboratory predictions. The results of in-tank corrosion monitoring are maintained in the DST System Operating Record.

Ultrasonic assessment of primary tank walls. The data from the ultrasonic testing are integrated with other construction and operations data to evaluate the remaining life and integrity each component and tanks. The results of ultrasonic assessment of primary tank walls are maintained in the DST System Operating Record.

Visual examination of primary and annulus tanks. The tanks are visually examined (using remote video equipment) for conditions in both the interior of the primary tank and the annulus surfaces of the primary and secondary tanks. Video examinations cover all four quadrants, covering more than 95 percent of the annulus floor. Areas of interest are re-examined as warranted. The records of visual examinations of primary and annulus tanks are maintained in the DST System Operating Record.

Pipeline integrity assessments. The Transfer System Integrity program assesses the suitability of continued use of waste transfer pipelines. Records of pipeline integrity assessments are maintained in the DST System Operating Record.

Tank integrity assessments. In accordance with WAC 173-303-640(2) for each tank system, the owner or operator must determine that the tank system is fit for use. Records of tank integrity assessments are maintained in the DST System Operating Record.

Structural integrity assessments. Dome deflection surveys and dome load controls are implemented to protect the structural integrity of the DSTs. The DST structures have been analyzed for static and dynamic loads. RPP-RPT-28968, *Hanford Double-Shell Tank Thermal and Seismic Summary of Combined Thermal and Operating Loads*, documents the results of this analysis. (Note: RPP-RPT-28968 may be revised, as appropriate, to document changes to the system or evaluation. Such changes are not subject to the RCRA permit modification process.) Tank survey benchmarks are checked to ensure dome deflection remains within allowable tolerances. Dome load controls ensure live and dead loads remain within structural allowances. Records of structural integrity assessments are maintained in the DST System Operating Record.

Formal leak assessments. In the event of a suspected primary tank leak, a formal assessment is conducted [WAC 173-303-640(7)]. The formal leak assessment process is based on probabilistic analysis to assess the mathematical likelihood (probability) that a specific tank is leaking or has leaked.
The process can be used to assess unexplained waste level increases (possible water intrusion) or waste level decreases (possible waste leakage). Records of formal leak assessments are maintained in the DST System Operating Record.

C.6.1.4 Waste Transfer System Integrity

The condition of waste transfer pipelines is evaluated to ensure they are suitable for continued operation, in accordance with WAC 173-303-640(2). The key elements of the Pipeline Integrity program include:

- Fitness for service
- Cathodic protection
- Hydraulic leak testing
- Pneumatic leak testing.

Assessment of the waste transfer system integrity is performed in conjunction with the overall tank integrity assessments in accordance with the schedule for tank integrity assessments Addendum I, "Inspection Plan."

C.6.1.4.1 Fitness-for-Service

The Fitness-for-Service program is intended to prevent leaks and failures of the waste transfer system. This objective is achieved by collecting data to understand, analyze, and trend damage mechanisms. The waste transfer lines included in this program are comprised of the double-wall transfer piping, the jumper systems, hose-in-hose transfer lines, transfer pump discharge piping, and the portion of drop-legs above the tank risers. Direct measurement of the pipeline thickness isn't possible for the primary pipes in small diameter buried pipe-in-pipes, so other means of data collection are used to assess the integrity of pipelines and predict remaining service life, including the following.

Empirical erosion/corrosion rate determination. When high-use lines and jumpers are removed for repair or disposal, a decision is made whether representative specimens will be submitted for forensic analysis. Obtaining wall thickness measurements prior reinstallation or disposal of high-use jumpers is used to inform corrosion monitoring. Results of empirical erosion/corrosion rate determinations are maintained in the DST System Operating Record.

Pipeline forensic corrosion examination. For high-use lines and jumpers, a decision is made whether representative specimens will be submitted for forensic analysis for erosion/corrosion wall thinning/pitting when removed from service. Results of pipeline forensic corrosion examinations are maintained in the DST System Operating Record.

Encasement corrosion rate determination. Erosion/corrosion rates are derived from empirical measurements to determine the future corrosion allowance in preference to rates derived from testing using simulants. When empirical data are not available, the erosion/corrosion rate of a material is derived from testing with simulants under conditions that represent actual service conditions. Results of encasement corrosion rate determinations are maintained in the DST System Operating Record.

C.6.1.4.2 Cathodic Protection

The cathodic protection system uses rectifiers to flow direct current power through site soil onto the cathodically protected pipelines. The cathodically protected pipelines are also connected to buried sacrificial anodes that are intended to corrode instead of the protected pipelines. Cathodic protection has not been applied to post-1995 lines protected with the coating system (encasement pipe protected by a fusion bonded epoxy dielectric coating, polyurethane insulation, and fiber-reinforced plastic insulation jacket) except when the lines may be subject to stray current corrosion from nearby cathodically protected structures. DST System cathodic protection details are provided in Table C.2.

Inspection and testing of the cathodic protection system is performed according to Addendum I, "Inspection Plan." Testing of the cathodic protection system includes testing rectifiers, pulse generator checks, and electrical resistance sensor testing. Records of cathodic protection inspections and annual testing/calibration are maintained in the DST System Operating Record.

