SRMC-CWDA-2024-00035
Revision 0

Proposal to Cease Waste Removal Activities in Tank 10 and Enter Sampling and Analysis Phase

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Waste Disposal Authority

May 2, 2024

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Presentation Outline

- **Meeting Objective**
- **Background**
- **Waste Removal History and Results**
- **Additional Cleaning Considerations**
- **Path Forward**
- **Request for Department of Energy (DOE), South Carolina Department of Health and Environmental Control (SCDHEC), and Environmental Protection Agency (EPA) Concurrence**

Acronyms

A–P	Annulus to Primary
ALT	Alternate
CERCLA	Comprehensive Environmental Recovery Compensation and Liability ACT
CGCP	Consolidate General Closure Plan
CM	Closure Module
CSMP	Commercial Submersible Mixing Pump
DIRT	Data Integrity Review Team
DOE	Department of Energy
DWPF	Defense Waste Processing Facility
EPA	Environmental Protection Agency
FFA	Federal Facility Agreement
HTF	H-Area Tank Farm
LL	Liquid Level
LVMJ	Low Volume Mixing Jet
LWTRSAPP	Liquid Waste Tank Residuals Sampling and Analysis Program Plan
MCL	Maximum Contaminant Level
PCWR	Preliminary Cease Waste Removal
S&A	Sampling and Analysis
SCD	Semi-Continuous Dissolution
SCDHEC	South Carolina Department of Health and Environmental Control
SPF	Saltstone Production Facility
STD	Standard
STP	Submersible Transfer Pump
SWPF	Salt Waste Processing Facility
TCCR	Tank Closure Cesium Removal

Meeting Objective

Obtain mutual agreement among DOE, SCDHEC, and EPA to:

1. **Suspend waste removal activities in Tank 10; and**
2. **Enter the Sampling and Analysis phase in Tank 10 consistent with the *Consolidated General Closure Plan for F-Area and H-Area Waste Tank Systems* (CGCP) and *Liquid Waste Tank Residuals Sampling and Analysis Program Plan* (LWTRSAPP)**

Tank 10 Primary

Common Values & Goals*

Values

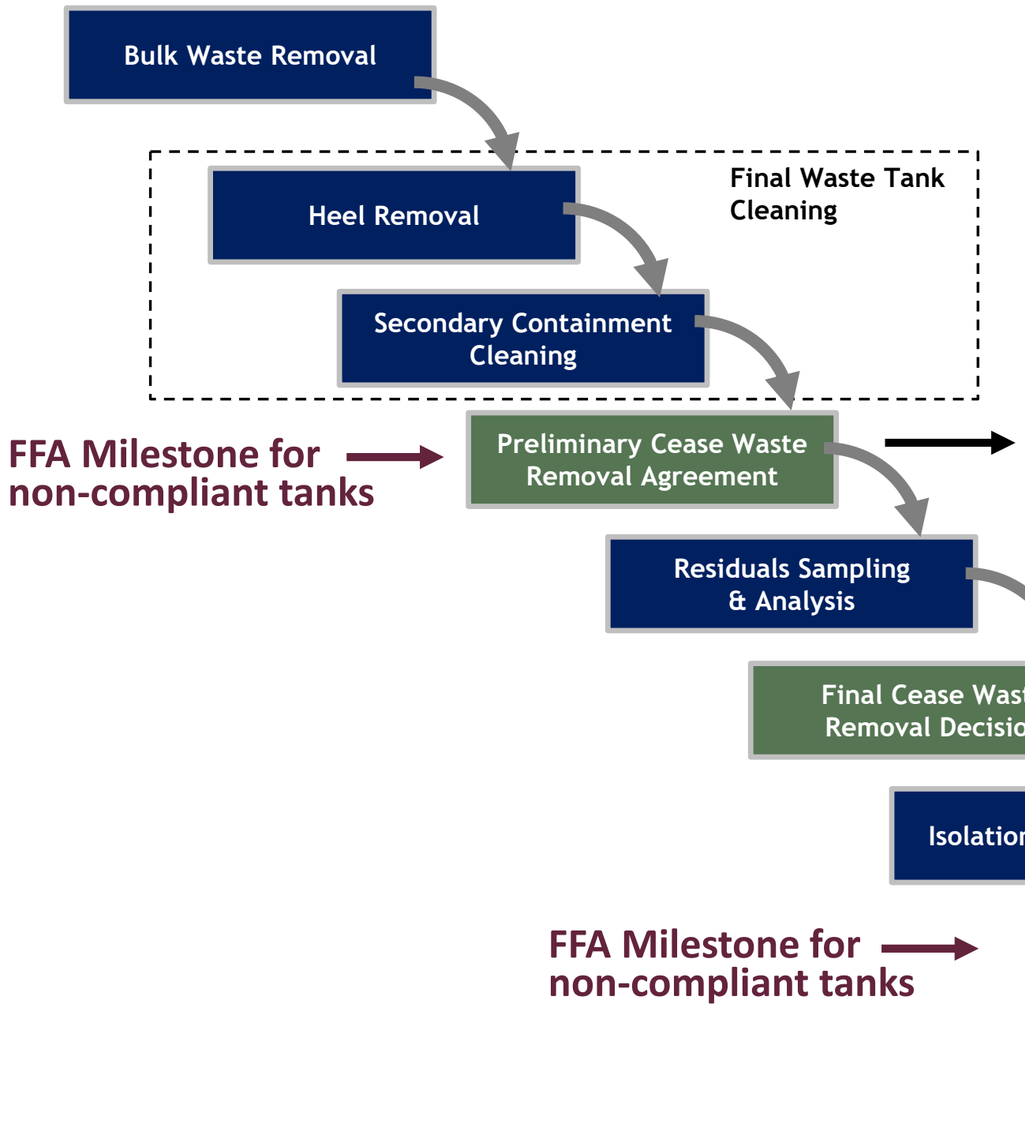
1. Maintain transparency with open communication between regulators, DOE, and the contractor on program progress, and significant emerging issues.
2. Ensure DOE's strategy and plans are subject to stakeholder engagement and input, including SCDHEC permitting processes, and CERCLA, as appropriate.
3. Maximize the amount of curies (especially long-lived radionuclides) vitrified and ready for ultimate disposal out of state.
4. Limit disposal of curies onsite at SRS so that residual radioactivity is as low as reasonably achievable.

Goals

1. Reduce risk to the environment by removing waste and closing tanks with a goal of completion of the liquid waste program by 2037.
2. Reduce operational and environmental risk by aggressively removing curies from the waste tanks.
3. Reduce operational and environmental risk by optimizing operations to minimize liquid waste program total life cycle.
4. Complete waste removal and subsequent grouting of all waste tanks and ancillary structures with a risk-based priority order: first to tanks in the water table, followed by F Tank Farm tanks, followed by remainder of waste tanks, followed by ancillary structures, recognizing the potential for future emergent conditions or opportunities.

**From Federal Facility Agreement (FFA) 2022 High Level Waste Tank Milestones Agreement* [WSRC-OS-94-42]

Tank Closure Process



Consolidated General Closure Plan

When DOE considers waste removal to be complete, DOE shall notify SCDHEC and EPA and provide any supporting documentation for review. If EPA and SCDHEC agree, they will independently provide letters of agreement to DOE. This agreement to proceed to the sampling and analysis phase is a non-binding preliminary decision and does not satisfy the requirements of FFA Appendix L, Requirement 9.b for demonstrating that waste removal activities may cease.

Federal Facility Agreement (FFA) Appendix L, Requirement 9.b.

…When DOE considers waste removal to be complete, DOE shall notify EPA and SCDHEC and provide any supporting documentation to SCDHEC and EPA for review. DOE, SCDHEC and EPA shall mutually agree that waste removal activities may cease.

Consolidated General Closure Plan

When the waste tank system has been stabilized with grout, as authorized by the approved Closure Module and cease waste approval letters from SCDHEC and EPA, DOE will have met the FFA commitment for removal from service

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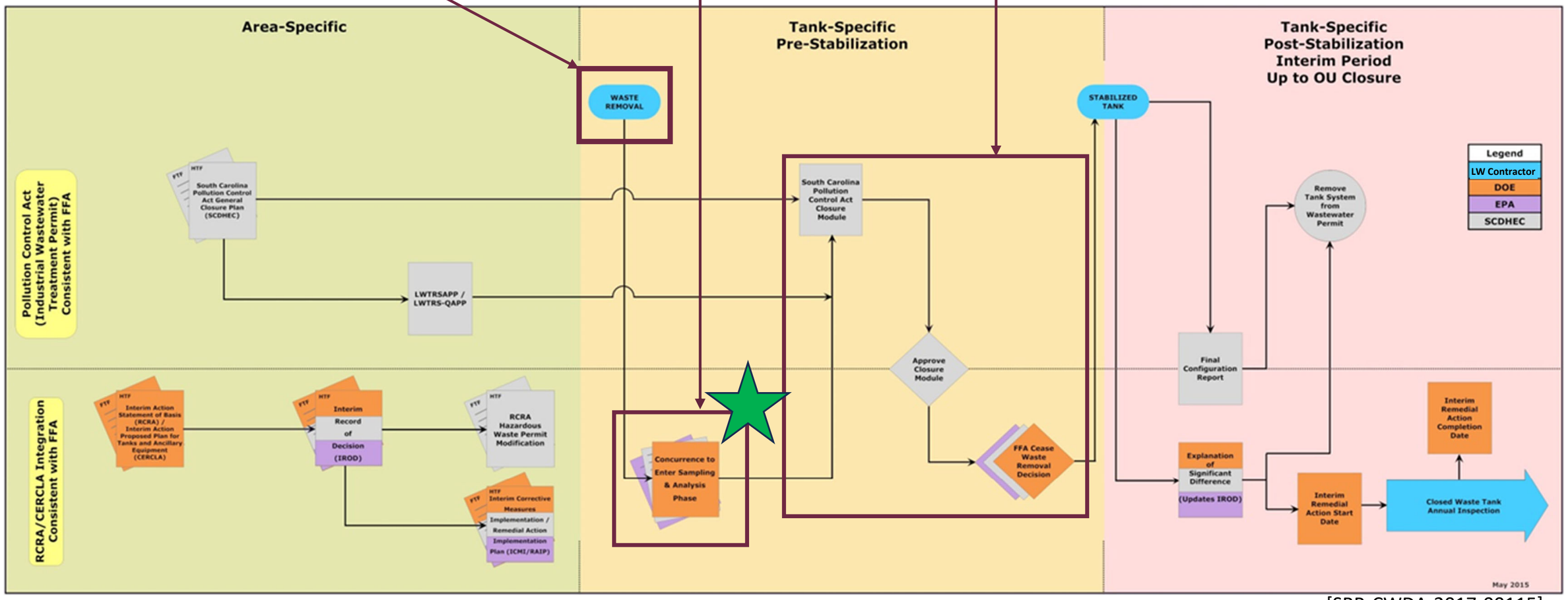
Following waste tank stabilization, the FFA commitment for removal from service (i.e., operational closure) will have been met.

