

**LOW-ACTIVITY WASTE PRETREATMENT 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 tracking 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
08/07/2025	PCN-LAWPS-2025-01 (8C.2025.Q3)
02/20/2025	8C.2024.4F
12/09/2024	PCN-LAWPS-2024-06 (8C.2024.Q4)
10/18/2024	8C.2024.2F
06/13/2024	PCN-LAWPS-2024-01 (8C.2024.Q2)
02/28/2023	PCN-LAWPS-2022-02 (8C.2023.Q1)
09/17/2021	8C.2021.8F
01/29/2021	8C.2020.12F

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**LOW-ACTIVITY WASTE PRETREATMENT SYSTEM
ADDENDUM C
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ADDENDUM C
PROCESS INFORMATION

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1 **C. PROCESS INFORMATION**

2 The Low-Activity Waste Pretreatment System (LAWPS) project encompasses two phases to provide the
3 necessary throughput to support full operation of the Waste Treatment and Immobilization Plant (WTP)
4 Low-Activity Waste (LAW) Facility. Phase One of the project will employ use of a single Tank Side
5 Cesium Removal (TSCR) unit that was initially designed to operate for approximately five years. Phase
6 Two will follow at a later date and either use a permanent cesium removal capability or additional TSCR
7 unit(s) to support sustained, long term WTP LAW operations.

8 This addendum provides a detailed discussion of the LAWPS Operating Unit Group (OUG). The
9 addendum provides technical details to describe the design and construction of the TSCR system
10 processes and equipment. The TSCR comprises a low-activity liquid mixed-waste tank storage and
11 treatment system located in the 200 East Area of the Hanford Site. The LAWPS OUG also includes two
12 storage areas for spent Ion Exchange Columns (IXC) that are generated during the treatment process. All
13 LAWPS facilities are located immediately adjacent to the southeast corner of the 241-AP Tank Farm. The
14 layout of the TSCR process area is shown on a simplified site plan in Figure C-1.

15 The supernatant waste treated in TSCR consists of aqueous phase liquids transferred from the
16 241-AP Tank Farm for treatment prior to transfer to the WTP LAW facility for vitrification. The TSCR
17 waste processing is controlled in a Control Room in 274AW (TSCR Control Enclosure remains available
18 as backup, located immediately south of the TSCR Process Enclosure), which is staffed continuously
19 during processing operations. The location of the Control Room in 274AW is shown in Figure C-2.
20 Section C.2.8 describes the Monitoring and Control System (MCS) that is located within the Control
21 Room in 274AW. The MCS controls and monitors the performance of TSCR process operations. When
22 TSCR processing operations are not occurring, the Control Room in 274AW is not required to be staffed
23 continuously.

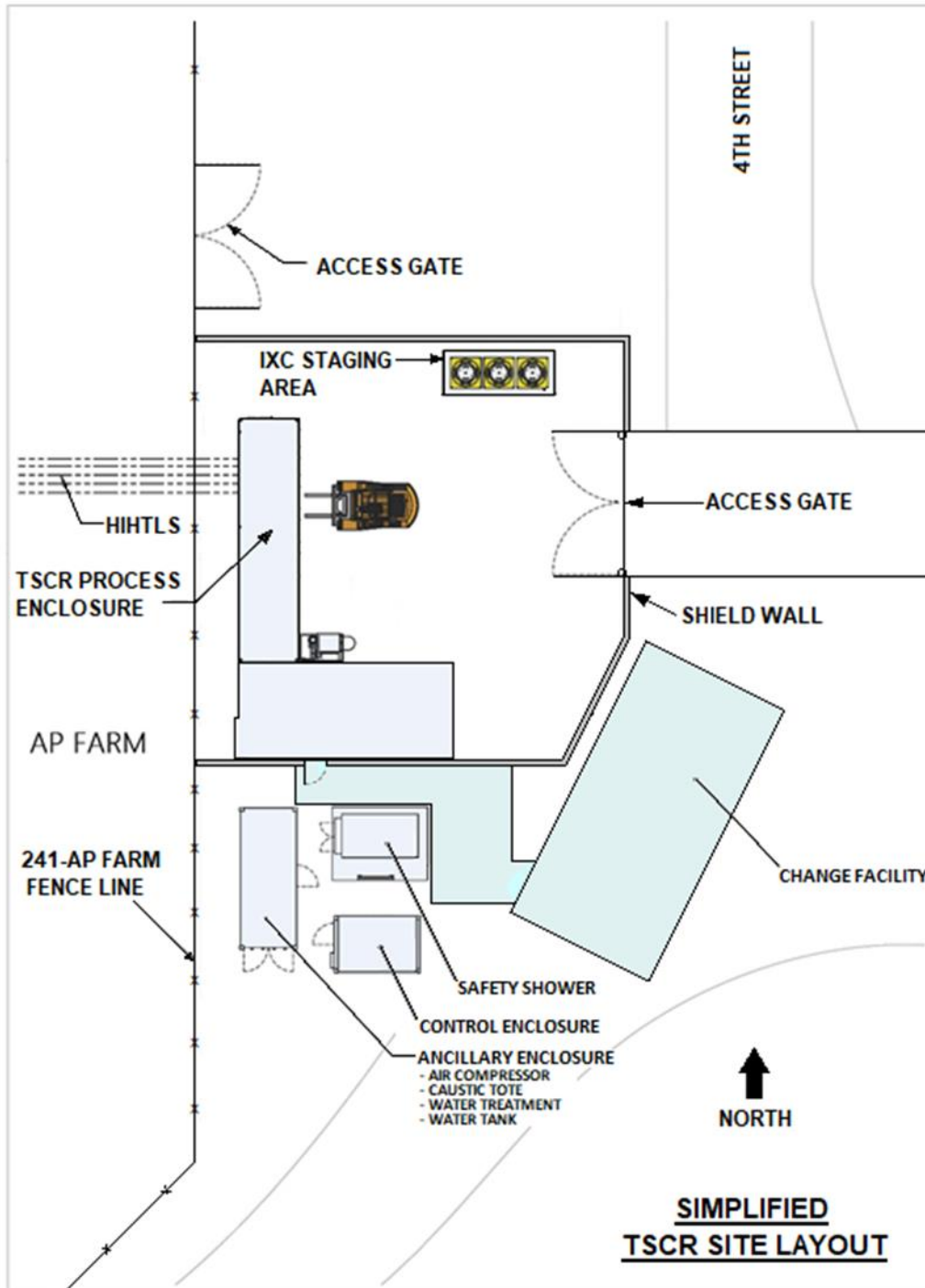


Figure C-1 Tank Side Cesium Removal Process Area Site Plan

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C.1 Tank Side Cesium Removal Process Description

The TSCR process flow diagram is provided in Figure C-3. Tank waste supernatant is transferred from Double-Shell Tank (DST) 241-AP-107 to the Process Enclosure where an approximately five-gallon per minute feed portion is diverted through the TSCR process system via a flow control valve. The feed stream is then filtered through a vertically mounted filter before passing through IXC for cesium removal.

1 Following cesium removal, the stream passes through a media trap designed to capture Ion Exchange (IX)
2 media in the unlikely event of an upstream screen failure in one of the IXC. The treated waste then
3 proceeds through a delay tank, which is sized to provide adequate holdup allowing the metastable barium
4 ($^{137}\text{Ba-m}$) to decay so that gamma measurements can be made to ensure processing goals for cesium
5 removal have been reached. After exiting the delay tank, the treated waste is then passed through two
6 in-line gamma monitors to verify cesium removal before being routed to DST 241-AP-106 for storage
7 and subsequent transfer to the WTP LAW facility for vitrification. Should the gamma monitors detect
8 elevated cesium levels, TSCR feed flow control valve is closed or may be diverted to DST 241-AP-108
9 prior to stopping waste processing. The balance of the feed stream not processed through TSCR is
10 continuously recycled back to DST 241-AP-107.

11 The following is a summary of the LAWPS component operations contained in this section.

- 12 • 241-AP-107 Waste Feed and Recirculation Return (Section C.2): Feed is transferred from
13 DST 241-AP-107 through a hose-in-hose transfer line (HIHTL) to the TSCR Process Enclosure.
14 A separate HIHTL from the Process Enclosure returns the unused portion of the feed stream back
15 to DST 241-AP-107.
- 16 • Filtration (Section C.2.1): Initial treatment of the feed stream occurs by vertically mounted filters.
17 Filtration removes solids to protect the downstream IXC media bed from becoming fouled. Two
18 filters are used, with one being offline. When the online filter differential pressure exceeds a
19 setpoint or an in-process time limit has been reached, the offline filter is placed into service and
20 the online filter is taken offline for back-pulsing with compressed air and a caustic wash. The
21 back-pulsed process waste stream is sent to DST 241-AP-108 via HIHTL. When back-pulsing
22 and/or caustic washing are no longer effective, each filter can be replaced.