Table C.2 Double-Shell Tank System Transfer Line Cathodic Protection

Line	Farm	High Point	Low Point	Cathodically Protected?	Type of Protection
SL-161	AN	AN-B VP	AN-01A	Yes	Cathodic
SL-162	AN	AN-B VP	AN-O2A	Yes	Cathodic
SL-163	AN	AN-B VP	AN-03A	Yes	Cathodic
SL-165	AN	AN-A VP	AN-05A	Yes	Cathodic
SL-166	AN	AN-A VP	AN-06A	Yes	Cathodic
SL-167	AN	AN-A VP	AN-07A	Yes	Cathodic
SL-168	AN	AN-B VP	AN-A VP	Yes	Cathodic
SN-261	AN	AN-B VP	AN-01A	Yes	Cathodic
SN-262	AN	AN-B VP	AN-02A	Yes	Cathodic
SN-263	AN	AN-B VP	AN-03A	Yes	Cathodic
SN-264	AN	AN-A VP	AN-04A	Yes	Cathodic
SN-265	AN	AN-A VP	AN-05A	Yes	Cathodic
SN-266	AN	AN-A VP	AN-06A	Yes	Cathodic
SN-267	AN	AN-A VP	AN-07A	Yes	Cathodic
SN-268	AN	AN-B VP	AN-A VP	Yes	Cathodic
SN-630	AN	AZ-VP	AN-01A	No	Insulated
SN-636	AN/AP	AP-02D	AN-04A	No	Insulated
SL-509	AP	AW-B VP	AP-VP	Yes	Cathodic
SL-510	AP	AW-A VP	AP-VP	Yes	Cathodic
SL-511	AP	AP VP	AP-01A	Yes	Cathodic
SL-512	AP	AP VP	AP-02A	Yes	Cathodic
SL-513	AP	AP VP	AP-03A	Yes	Cathodic
SL-514	AP	AP VP	AP-04A	Yes	Cathodic
SL-515	AP	AP VP	AP-05A	Yes	Cathodic
SL-516	AP	AP VP	AP-06A	Yes	Cathodic
SL-517	AP	AP VP	AP-07A	Yes	Cathodic
SL-518	AP	AP VP	AP-08A	Yes	Cathodic
SN-609	AP	AW-02A	AP-VP	Yes	Cathodic
SN-610	AP	AW-02A	AP-VP	Yes	Cathodic
SN-611	AP	AP VP	AP-01A	Yes	Cathodic
SN-612	AP	AP VP	AP-02A	Yes	Cathodic
SN-613	AP	AP VP	AP-03A	Yes	Cathodic
SN-614	AP	AP VP	AP-04A	Yes	Cathodic
SN-615	AP	AP VP	AP-05A	Yes	Cathodic
SN-616	AP	AP VP	AP-06A	Yes	Cathodic
SN-617	AP	AP VP	AP-07A	Yes	Cathodic
SN-618	AP	AP VP	AP-08A	Yes	Cathodic

Table C.2 Double-Shell Tank System Transfer Line Cathodic Protection

Line	Farm	High Point	Low Point	Cathodically Protected?	Type of Protection
SN-622	AP	AP-02A	AP-02D	Yes	Cathodic
SN-637	AP	AP-06A	WTP	—	—
SN-700	AP	AP-02D	WTP	No	Insulated
SN-701	AP	AP-02D	WTP	No	Insulated
SL-162	AW	AW-B VP	AW-02A	Yes	Cathodic
SL-163	AW	AW-A VP	AW-03A	Yes	Cathodic
SL-164	AW	AW-B VP	AW-04A	Yes	Cathodic
SL-165	AW	AW-A VP	AW-05A	Yes	Cathodic
SL-166	AW	AW-B VP	AW-06A	Yes	Cathodic
SL-169	AW	AW-A VP	AW-B VP	Yes	Cathodic
SL-170	AW	242-A	AW-02A	Yes	Cathodic
SL-171	AW	242-A	AW-02A	Yes	Cathodic
SL-172	AW	AW-B VP	AW-02A	Yes	Cathodic
SN-261	AW	AW-A VP	AW-01A	Yes	Cathodic
SN-262	AW	AW-B VP	AW-02A	Yes	Cathodic
SN-263	AW	AW-A VP	AW-03A	Yes	Cathodic
SN-264	AW	AW-B VP	AW-04A	Yes	Cathodic
SN-265	AW	AW-A VP	AW-05A	Yes	Cathodic
SN-266	AW	AW-B VP	AW-06A	Yes	Cathodic
SN-267	AW	AW-A VP	AW-02A	Yes	Cathodic
SN-268	AW	AW-B VP	AW-02A	Yes	Cathodic
SN-271	AW	AW-A VP	AW-B VP	Yes	Cathodic
SN-272	AW	AW-02A	AW-02E	Yes	Cathodic
SN-274	AW	AW-B VP	AW-04A	Yes	Cathodic
SN-275	AW	242-A	AW-02E	Yes	Cathodic
DR-334	AW	242-A	AW-02D	Yes	Cathodic
DR-335	AW	242-A	AW-02D	Yes	Cathodic
DR-338	AW	242-A	DR-334	Yes	Cathodic
DR-339	AW	Capped	DR-343	No	—
DR-343	AW	242-A	AW-02D	Yes	Cathodic
SN-633	AY	AY-02A	AZ VP	No	Insulated
SN-635	AY	AY-02A	AY-01A	No	Insulated
SN-631	AZ	AZ-02A	AZ-01A	No	Insulated
SN-632	AZ	AZ-VP	AZ-01A	No	Insulated
SN-634	AZ	AP-02D	AZ-VP	No	Insulated
SN-637	AZ	Capped	AZ-VP	No	Insulated
SL-177	SY	SY-A VP	SY-02A	Yes	Cathodic