Pathway to Closure

We believe this step is complete

Focus of today's discussion – agreement to move to Sampling & Analysis Phase

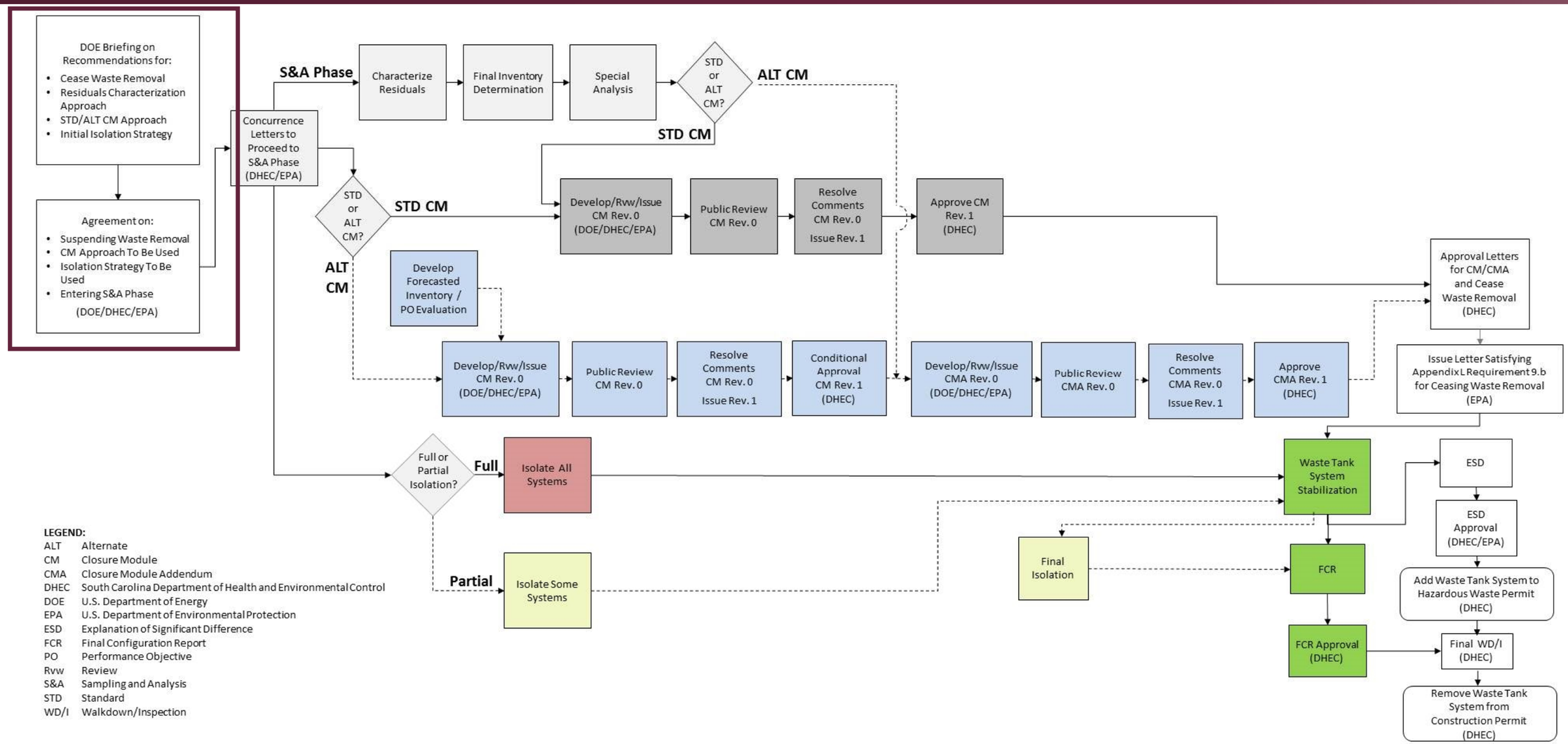
If agreement to proceed is reached, next phase is to quantify hazards and document risk through closure module process.



[SRR-CWDA-2017-00115]

(CGCP Figure 10.3-1)

Pathway to Closure



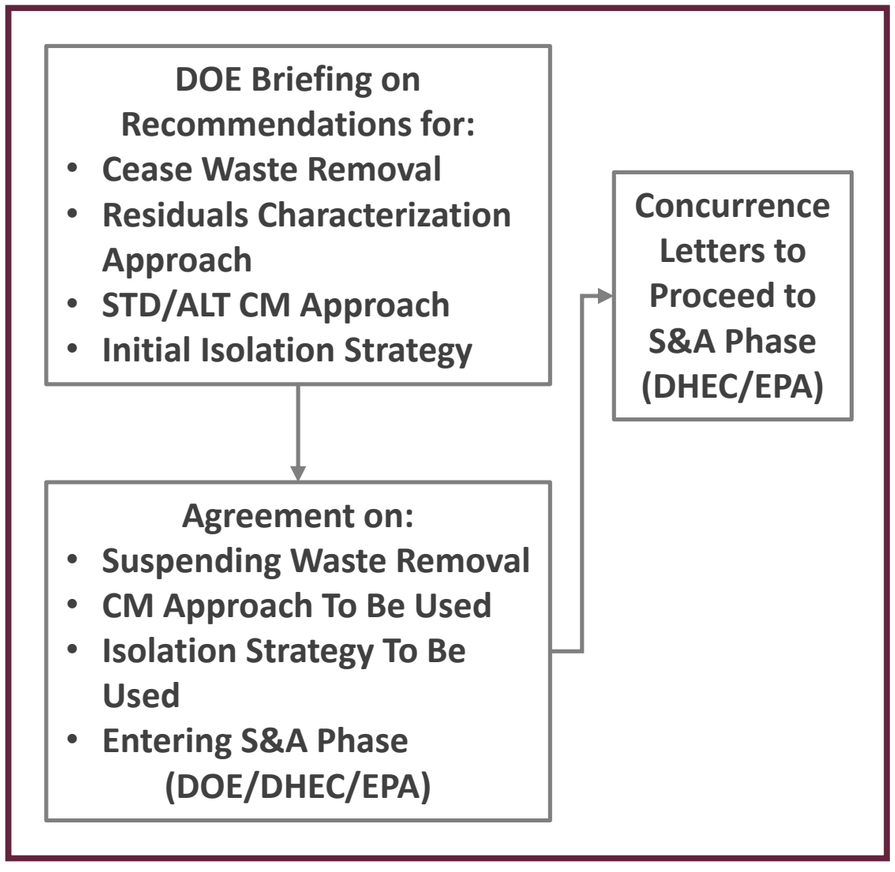
LEGEND:

ALT	Alternate
CM	Closure Module
CMA	Closure Module Addendum
DHEC	South Carolina Department of Health and Environmental Control
DOE	U.S. Department of Energy
EPA	U.S. Department of Environmental Protection
ESD	Explanation of Significant Difference
FCR	Final Configuration Report
PO	Performance Objective
Rvw	Review
S&A	Sampling and Analysis
STD	Standard
WD/I	Walkdown/Inspection

Closure Module Approval and Waste Tank System Removal from Service Process (CGCP Figure 11.4-1)

[SRR-CWDA-2017-00115]

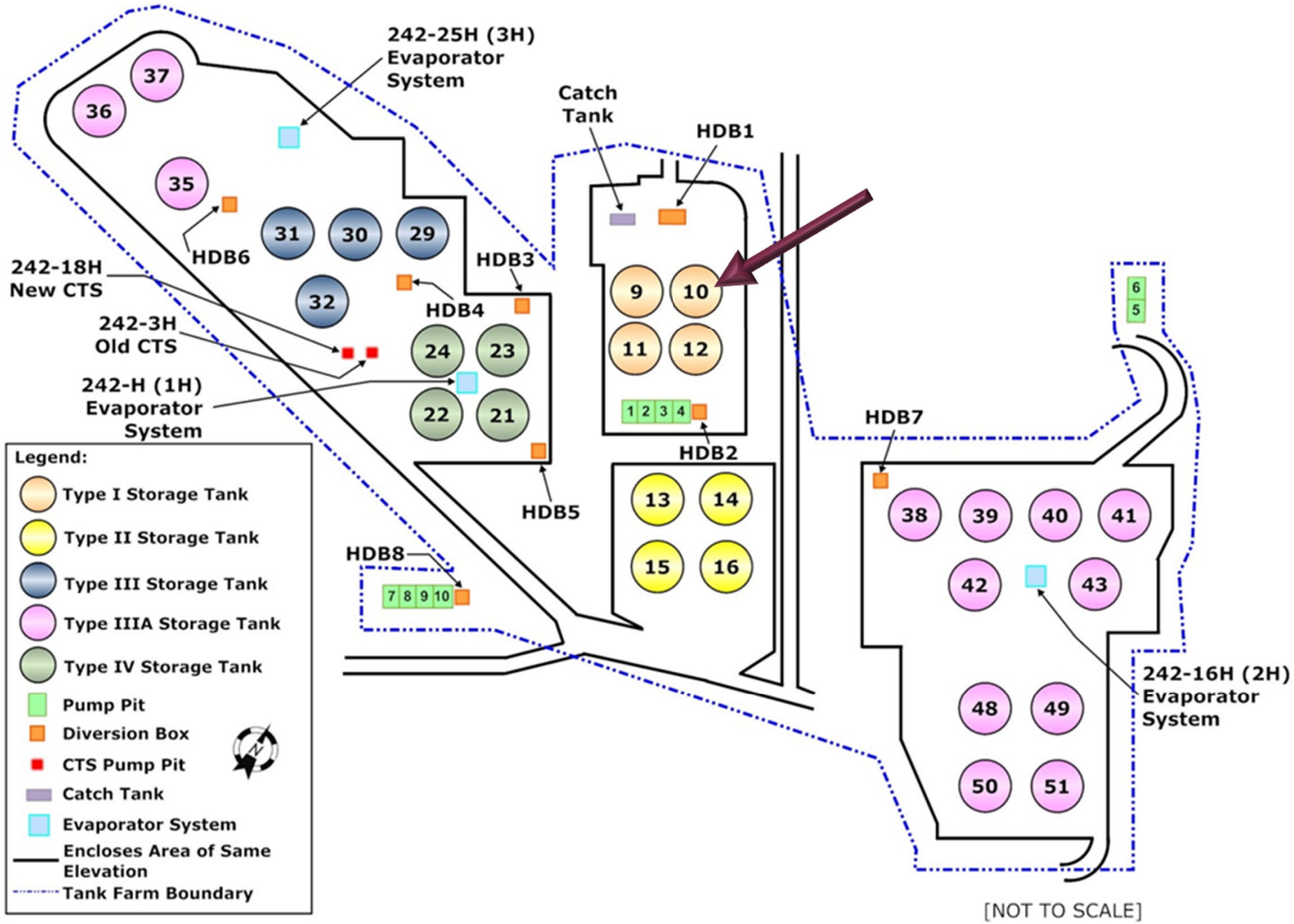
Preliminary Cease Waste Removal (PCWR)



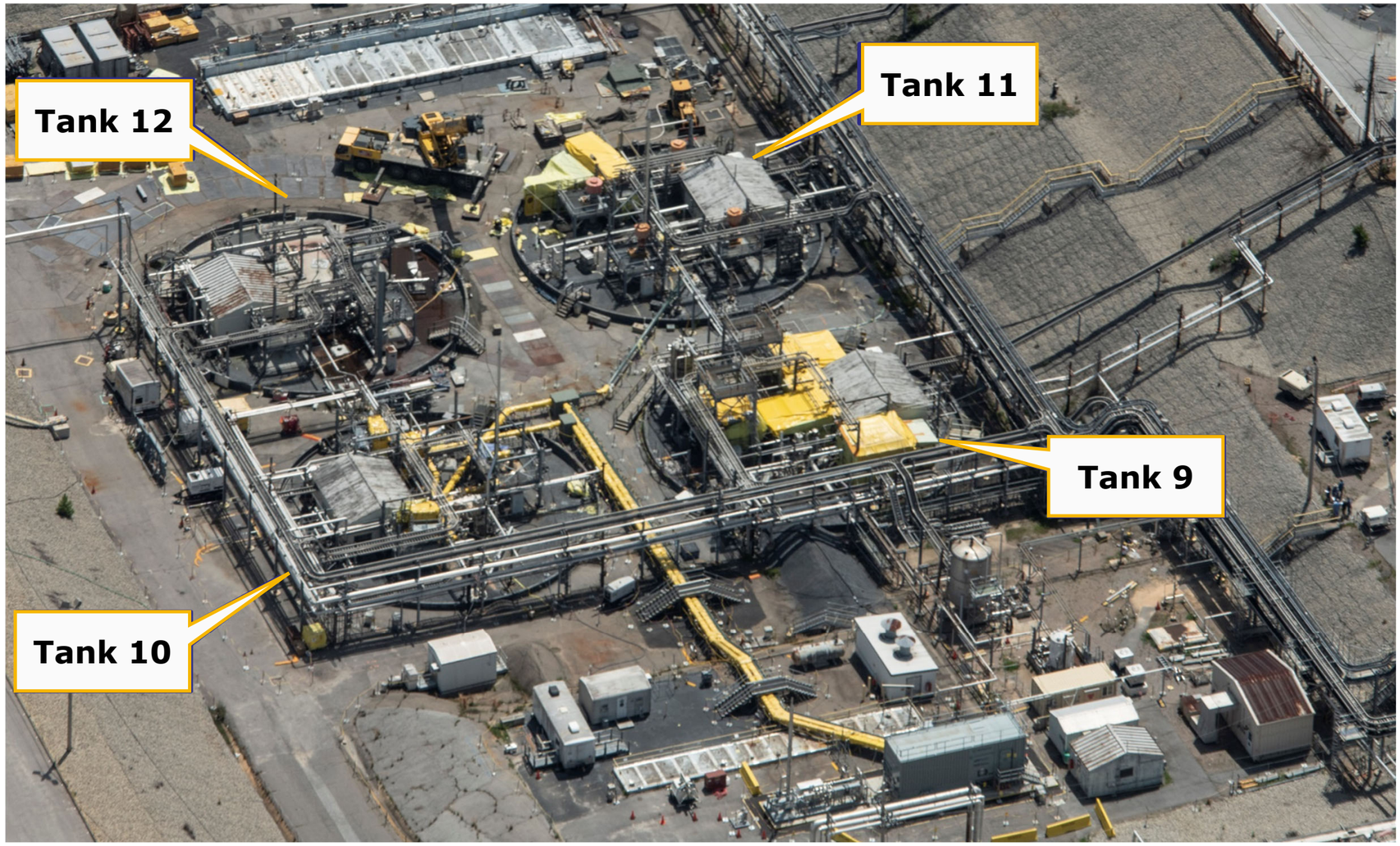
Legend:

ALT	Alternate
CM	Closure Module
DHEC	South Carolina Department of Health and Environmental Control
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
S&A	Sampling and Analysis
STD	Standard

H-Tank Farm (HTF) Layout



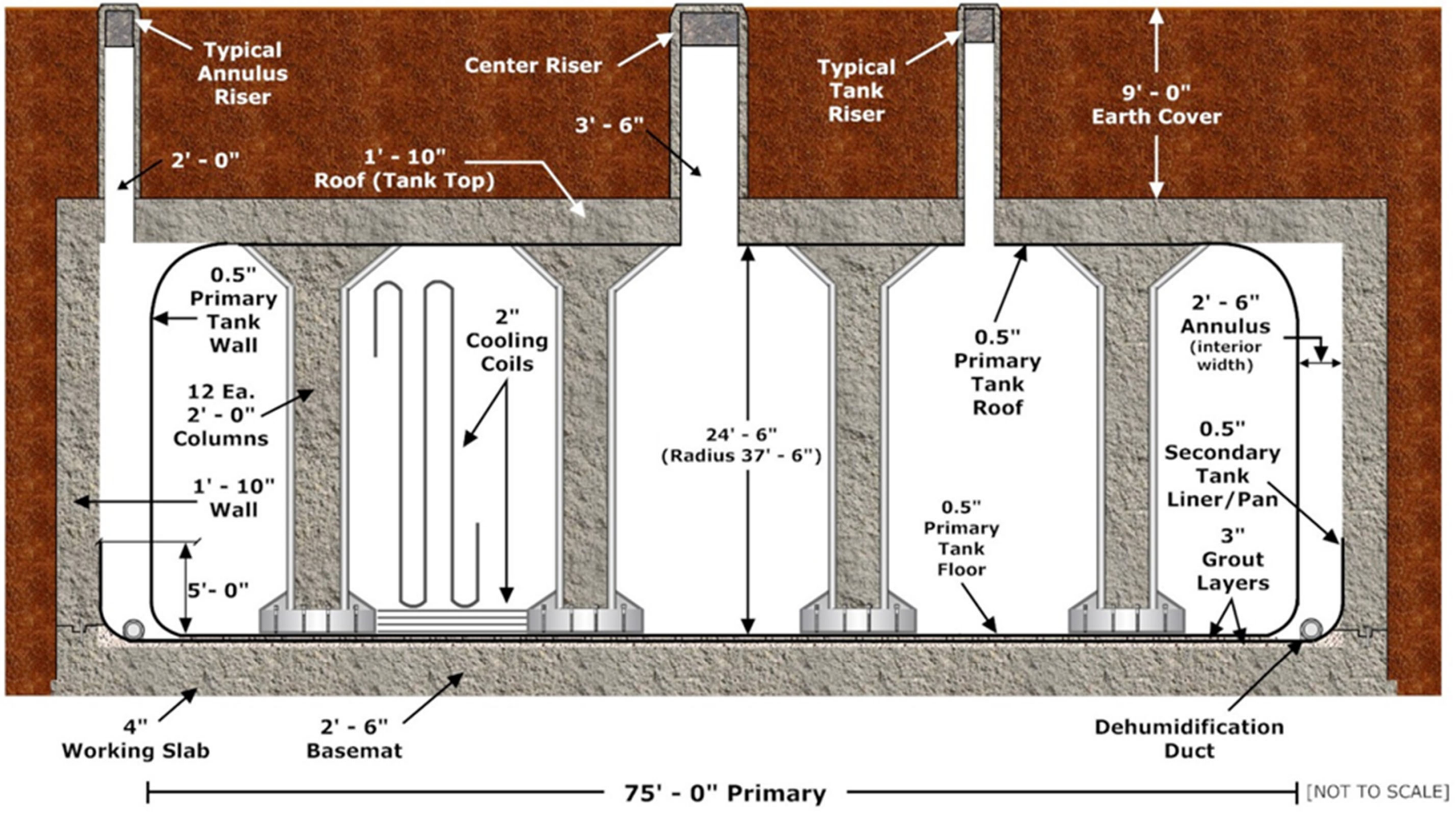
Tank 10 Within HTF



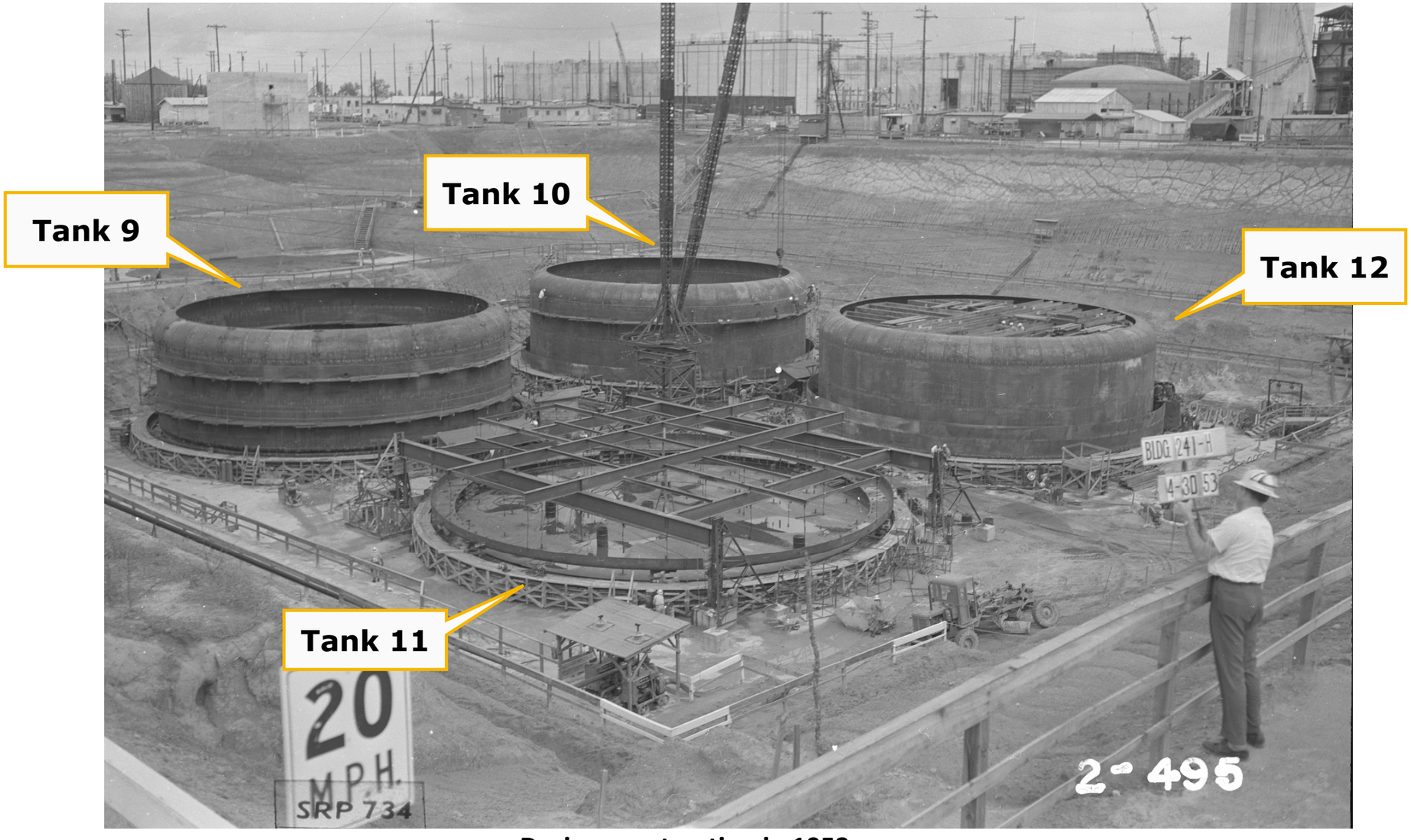
Typical Type I Tank

- **Carbon steel primary tank and secondary liner (annular pan) all contained in a concrete vault**
- **Nominal working capacity: 750,000 gallons**
- **For a Type I Tank, 1” of waste equals 2,710 gallons**
- **Primary tank diameter: 75 feet**
- **Primary tank height: 24.5 feet**
- **Annular pan diameter: 80 feet**
  - 2.5-foot annular space surrounding primary
- **Annular pan height: 5 feet**
- **12 interior support columns**
  - 2-foot diameter
- **34 vertical cooling coil runs suspended from the ceiling**
- **2 horizontal cooling coil runs supported above the floor**