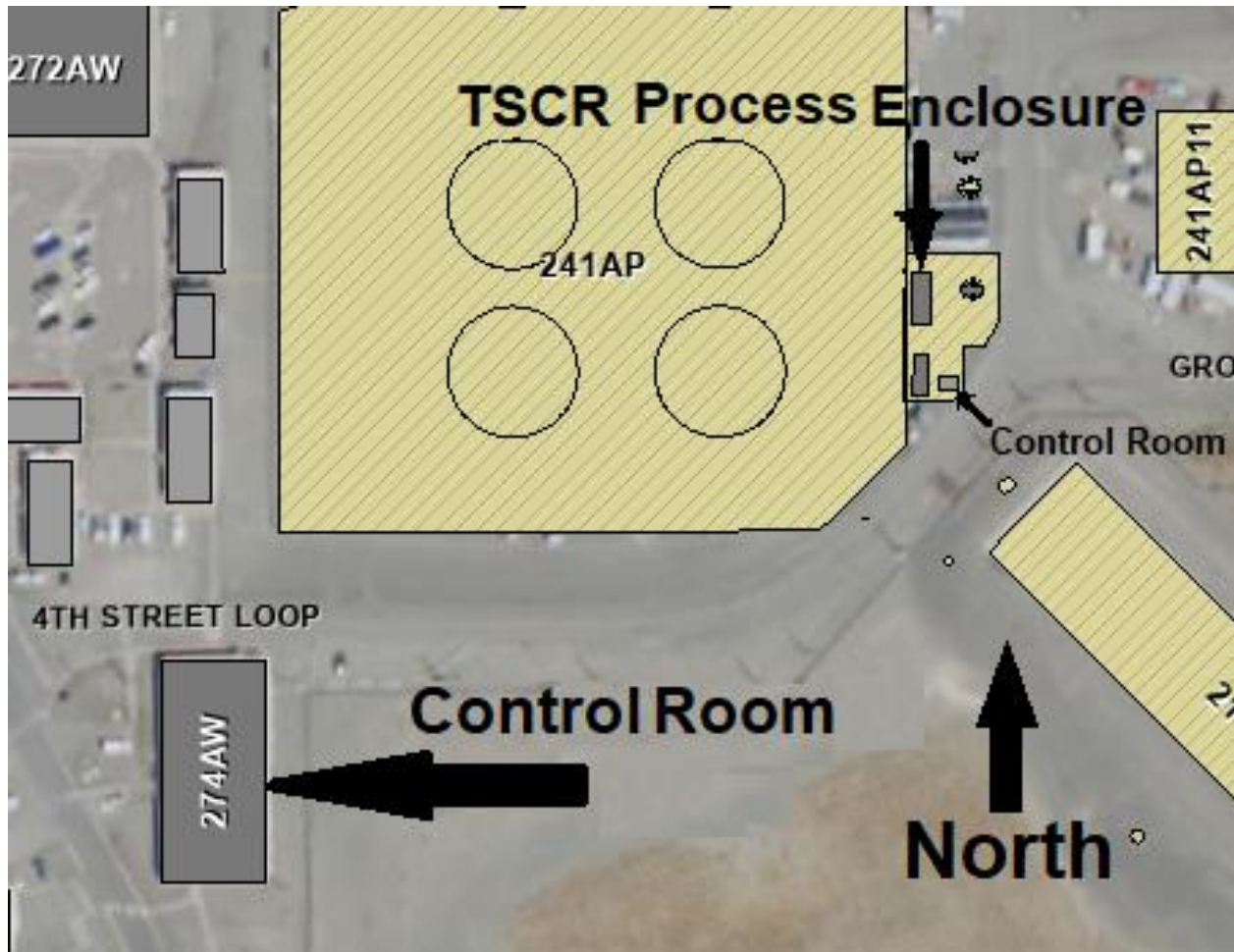


Figure C-2 Location of Control Room in 274AW

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- Ion Exchange (Section C.2.2): The filtered feed is passed through three IXC (lead, lag, and polish positions). The lead and lag columns remove the bulk of the cesium by adsorbing it onto crystalline silicotitanate (CST) IX media designed to preferentially remove cesium from high pH and sodium solutions. High pH of the waste is the result of carbon steel corrosion protection requirements in the DST system. Cesium removal continues until it is determined that the IX media becomes saturated to a point that cesium removal efficiency declines and cesium concentration passing through the columns rises above a pre-determined limit. The process will then be shut down, and the lead and lag IXC will be removed from service and replaced with fresh columns. The polish column then becomes lead for the next loading cycle.
- Gamma Monitoring and Treated LAW Transfer (Section C.2.3): After exiting the lag/polish columns, the waste is routed through a media trap. This feature prevents escape of IX media from the columns in the unlikely event of IXC screen failure. Loss of media downstream would potentially render treated waste off specification for cesium. After passing through the media trap, the waste is then routed through a delay tank. The delay tank includes a baffled chamber and is sized to provide sufficient retention time to allowing the metastable barium ($^{137}\text{Ba-m}$) to decay so that accurate gamma measurements can be made to ensure processing goals for cesium removal have been reached. Gamma monitoring is performed just downstream of the delay tank outlet. The treated supernatant is then transferred via HIHTL to DST 241-AP-106 for accumulation and subsequent transfer to the WTP LAW facility for vitrification.

- 1 • IXC Change-Out (Section C.2.4): Following system shutdown, IXC change out is initiated by
2 displacing remaining LAW in all process components with dilute sodium hydroxide (NaOH),
3 which is followed by a water flush. This serves to de-inventory the TSCR Process Enclosure
4 establishing conditions necessary for personnel entry. Caustic and water flush solutions are
5 returned to DST 241-AP-108 via a HIHTL. After waste displacement and flushing, the columns
6 are bulk dewatered using compressed air. This effluent is also returned to DST 241-AP-108. The
7 columns are then dried for between one and four days using compressed air, which is vented to
8 DST 241-AP-108.
- 9 • Reagent, Water, and Service Air (Section C.2.5): The reagents necessary to support TSCR
10 operations are dilute NaOH and process water. NaOH is supplied by a tote and process water is
11 made up in the Ancillary Enclosure from potable water delivered by truck. Both are introduced
12 into the TSCR Process Enclosure via pumps. A compressor is used to supply service air for
13 remote valve actuation, filter back-pulse, sweep air, bulk water displacement from the columns,
14 and column drying. All three systems are in the Ancillary Enclosure which is south of the Process
15 Enclosure. The NaOH, process water, and compressed air systems are protected with a misroute
16 prevention system that ensures neither system can become cross contaminated by process waste
17 systems.
- 18 • Spent IXC Transfer and Storage (Section C.2.6): Once air dried, the columns are disconnected
19 and removed from the Process Enclosure with a forklift. During normal operations, the columns
20 are transported directly to the IXC storage pad where they are affixed to a mounting plate on the
21 pad. The mounting plate ensures the columns remain upright in a seismic event. Should a column
22 become externally radiologically contaminated during process operations and require
23 decontamination, or other corrective actions, it can be temporarily placed in the IXC staging area.
24 The IXC staging area can hold three columns that are affixed to mounting plates on the balance of
25 facility pad to ensure the columns remain upright in a seismic event. Once decontaminated, or
26 other corrective actions completed, a column or columns are removed from the IXC staging area
27 and transferred to the IXC storage pad via a dedicated concrete travel path.
- 28 • Process and Enclosure Ventilation (Section C.2.7): The TSCR Process Enclosure includes a
29 process ventilation system and a process drain system. Both discharge to DST 241-AP-108 via
30 separate dedicated HIHTLs. The process ventilation system remains closed during operations and
31 is only opened during column change-out after LAW displacement and flushing are completed.
32 The TSCR Process Enclosure also is equipped with a separate ventilation system that only
33 provides ventilation within the process area during manned entries into the enclosure. This
34 ventilation system is not operated during waste processing. Heating and cooling is provided for
35 process temperature control, and for manned entries into the enclosure.
- 36 • Process Control and Monitoring (Section C.2.8): The Control Enclosure and the Control Room in
37 274AW provide process controls through a MCS for TSCR and is manned at all times during
38 waste processing. The Control Enclosure remains available as backup and is located immediately
39 south of the Process Enclosure and is connected to the tank farms Control Room in 274AW. This
40 allows the Control Enclosure and Control Room in 274AW to receive leak detection signals from
41 the 241-AP Farm allowing process shutdown upon indication of a leak within the farm
42 connections to the TSCR Process Enclosure.

43 **C.2 241-AP-107 Waste Feed and Recirculation Return**

44 The TSCR Process Enclosure receives qualified feed from DST 241-AP-107. Feed qualification and
45 waste acceptance are discussed in detail in Addendum B, “Waste Analysis Plan.” Supernatant will be
46 transferred to the Process Enclosure through a dedicated HIHTL at a flow rate of approximately
47 60 gallons per minute. Of the 60 gallon per minute feed stream, approximately five-gallons per minute
48 portion is diverted into the TSCR process system via a flow control valve with the remainder returned to

1 DST 241-AP-107 via a dedicated return HIHTL. The feed stream is then filtered through a vertically
2 mounted filter before passing through the IXC for cesium removal.

3 The HIHTL feed and return lines represent one of the three process interfaces between the TSCR Process
4 Enclosure and the 241-AP Tank Farm. The other two being the vent and drain HIHTLs between the
5 Process Enclosure and DST 241-AP-108, and the treated LAW transfer HIHTL between the Process
6 Enclosure and DST 241-AP-106. HIHTL layouts between TSCR and the 241-AP Tank Farm are shown
7 on Figure C-7.

8 **C.2.1 Filtration**

9 Two filters are used, with one being in service and the other offline. The online filter is taken out of
10 service for back-pulsing with air approximately once per day, or if it reaches a high differential pressure
11 beforehand. During back-pulsing, the offline filter assumes the online function. When filter recovery is
12 diminished as indicated by a more frequent high differential pressure readings over repeated backwash
13 cycles, each filter can undergo a caustic wash or be replaced. The filters operate in up-flow with feed
14 entering at the bottom and flowing up through the filter elements where solids are retained. Filtrate
15 continues up through the filter element core into the top head where it exits out the filtrate nozzle and
16 proceeds to the lead IXC.

17 The MCS automatically and remotely aligns valves to bring the second filter online. Two filters are now
18 operating in parallel for a short period while valves are then aligned to remove the first filter from service.
19 The drain outlet valve is opened on the filter to be back-pulsed, which allows a small amount of liquid to
20 drain from the filter. Most of the liquid is retained, particularly within the filter element interior core up
21 through the top head because retained solids create a thin cake on the outside of the filters that inhibits
22 liquid drainage. Then the air receiver outlet isolation valve is opened, discharging 20 gallons of air at
23 70-80 pounds per square inch gauge (psig) into the filter top head.

24 Expansion of air from the receiver forces liquid out of the top head, down through the filter elements and
25 out the bottom head of the filter. Air, filtrate, and solids dislodged from the outside of the filter elements
26 exit through the backwash outlet. Air, liquid, and backwash solids will continue into the drain manifold
27 and are discharged through the HIHTL to DST 241-AP-108. The air receiver air capacity is sufficient to
28 empty the contents of the filter and the HIHTL routed to DST 241-AP-108. After a backwash, the filter is
29 virtually emptied of liquid. The filter is then filled with 0.1M NaOH and performs a soak to loosen any
30 hard to remove particulates from the filter. After a period of time, the filter undergoes a second blowdown
31 to remove the soak fluid and is again filled with 0.1M NaOH and placed in standby, awaiting to be
32 brought online. Figure C-4 depicts a filter assembly.

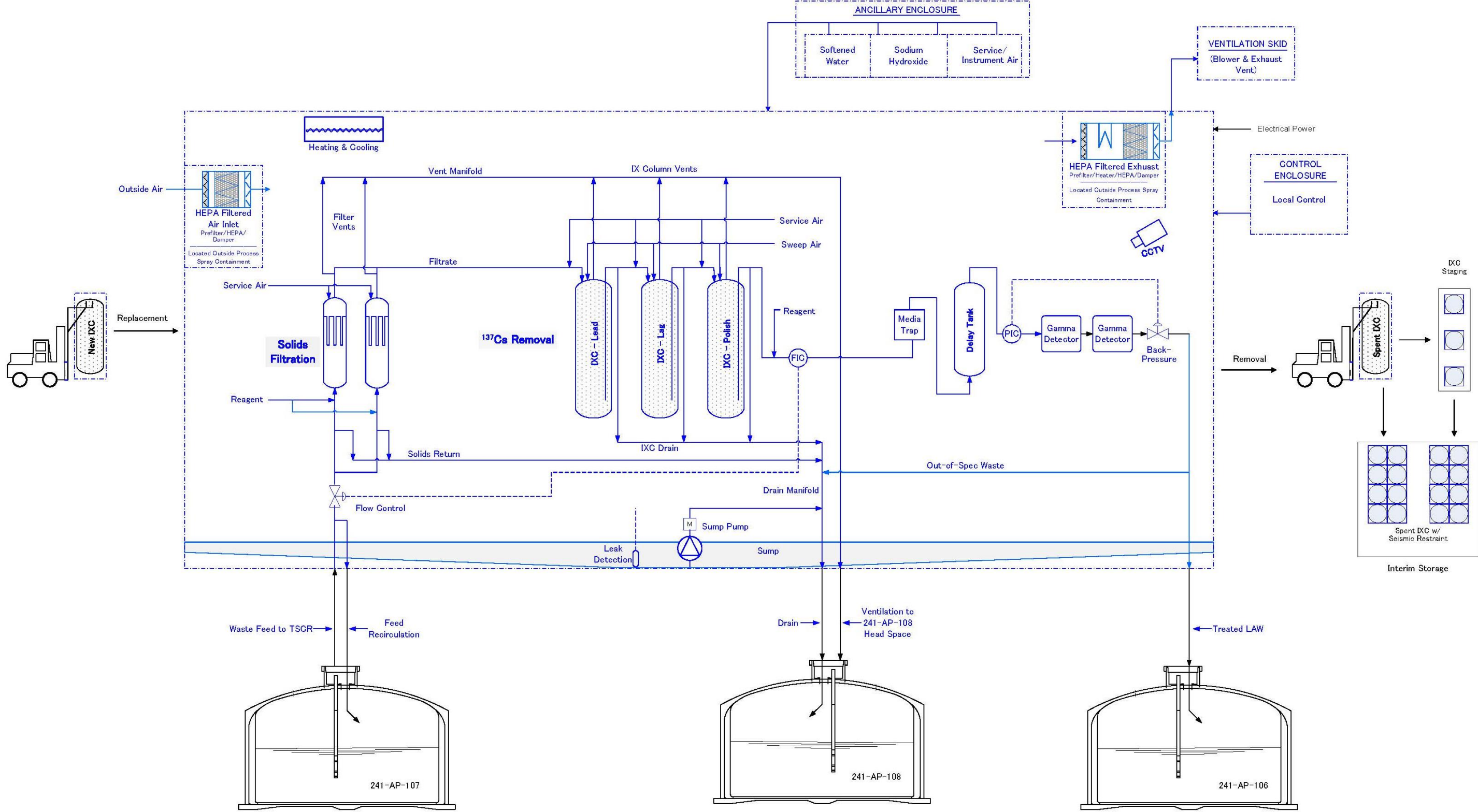


Figure C-3 Tank Side Cesium Removal Process Flow Diagram

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Figure C-4 Filter Assembly

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The filters have a five-year design life and include a shield assembly to facilitate filter replacement with minimal dose to workers. An outline of the replacement sequence is as follows:

Backwash: Backwash the filter (as previously described) and leave it completely empty of liquids.