Table C.2 Double-Shell Tank System Transfer Line Cathodic Protection

Line	Farm	High Point	Low Point	Cathodically Protected?	Type of Protection
SL-180	SY	SY-A VP	SY-B VP	Yes	Cathodic
SN-277	SY	SY-A VP	SY-02A	Yes	Cathodic
SN-278	SY	SY-B VP	SY-01A	Yes	Cathodic
SN-279	SY	SY-B VP	SY-03A	Yes	Cathodic
SN-280	SY	SY-A VP	SY-B VP	Yes	Cathodic
SN-285	SY	SY-A VP	SY-02A	Yes	Cathodic
SN-286	SY	SY-B VP	SY-02A	Yes	Cathodic
SNL-5350 (1)	SY	SSS 5350	SY-01A	No	Non-metallic
SNL-5350 (2)	SY	219-S	SSS 5350	No	Non-metallic
SNL-5351 (1)	SY	SSS 5351	SY-03A	No	Non-metallic
SNL-5351 (2)	SY	219-S	SSS 5351	No	Non-metallic
SNL-3150 (1)	SY	6241-V	AN-01A	No	Insulated
SNL-3150 (2)	SY	6241-V	6241-A	No	Insulated
SNL-3150 (3)	SY	6241-A	SY-A VP	No	Insulated
SLL-3160 (1)	SY	6241-V	241-AN-104	No	Insulated
SLL-3160 (2)	SY	6241-V	6241-A	No	Insulated
SLL-3160 (3)	SY	6241-A	SY-B VP	No	Insulated

C.6.1.4.3 Hydraulic Leak Checks

Leak checks of mechanical connections are used to demonstrate a leak-tight seal in the primary piping whenever a new connection is made, during maintenance activities when an existing connection is disassembled and remade, or when a connection has been suspected of leaking.

Hydraulic leak checks are performed with a liquid, as described below, and the acceptance criterion for the leak check is zero visible leakage at the connection. There are three different methods for in-service hydraulic leak checks in the waste transfer system.

Method 1. Service water pressure is reduced through a control valve to the test pressure, with the set point varying from test to test. Slowly close a downstream valve to subject the connection to service/skid water pressure. The mechanical connections are visually examined, typically by remote cameras located near the connection(s) of interest. This is the most common in-service leak check.

Method 2. If no downstream valves can be used to isolate the flow (e.g., PUREX connector to interface a jumper with a tank drop-leg, or a PUREX connector to interface a jumper to a pump discharge nozzle), then the leak test of the connection is performed using the available dynamic pressure of the leak check route. The connection is visually examined, typically by remote cameras located near the connection(s) of interest.

Method 3. If leak testing a connection with water is not practical (e.g., service water is not available), then an in-service leak check may be performed at the beginning of the initial waste transfer through the connection. The connection is visually examined, typically by remote cameras located near the connection(s) of interest. This in-service leak check practice is rarely used.

Results of hydraulic leak checks are maintained in the DST System Operating Record.

C.6.1.4.4 Pneumatic Leak Checks

Pneumatic pressure tests are performed on the encasement of existing transfer lines, excluding HIHTLs, to verify that the pressure boundary of the encasement has not been compromised. In cases where the primary line is vented to the tank dome, the pressure test also validates the primary line pressure boundary. All buried pipeline encasements included in the Fitness-for-Service program are pneumatically tested before first use to verify the integrity of the encasement. The encasements are tested once every ten years thereafter or before next use, whichever duration is longer. Results of pneumatic leak checks are maintained in the DST System Operating Record.

Pneumatic testing of the encasement complies with the test requirement specified by the IQRPE in RPP-17266, *Plan for Development of the DST Integrity Assessment Report*. Pneumatic encasement testing is conducted for all transfer lines in the Fitness-for-Service scope excluding HIHTLs and is re-tested on a 10-year schedule or prior to next use, whichever is greater. The schedule for pneumatic encasement testing is tracked on engineering drawing H-14-107347, Sheet 1. Pneumatic encasement test of metallic lines is also performed when the encasement is discovered to contain standing water after the standing water has been removed and the pipe dried.

C.6.1.5 Pit Coating Inspections

Protective coatings are used to prevent damage to the concrete pit structures should a leak event occur. Waste materials have the potential to degrade the concrete matrix. Sound engineering and requirements for double encasements of hazardous waste dictates that a barrier be used to prevent damage. The visual inspection of secondary containment protective coatings is performed by a certified inspector, as specified in Addendum I, “Inspection Plan.” When a certified inspector is not available to access the secondary containment protective coatings for direct visual examination of the secondary containment protective coating, an alternate method utilizing a QA inspector will take photographs of the special protective coating for examination by a certified inspector.

Coating inspections can be either a full inspection or partial inspection. Partial inspections are performed for specific areas (e.g., to look for damage due to jumper change, during removal of equipment, scaffolding installation, or removal). Portable components and objects such as floor mats, scaffolding, debris, shielding, leak detectors, temperature monitoring equipment are removed from the specific area being inspected for both full and partial inspections. Performing a partial coating inspection does not reset the schedule for conducting full inspections. Inspection intervals for full pit liner and coating inspections are established based upon the type of coating materials used. The frequency of coating inspections is specified in Addendum I.

Procedures describing the inspection and repair of pit coatings are outlined in TO-040-050, *Performance Inspections of Pit Coatings*. By reference, inspection tasks included in this report refer to WAC-173-303-640. Additional inspection documentation is described in Hanford Site Forms, Pit Protective Coating Inspection (A-6006-537) and Pit Protective Coating Engineering Review (A-6006-538). All pit surfaces are required to be cleaned such that an appropriate visual inspection can be conducted. Given the radiological hazards associated with these areas, inspection is normally planned to occur in conjunction with other activities in the same location.

C.6.1.6 Dome Loading

RPP-RPT-25608, *Hanford Double-Shell Tank Thermal and Seismic Project – Increased Concentrated Load Analysis*, concluded the DSTs can withstand concentrated loads that may be greater than can be practically applied.