Tank 10 - Type I Tank Design



HTF Type I Tanks



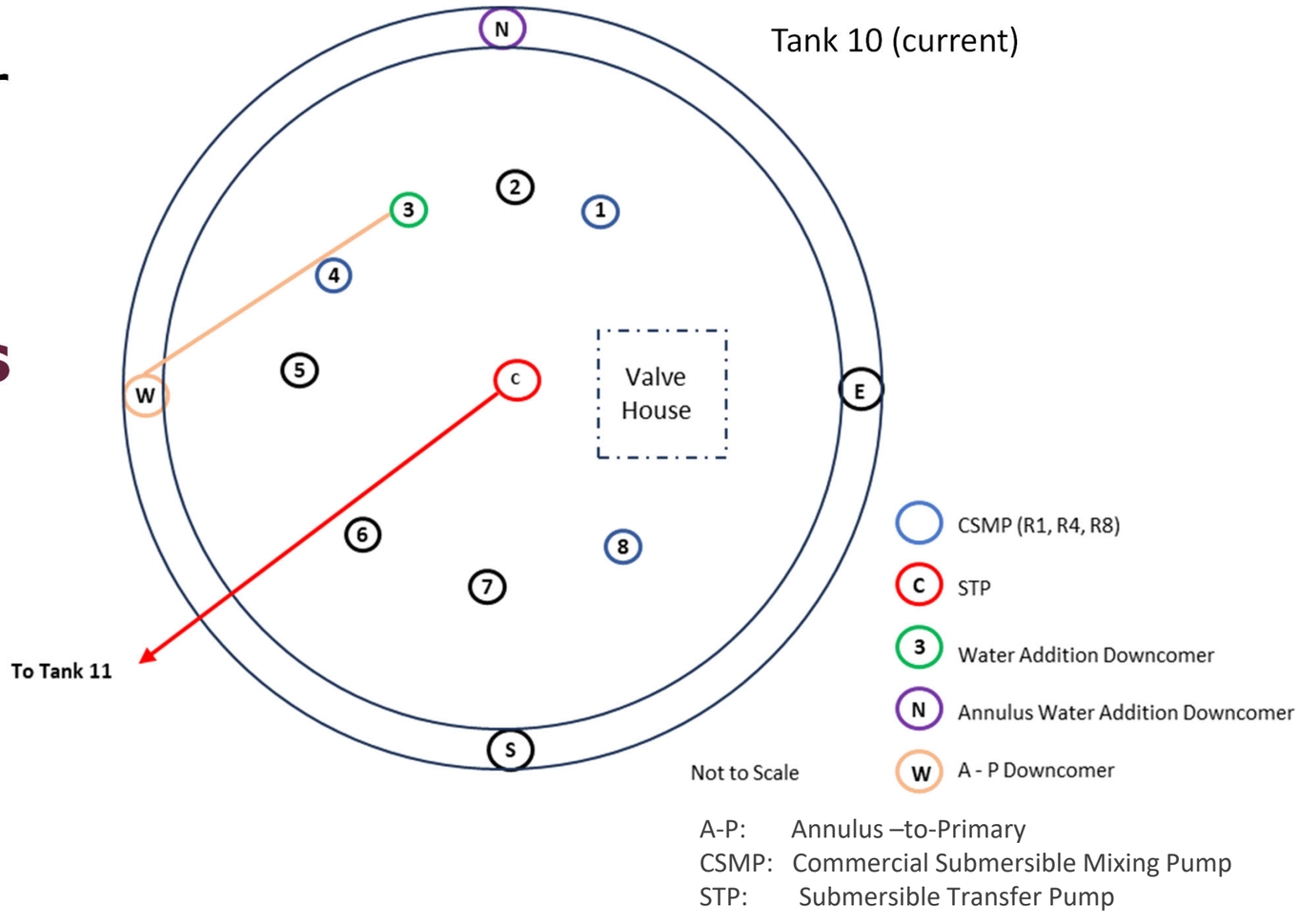
During construction in 1953

Typical Type I Tank Challenges

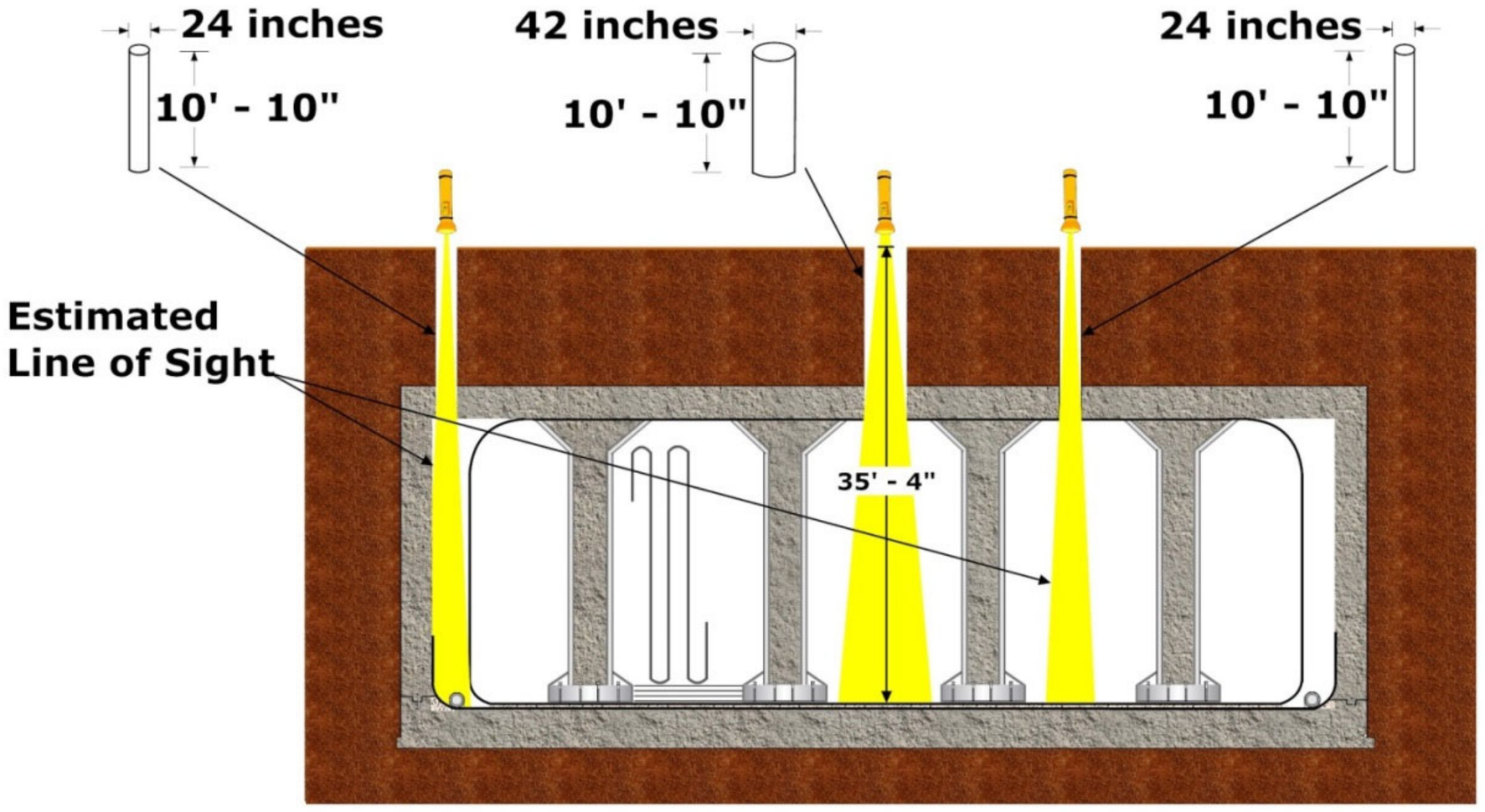
- **Type I tanks are some of the most challenging waste tanks for waste removal**
- **Challenges include:**
  - Limited access ports (risers)
  - Presence of roof support columns
  - Approximately 22,800 linear feet (over four miles) of 2-inch diameter vertical and horizontal cooling coils
  - "Field-to-fit" horizontal cooling coil "fences"
- **Tanks were not designed with waste removal in mind**

Type I Tank Riser Limitations

- **Primary access**
  - Eight 24-inch risers
  - One 42-inch central riser
- **Annulus access**
  - Four 24-inch risers
- **Limited riser entrances hinder:**
  - Pump placement
  - Cleaning operations
  - Camera viewing
  - Sampling options



Type I Tank Riser Limitations

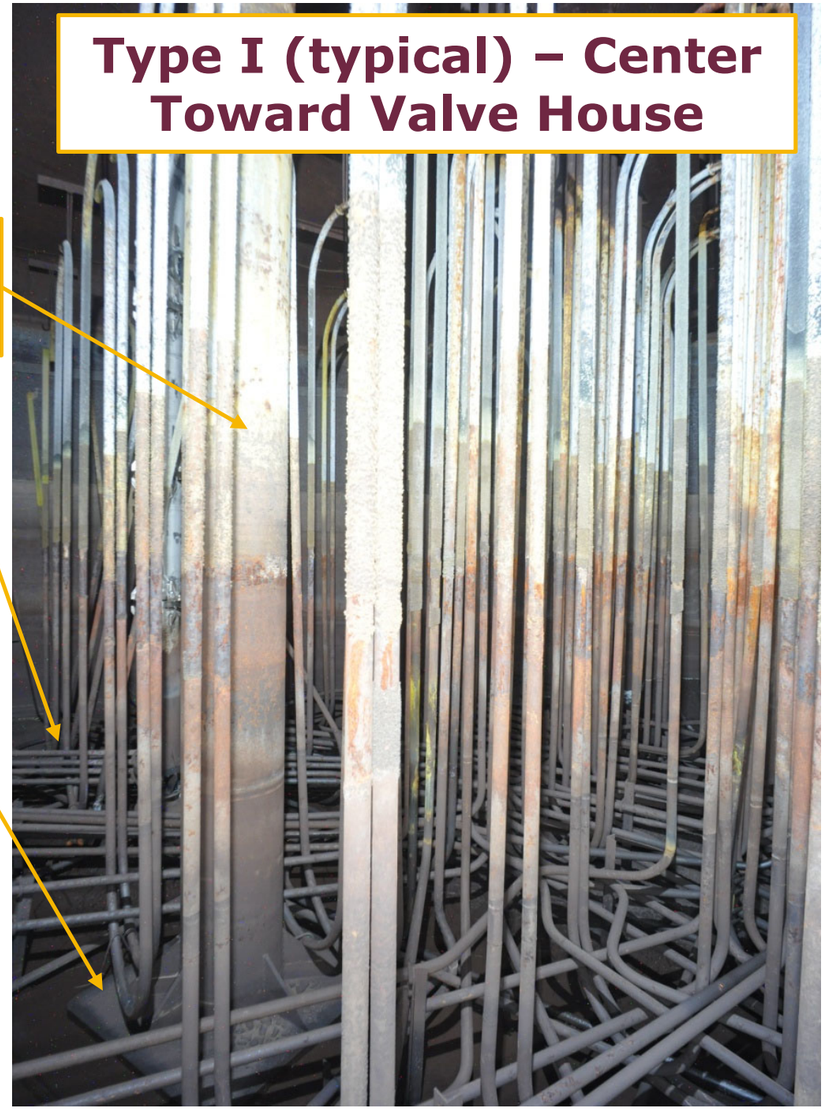


NOTE: Risers may be impeded by installed equipment.

[NOT TO SCALE]

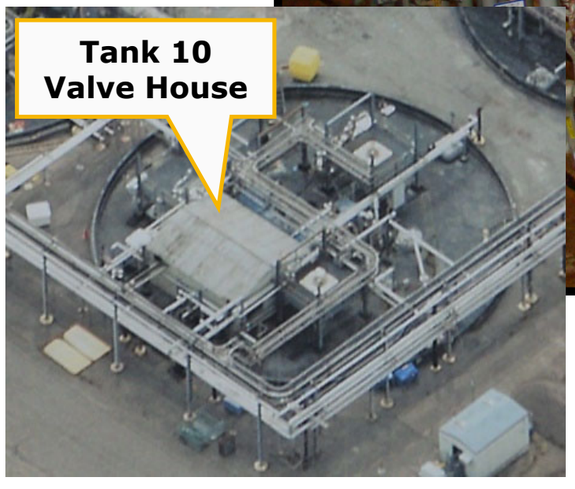
Type I Tank Columns and Cooling Coils

- **A total of 12 support columns in each Type I tank**
  - Carbon steel filled with concrete
  - 2-foot diameter
  - 4.5-foot x 4.5-foot x 4.5-inch base plate
- **Type I tanks contain approximately 22,800 linear feet of 2-inch diameter cooling coils**
- **Horizontal coils were installed "field-to-fit"**
- **Columns and cooling coils together impact installation and/or operation of waste removal related equipment**
  - Effective cleaning radius of pumps
  - Full installation of pumps
  - Sampling device deployment