Vent: The filter vent is opened eliminating pressure on the housing.

Filter Disconnect: A radiological survey is completed prior to any mechanical disconnects. Contamination control measures are performed after each hose disconnect to help prevent the spread of contamination.

Disconnect the mechanical joint on the filtrate nozzle of the selected filter. Disconnect mechanical joint on the inlet/drain nozzle of the selected filter.

Close the filter vent valve. The filter will be flushed, isolated, and removed per a work plan.

Filter Removal and Installation: The bay containing the filter to be removed is located on the inside of the enclosure, which requires the outer enclosure access door to be opened. The filter is then removed using a lifting yoke attached to a forklift. A new filter is then installed into the Process Enclosure followed by making inlet and outlet connections. After being filled, vented, and leak tested, the new filter will be ready for use.

C.2.2 Ion Exchange

The IXC removes Cs-137 from filtered waste using non-elutable CST IX media housed within three columns. The filtered feed is passed through three IXC (lead, lag, and polish positions). The lead and lag columns remove the bulk of the cesium by adsorbing it onto the CST IX media designed to preferentially remove cesium from high pH and sodium waste. Cesium removal continues until it is determined that the lead and lag IXCs become saturated to a point that cesium removal efficiency declines and the effluent cesium concentration rises above a pre-determined limit. The polish IXC will be brought online, and

1 waste processing will continue until the effluent waste cesium concentration rises to a pre-determined
2 limit. The process will then be shut down, and the lead and lag IXC will be removed from service and
3 replaced with fresh columns. The polish column then becomes lead for the next loading cycle.

4 The IXC lead/lag/polish cesium loading cycle is expected to take approximately 30 days depending on the
5 LAW feed characteristics and degree of media exhaustion in the lead (formerly polish position) IXC
6 when the loading cycle commences. IXC change-out will require approximately ten days of downtime; of
7 which, up to four days will be used for drying the spent IXC. However, should an increase in operational
8 efficiency be required to meet processing goals, drying can be completed in one day reducing the
9 downtime associated with column change-out.

10 When the treated effluent approaches the treated waste set-point, the lead and lag IXC are deemed
11 exhausted/loaded and are removed from service. Primary steps associated with IXC replacement are:

- 12 • Displacement of LAW with 0.1 M NaOH.
- 13 • Water rinsing of lead and lag columns to remove NaOH.
- 14 • Bulk dewatering with compressed air.
- 15 • Drying of lead and lag columns.
- 16 • Removal of lead and lag columns from system.

17 **C.2.3 Gamma Monitoring and Treated Low-Activity Waste Transfer**

18 After exiting the polish column, the treated waste is routed through a media trap. This feature prevents
19 escape of IX media from the columns in the unlikely event of IXC retention screen failure. Loss of media
20 downstream would potentially render treated waste off specification for cesium. After passing through the
21 media trap, the treated waste is then routed through a delay tank. The delay tank includes a baffled
22 chamber and is sized to provide adequate holdup time allowing the metastable barium ($^{137}\text{Ba-m}$) to decay
23 so that gamma measurements can be made to ensure processing goals for cesium removal have been
24 reached.

25 TSCR is equipped with gamma monitoring instrumentation to ensure treated waste being transferred to
26 the downstream DST 241-AP-106 meets the WTP LAW acceptance criteria for cesium. There are two
27 gamma monitors in series designed and shielded to enable detection down to less than $1.8\text{E-}05$ Ci/L,
28 which is approximately ten times below the WTP LAW acceptance criteria for cesium. The gamma
29 monitors are capable of measuring over a six-decade range and the in-series configuration improves
30 measurement reliability.

31 Treated LAW leaving the IXCs will have the lowest cesium concentration at the beginning of a loading
32 cycle and then trend up as loading continues. When the treated LAW approaches the gamma high
33 set-point, operators will initiate a system shutdown. The set-point is variable based on the feed tank
34 sodium concentration. Set-points for each campaign will be recorded and entered into the LAWPS OUG
35 Operating Record. If the gamma high-high set-point is reached, the TSCR system will automatically shut
36 down and divert the waste to DST 241-AP-108. Using knowledge of CST performance data, operations
37 personnel will be able to forecast the approximate time of lead/lag IXC exhaustion and have fresh IXC
38 ready to install in the lag and polish positions (previous polish position becomes the lead position). All
39 treated supernatant with acceptable gamma levels is automatically transferred to DST 241-AP-106 via the
40 system pressure provided by the 241-AP-107 feed pump.

41 **C.2.4 Ion Exchange Columns Change-Out**

42 The following steps are performed to remove waste inventory, place Process Enclosure in a safe standby,
43 and remove spent columns.

- 1 Waste Displacement: After operations are stopped, 0.1 M NaOH is pumped through the same path that
2 waste had previously been flowing to displace waste in the filters and IXC's, and effluent components
3 (media trap and delay). The displacement solution (waste and 0.1 M NaOH) will exit from the delay tank
4 into the drain manifold and discharge to DST 241-AP-108.
- 5 Lead/Lag Column Rinse: The two columns are rinsed with softened water that is discharged to
6 DST 241-AP-108 via the drain manifold and drain HIHTL.
- 7 Column Blowdown/Sweep-Air: The filters, IXC's, media trap, and delay tank are bulk dewatered with
8 service air to the drain manifold.
- 9 Air Drying of Lead/Lag IXC: Drying air (service air) is started at > 30 standard cubic feet per minute
10 (SCFM) per IXC, or > 60 SCFM total. Drying air will continuously flow through each ion exchange
11 column for up to four days. As noted previously, drying can be accomplished in one day should
12 operational needs require.
- 13 After drying, drying air is secured, IXC vents are opened, and IXC drain outlets are closed (the path
14 drying air flowed to drain manifold is closed).
- 15 Disconnect IXC and Establish Ventilation-Flow: The following steps are completed to disconnect the
16 IXC from the piping rack and establish confinement ventilation flow.
- 17 A radiological survey is completed to identify any changes in dose rates that may have taken place during
18 IXC drying. After verifying the vent manifold pressure is below atmospheric, the outlet hose is
19 disconnected and controlled to prevent spread of contamination. A "plug" is installed on the IXC outlet
20 nozzle in preparation for removal and storage.
- 21 The next step involves removing the IXC inlet hose, controlled to prevent the spread of contamination,
22 and installing a vent intake assembly on the inlet nozzle of the selected column that includes a filter. After
23 isolating sweep air, the IXC vent hose and sweep air hose are disconnected and controlled to prevent
24 contamination. A vent exhaust assembly that includes a filter is then installed on the vent nozzle of the
25 IXC being removed and a gas sample port assembly is installed on the sweep air nozzle. The difference in
26 vent height, air moisture content, and temperature between the intake and outlet filters will cause
27 sufficient convective air flow through the IXC headspace to maintain the H₂ concentration below the
28 Lower Flammability Limit (LFL). The IXC is now ready to be removed from the Process Enclosure.
- 29 Move IXC from Process Enclosure to Storage Pad or Staging Area: The following steps are completed to
30 remove an IXC from the Process Enclosure for relocation to either the IXC staging area or IXC storage
31 pad.
- 32 Radiological surveys are completed to ensure surfaces are sufficiently clean to allow outdoor IXC
33 storage. If contamination above radiological limits is identified, then decontaminate the IXC and/or wrap
34 it in an approved material to allow movement of the column to the IXC staging area for decontamination.
- 35 The Process Enclosure exterior door is opened in preparation for IXC removal. If contamination above
36 radiological limits is identified, then decontaminate the IXC and/or wrap it in an approved material to
37 allow movement to the IXC staging area where additional decontamination can be performed.
- 38 Using a forklift fitted with the IXC lifting yoke, the IXC is removed from the Process Enclosure as
39 depicted in Figure C-5, and transferred directly to the nearby IXC storage pad where it is secured to a
40 mounting plate.

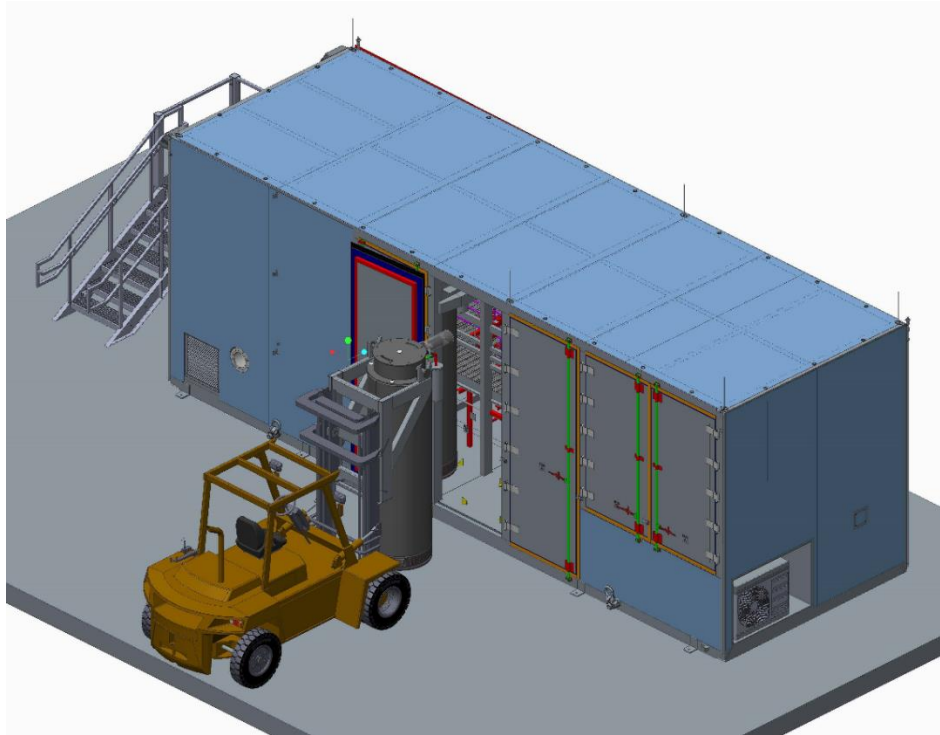


Figure C-5 Ion Exchange Columns Removal

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Following IXC removal, the forklift installs a fresh column in the empty position. Hose connections for the inlet, outlet, vent and sweep-air from the valve rack to the IXC are then reconnected.

This process is the same for lead and lag, (or in rare instances polish) column replacement. Once the new columns are in place and all connections are made, they are charged with process water and leak tested prior to resumption of waste processing.

C.2.5 Reagent, Water, and Service Air

The reagents necessary to support TSCR operations are NaOH and process water. NaOH is supplied by a container and will be replenished by delivery. Process water is made up in the Ancillary Enclosure from potable water delivered by truck. The NaOH is combined in-line with the process water to produce dilute caustic which is then introduced into the TSCR Process Enclosure via pumps. Prior to use, potable water is treated by a softener system. A compressor is used to supply service air for remote valve actuation, filter back-pulse, bulk water displacement from the columns, and IX media drying as part of change-out. All three systems are located south of the Process Enclosure in the Ancillary Enclosure. The NaOH, service air, and process water systems are protected with a misroute prevention system that ensures neither system can become cross contaminated by process waste systems.

C.2.6 Spent Ion Exchange Columns Transfer and Storage

Under normal conditions, the forklift fitted with the IXC lifting yoke transfers a spent IXC from the Process Enclosure via a concrete travel path directly to the adjacent IXC storage pad where it is secured to a mounting plate. The IXC storage pad is sized to store 150 columns, which accommodates the expected generation rate of two columns per month for the projected five-year duration of TSCR (LAWPS Phase 1) operations with some added contingency space. Upon arrival on the storage pad, the IXC are affixed in place to a mounting plate that is secured to concrete slab embed plates. The IXC storage pad is fenced and locked except when staffed for operational activities. Refer to Figure C-6 for the IXC storage pad layout.