C.6.1.7 Integrity Assessment

The DST System is an existing tank system that is subject to periodic integrity assessments that are overseen by an IQRPE [WAC 173-303-640(2)(a) and (d)]. An IQRPE also performs assessments of new components and major repairs in accordance with WAC 173-303-640(3). The initial integrity assessment of the DST System was completed in 2006 (RPP-28538, *IQRPE Double-Shell Tank Integrity Assessment Report*, HFFACO Milestone M-48-14). A subsequent tank integrity assessment was completed in 2016 (RPP-RPT-58441, *Double-Shell Tank System Integrity Assessment Report*). Integrity assessment documentation, including the schedule for future assessments, is maintained in the DST System Operating Record.

C.6.2 Response to Leaks or Spills and Disposition of Leaking or Unfit-for-Use Tank System

If a leak from tank system or secondary containment system is discovered, the system will be removed from service. Operations would cease, including waste additions into the tank system and inspections of the system would commence to determine the cause of the leak.

Immediate response to releases to the environment would include containment to prevent further migration of the leak or spill to soils or surface water. An investigation would commence to determine how to remove and dispose of any contamination of the environment.

If a spill or leak occurs from ancillary equipment, the spilled waste would be removed from secondary containment within 24 hours or as timely as possible to prevent harm to human health or the environment.

If accumulated liquids are discovered in a DST annulus and determined to be water (e.g., precipitation, water intrusion), a plan would be developed to remove the water in a timely fashion as possible to prevent overfilling the secondary containment system. The annular space in the DSTs do not have a permanently installed pumping system installed, therefore it is not possible to remove accumulated liquid within 24 hours. There are multiple methods for removing water from the annular space, including pumping or evaporation using a ventilation system.

If accumulated liquid is determined to be leakage from the primary tank, a plan for removal will be developed. Removal and recovery of the highly radioactive waste from a leaking or unfit-for-use DST requires extensive work planning, engineering, procurement, training, and environmental permits. The series of work activities would be planned and executed following development of a series of evaluations, which lead to documents that may include, for example, a tank waste retrieval work plan, environmental permitting plan, documented safety analysis, and others. This series of documents provides practical work evolutions and controls that ensure the proper type of equipment is installed and the tank waste is removed using safe, efficient, compliant work practices on a documented schedule, which demonstrates practicability.

Following removal of the waste, the owner/operator would follow a written plan to inspect the tank and secondary containment to determine if the tank is amenable for repair. If the tank is not amenable for repair, the tank will be closed.

C.6.3 Certification of Major Repairs

In accordance with WAC 173-303-640(7)(f), if repairs made to the tank system are extensive (e.g., installation of an internal liner, repair of a ruptured primary containment or secondary containment vessel), the repair is inspected by an IQRPE before the tank system is returned to service.

Tank system repairs that are considered minor and that do not require IQRPE inspection involve maintenance of structures and components that are subject to wear, and repairs that do not alter the function or design. Examples of minor repairs include repairs to pit coatings that do not require complete removal and installation of a new liner; replacement of valves and pumps or replacing a section of pipe that is showing signs of wall thinning. Repaired components are subject to tightness testing before they are returned to service [WAC 173-303-640(7)(f)].

C.6.4 Tank Treatment

Within the DST System, waste treatment occurs in the DSTs, but waste treatment does not occur in Catch Tanks 241-AZ-301 or 204-AR-TK-1. Specific treatment processes that are performed in the DSTs include pH adjustment and chemical additions.

- pH adjustment is the primary method of treatment for DST contents. Examples of bases that could be used as pH adjusting agents include sodium hydroxide, calcium hydroxide, and calcium carbonate. Examples of acids that could be used as pH adjusting agents include hydrochloric acid, oxalic acid, and sulfuric acid. This treatment is used to make DST waste more amenable for storage. The desirable pH for corrosion prevention in the DSTs is pH 12, and this can change based on changes to the waste as it ages and new data about the waste becomes available. Other factors that influence desirable pH include temperature of the waste, the concentration of corrosion promoting ions, and the concentration of corrosion inhibiting ions.
- Addition of corrosion-control chemicals is also used to make the waste more amenable for storage in the DST System. Typically, sodium nitrite and/or sodium hydroxide are added for corrosion protection. Waste additions and periodic evaluations of changes in tank chemistry can indicate corrosion-control chemical additions are needed to bring the waste into desirable ranges.

Waste from DSTs is used as a substitute for clean water to sluice and mobilize waste in tanks during waste retrieval activities. This waste-minimization technique avoids generating additional volumes of mixed waste. The sluiced waste is returned to the DST System, forming a closed-loop system.

Waste treatment occurs in the DST System, as described in Addendum B, “Waste Analysis Plan.” The pH of the waste is adjusted using caustic solutions as required to maintain the desirable high pH environment to minimize corrosion to carbon steel. Caustic additions usually require addition of large volume of high-strength sodium hydroxide delivered in commercial tanker trucks. Other corrosion-control agents that may be added to the tanks using tanker shipments are sodium nitrate or sodium nitrite.

Water may be added to change the viscosity of some wastes to prevent buildup of trapped gases that are produced through radiolysis. Some changes to the waste occur, which is incidental to the process of consolidating waste for centralized storage and treatment; however, wastes are not deliberately treated to meet applicable land disposal restriction standards in the DST System.

C.6.5 Waste Transfers

Waste transfers are an operational function of the DST System. Waste transfers into the DST System are subject to the waste analysis process as described in Addendum B, “Waste Analysis Plan.”
Waste transfers from the DST System to a downstream treatment unit are subject to the waste analysis requirements of the receiving facility. The DST transfers include but are not limited to the following:

- DST to 242-A Evaporator waste transfers.
- DST to DST waste transfers.
- DST supernate transfers for SST retrieval.
- SST to DST waste transfers.
- 222-S Laboratory to DSTs waste transfers.
- 242-A to DST slurry, process condensate, feed returns, and flush water transfers.
- Providing feed, receiving returns, waste residues, and flush water from LAWPS.