Type I Tank Cooling Coil Valve House

Valve House Interior

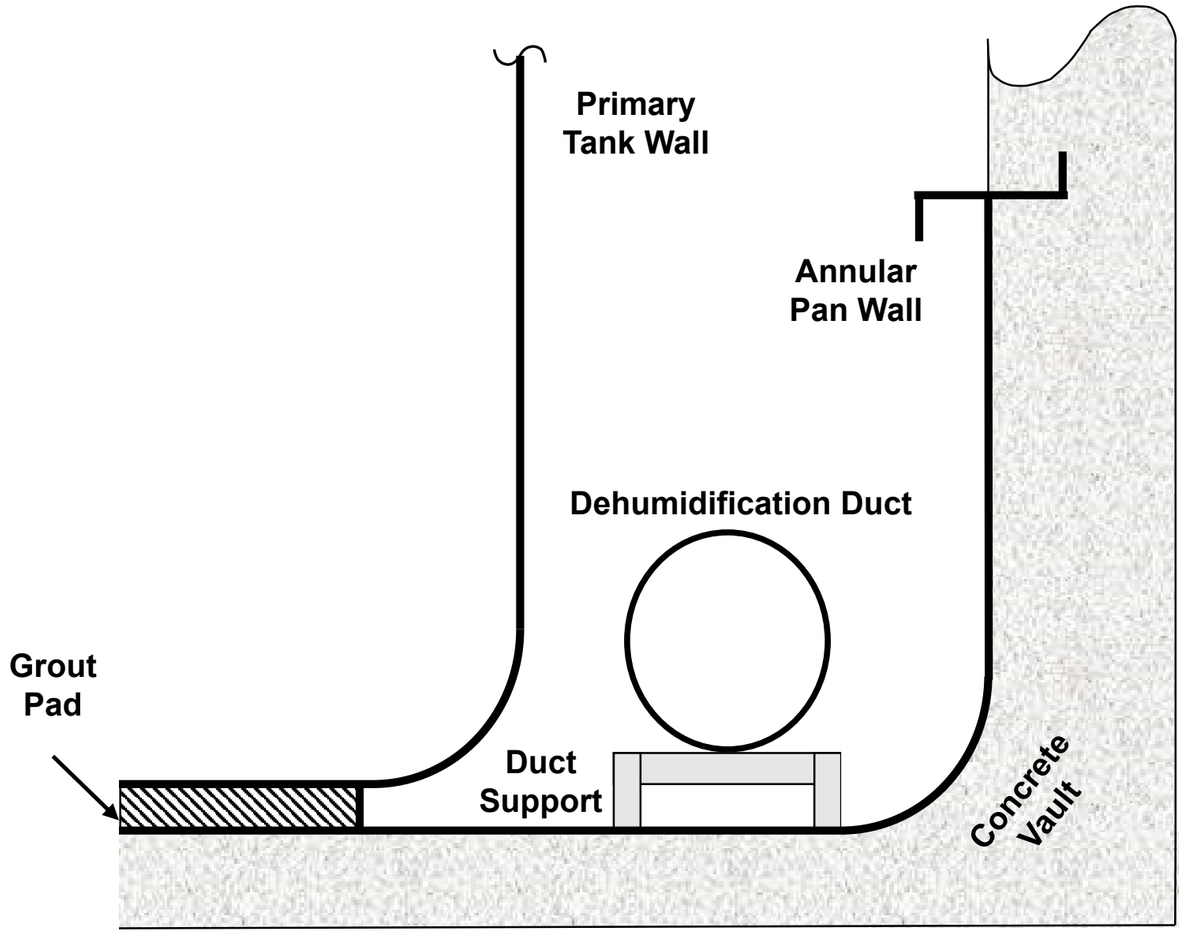


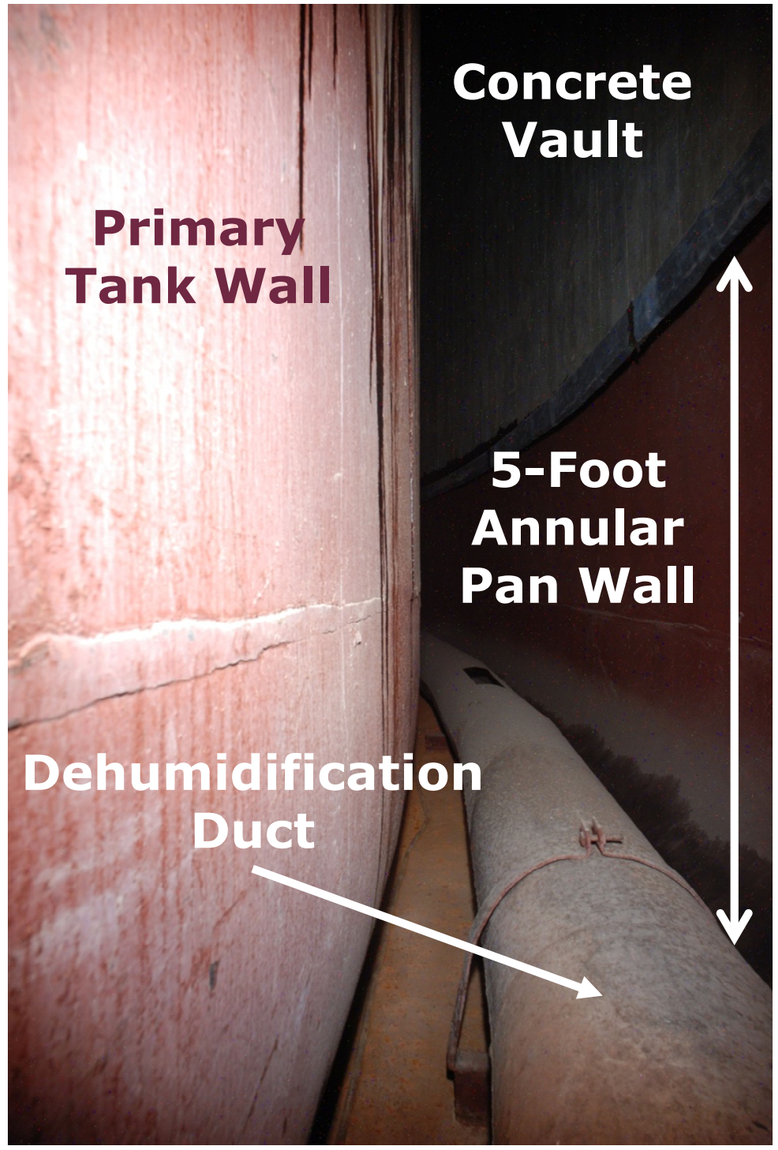
View From Inside Tank (Under the Valve House)

Cooling coil lines entering and exiting waste tank

Type I Tank Annular Region

5-foot high, 80-foot diameter annular pan provides secondary containment

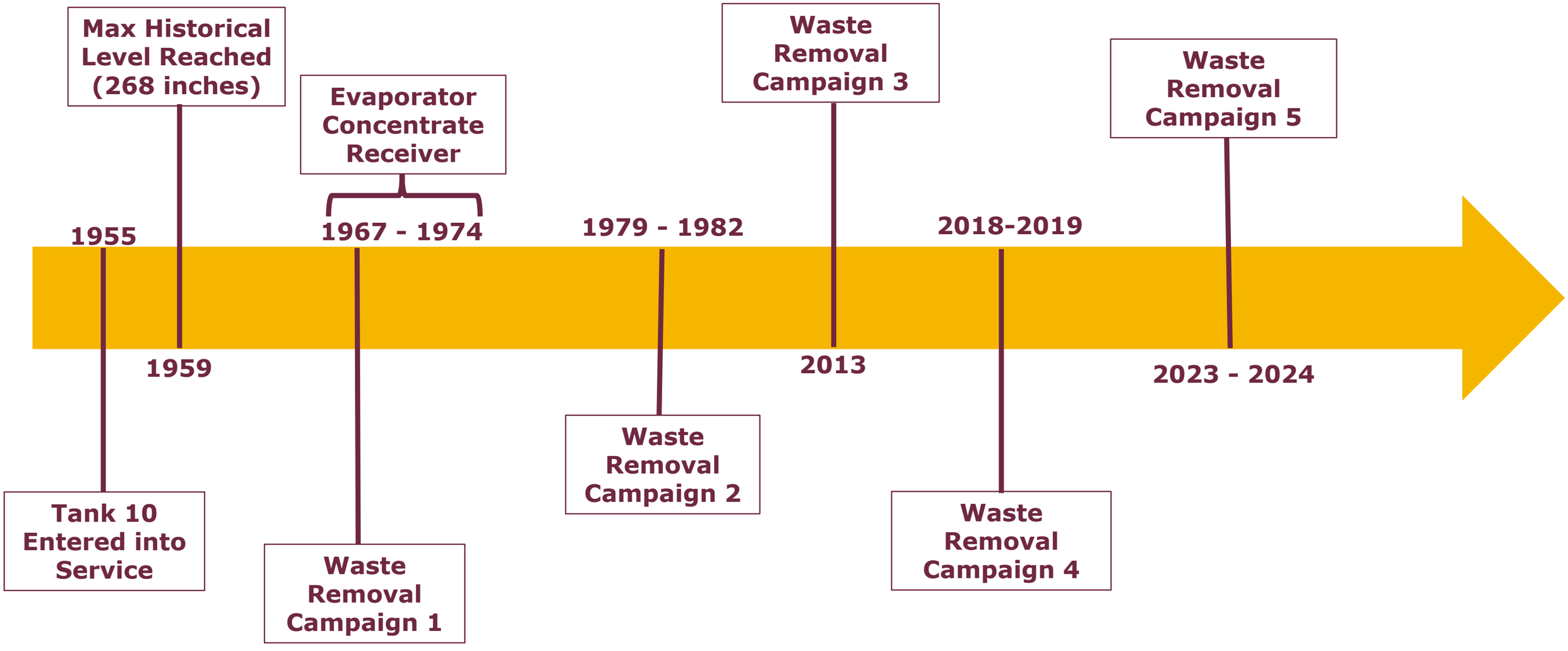




Tank 10 Operational History

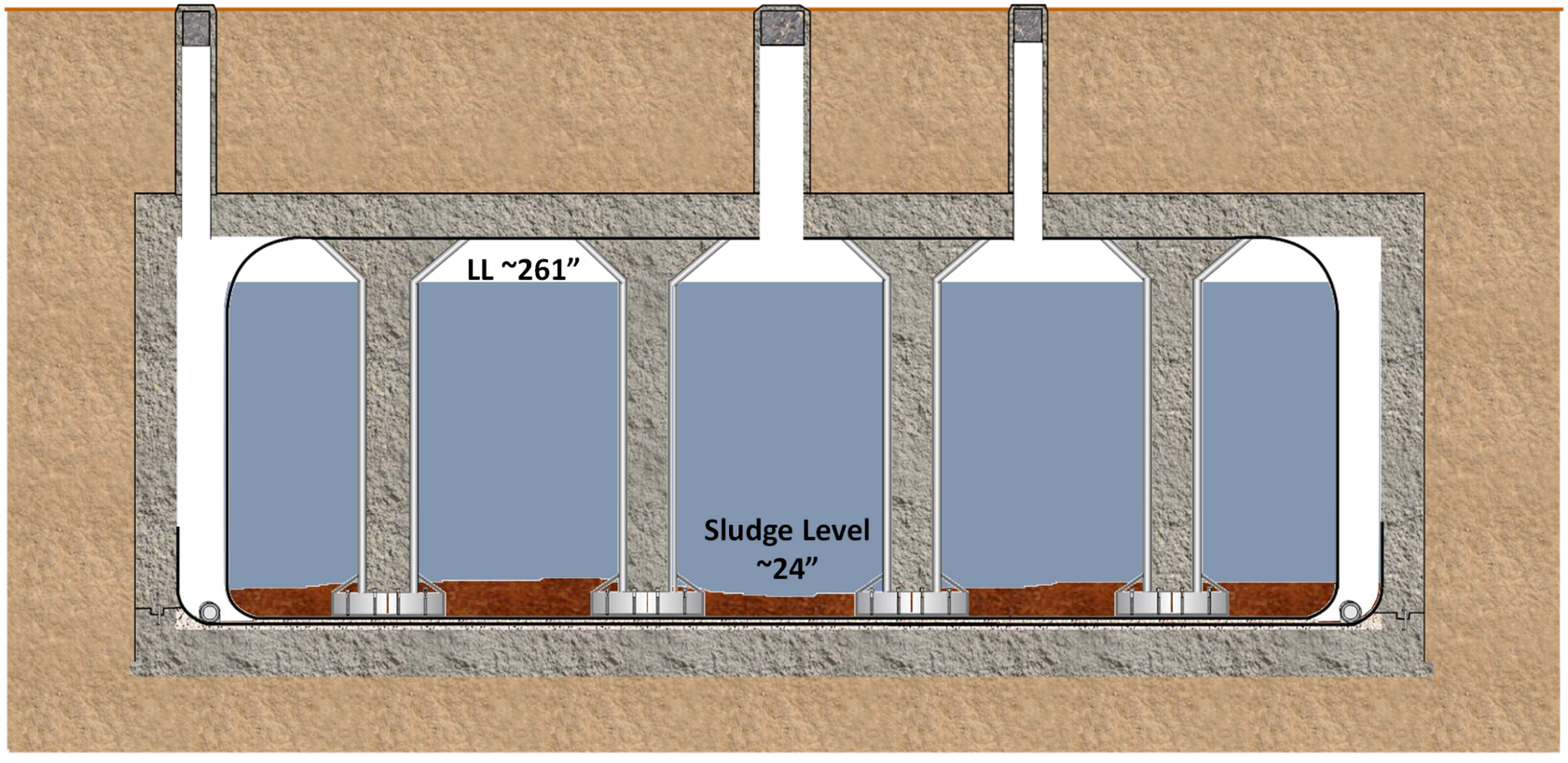
- **Constructed between 1951 and 1953**
- **Received H-Canyon waste from 1955 through 1959**
- **Maximum historical waste level in 1959**
  - 268” vs. fill limit of 271” or 726,000 gallons (combination of sludge and supernate)
- **Waste removal performed in 1967**
- **Served as 242-H Evaporator concentrate receipt tank from 1967 through 1974**
  - Saltcake level reached an estimated 186” or ~500,000 gallons
- **Waste storage / waste retrieval activities 1974 to present**
  - Served as the Tank Closure Cesium Removal (TCCR) Unit salt solution feed tank from November 2018 through February 2022
- **First material discovered in annulus pan in 1959 (leak-site unknown)**
  - Through 2023, a total of thirty-five leak-sites documented [SRMC-LWE-2024-00015]
    - *Camera access restricted to North, East and West annulus risers.*
    - *South riser inaccessible*
  - Lowest leak site identified at 24” above the tank bottom and the highest at 140” above the tank bottom [U-ESR-H-00234, SRMC-LWE-2024-00015]
  - There were approximately 7-8 inches of salt waste in the annulus pan (@ ~400 gallons/inch) prior to annulus cleaning activities