1 If contamination above radiological limits is identified during preparations for removal of a spent IXC
2 from the Process Enclosure, the IXC can be wrapped and transferred to the IXC staging area where
3 additional decontamination can be performed. The IXC staging area provides temporary storage and any
4 spent IXC placed in this location will be moved to the IXC storage pad once any necessary corrective
5 measures have been completed. The IXC staging area can accommodate three columns and is located
6 within the Process Enclosure fenced area. Reference Figures C-1 and C-6 for the storage area layouts.
7 Additional information regarding both container storage areas is provided in Section C.5.

8 **C.2.7 Process and Enclosure Ventilation**

9 There are two independent ventilation systems supporting TSCR operations; the Process Ventilation
10 system, and the Process Enclosure ventilation system. Both are discussed separately in the following.

11 The Process Ventilation system consists of a vent collection header that connects the filters and IXCs.
12 The vent header is routed through valves out of the Process Enclosure to the headspace of DST
13 241-AP-108 via a dedicated HIHTL. The Process Ventilation system remains closed during waste
14 processing, waste displacement and IXC rinse, bulk dewatering, and IXC drying activities. The Process
15 Ventilation System opens upon process shutdown to support column or filter change-out and equipment
16 maintenance. Air is used to maintain a flow from the process components to the DST headspace. In
17 addition, the slight negative pressure is maintained by an eductor located upstream of the HIHTL
18 connection. The eductor uses compressed air controlled by a manual flow control valve as the motive
19 force and the vent line as the suction. The discharge is routed back to the vent line and DST 241-AP-108.

20 The TSCR Process Enclosure ventilation unit is used to provide fresh air prior to personnel entry for
21 column and filter change-out or maintenance activities. The ventilation system is also operated during
22 routine process operations to provide heating and cooling for the enclosure to support process temperature
23 requirements, and personnel comfort as necessary during manned entries. High efficiency particulate air
24 filters on the fresh air intake and exhaust vent are only provided for equipment cleanliness within the
25 enclosure. These filters are not credited for providing confinement ventilation.

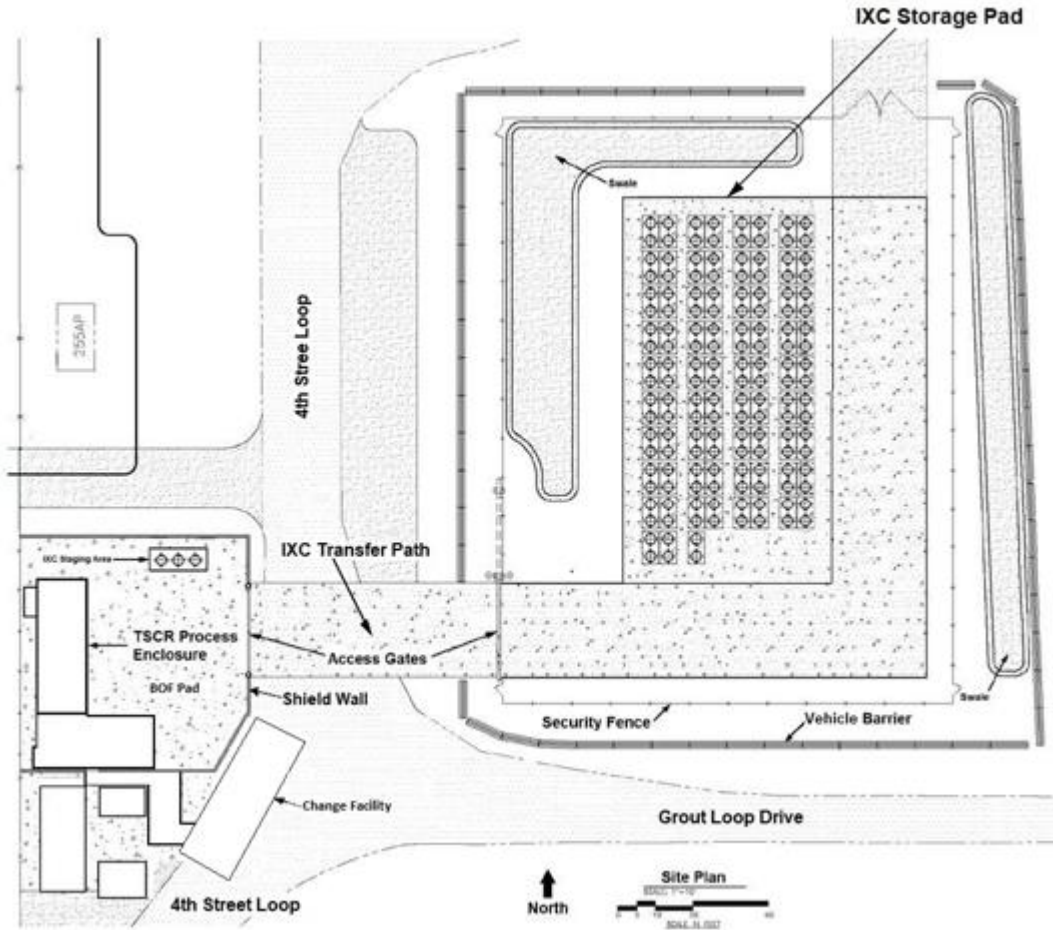


Figure C-6 Ion Exchange Columns Storage Pad Layout

C.2.8 Process Control and Monitoring

The Control Enclosure is a climate controlled, prefabricated office structure that serves as the backup TSCR control room. Primary process operations control, automated/remote maintenance evolutions (e.g., filter backwash, system flush, IXC blow-down, etc.), and ventilation system functions are controlled from the Control Room in 274AW. Capabilities include alarm monitoring and video monitoring of the process equipment that is facilitated via Human Machine Interface (HMI) and Programmable Logic Controller that controls all TSCR operations. The Control Enclosure (as the backup TSCR control room) also is interfaced with the Control Room in 274AW and receives leak detection signals from the 241-AP Farm, which allows shutdown on indication of a HIHTL leak detected by 241-AP Farm instrumentation.

Startup commences with start of either 241-AP-107 feed pump, AP07F-WT-P-001 or AP07F-WT-P-002. Flow continues through a short recirculation-piping loop within the Process Enclosure then back to 241-AP-107. This recirculation loop contains flow control valve WP-FCV-306 that opens to a set point of five gallons per minute allowing waste to enter the process system components initiating waste treatment.

Leak detection indication, whether from the Process Enclosure secondary containment or from AP Farm, activates an interlock or alarms allowing shutdown of process operations. The following pumps are stopped upon activation of a Process Enclosure leak detector:

- 241-AP-107 Feed Pump (AP07F-WT-P-001 or AP07F-WT-P-002).

- 1 • Caustic Pump (RA-P-130).
- 2 • Potable Water Pump (RA-P-139).

3 A leak detection signal from the 241-AP Farm HIHTL ends activate an alarm in the Control Room in
4 274AW (with TSCR Control Enclosure as a backup) and an interlock closes flow control valve
5 WP-FCV-306, which stops processing.

6 The MCS provides for process monitoring, modulating control, and process interlocks, and sequencing.
7 TSCR controls are integrated into the Tank Farm Local Area Network (TFLAN), and the primary
8 operator interface is located at the Control Room in 274AW. A high level of automation is utilized to
9 minimize direct operator interaction with TSCR and 241-AP Farm process operations. Instruments,
10 including those for leak detection, differential pressure, temperature and flow are listed in Addendum I,
11 “Inspection Plan.” A detailed description of all warnings, alarms, set-points, and interlocks are provided
12 in RPP-RPT-61220, *Control Logic Narrative* (as amended) included in Appendix 2.13.

13 The Control Enclosure is located south of, and outside, the TSCR Process Enclosure fenced area.
14 Reference Figure C-1.

15 **C.2.9 Operation and Maintenance Procedures**

16 Procedures are used to perform work, maintain design integrity, protect the health and safety of people
17 and the environment, and convey instructions to individual workers. Procedures include two types;
18 administrative and technical.

19 Administrative procedures are not directly used to operate or maintain tank farm facilities or equipment.
20 Collectively, administrative procedures describe a comprehensive set of controls, interactions, business
21 practices, and communications deemed essential by management for the safe and efficient operation of
22 the contractor, as well as to meet contractual and legal obligations.

23 Technical procedures are written to provide the appropriate instructions to ensure the facility is operated
24 within its design basis and are used to support safe operation of the facility. They provide specific
25 direction for operating or maintaining systems and equipment. They describe the process for production,
26 operation, manipulation of equipment and facilities, or maintenance activities.

27 Technical procedures are developed for all anticipated operations, evolutions, tests, and abnormal or
28 emergency situations. They are written from applicable source documents, such as specification
29 requirements and vendor information. They are based on design controls (specification, drawings),
30 operational controls (documented safety analysis reports, technical specifications), management controls
31 (industrial safety, training), and experience (lessons learned programs). They are developed with
32 emphasis on the human-factors aspect of their intended use.

33 Technical procedures focus primarily on accomplishing facility and activity level activities. They provide
34 direction and information on how to accomplish the technical tasks associated with the full life cycle of
35 performing work.

36 Technical procedures are defined as specific types, including but not limited to:

- 37 • Operating.
- 38 • Emergency Response.
- 39 • Abnormal Operating.
- 40 • Alarm Response.
- 41 • Functional Test.
- 42 • Operator Rounds.
- 43 • Operations Radiological Inspections.

- 1 • Industrial Hygiene Technician Procedures.
- 2 • Laboratory Technology/Analytical.
- 3 • Maintenance.

4 TSCR operations includes use of approximately 30 technical procedures to ensure waste processing and
 5 spent IXC storage are conducted in a manner that is protective of human health and the environment. Any
 6 problems or deficiencies noted are prioritized and tracked using the Rounds Action Tracking List
 7 (RATL). Additional detail on inspection schedules and remedies are provided in Addendum I,
 8 “Inspection Plan.”

9 Operations and maintenance procedures ensure appropriate controls and practices are in place to ensure
 10 the LAWPS Dangerous Waste Management Units will be operated in a safe and reliable manner that will
 11 not result in damage to regulated systems and components. These include the TSCR Process Enclosure,
 12 IXC Staging and Storage Areas, HIHTLs, and hard piped transfer lines.

13 **C.3 Waste Transfer Lines**

14 Waste transfer lines supporting the projected five-year duration of TSCR operations (LAWPS Phase 1)
 15 are of HIHTL type. HIHTL use may extend beyond the initial five-year duration of TSCR operations if a
 16 service life extension evaluation is reviewed and approved by an Independent Qualified Registered
 17 Professional Engineer (IQRPE). The baseline service life prior to an extension is three years.
 18 RPP-RPT-64365, *Tank Side Cesium Removal Evaluation of Hose-in-Hose Transfer Line Service Life*
 19 (Appendix 2.15) was prepared to evaluate extending the TSCR HIHTL service life. RPP-IQRPE-50140,
 20 *IQRPE Evaluation of TSCR HIHTLs and Hose Jumper Service Life Extension* (Appendix 2.11)
 21 documents that the HIHTLs should remain fit-for-use if operated according to the IQRPE guidance. The
 22 unit must be operated and maintained according to the recommended guidelines to allow HIHTL service
 23 life extension. Waste transfer lines conveying pretreated feed from the 241-AP Farm to the WTP interface
 24 point and WTP effluent returns back to the 241-AP Farm are of hard line pipe-in-pipe type. The following
 25 sections describe both waste transfer line types. For the purposes of this permit application, the two
 26 pipe-in-pipe transfer lines (241-AP-106 pretreated feed to WTP LAW and WTP Effluent Management
 27 Facility [EMF] condensate returns to DST 241-AP-102) are included to allow for design and installation
 28 of tie-in segments. Relevant design documents for the new portions of these two transfer lines are
 29 included in the design media Appendices 2.4 through 2.11. Relevant design documents for the existing
 30 portions of these two lines have been provided as supplemental information to this application.

31 **C.3.1 Hose-in-Hose Transfer Lines**

32 Five HIHTLs support TSCR operations and include the following:

- 33 1. TSCR Process Enclosure to 241-AP-106 pretreated LAW transfer line.
- 34 2. TSCR Process Enclosure to 241-AP-107 feed recirculation line.
- 35 3. 241-AP-107 to TSCR Process Enclosure feed line.
- 36 4. TSCR Process Enclosure to 241-AP-108 drain line.
- 37 5. TSCR Process Enclosure to 241-AP-108 vent line.