- Pumping inactive tanks to remove intrusion water.

Waste or water from condensation, intrusion, or non-destructive testing of the tank system may also be transferred from a DST annulus to a DST. In addition, waste might need to be transferred out of a waste transfer-associated structure (e.g., a valve box or pit).

Tank wastes are maintained at a relatively high pH based on corrosion control considerations and caustic may be added to waste transferred from the 222-S Laboratory. Therefore, the transfers described above will meet compatibility requirements.

Before transferring waste, Tank Farm Operations performs several activities to ensure the waste transfer will not pose a threat to human health or the environment. These activities include, but are not limited to the following:

- Evaluation of transfer system status and configuration
  - Use the Routing Board (drawing H-14-107346, *DST Waste Transfer Piping Diagram*) to ensure a safe and compliant waste transfer will occur and to identify flow path for the transfer and identify isolation boundaries.
  - Check equipment condition (maintenance/calibrations) to verify the ability to support the transfer.
  - Conduct assessment of needed procedures and plans.
  - Conduct assessment of needed staff training and qualifications.
- Evaluation of waste acceptance/compatibility
  - Refer to the Waste Analysis Plan and waste compatibility assessment.
  - Establishing the transfer route (operating actions).
  - Establish jumper and valve alignments.
  - Establish post-transfer flush and drain requirements.
  - Leak test the transfer route (typical).
- Waste transfer
  - Remove administrative locks for waste transfer pump.
  - Monitor the transfer and connected systems (multiple systems, but the RCRA-compliant system of record is the pit leak detectors).
  - Flush and drain the transfer route.
  - Document material balance calculations.

In addition to the above, relatively small volume transfers of potentially contaminated water are routinely made to the DSTs (e.g., flush water following transfers, flush water for tank equipment removal and contamination reduction, intrusion water in leak-detection pits/radiation detection drywells). Another such transfer involves the water that accumulates in the non-potable water or greywater tank in the decontamination unit and safety shower trailers.

When aqueous waste is transferred using tankers, the waste is pumped through an inline filter to remove radioactive solids that can settle out during transport. Filtration to remove radioactive solids does not make the waste non-dangerous, less dangerous, safer for transport, amenable for energy or material resource recovery, amenable for storage, or reduced in volume. Filtration to remove radioactive solids is not a RCRA treatment process (WAC 173-303-040). Disposable inline filters are managed as newly generated waste. The wastes treated by filtration include intrusion water or other aqueous waste that is a mixed waste. Section C.6.12.4 discusses tanker loading operations.

C.6.6 Management of Ignitable, Reactive, or Incompatible Wastes

Although ignitable or reactive waste might be received in the DST System, such waste is mixed with water or dilute solutions to deactivate the ignitable or reactive characteristics prior to storage in a DST, meeting the requirements of WAC 173-303-640(9). The methods for ensuring deactivation have been complete are prescribed in the waste transfer procedure.

Mixing of incompatible waste in the DST System is prevented through the waste compatibility assessment program that is applied to all wastes added to any DST as well as wastes transferred from one DST to another, meeting the requirements of WAC 173-303-640(10). This process is described in Addendum B, "Waste Analysis Plan."

C.6.7 Double-Shell Tank Marking and/or Labeling

The DST System tanks, and ancillary equipment are located underground, below grade, or in a vault. The tanks are inaccessible to any persons who are not informed of the hazards associated with the high-level mixed waste stored in the tanks. Marking or labeling the tanks in accordance with WAC 173-303-806(4)(c)(xi) is impractical because the markings would not be visible. The Permittees comply with and maintain the security measures, equipment, and warning signs specified in Addendum E, "Security," and by the requirements in WAC 173-303-310 incorporated by reference. The DST tanks are buried and completely below grade; therefore, the intent of WAC -173-303-640(5)(d) is met by complying with WAC 173-303-310.

C.6.8 Air Emissions

This section addresses the Air Emission Standards under WAC 173-303-690 and 40 CFR 264 Subpart AA, WAC 173-303-691 and 40 CFR 264 Subpart BB, and WAC 173-303-692 and 40 CFR 264 Subpart CC. The DST System also has ventilation systems on the tanks for non-RCRA purposes that are permitted through the Air Operating Permit.

C.6.8.1 Applicability of WAC 173-303-690 Subpart AA Standards for Process Vents

The air emission standards for process vents, found in WAC 173-303-690 and 40 CFR 264, Subpart AA apply to process vents associated with distillation, fractionation, thin-film evaporation, solvent extraction, or air or steam stripping operations that managed hazardous waste with total organic carbon concentrations of at least 10 ppm by weight. The requirements of WAC 173 303-690 (Subpart AA) are not applicable if the DST System does not use any process vents that perform distillation, fractionation, thin-film evaporation, solvent extraction, or air or steam stripping operations [WAC 173-303-690(1)(b)].

C.6.8.2 Applicability of WAC 173-303-691 Subpart BB Standards for Equipment Leaks

The air emission standards for equipment leaks, found in WAC 173-303-691 and 40 CFR 264, Subpart BB, apply to equipment that contains or contacts hazardous wastes with organic concentrations of at least 10 percent by weight. The requirements of WAC 173-303-691 (Subpart BB) are not applicable as long as aqueous waste with 10 percent or greater organic concentration is not accepted for treatment or storage in the DST System.