Tank 10 Historical Timeline



Tank 10 Waste Removal Campaign 1

At the start of Campaign 1 (January 1967)



LL - Liquid Level

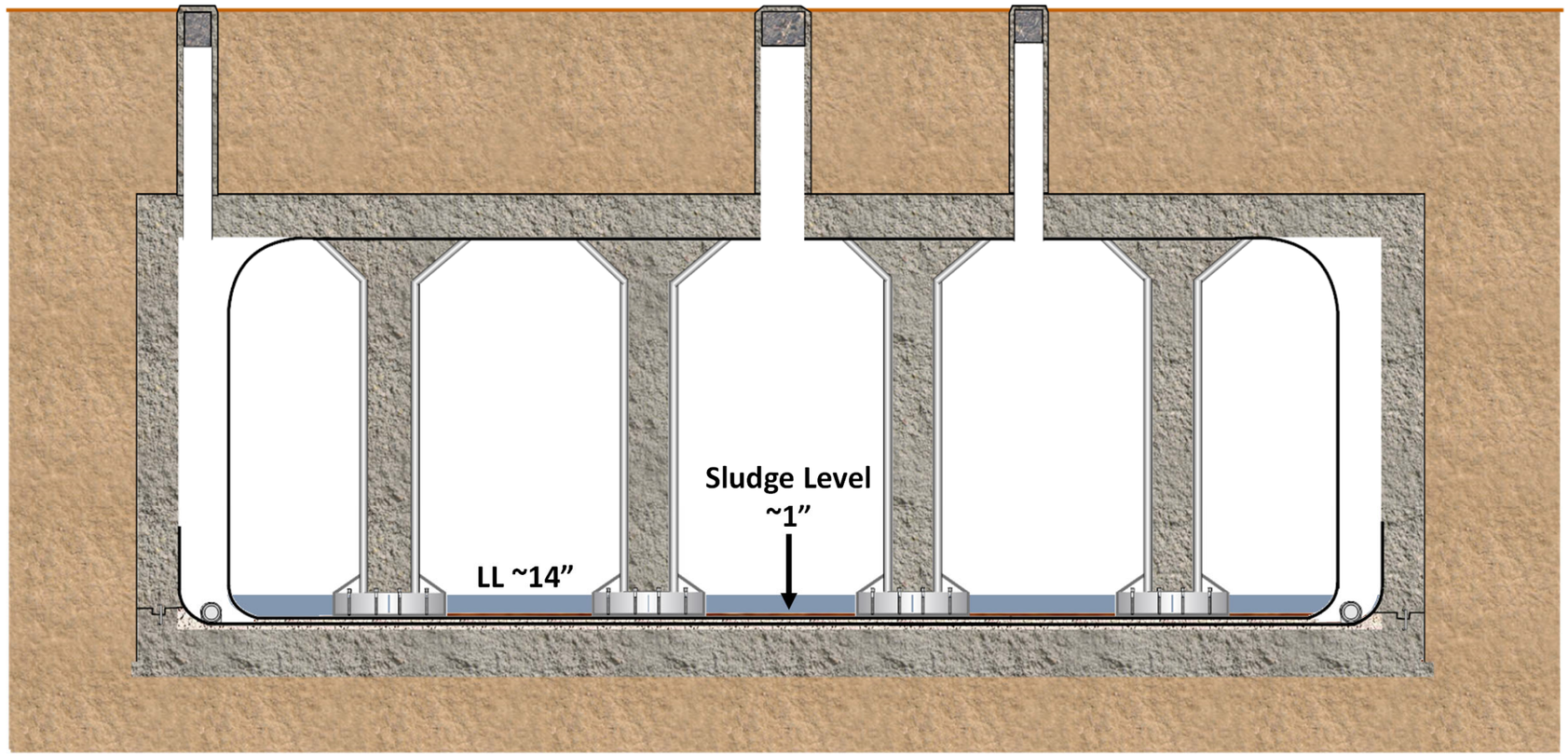
Tank 10 Waste Removal Campaign 1

- **Supernate and solids removed to prepare Tank 10 to be a 242-H Evaporator concentrate receipt tank**
  - Removed supernate above sludge solids
  - Sludge removal utilized five high-pressure sluicers and multiple transfer pumps
  - Removed ~232K gallons of sludge slurry (~63K gallons of sludge) [DPSP 67-1-2-S]
  - Estimated remaining sludge volume of approximately 2,700 gallons (~1”)[DPSP 67-1-2-S, DPSPU 78-11-11]

High-Pressure Sluicing Device

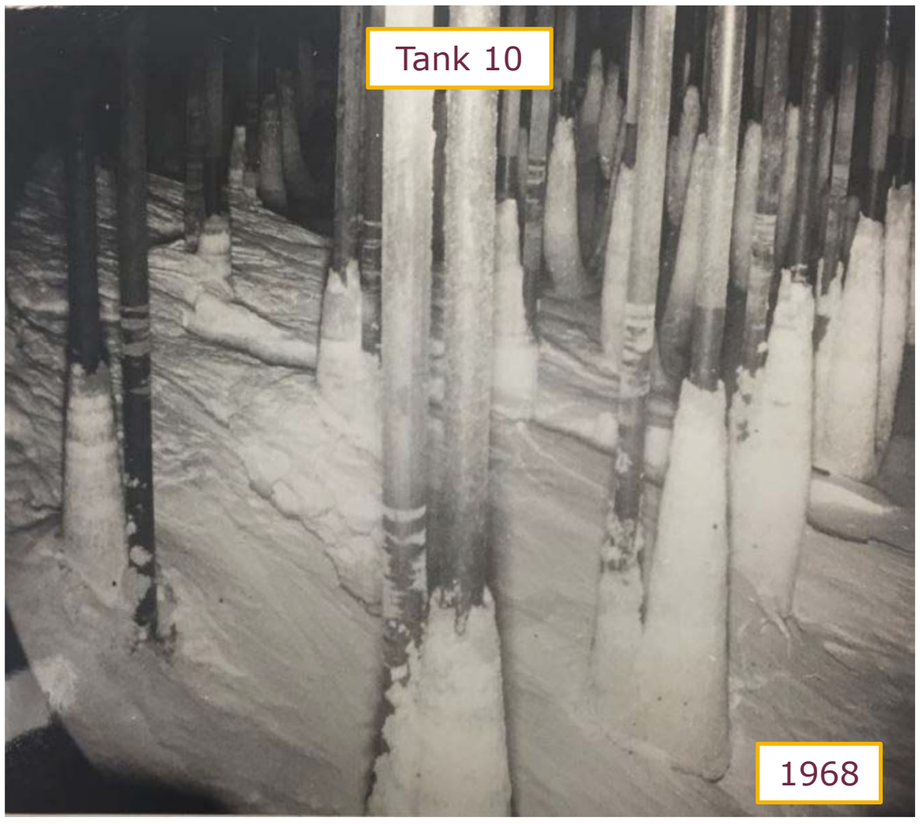
Tank 10 Waste Removal Campaign 1

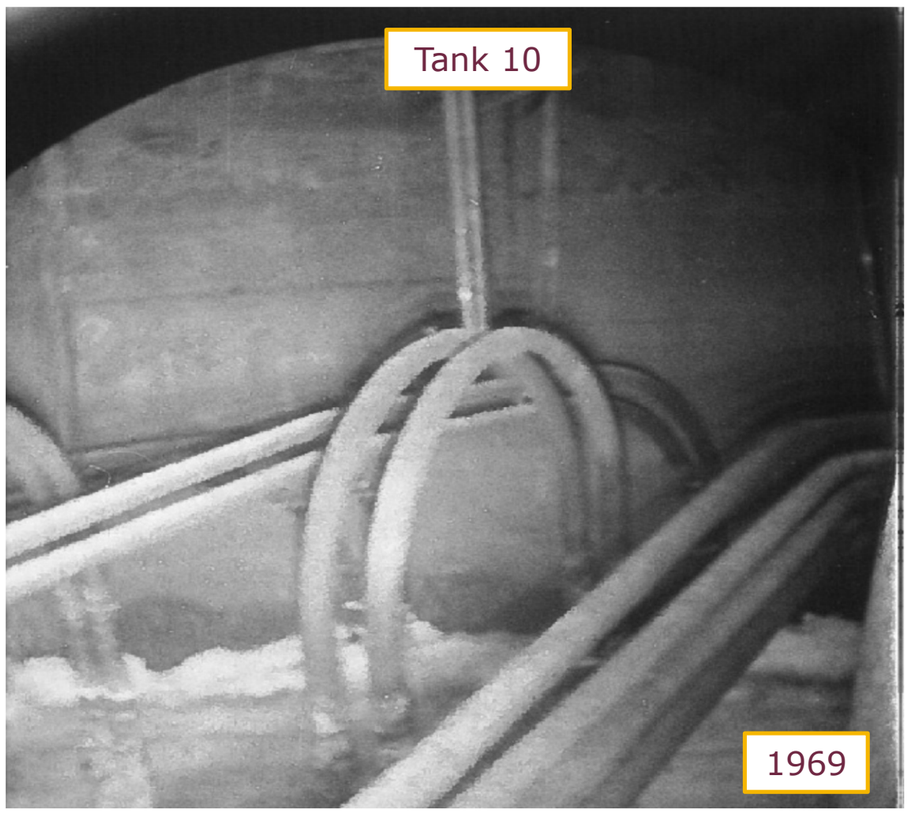
At the completion of Campaign 1 (February 1967)