38 Refer to Figure C-7 for a simplified HIHTL layout. HIHTL primary hoses have a nominal inside diameter
 39 of two inches with the secondary hoses having a nominal inside diameter of four inches. Hoses
 40 accommodate the end fittings for primary and secondary hoses on both the DST 241-AP Farm attachment
 41 points and TSCR Process Enclosure attachment points. HIHTLs for TSCR had been originally intended to
 42 have a three-year service life, which was later determined to be extended through 2029 or a maximum of
 43 ten years from date of manufacture based on RPP-RPT-64365, *Tank Side Cesium Removal Evaluation of*
 44 *Hose-in-Hose Transfer Line Service Life* (in Appendix 2.15) accompanied by an IQRPE certification,
 45 RPP-IQRPE-50140, *IQRPE Evaluation of TSCR HIHTLs and Hose Jumper Service Life Extension*

(in Appendix 2.11). Installed HIHTL assemblies will be certified by an independent, qualified installation inspector or an IQRPE prior to first receipt of waste. When HIHTLs are removed from service they will be correctly managed under the generator regulations in Washington Administrative Code (WAC) 173-303-170 through -230 and associated records will be filed in the LAWPS OUG Operating Record.

Both primary and secondary hose tube material are constructed of ethylene propylene diene monomer (EPDM) which meets the chemical compatibility requirements for use with Hanford tank waste. Braiding reinforcement is provided to meet the pressure and tensile strength requirements identified for the hoses with reinforcement material being fully encapsulated. Primary hose ends are fitted with a ChemJoint™¹ coupling. Refer to Figure C-8 for a typical HIHTL configuration. The TSCR enclosure represents the high point for the HIHTL and therefore, leak detection for all five HIHTLs occurs at the 241-AP Farm, which is the low point of the lines. All efforts have been made to minimize low points which could hold up waste between the TSCR enclosure and the AP tank farm. The leak detection has been designed to detect a leak within 24 hours, minimum detectable leak rates are provided in Table C-6. The HIHTL will be tightness tested in accordance with the required standards in Table C-3. Refer to Section C.6.3.2 for additional detail regarding HIHTL secondary containment and leak detection. The following table provides additional HIHTL attributes.

Table C-1 Hose-in-Hose Transfer Lines/Jumper Attributes

	Line/Jumper Number	Origination/Connection	Destination/Connection	MFR Date*	Length (ft.)**
1	HIHTL-AP106-SN-101	TSCR	241-AP-10P-106 Drop Leg, Riser 002	8/31/2019	225
2	HIHTL-AP107-SN-102	TSCR	AP-07F Pump Pit, Drop Leg	9/1/2019	315
3	HIHTL-AP107-SN-103	AP-07F Pump Pit	TSCR	9/1/2019	315
4	HIHTL-AP108-SN-104	TSCR	241-AP-108 Drop Leg, Riser 015	8/31/2019	165
5	HIHTL-AP108-SN-105	TSCR	241-AP-108 Drop Leg, Riser 015	8/31/2019	170
6	AP07F-WT-EPDMJ-[A-B]***	AP-07F Pump Pit	HIHTL-AP107- SN-103, AP-07F Pump Pit	5/1/2019	3.75
7	AP07F-WT-EPDMJ-[C-D]***	TSCR, HIHTL- AP107-SN-102	AP-07F Pump Pit	5/1/2019	4.5

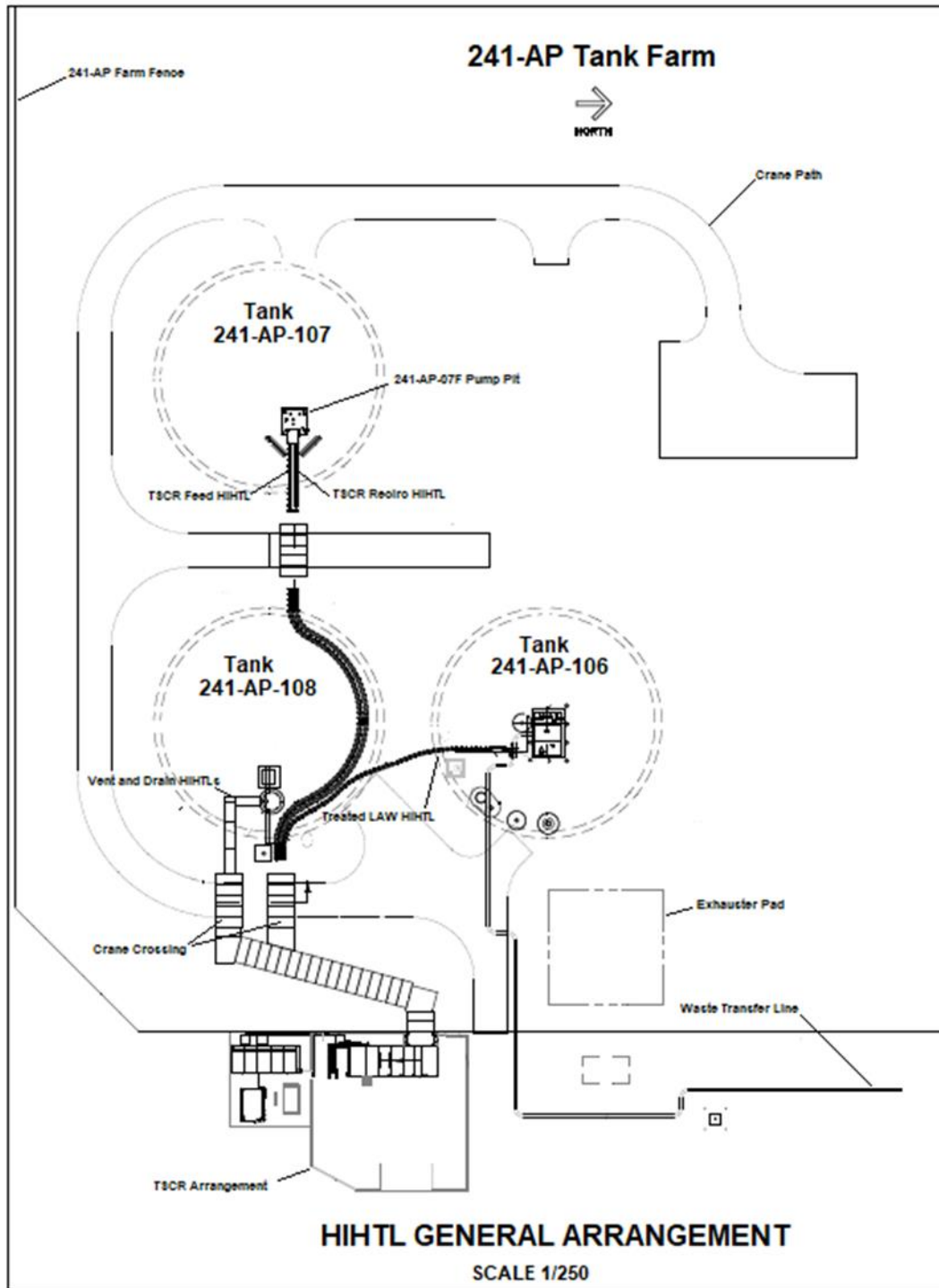
*Service life expires ten years from date of manufacture (MFR).

**Nominal length.

***Hose jumpers are outside the boundary of the LAWPS OUG, however the manufacture date remains applicable to the extended use expiration date.

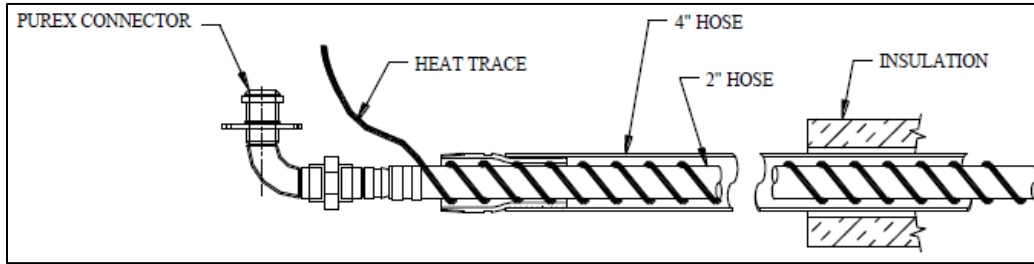
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¹ChemJoint is a trademark of Campbell Fittings, Inc., Boyertown, Pennsylvania.



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Figure C-7 Simplified Hose-in-Hose Transfer Lines Layout



1 **Figure C-8 Typical Hose-in-Hose Transfer Lines Configuration**

2
3 **C.3.2 241-AP Farm to Waste Treatment Plant Interface Point Transfer Lines**

4 As part of Project W-211, *Initial Tank Retrieval Systems*, three pipe-in-pipe waste transfer lines were
5 previously installed between Tank Farms and WTP. These transfer lines were designed and originally
6 intended to transfer full feed to the WTP Pretreatment Facility. A portion of two of the three transfer lines
7 have been selected for use in the Direct-Feed Low-Activity Waste (DFLAW) program. One waste
8 transfer line will convey pretreated waste feed from DST 241-AP-106 to the WTP LAW facility for
9 vitrification. The second waste transfer line will convey secondary process effluent from the WTP EMF
10 facility back to DST 241-AP-102. For the purposes of this permit application, the Tank Farms portion of
11 both transfer lines ends at the WTP interface point (reference Figure C-9).

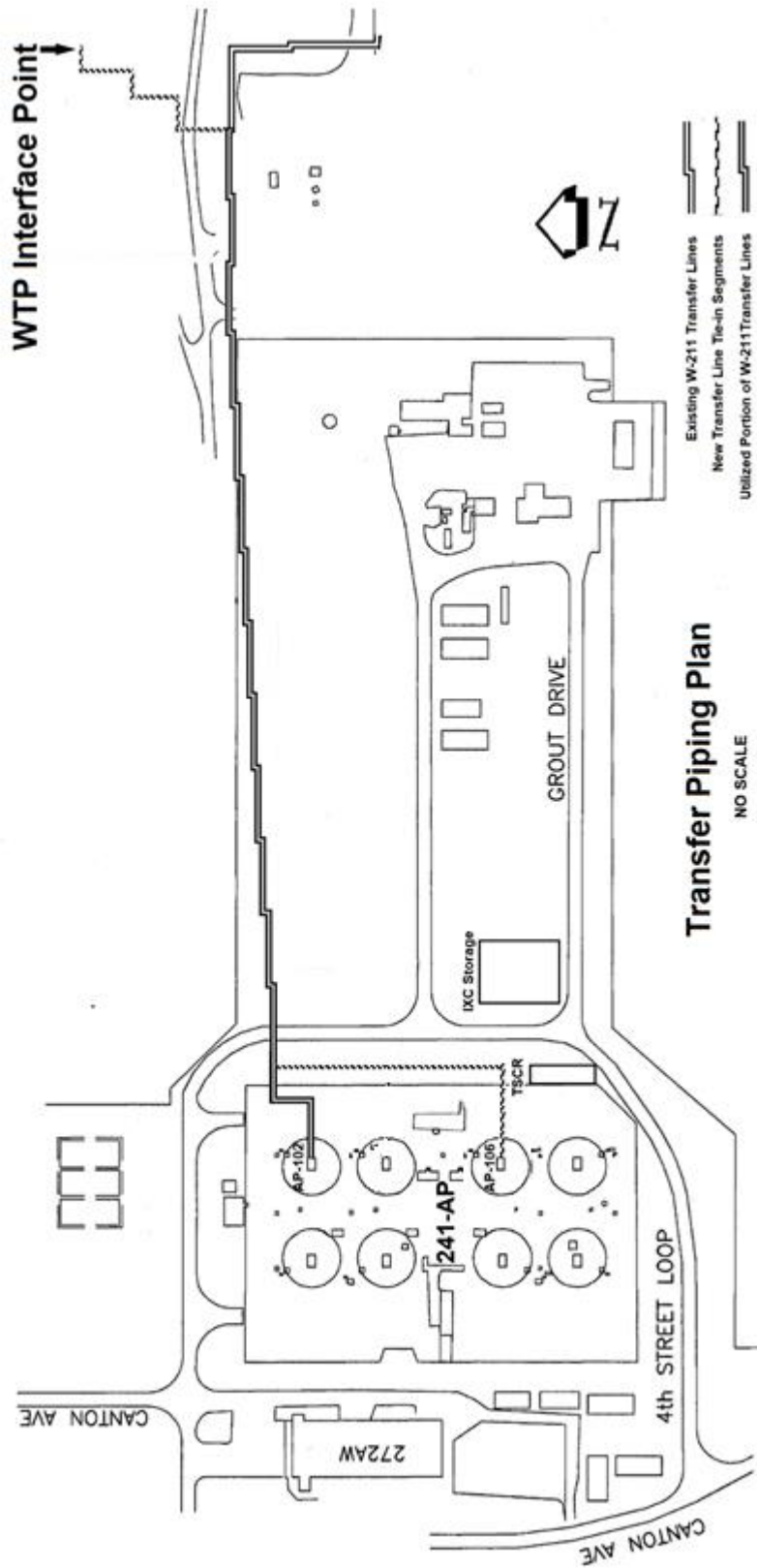
12 Both transfer lines utilize a significant portion of the existing WTP “full-feed” lines installed from the
13 241-AP Farm to the WTP Pretreatment Facility as part of Project W-211. Figure C-9 provides a graphic
14 representation of the approximate length of the utilized portion of the W-211 transfer lines.