C.6.8.3 Applicability of WAC 173-303-692 Subpart CC Standards for Tanks

The air emission standards for tanks, surface impoundments, and containers, found in WAC 173-303-692 and 40 CFR 264, Subpart CC apply to units that manage wastes with average volatile organic concentrations equal to or exceeding 500 ppm by weight, based on the dangerous waste composition at the point of origination [40 CFR 264.1082(c)(1)]. Pursuant to WAC 173-303-692(1)(a)(vi) and

40 CFR 264.1080(b)(6), the Subpart CC standards do not apply to waste management units used solely for the management of radioactive mixed waste in accordance with all applicable regulations under the authority of the Atomic Energy Act and the *Nuclear Waste Policy Act of 1982*. The requirements of WAC 173-303-692 (Subpart CC) are not applicable if the DWMUs are used solely for management of radioactive mixed waste in accordance with all applicable regulations under the authority of the Atomic Energy Act and the Nuclear Waste Policy Act and are therefore exempt [WAC 173-303-692(1)(b)(vi)].

C.6.9 Ventilation

This section describes the ventilation systems associated with the primary tanks and tank annular space. Information on the ventilation systems is provided for informational purposes only since the ventilation systems are not "ancillary equipment" used to distribute, meter, or control the flow of dangerous waste (WAC 173-303-040). This information is provided for completeness and to demonstrate acceptable knowledge of the condensate waste stream that may or may not be returned to the tanks upon generation. The 241-AN, 241-AP, 241-AW, and 241-SY Tank Farms have a primary tank ventilation system and separate annulus ventilation system, each with a manifold that serves all tanks within each farm. The 241-AY and 241-AZ Tank Farms are adjacent and share primary and annulus ventilation systems. More detail on the design and operation of the exhausters is contained in the Hanford Air Operating Permit, 00-05-006, Renewal 2, Revision B, issued by Ecology.

C.6.9.1 Primary Tank Ventilation

The DST System is designed to prevent the buildup of gases in the tanks to comply with Atomic Energy Act safety requirements. The primary function of the DST primary tank ventilation systems is to provide sufficient tank headspace ventilation to control the release of radionuclides and prevent the buildup of gasses in the tank headspace that may be produced through radiolysis. Air enters the tank headspace through an inlet filter and is then drawn out through a filtered exhaust system. The system is operated to maintain the primary tank headspace at a slight pressure negative with respect to atmospheric pressure. Negative pressure within the tank headspace maintains a controlled, continuous airflow pattern from the environment into the tank, then out through the high-efficiency particulate air (HEPA)-filtered exhaust system. If the internal tank pressure were allowed to become positive, contaminated vapor might escape the tank and be released uncontrolled into the outside environment. Radioactive particulates are removed from the exhausted air stream to meet the emission standards.

C.6.9.2 Double-Shell Tank Annulus Ventilation

Moisture can accumulate in the DST annulus from condensation and from water intrusion. Water is deliberately added to the DST annulus during non-destructive testing of the primary tank walls and is removed by operating the annulus ventilation system. Use of a ventilation system accelerates the rate of evaporation by providing outside air to the annulus, which usually has a lower relative humidity. The annulus ventilation system is operated in a manner that minimizes corrosion in the annular space.

When it is operated, the annulus ventilation systems draw outside air into an air inlet. The inlet air is distributed to a central air-distribution chamber below the primary tank. The air flows from the distribution chamber through the air-distribution grid to the annulus. Exhausted air then is drawn out of the annulus through underground ducts. The ducts merge to form a common header from each tank within a farm. The underground headers merge into a single header that is routed to above grade.

C.6.9.3 Condensate Management

Operation of the ventilation systems generates a condensate waste stream. Moisture in the tank headspace and entrained in the exhaust air stream must be removed to protect downstream components in the ventilation system. Moisture on the HEPA filters can cause degradation of the filter media. Moisture that condenses on cooler surfaces inside the ventilation system also must be removed. Removal of this moisture limits the amount of moisture that collects on the filters and protects the filters from premature failure, thus increasing the reliability of the filters to perform their function.

A condensate collection system routes condensate through collection and gravity draining in a network of drain lines to seal pots, and eventually back to a tank, forming a closed-loop system. The seal pots provide a drain path to return condensate to a DST, allow drainage while sealing this path to prevent air from escaping.

In the 241-AY and 241-AZ Tank Farms, condensate is usually collected and removed rather than returned to a DST to conserve tank space. In these cases, the condensate is a waste stream produced from operation of the air emission control equipment. Uncontained gasses are not a solid waste under RCRA, so the condensate derived from managing a non-solid waste cannot carry any listed waste codes, and does not designate as a characteristic or state-only dangerous waste. Condensate generated upstream of the HEPA filters and is usually contaminated with radioactive material, so it is managed at an appropriate onsite facility. Condensate is a non-dangerous waste but is included to provide information on a waste stream that is added to some DSTs.

C.6.10 Leak Detection

The DST System provides leak detection meeting the requirements of WAC 173-303-640(4)(c)(iii) for tanks, piping, and structures that provide secondary containment for pumps, valves, and other tank system components. Due to the inaccessibility of this equipment, the leak-detection systems are remotely monitored. Addendum I, “Inspection Plan,” provides for inspections of leak-detection systems.

C.6.10.1 Leak Detection Primary and Secondary Containment Structures

The DST Waste Storage System provides three types of leak detection:

- Primary tank leakage: liquid monitoring in annulus
- Primary tank leakage: primary tank waste level measurement
- Pit leak detection: conductivity probes located near the pit floors.

If liquid level monitoring data indicates there is an unexpected change in level, it is evaluated to see if it is statistically significant or of sufficient magnitude to indicate a leak. Liquid level measurements are subject to error and outside influences including atmospheric conditions, evaporation, and waste buildup on displacer weights. If the level change cannot be explained, a formal leak assessment (Section C.6.1.3) is conducted to determine if the primary tank has leaked.

In addition to installed leak-detection equipment, administrative and operational measures are used to detect potential leaks during waste transfers. These controls include radiation monitoring and maintaining material balances, the use of in-pit video cameras, or visual observation.