Tank 10 Post Campaign 1

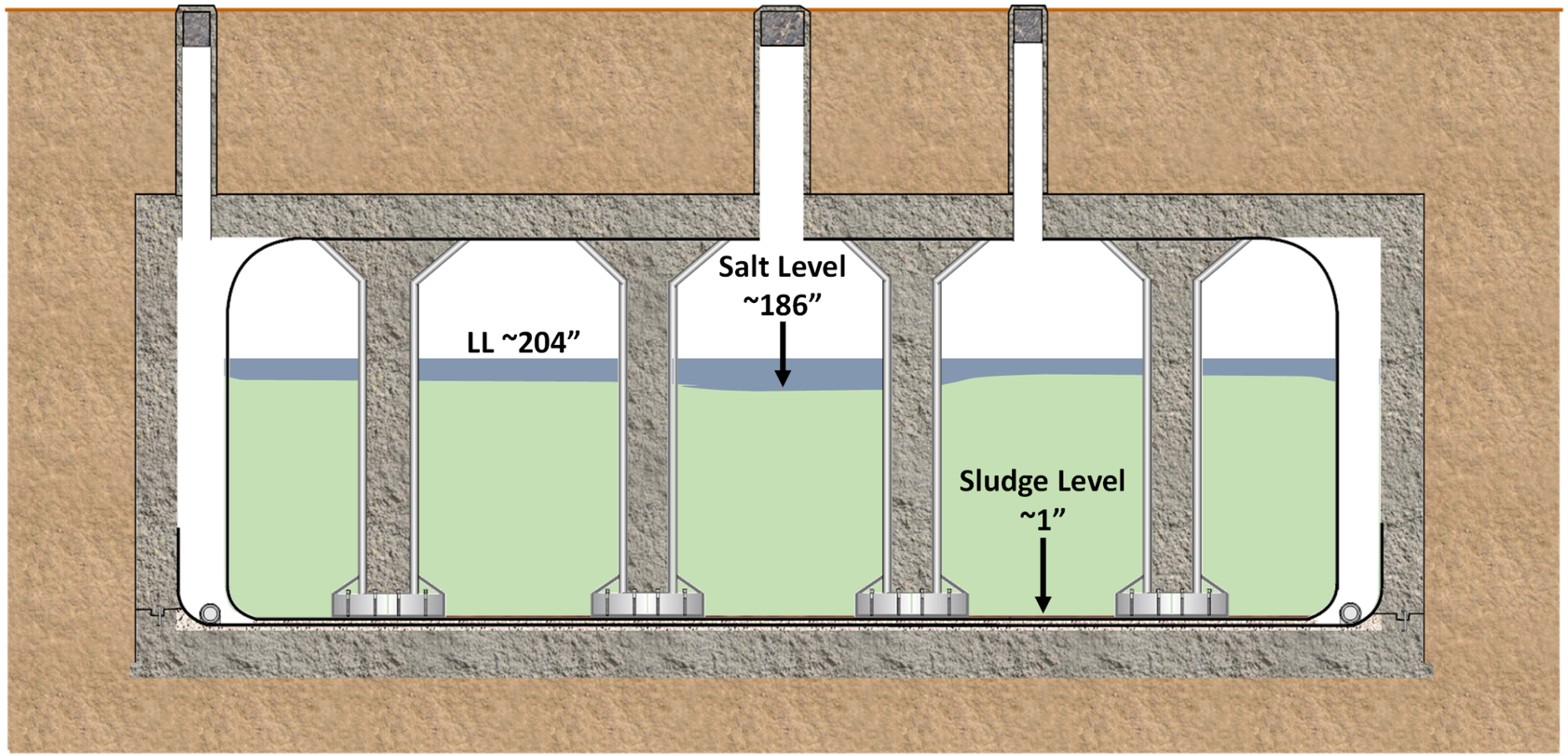
- **Salt accumulated in Tank 10 while it served as the 242-H Evaporator concentrate receipt tank from 1967 through 1974**





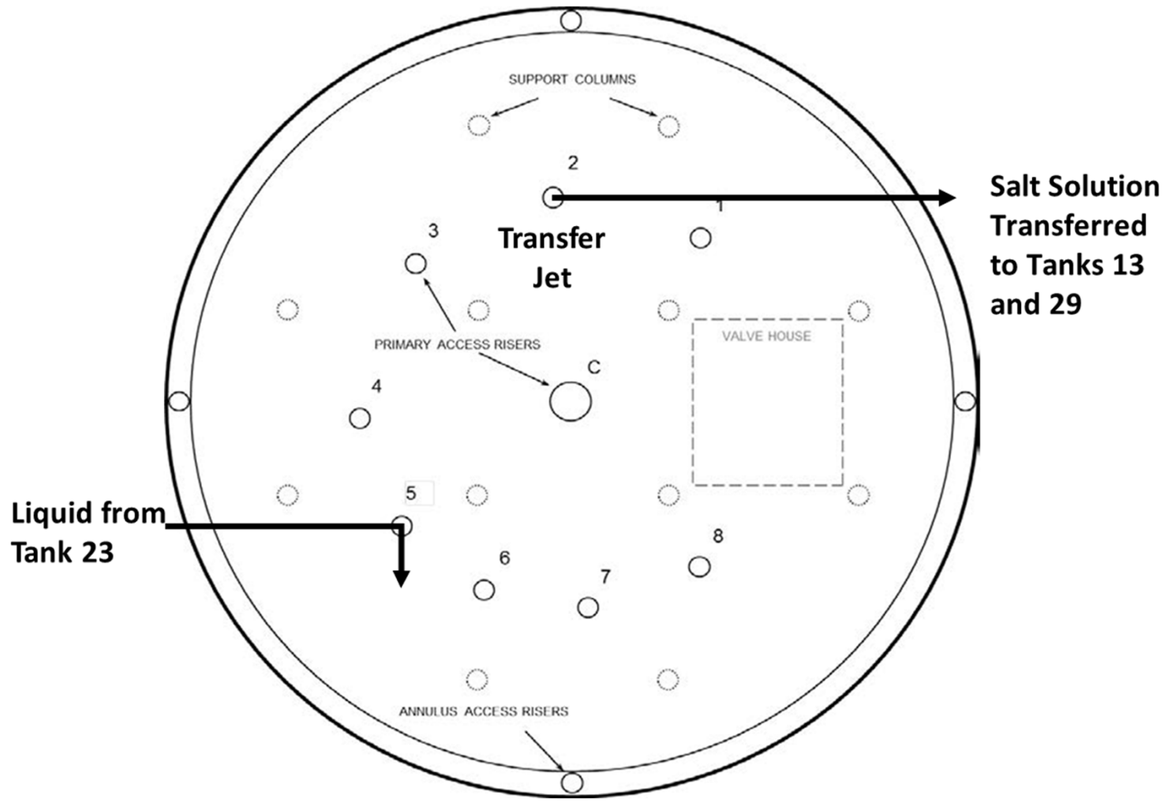
Tank 10 Waste Removal Campaign 2

At the start of Campaign 2 (May 1979)



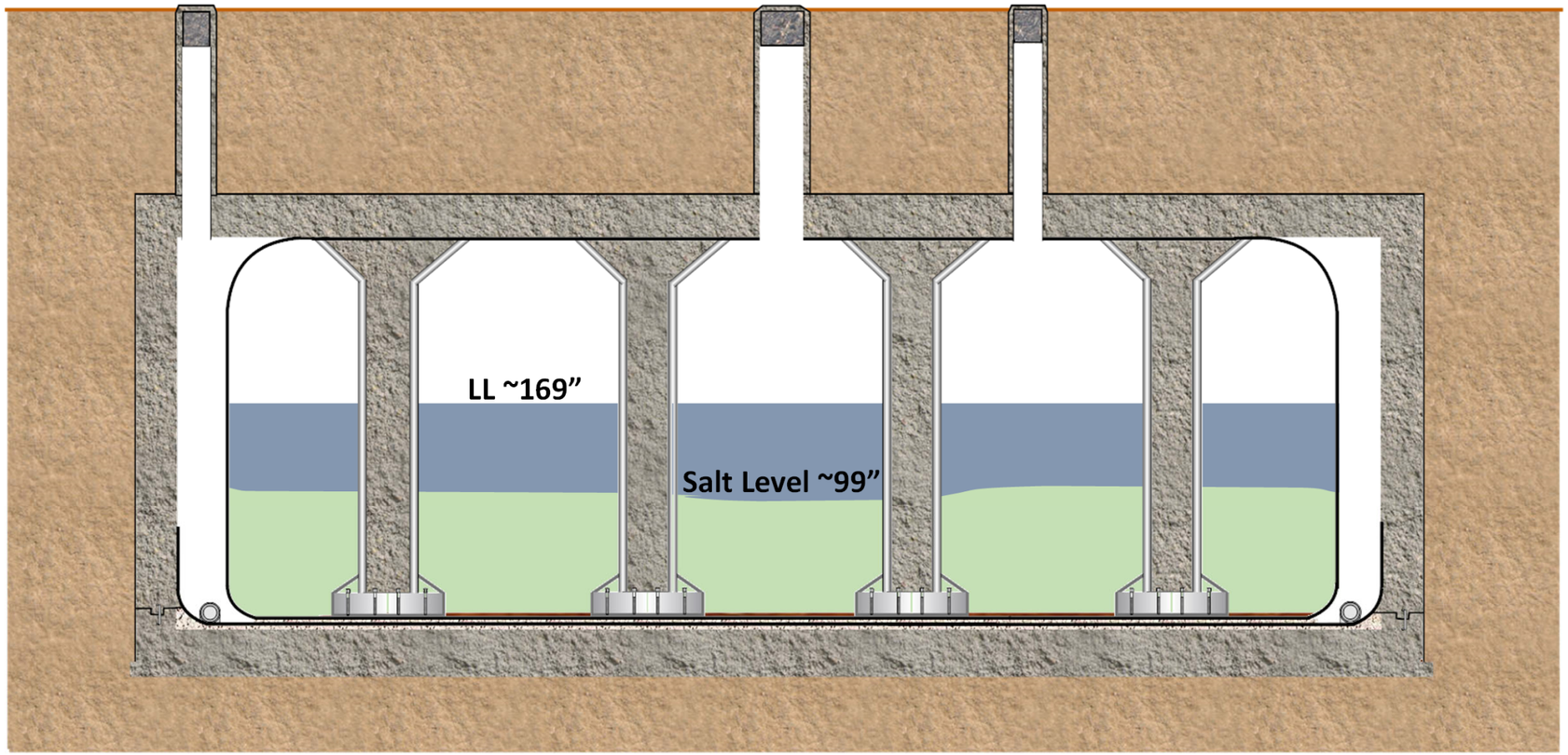
Tank 10 Waste Removal Campaign 2

- **Saltcake removal demonstration using density gradient dissolution method was performed from 1979 to 1982 [DPSP 79-17-11, DPSP 82-21-11]**
  - Prior to saltcake removal, it was estimated that Tank 10 contained approximately 500K gallons of saltcake [DPSP 82-21-11]
  - An estimated 235K gallons of saltcake were removed during this campaign [DPSP 83-21-3]
  - Approximately 265K gallons of saltcake remained in Tank 10 after Campaign 2



Tank 10 Waste Removal Campaign 2

At the completion of Campaign 2 (November 1982)

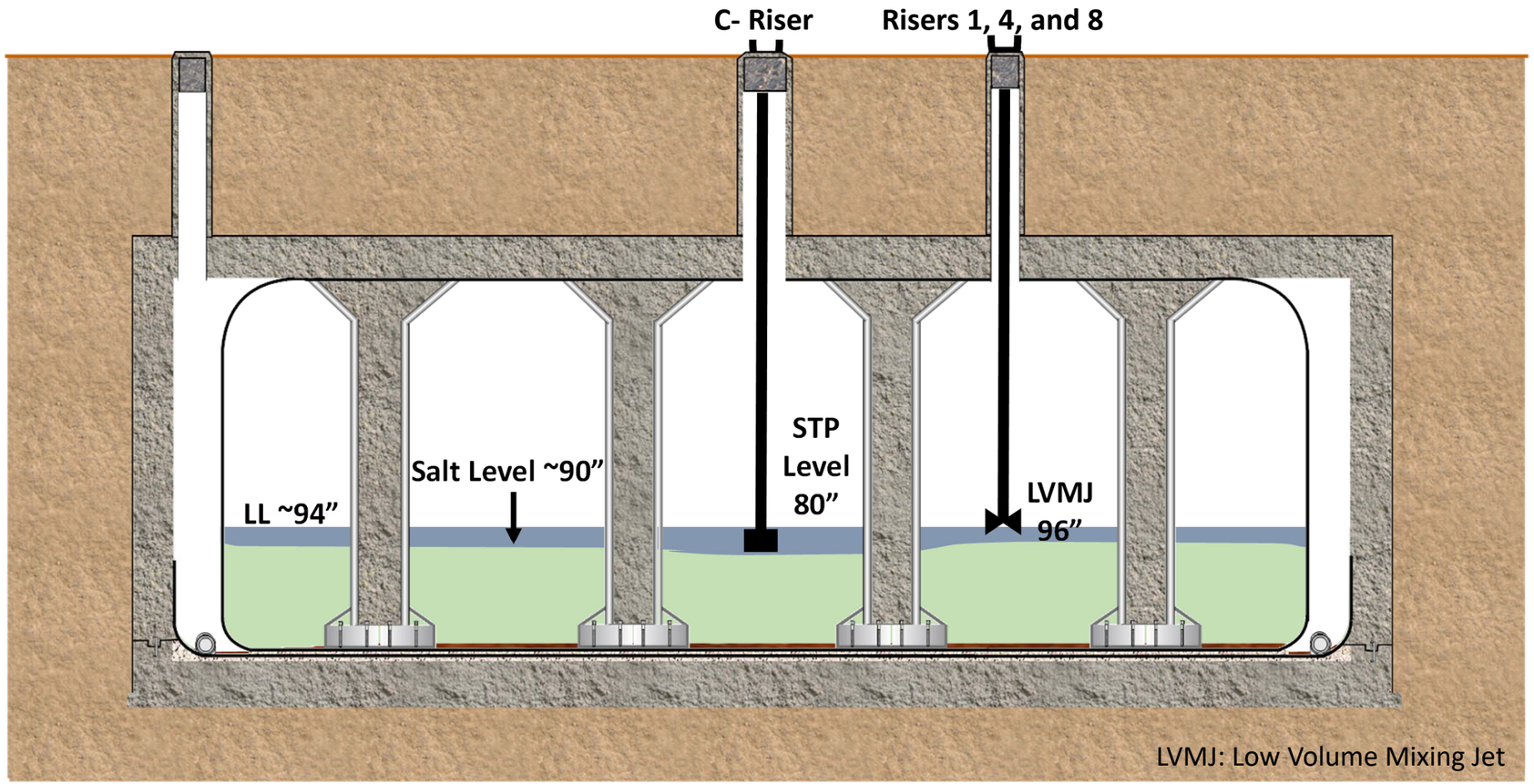


Tank 10 Post Campaign 2

- **Following Campaign 2 approximately 300K gallons of liquid (water and supernate) were transferred into and out of Tank 10 from the mid-1980's through the early 1990's to support various operational needs. [WSRC-TR-93-425]**
- **These transfers likely removed saltcake from Tank 10, but saltcake removal volume was not assessed**
- **The change in the saltcake level at the end of Campaign 2 to the beginning of Campaign 3 is likely attributed to these liquid additions/transfers**