15 The three Project W-211 installed lines include SN-637, SN-700, and SN-701, with SN-637 selected for
16 waste feed delivery to WTP, and SN-700 selected for EMF returns. A new segment from DST
17 241-AP-106 was installed to the tie-in point at SN-637. This also required installation of a new segment
18 from the SN-637 take-off point to the WTP Interface Point. The reverse was performed for EMF returns
19 to DST 241-AP-102. A new segment was installed from the WTP Interface Point to the SN-700 tie-in
20 point with the remainder of SN-700 being used to the AP-02D valve pit. Transfer line SN-701 will remain
21 unused in the DFLAW configuration. The routing of the two modified transfer lines is shown on
22 Figure C-9.

23 **C.4 Fire Suppression and Fire Alarm**

24 TSCR is not connected to the 200 East Area fire water supply system. However, the Process Enclosure is
25 equipped with a fire suppression system supplied by a nitrogen driven water mist skid located within the
26 Ancillary Enclosure. The system is activated by smoke detectors or manual pull stations. Upon activation,
27 pressurized nitrogen drives water through the system. Inspection of fire system components is found in
28 Addendum I, “Inspection Plan,” Table I-1. Nearby hydrants supplement fire suppression and also serve
29 the IXC staging and storage areas. The Hanford Fire Department is equipped with fire engines for control
30 of fires requiring high water volume and pressure.

31 LAWPS OUG facilities, including the spent IXC storage pad, rely primarily on the Hanford Fire
32 Department to respond to fires and other emergencies as described in Hanford Facility Permit
33 Attachment 4, *Hanford Emergency Management Plan*, (DOE/RL-94-02). The Hanford Fire Department
34 provides all the necessary equipment and personnel to respond to emergencies. Operators will respond to
35 emergencies in accordance with the LAWPS Addendum J, “Contingency Plan” and are trained in the use
36 of emergency systems, response to fires, and use of communications equipment.



1

Figure C-9 241-AP Farm to Waste Treatment Plant Transfer Piping Plan

1 C.5 Container Storage

2 LAWPS OUG includes two container storage areas used to manage spent IXC. The first is the IXC
3 Storage Pad located immediately east of the LAWPS facilities. The IXC storage pad is sized to store
4 150 columns, which accommodates the expected generation rate of two columns per month for the
5 approximate five-year duration of TSCR (LAWPS Phase 1) operations with some added contingency
6 space. The storage pad could also accommodate media traps, should that waste form be generated during
7 waste processing. The media trap is a contingency feature located just upstream of the delay tank and is
8 designed to capture IX media in the unlikely event of a screen failure within an IXC that could result in
9 IX media being released into the process stream. A media trap is a small component approximately
10 17 inches by 3 inches that resembles a small cartridge filter. The IXC Storage Pad will also store one
11 spent IXC from the Test Bed Initiative demonstration project.

12 Storage pad dimensions account for row and aisle spacing requirements in accordance with
13 WAC 173-303-630(5)(c). The IXC storage pad is approximately 110 feet long by 75 feet wide, orientated
14 in a north-south configuration. The reinforced slab is 12 inches thick with 30-inch turndowns to provide
15 adequate load carrying capacity to meet seismic and loading requirements. The storage pad is connected
16 to the Balance of Facilities (BOF) concrete pad (where the TSCR Process Enclosure resides), by a
17 concrete travel path (reference Figure C-6).

18 The IXC staging area is located immediately adjacent to the TSCR Process Enclosure. This container
19 storage area can accommodate three columns and is intended as a contingency location for columns that
20 may require decontamination, or other corrective actions, prior to placement onto the IXC Storage Pad.
21 The IXC staging area concrete slab is integral to the BOF slab and will be demarcated with striping and
22 stanchions as appropriate. Refer to Section C.2.6 and Figures C-1 and C-6 for additional information on
23 both container storage areas. Columns will remain in the IXC staging area for no longer than one year and
24 may remain on the IXC storage pad for up to 50 years.

25 Both container storage areas are located within fenced and gated boundaries with access controls.
26 Because the IXC will not contain free liquids and do not hold waste types listed in WAC 173-303-
27 630(7)(c), secondary containment is not provided for either storage area. Both areas are sloped to remove
28 liquids resulting from precipitation in accordance with WAC 173-303-630(7)(c)(i). The specifications and
29 requirements for the design of both storage areas are found in RPP-SPEC-62054, *TSCR IXC Concrete*
30 *Storage Pad System: Tank Farm System Infrastructure Upgrades Specification* and RPP-CALC-62547,
31 *Structural Analysis of TSCR IXC Storage Pad* (both as amended).

32 Other secondary solid waste that results from the balance of process operations is considered newly
33 generated waste that requires packaging for shipment, treatment if necessary, and disposal. Some waste
34 may require treatment to address Land Disposal Restrictions prior to disposal.

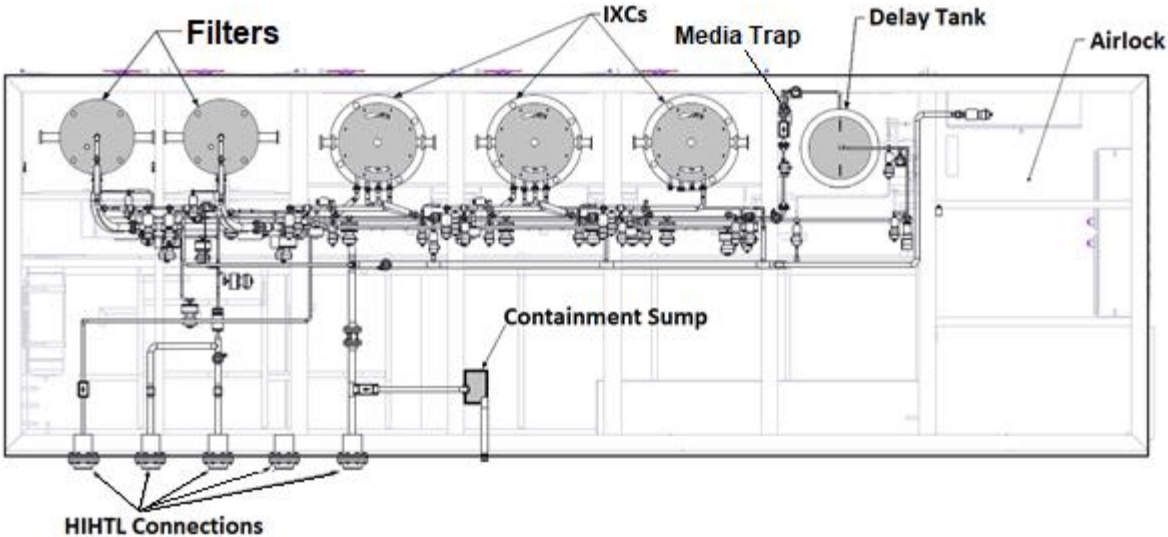
35 Secondary waste will be managed in accordance with the applicable sections WAC 173-303-200,
36 accumulation standards and WAC 173-303-630, *Use and management of containers*. Secondary solid
37 waste generated from LAWPS operations will not result in any unique waste forms requiring specialized
38 packaging, transportation, treatment, and disposal considerations. Waste stream types generated from
39 LAWPS operations may include, but are not limited to the following examples:

- 40 • Personal protective equipment/step-off pad waste.
- 41 • Decontamination materials.
- 42 • Spill cleanup materials.
- 43 • Maintenance debris waste (e.g., tank waste contacted filters, valves and instruments).

44 In addition, satellite accumulation areas may be used as necessary for routinely generated dangerous
45 waste in accordance with WAC 173-303-174.

1 **C.6 Tank Systems**

2 This section provides specific information on the TSCR tank system and includes discussion on the type
 3 of waste to be managed in the system, tank system design information, integrity assessments, and
 4 additional information on the TSCR tank system components that treat and store mixed waste.
 5 Modifications to the 241-AP Tank Farm beyond those described in this addendum are not associated with
 6 the LAWPS OUG and are not included in this application. The TSCR Process Enclosure tank system
 7 components are discussed in Sections C.1 and C.2 and the locations of the tank system process
 8 components are presented in Figure C-10.
 9



10 **Figure C-10 Tank Side Cesium Removal Process Enclosure Layout**
 11 **(Simplified Plan View)**

12 The primary TSCR tank system components are shown in Table C-2.
 13

14 **Table C-2 Primary Tank Side Cesium Removal Tank System Components**

Component	ID Number	Function	Volume
Feed Filters (2)	WP-FLT-325A WP-FLT-325B	Solids Filtration	49.5 gallons
IXC (3)	WP-IX-400A WP-IX-400B WP-IX-400C	Cesium Removal	162.6 gallons
Media Trap	WP-RT-500	IX Media Confinement	0.25 gallons
Delay Tank	WP-TK-550	Barium Decay	300 gallons

15

1 C.6.1 Design Requirements

2 The following sections provide an overview of the design specifications for the TSCR tank system
3 components. In accordance with the new tank system requirements of WAC 173-303-640(3), the
4 following tank components and specifications were assessed:

- 5 • Dimensions, capacities, wall thicknesses, and pipe connections.
- 6 • Materials of construction and compatibility of materials with the waste being processed.
- 7 • Materials of construction of foundations and structural supports.
- 8 • Review of design codes and standards used in fabrication and construction.
- 9 • Review of structural design calculations, including seismic design basis.
- 10 • Waste characteristics and the effects of waste on corrosion.

11 A design assessment to establish compliance with WAC 173-303-640(3) has been performed and certified
12 by an IQRPE. The design assessment reports found the tank system design in compliance with
13 WAC 173-303-640(3).

14 The specifications and requirements for the design and fabrication of the TSCR tank system and ancillary
15 equipment are documented in the following:

- 16 • TSCR specifications for design and fabrication are documented in RPP-SPEC-61910,
17 *Specification for the Tank Side Cesium Removal Demonstration Project* (as amended).
- 18 • DST Project specifications for supporting infrastructure are documented in RPP-SPEC-60547,
19 *Low Activity Waste Pretreatment System: Tank Farm System Infrastructure Upgrades*
20 *Specification* (as amended).
- 21 • HIHTL specifications for design and fabrication are documented in RPP-14859, *Specification for*
22 *Hose-in-Hose Transfer Line and Hose Jumpers* (as amended).
- 23 • Project W-211 transfer line specifications for the design and fabrication of the pipe-in-pipe
24 transfer line components are documented in HNF-SD-W211-FDC-001, *Functional Design*
25 *Criteria, Project W-211, Initial Tank Retrieval Systems* (as amended) and W-211-TP-P1,
26 *Procurement Specification Double Containment Piping TFC/WTP Waste Transfer Piping*
27 (as amended).
- 28 • DST Project specifications for the design and fabrication of the transfer line tie-in segments to the
29 W-211 transfer lines are documented in RPP-SPEC-62029, *Waste Feed Delivery: Tank Farm*
30 *System Infrastructure Upgrades Specification* (as amended).