C.6.10.2 Primary Tank Leak Detection – Level Monitoring in Annulus

The primary tank leak detection for the DST System consists of three equally spaced level monitors installed in the annulus that are designed to detect the presence of liquid in the annulus. The level monitor gauges are monitored by a computer monitoring system. The level gauge measurement principle used by the level monitors is based on the detection of variations in the weight of a displacer suspended in the annulus or process fluid. The displacer is connected to a wire wound on a precision measuring drum. The measuring drum and associated electronics are mounted on a tank riser. A level change causes a change in the weight of the displacer, which is detected by a force transducer. When used as a leak detector, the displacer is suspended 0.25 inches (± engineering tolerances) from the annulus floor, causing the displacer weight to decrease to its specified interface set-point weight. The depth the liquid reaches at this point is referred to as the “immersion depth.” The immersion depth is set at 0.15-inch (± engineering tolerances) from the annulus. When liquid reaches this level, the level monitor gauge reports a change in liquid level and a leak is detected. Response to a confirmed leak detected in a DST annulus is conducted according to Addendum I, "Inspection Plan."

C.6.10.3 Primary Tank Leak Detection – Waste Level Monitoring

The waste level monitor is the primary level measuring device. The monitor can measure distances to 0.1 inch and is used for maintaining strict accountability of the waste. Each tank in the DSTs has one level monitor. The waste level monitor measures the liquid level in the tank, a computer monitoring system polled by computer monitoring system as suitable for the storage conditions. The level monitor sends a digital signal to a communications interface unit, which sends the signal to the computer system for data storage and processing. Waste level readings are compared to previous readings; trending the waste level readings can indicate a leak from the primary tank.

C.6.10.4 Secondary Containment Structure Leak Detection – Pit Leak Detection

Pit leak detectors are the conductivity probe type. Several variations of pit leak detectors may be used, and periodically they are modified and changed in the pits. With exception of the valve pits and central pump pits, the current style in use at the DSTs is a combination leak detector and floor drain assembly that uses a spring-loaded check valve requiring liquid accumulation to a detectable depth before draining occurs. The floor drain is a removable assembly that includes a check valve and a conductivity leak detector probe. The check valve holds any spills or leaks so they will be detected by the conductivity probe, resulting in a leak-detection alarm. A lifting bale is attached to the assembly body to allow it to be manually removed or replaced. The check valve prevents backflow from the riser into the pit. The floor drain assembly nozzle drops into an embedded fitting that is part of the drainpipe. If either the check valve or the leak-detection probe needs maintenance, the assembly can be removed by simply lifting the unit out after the probe electrical connection is unplugged.

The central pump pit and valve pit structures contain a leak detector that is suspended from the cover block and is wired to a leak detection and power supervisor circuit, which is connected to the computer monitoring system. Other pit leak detectors are freestanding. They include an assembly to support the probes and adjustable legs to set the probe height above the floor. When a leak or circuit failure is detected, the local leak-detection station strobe annunciates and the computer monitoring system annunciates a graphic alarm and a text alarm. Pump shutdown is accomplished in response to the local strobe or computer monitoring system annunciation. The suspended leak detector probe height is typically set to within 0.25 inch of the pit floor. The pits provide containment and detection for leaks in the structures. If the leak occurs in the buried portion of a transfer line, the encasement piping provides containment as the liquid drains into a pit to prevent leakage to the environment. Transfer pipes are sloped, generally toward the receiving tank. The transfer line encasement drain valves are verified to be open during transfers so that leakage in the encasement will drain to the pit and cause a leak detector alarm.

Prior to a waste transfer, pit leak detectors are checked to ensure they are calibrated and functioning properly. If a pit leak detector is not available, a video camera can be installed to provide the ability to inspect visually the pit for spills or leaks. Pits are monitored for leaks when in use accordance with Addendum I, "Inspection Plan."

C.6.10.5 Routing Board

Hanford drawing H-14-107346, *DST Waste Transfer Piping Diagram*, comprises the Routing Board. The Routing Board is an engineering drawing that portrays the DST waste transfer components that are RCRA-compliant and those that are awaiting closure.

The Routing Board drawing is maintained to reflect changes to system status. The Routing Board is displayed behind a controlled-access enclosure in 274-AW to provide a visual depiction of transfer system piping configuration. The Routing Board is used to identify the components in the DST waste transfer system, including DSTs, transfer piping, valves, pumps, pits, encasements, and transfer structure leak-detection systems. The interface boundaries with facilities that have physically connected transfer lines are also identified on the Routing Board. The Routing Board also depicts the isolation points for components that are no longer fit for use.

The Routing Board provides unique color and line-style format to show the DST waste transfer system components and interface boundary with other connected Unit Groups. The Routing Board supports safe and reliable DST System operations and tank waste retrieval, staging, and delivery efforts, including waste feed delivery to downstream treatment facilities. An electronic version of the Routing Board is intended to replace the paper version and would be more widely accessible.

C.6.11 Waste Transfer Process

Before transferring waste, the TOC performs several activities including:

- Verify sufficient space is available in the receiving tank for the waste volume and flush water
- Verify waste compatibility through a waste compatibility assessment as described in Addendum B, "Waste Analysis Plan."
- Verify waste is acceptable for transfers coming into the DST System through the waste profiling process described in Addendum B, "Waste Analysis Plan."
- Verify operability of equipment.

A baseline material balance is developed before the transfer for both the sending and receiving storage tanks. The material balance is reviewed periodically during the transfer to provide early leak detection and avoid filling tanks above safe levels. After the transfer is complete, transfer lines are flushed with water, if required, and a final material balance is recorded for both tanks.