31 All the primary dangerous waste tank system treatment components in the TSCR Process Enclosure are
32 constructed of stainless steel. According to the design basis, it was determined stainless steel provides
33 adequate corrosion protection for these process components with a five-year design life.

34 C.6.1.1 Codes and Standards for Tank System Design and Construction

35 Specific standards for the manufacture of TSCR process systems are briefly discussed in the following
36 sections. In addition to these codes and industrial standards, a seismic analysis for each process system is
37 required [WAC 173-303-806(4)(a)(xi)]. The seismic analysis was performed in accordance with
38 Department of Energy (DOE) Order 420.1C.

39 Codes and standards applicable to the design, construction, and testing of the tanks, ancillary piping
40 systems, and hose systems are established in Table C-3.

Table C-3 Codes and Standards for Tanks and Ancillary Systems

Code/Standard	Title
American Society of Mechanical Engineers (ASME) – B31.1 (latest edition)	<i>Power Piping</i>
ASME – B31.3 (latest edition)	<i>Process Piping</i>
ASME – Boiler and Pressure Vessel Code (latest edition)	<i>Rules for Construction of Pressure Vessels</i>
ASME – NQA-1A (Addendum A, latest edition)	<i>Quality Assurance Requirements for Nuclear Facility Applications</i>
American Welding Society (AWS) – D1.1/D1.1M (latest edition)	<i>Structural Welding Code – Steel</i>
AWS – D1.6/D1.6M (latest edition)	<i>Structural Welding Code – Stainless Steel</i>
National Association of Hose and Accessories Distributors (NAHAD) 500 (latest edition)	<i>Industrial Hose Assembly Specification Guidelines</i>
NAHAD 600 (latest edition)	<i>Composite Hose Assembly Specification Guidelines</i>
Rubber Manufacturers Association, Inc (RMA) IP-2 (latest edition)	<i>Hose Handbook</i>

1
 2 The application of these standards to the fabrication and installation of the TSCR tank system, transfer
 3 piping, and hoses, combined with independent verification of completed systems ensures that the tank and
 4 tank supports have sufficient structural strength and that seams and connections are adequate to ensure
 5 tank integrity. In addition, each tank system component will meet strict quality assurance requirements.
 6 Any tank system component constructed off-site will be tested for integrity and leak tightness before
 7 shipment to the Hanford Facility. Following installation, the systems will be inspected for damage to
 8 ensure against leakage and to verify proper operation. If a tank system component was damaged during
 9 shipment or installation, repairs will be made and leak tightness testing will be repeated on-site.

10 **C.6.1.2 Design Information for Tank Side Cesium Removal and Transfer Lines**

11 The TSCR Process Enclosure and transfer lines (both hard pipe and HIHTL) will be constructed to meet a
 12 series of design standards, as discussed in the following sections. Table C-3 above presents the applicable
 13 design standards and codes for tank systems, and Tables C-4 and C-5 provide additional information on
 14 key ancillary equipment and materials of construction associated with the TSCR and waste transfer
 15 systems. All piping systems are designed to withstand the effects of internal pressure, weight, thermal
 16 expansion and contraction, and any dynamic flow. The design of these units have been evaluated in an
 17 engineering design assessment certified by an IQRPE. The certified design assessments are documented
 18 in four reports included in the LAWPS OUG Appendix 2.11. Follow-on integrity assessments, including
 19 frequency, will be established following completion of the design assessment.

Table C-4 Materials of Construction and Design

System	Number	Material	Design
Filters (2)	WP-FLT-325A WP-FLT-325B	316/316L Stainless Steel	Appendix 2.11
IXC 1	WP-IX-400A	316/316L Stainless Steel	Appendix 2.11
IXC 1	WP-IX-400B	316/316L Stainless Steel	Appendix 2.11
IXC 1	WP-IX-400C	316/316L Stainless Steel	Appendix 2.11
Media Trap	WP-RT-500	316/316L Stainless Steel Hastelloy® C-276 (screen)	Appendix 2.11
Delay Tank	WP-TK-550	316/316L Stainless Steel	Appendix. 2.11
TSCR Piping & Valves	Various	304/304L and 316/316L Stainless Steel	Appendix 2.11
TSCR Process Enclosure Secondary Containment (includes sump and pump)	N/A	Epoxy Coated Carbon Steel	Appendix 2.11
Misroute Prevention Secondary Containment	N/A	304/304L Stainless Steel	Appendix 2.11
HIHTLs (5)	HIHTL-AP106-SN-101 HIHTL-AP107-SN-102 HIHTL-AP107-SN-103 HIHTL-AP108-SN-104 HIHTL-AP108-SN-105	EPDM	Appendix 2.11
Pipe-in-Pipe Transfer Lines (primary) ¹	SN-637 SN-700	316/316L Stainless Steel (new) 304L (existing)	Appendix 2.8 Appendix 2.5

¹Includes utilized portions of existing W-211 transfer lines and new tie-in segments.

Hastelloy® is a registered trademark of Haynes International.

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C.6.1.3 Integrity Assessments

The initial design assessment for TSCR attests to the adequacy of design and integrity of the tank system to ensure that the tanks and ancillary equipment will not collapse, rupture, or fail over the intended life considering intended uses. Specifically, the assessment documents the following considerations:

- Standards used during design of the tank system.
- Characteristics of the waste feed.
- Adequacy of the materials of construction to provide corrosion protection from the solution in waste feed.

The results of the assessment demonstrate that the tank system and ancillary equipment have sufficient structural integrity and are acceptable for storing and treating dangerous and/or mixed waste. The assessment concludes that the tank system and ancillary components are designed to withstand a design-basis earthquake.

1 If TSCR were to be operated longer than five years (current design life), a tank integrity assessment
2 program and schedule, to include a corrosion inspection program, if necessary, will be developed and will
3 include periodic follow-on integrity assessments. The frequency of follow-on integrity assessments will
4 be determined by the initial assessment and include considerations for age of the tank system, materials of
5 construction, characteristics of the waste, operating experience, and recommendations of the initial design
6 assessment. It is common for each of these tank types to be assessed on a frequency adequate to
7 determine if corrosion or other indications of deterioration is occurring. The tank integrity assessment
8 program and schedule will be developed and entered into the LAWPS OUG Operating Record prior to the
9 first receipt of waste.

10 **C.6.2 Additional Requirements for New Tanks**

11 Procedures for proper installation of tanks, tank supports, piping, concrete, etc., are included in
12 construction specifications. During and following installation, an independent qualified installation
13 inspector or an IQRPE will inspect the tanks and secondary containment in accordance with
14 WAC 173-303-640(3)(c). Deficiencies identified are to be documented and a determination will be made
15 as to repair/rework or use-as-is. All deficiencies requiring corrective action will be repaired to the
16 satisfaction of the engineer. The tanks and ancillary equipment will be leak tested as part of acceptance of
17 the system from the fabrication contractor. Information on the inspections and leak tests are to be
18 included in the construction/installation certification, which will be entered into the LAWPS OUG
19 Operating Record.

20 **C.6.3 Secondary Containment and Leak Detection**

21 This section describes the design and operation of secondary containment and leak detection systems for
22 the TSCR Process Enclosure and transfer lines (HIHTL and pipe-in-pipe).

23 **C.6.3.1 Secondary Containment for the Tank Side Cesium Removal Process Enclosure**

24 The TSCR Process Enclosure utilizes two secondary containment features; one that provides containment
25 for all process area tank system components, and second system providing containment for the misroute
26 prevention interface within the Process Enclosure airlock. The basis for sizing the secondary containment
27 system in the TSCR Process Enclosure process area is documented in calculation RPP-CALC-62500,
28 *Process Enclosure Secondary Containment Sizing* (as amended). Supporting design and construction
29 specifications ensures the foundation is capable of supporting the tank and secondary containment
30 systems and that uneven settling and failures from pressure gradients should not occur.

31 The TSCR Process Enclosure secondary containment system is integral to the process unit and underlies
32 all tank system components within the structure. The system is designed to contain a leak from any
33 process component within the Process Enclosure and is constructed of epoxy coated carbon steel. The
34 underlying concrete foundation is designed with reinforcing steel. The concrete slab and footing
35 dimensions preclude failure caused by load pressures and climatic conditions (e.g., frost heave).
36 Established principles and techniques for structural analysis, soil mechanics, and concrete and structural
37 steel design were used in the design calculations for the foundation and Process Enclosure structure. In
38 each of the analyses, the major design criteria are established from the documents listed in Table C-5.

39 The second containment system is comprised of a National Electrical Manufacturers Association
40 (NEMA) 4X rated liquid tight cabinet. The cabinet is constructed of stainless steel and houses reagent
41 feeds (e.g., water, caustic, and service air) into the Process Enclosure process area. The cabinet provides
42 containment in the unlikely event of waste misroute into any of the reagent feed lines. The cabinet is
43 equipped with a drain line with a leak detector installed within the drain line above a closed valve. If the
44 leak detector is activated, the valve automatically opens and drains any leaked liquids into the Process
45 Enclosure drain manifold, which routes the leaked material directly to 241-AP-108. Reference
46 Figure C-11 for the NEMA cabinet location.

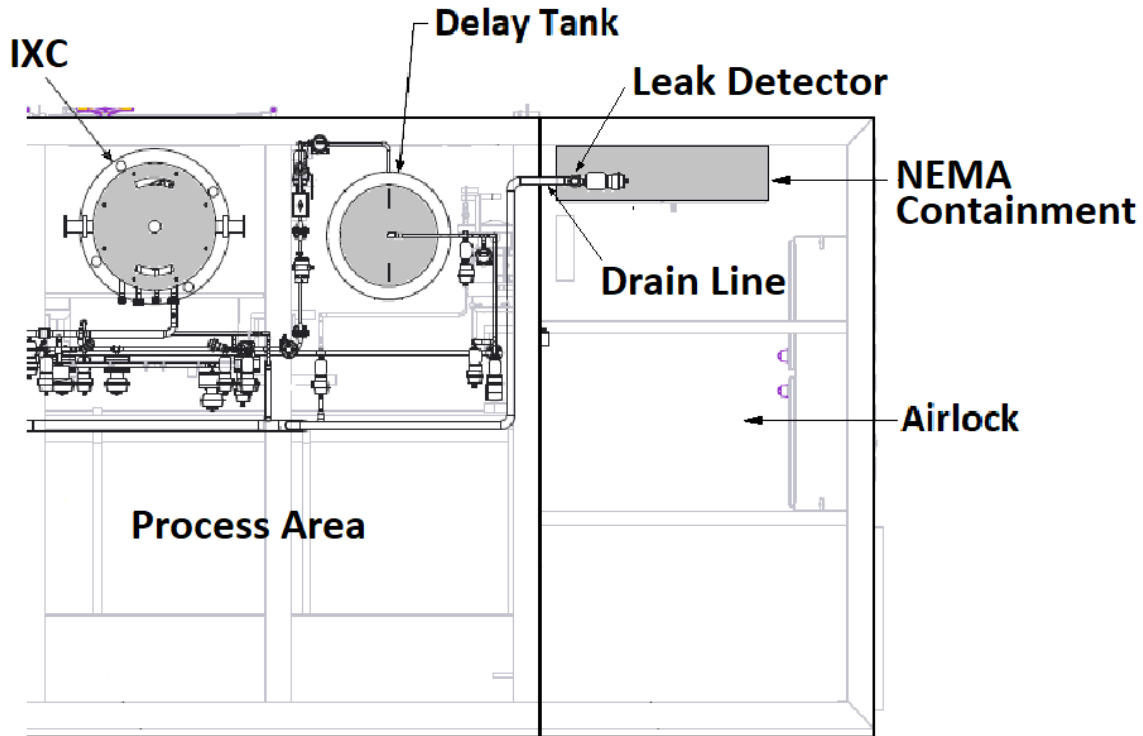


Figure C-11 National Electrical Manufacturers Association Containment Cabinet

Table C-5 Codes and Standards for Structural Systems

Document	Title
DOE Order 420.1C (latest edition)	Facility Safety
International Building Code (IBC) 2015	International Building Code
American Concrete Institute (ACI) 301 (latest edition)	Standard Specification for Structural Concrete
ACI 318 (latest edition)	Building Code Requirements for Structural Concrete
ACI 349 (latest edition)	Code Requirements for Nuclear Safety-Related Concrete Structures and Commentary

3
 4 The TSCR Process Enclosure secondary containment system is designed to contain 100 percent of the
 5 volume of the largest tank within its boundary in accordance with WAC 173-303-640 (4)(e)(i)(A). The
 6 300-gallon delay tank bound the necessary volume. RPP-CALC-62500, *Process Enclosure Secondary*
 7 *Containment Sizing Calculation* documents the basis for this secondary containment sizing.