Pre-established routes are used to transfer liquid waste safely from one location to another in response to processing requirements, changing tank storage needs, or tank leaks. The Routing Board is used to establish a compliant waste transfer route. Typical waste transfer operations for transfer through underground transfer lines and HIHTLs are discussed below. Where distinguishing additional operations for the slurry transfer line is necessary, the key operations have been noted.

C.6.11.1 Initial Configuration (Prestart)

Prestart conditions are verified before a waste transfer is begun using the following procedures:

- Verify the proper valve alignment for the waste transfer route through compliant components.
- Verify leak-detector functionality–set up video cameras where leak detectors are unavailable.
- Verify that the electrical distribution and instrument air support systems are operable.

C.6.11.2 Waste Transfer Operations

Under normal operations, waste transfers are monitored using a totalizing flow meter or by monitoring tank levels to prevent overtopping. When the desired volume is reached, pumping is stopped, and the piping is allowed to drain before the transfer lines are flushed.

For cross-site transfers using the Cross-Site Transfer Line, the lines are vented at the vent station to allow air to enter the line during the drain cycle to allow complete liquid drainage to occur.

The transfer system is monitored for leaks via the TFMCS human-machine interface units, which are installed at various locations. This system monitors the leak-detection system along the entire transfer route and annunciates in the event liquid is detected in secondary containment, alerting operations of a potential leak. If the pre-established conditions for shutdown of the transfer are met, then the transfer is ceased. After shutting down the transfer, the system is evaluated to determine the cause of the alarm and restore the system to working order.

The TFMCS can provide information on the following types of equipment or systems:

- Alarm status
- Continuous air monitor status (ventilation, stack, annulus)
- Leak detectors (pit and tank annulus
- Motor control center status
- Pit and encasement temperature monitoring
- Programmable logic controller status
- Pump status
- Tank parameters (pressure, level, temperatures)
- Ventilation status (primary and annulus).

C.6.11.3 Tanker Truck Loading and Unloading

Containerized wastes are occasionally transferred to a DST via a riser. This waste may be transferred to a DST riser from a tanker truck or other containers (e.g., a drum) through an over-ground temporary transfer line using a hose-in-sleeve method with secondary containment, leak detection, and removal of waste from secondary containment to meet WAC 173-303-395(4). Containerized wastes offloaded to a DST in this manner usually consist of intrusion water removed from SST System catch tanks and other inactive structures with minor amounts of contamination.

Secondary containment is designed with a drip pan under the pump skid capable of containing the full volume of the hose transfer line and the pump skid. A catch container is placed under connection points while uncoupling threaded or quick disconnect fittings. The catch container can hold the full volume of liquid expected during disconnect and may be plastic bag with absorbent material or a drip pan. All hose connection points are sleeved such that the plastic sleeve encapsulates non-welded joints.

Visual inspection of the hose and associated components, including the connection points, is used as leak detection during the manned transfers. This includes stationing personnel at the feed valve or pump to stop the waste flow should a leak be detected in place of an automatic shutoff device. If a leak occurs during a transfer, the transfer will be stopped, and waste will be removed from both the primary and secondary containment.

Waste in the secondary containment is removed by either draining the sleeving holding waste to an approved container or absorbing the liquid with absorbent. If a drip pan is used, liquid in the pan will either be pumped to a waste container and disposed of at the designated receiving location or absorbed with absorbent and placed in a container. The absorbed waste will be handled as newly generated waste and disposed of in accordance with WAC 173-303 regulations.

C.6.12 Engineering Drawings

The engineering drawings are listed in Table C.3 and comprise the design basis for the DST System and illustrate the configuration of the tank system components.

Upon completion of a construction project, as-built drawings, which incorporate the design and construction modifications resulting from all project design change documentation and nonconformance documentation, as well as modifications, will be made pursuant to the modification procedures of WAC 173-303-830. Current copies of these drawings are maintained in the DST System Operating

Record. Drawings not listed in Table C.3 may be referenced by drawings listed in the table are considered references and not subject to the modification procedures of WAC 173-303-830.

Table C.3 Engineering Drawings

Drawing Number	Drawing Name
H-2-37771, Sheet 1	Hydraulic Diagram TK-241-SY-101, 102 & 103
H-2-64313, Sheet 1	Structural, Concrete Pump Pit Plans and Sections
H-2-64449, Sheet 1	Tank and Elevation and Details
H-2-70427, Sheet 1	Hydraulic Diagram 241-AW Tank Farm
H-2-70706, Sheet 1	Piping Plan & Profile 204-AR to 241-1-1 Valve Pit
H-2-71985, Sheet 1	Hydraulic Diagram 241-AN Tank Farm
H-2-90446, Sheet 1	Structural, Annulus Pump Pits Plans & Sections
H-2-90447, Sheet 1	Structural, Central Pump Pits Plans & Sections
H-2-822403, Sheet 1	P&ID Diversion Box 6241-A
H-2-822404, Sheet 1	P&ID Vent Station 6241-V
H-14-020631, Sheets 1-3, 5	Waste Storage Tank System O&M System P&ID
H-14-020801, Sheets 1-6	Waste Transfer System O&M System P&ID
H-14-020802, Sheets 1-6	Waste Transfer System O&M System P&ID
H-14-020803, Sheets 1-6	Waste Transfer System O&M System P&ID
H-14-020806, Sheets 1-5	Waste Transfer System O&M System P&ID
H-14-020807, Sheets 1-7, 9	Waste Transfer System O&M System P&ID
H-14-020831, Sheets 2-4, 6, 7	Waste Transfer System O&M System P&ID
H-14-107346, Sheets 1-7	DST System Routing Board
H-14-107347, Sheets 1-2	DST Waste Transfer System NACE Inspection and Encasement Pressure Test