8 The total volume of the Process Enclosure secondary containment system is 432 gallons. The containment
 9 system is sloped to a single low-point sump equipped with a leak detector and pump allowing for
 10 detection and removal of any leaked waste. Leaked waste would be pumped from the secondary
 11 containment sump through the drain manifold to 241-AP-108. Leak detection alarms are monitored in
 12 accordance with Addendum I, "Inspection Plan."

13 TSCR has no outside dangerous waste storage or treatment tanks that require consideration of the
 14 additional volume from a 25-year, 24-hour storm event [WAC 173-303-640(4)(e)(i)(B)].

C.6.3.2 Secondary Containment and Operation of Transfer Lines

All five HIHTLs are provided secondary containment by the outer encasement hose. The TSCR Process Enclosure HIHTL connection represent the high point for all five lines, therefore, leak detection is provided by low point instruments located at the 241-AP Farm connections. All the lines have been designed to minimize low points between the TSCR enclosure and the AP Tank farm. However, due to structures, required equipment travel routes in the farms or the need to shield the lines, there are some localized low points. The following table identifies the location of low-point leak detection for each HIHTL. A seven-gallon per hour leak can be detected in any of the five hoses within 24 hours.

Table C-6 Secondary Containment for Hose-in-Hose Transfer Lines and Hard Piped Transfer Lines

# Transfer Line	Line Number	Destination/Connection	Leak Detector Location and Minimum Leak Rate to Detect in 24 Hours
1	HIHTL-AP106-SN-101	241-AP-106, Riser 002	Within Drop Leg, 4 g/hr
2	HIHTL-AP107-SN-102	AP-07F Pump Pit	Within Drop Leg, 7 g/hr
3	HIHTL-AP107-SN-103	AP-07F Pump Pit	Within Pump Pit, 7 g/hr
4	HIHTL-AP108-SN-104	241-AP-108, Riser 015	Within Drop Leg, 4 g/hr ¹
5	HIHTL-AP108-SN-105	241-AP-108, Riser 015	Within Drop Leg, 4 g/hr ¹
N/A	SN-637 (high point)	WTP ICD-30 interface point	EMF low-point drain, 0.5 g/hr
N/A	SN-637 (high point)	241-AP-106, AP-06A Pit	Within Pump Pit, 3 g/hr
WTP to AP Farm	SN-700	241-AP-102	EMF-low-point drain, 0.5 g/hr

¹Leak rates are HIHTL-AP108-SN-104 and HIHTL-AP108-SN-105 are bounded by the 4 g/hr leak rate calculated for HIHTL-AP106-SN-101 as they are continuously sloped.

241-AP Farm leak detection signals are shared with the TSCR Process Enclosure allowing for shutdown of process operations upon indication of a leak with any of the five HIHTLs (reference Section C.2.8). The HIHTL primary hose can be flushed and air blown from the TSCR Process Enclosure back to the tank the HIHTL is connected to. In the event any leaked waste from a primary hose to the secondary, that material will be removed by compressed air and/or water flushing from the TSCR Process Enclosure end back to the tank the HIHTL is connected to. This would require both primary and secondary hoses to be disconnected from the Process Enclosure. If a HIHTL developed a leak to the secondary containment system or the environment, TSCR waste processing must stop and the leaking HIHTL would be taken out of service per WAC 173-303-640(7)(a) and replaced with a new HIHTL or hard walled pipe after the Department of Ecology’s (Ecology) approval to do so after submitting to Ecology any relevant and requested information for the cause of the leak. Valves isolating the vent and drain manifolds remain closed when either HIHTL-AP108-SN-104 or HIHTL-AP108-SN-105 is not in use. An educator using compressed air maintains a negative on the vent manifold prior to removing IXC connections, which prevents vapors from 241-AP-108 entering the TSCR Process Enclosure.

Secondary containment for hard-piped transfer lines are provided by the outer encasement pipe. Both the 241-AP Farm to WTP feed line and WTP EMF return line are sloped from the 241-AP Farm to the WTP EMF facility, which is equipped with a low-point leak detector that provides indication of a leak. WTP EMF leak detection signals will be provided to the DST Central Control room allowing for shutdown of waste transfers upon indication of a leak within either transfer line.

1 A dedicated pipeline is used to transfer the DFLAW conditioned liquid effluent generated by TSCR to the
2 EMF. The feed line runs through EMF (for access to the low-point drain) to the LAW Concentrate
3 Receipt Vessel. The feed has undergone previous qualification to ensure it meets WTP acceptance. Upon
4 WTP approval of the Tank Operations Contractor's (TOC) request to transfer effluent, each facility verifies
5 ready to transfer/receive status, and TOC provides notification of start of transfer. During the transfer, the
6 TOC performs inline process monitoring and will stop the process in a fail-safe condition in the event of
7 an abnormal condition such as detection of a leak, removal of a permissive signal, or interlock. The Leak
8 Detector for in the AP06A Pump Pit (AP06A-WT-WTL-SN-637) is monitored by the TOC during WTP
9 feed transfers through SN-637.

10 The TOC initiates shutdown of the 241-AP-106 transfer pump when the target transfer volume is reached
11 or a transfer/receipt permissive is removed. Following completion of the transfer, the TOC and WTP will
12 evaluate the anticipated schedule for the next effluent batch transfer. If no transfer is scheduled within the
13 next 14 calendar days, WTP will flush the transfer line to 241-AP-106 with an appropriate flushing media
14 (e.g., EMF process condensate, deionized water, raw water). Residual flush media will be permitted to
15 drain into the EMF Low Point Drain Vessel, after which the TOC and TOC transfer/receipt systems are
16 subsequently isolated until the next transfer. If the next transfer will be performed with 14 days, transfer
17 line flushing is not required. The same flushing process is used for the EMF to 241-AP-102 process
18 condensate return transfer line.

19 **C.6.4 Tank Management Practices**

20 Tank management practices addressing rupture, leakage, and corrosion prevention are discussed as
21 follows.

22 Because TSCR treats DST system aqueous supernatant with a low solids content, this feed waste stream
23 can be managed such that erosion and corrosion is not a significant concern. Additionally, the materials of
24 construction used in the TSCR Process Enclosure, HIHTLs, and hard-piped transfer lines make it unlikely
25 that an aqueous waste would corrode a tank, hose, or piping materials.

26 Aqueous waste being processed through TSCR observed on, around or coming from mechanical
27 connections (e.g., Swagelok, ChemJoint, etc.) during batch processing within the process enclosure that
28 are insufficient in volume or rate to activate leak detection alarms within the TSCR process enclosure will
29 be visually monitored for volume change, documented on an inspection checklist, summarized in the
30 quarterly report required by Permit Condition III.1.J.7. During the next maintenance outage
31 (normally during an ion exchange column changeout), any waste deposited outside the processing system
32 will be cleaned up, properly disposed of in accordance with operating procedures and the system will be
33 repaired before restart of operation. Until properly cleaned up, a daily visual inspection will be conducted
34 in accordance with Addendum I, Table I-1, to verify the discovered waste would not lead to a leak in a
35 tank system component.

36 Should a leak in any tank system component activate the leak detection system, the leak is immediately
37 stopped by isolating the leaking component and removing the tank system component from service.
38 Following isolation, the requirements of WAC 173-303-640(7), incorporated by reference, are followed.
39 These requirements include repair or closure of the tank/tank system component preceded by removal of
40 any waste. Any major repairs require certification. If repairs are not practical or successful, the tank
41 system would undergo closure in accordance with Addendum H, "Closure Plan."

42 External corrosion protection (i.e., cathodic protection) is not required for the TSCR Process Enclosure
43 tank system components as they are contained within an above ground structure and are not in contact
44 with soil or moisture. HIHTLs are protected from contact with soil or moisture with an exterior insulating
45 system. Hard-piped transfer lines are protected from external corrosion by a protective coating system.

1 **C.6.4.1 Overfilling Prevention**

2 Because TSCR Process Enclosure tanks system components are designed and operated as a once-through,
3 closed pressure vessel system, tank overfill controls and features are not applicable. The Control Room in
4 274AW MCS monitors all processing parameters and is equipped with alarms that annunciate on any
5 indication of system malfunction that includes alarms and interlocks to shut the system down.

6 **C.6.5 Labels or Signs**

7 Each tank or primary process unit component (i.e., filters, IXC, etc.) in the TSCR Process Enclosure are
8 identified by an attached nameplate that includes the equipment number. Additionally, the Process
9 Enclosure will bear a legend that identifies the systems and waste in a manner that adequately warns
10 employees, emergency personnel, and the public of the major risk(s) associated with the waste being
11 stored or treated in the tank system.

12 Access to the fenced and gated TSCR Process Enclosure area, including the IXC staging area, is posted
13 with black and white signs bearing the words “Danger–Unauthorized Personnel Keep Out.” Signs are
14 posted at each entrance gate to the facility. The same posting is affixed to the IXC storage pad gate and
15 entrances. Individual IXC will bear labels in accordance with WAC 173-303-630(3). Refer to
16 Addendum E, “Security,” for additional information on signs and postings.

17 **C.6.6 Management of Ignitable or Reactive Wastes in Tanks Systems**

18 TSCR treats aqueous waste that does not meet the definition of an ignitable or reactive waste in
19 accordance with WAC 173-303-090(5). Therefore, design requirements, controls, and inspections
20 associated with the management of ignitable or reactive waste are not applicable to TSCR. Additional
21 information regarding qualification of TSCR feed waste acceptance criteria is found in Addendum B,
22 “Waste Analysis Plan.”

23 **C.6.7 Management of Incompatible Wastes in Tanks Systems**

24 TSCR treats dilute solutions of aqueous waste that is mixed and sampled prior to receipt that pose no
25 compatibility issues. TSCR Process Enclosure returns to the 241-AP Farm tanks will meet the
26 DST System Waste Acceptance Criteria.

27 **C.7 Organic Air Emissions Control**

28 This section addresses organic air emission standards per 40 Code of Federal Regulations (CFR) 264,
29 Subpart AA (WAC 173-303-690) and Subpart BB (WAC 173-303-691). The requirements of
30 WAC 173-303-690 (Subpart AA) are not applicable because TSCR does not perform distillation,
31 fractionation, thin-film evaporation, solvent extraction, or air or steam stripping operations
32 [WAC 173-303-690(1)(b)]. The requirements of WAC 173-303-691 (Subpart BB) are not applicable
33 because aqueous waste with 10 percent or greater organic concentration is not accepted for treatment at
34 TSCR.

35 **C.7.1 Applicability of Subpart CC Standards**

36 The air emission standards of WAC 173-303-692 (40 CFR 264, Subpart CC) apply to tank, surface
37 impoundment, and container storage units that manage wastes with average volatile organic
38 concentrations equal to or exceeding 500 parts per million (0.05 percent) by weight, based on the
39 hazardous waste composition at the point of origination. However, waste management units that are used
40 solely for management of radioactive mixed waste are exempt [WAC 173-303-692(1)(b)(vi)]. Since only
41 radioactive mixed waste is managed at the TSCR, these requirements are not applicable to TSCR
42 operations.

1 **C.8 Engineering Design Media**

2 Tabular listings and copies of Professional Engineer-stamped TSCR Process Enclosure, HIHTL,
3 hard-piped transfer lines, and IXC storage areas design drawings, calculations and other documentation
4 reflecting the design submitted with this application package are provided in the LAWPS Appendices 2.4
5 through 2.11.

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