Tank 10 Waste Removal Campaign 3

At the start of Campaign 3 (May 2013)



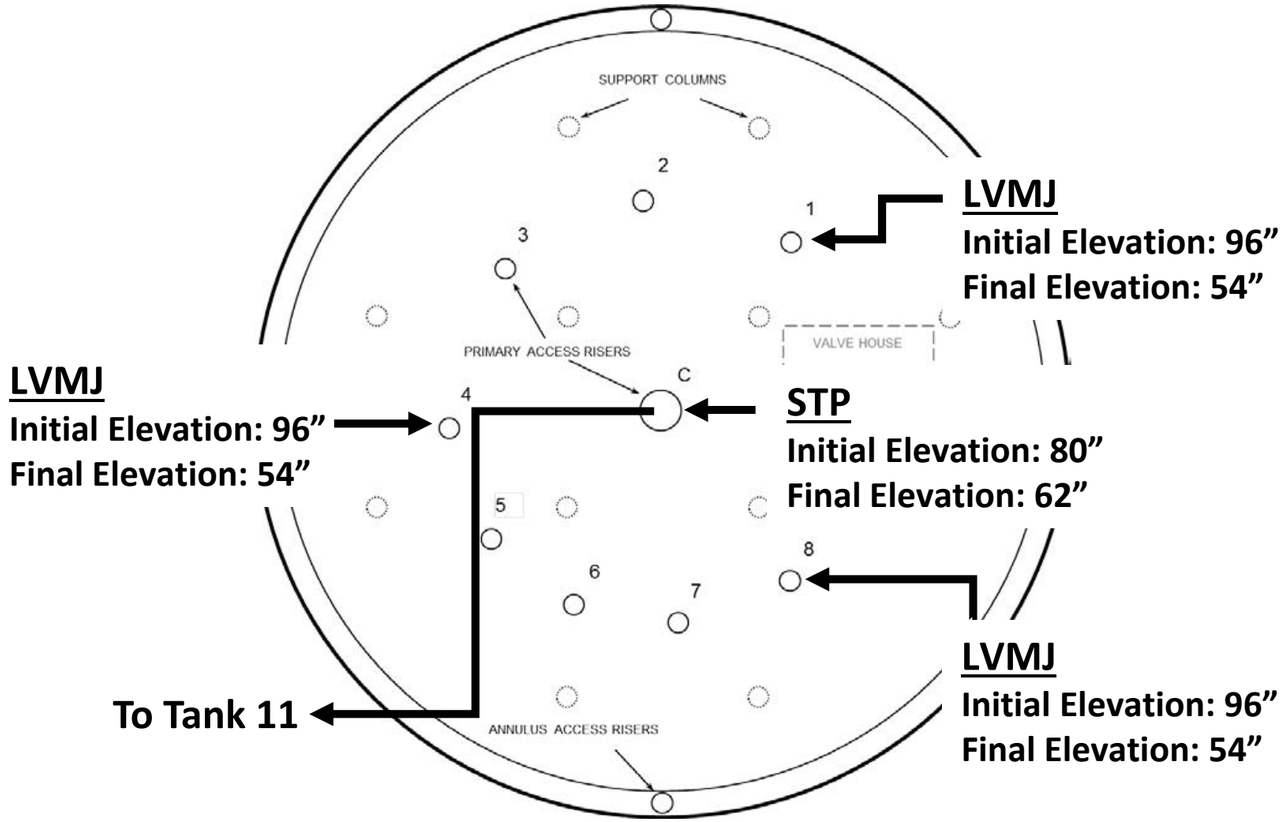
Note: The initial saltcake level represents the final saltcake level after Campaign 3 plus the volume of saltcake estimated to be removed during the campaign.

Tank 10 Waste Removal Campaign 3

- **Saltcake removal resumed using Semi-Continuous Dissolution (SCD) in May 2013**
- **Well water added to Tank 10 through three Low Volume Mixing Jets (LVMJs)**

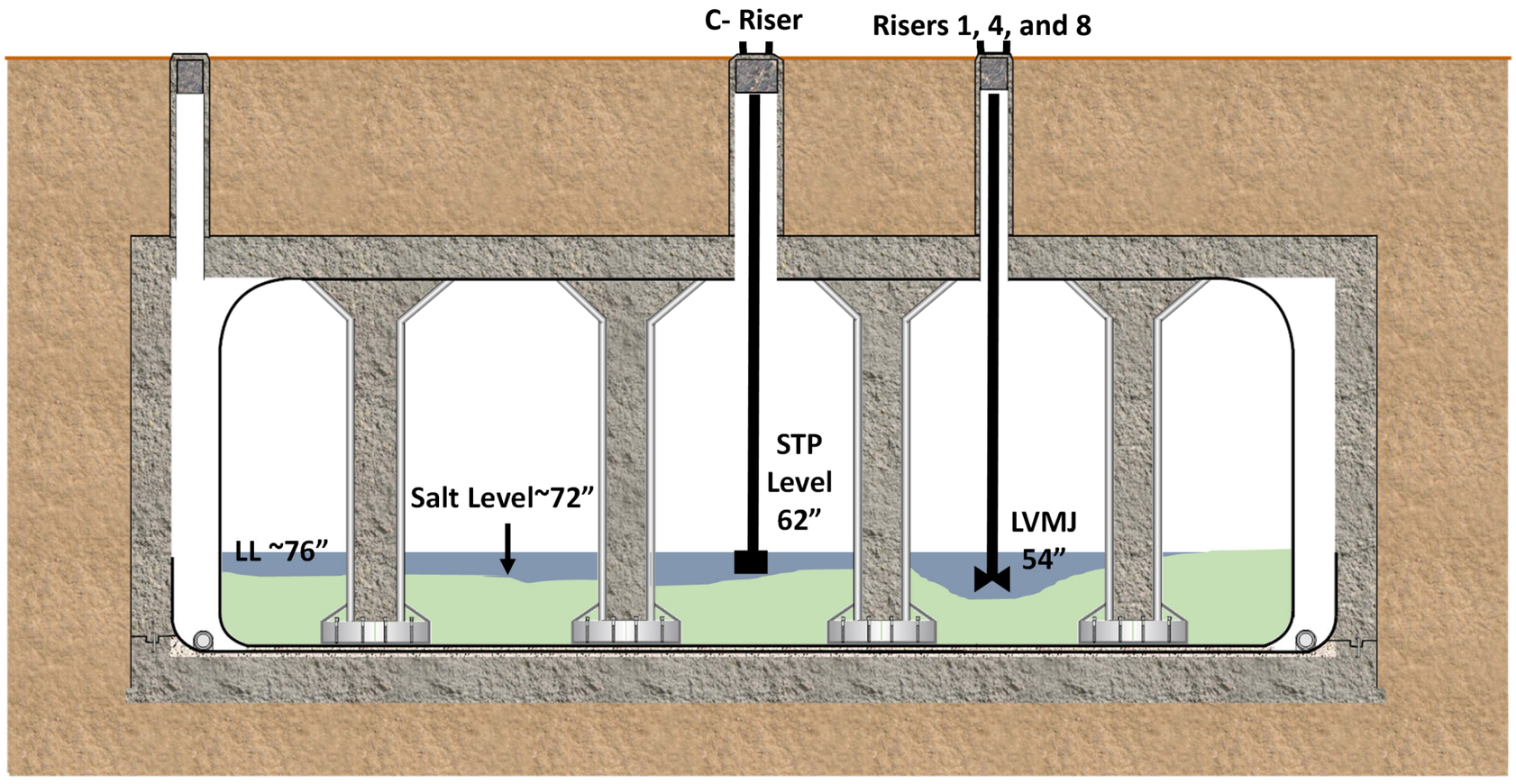
Tank 10 Waste Removal Campaign 3

- **A submersible transfer pump (STP) transferred ~96K gallons of salt solution from Tank 10 to Tank 11 to support Salt Batch 7**
- **There were no saltcake level measurements or mapping following Campaign 3 [G-TRT-H-00046]**
- **Based on a saltcake level measurement in October 2014, the Data Integrity Review Team (DIRT) estimated that the saltcake level was ~72” (195K gallons) in Tank 10 after Campaign 3 [G-TRT-H-00046]**
- **An estimated 49K gallons of saltcake were removed [SRR-LWE-2013-00099]**



Tank 10 Waste Removal Campaign 3

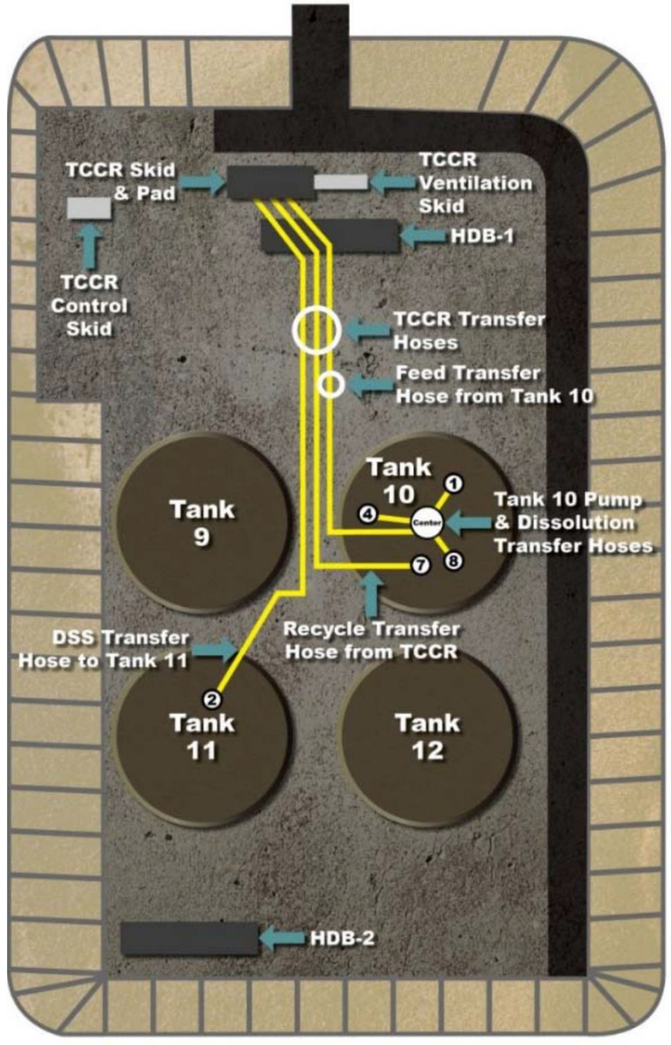
At the completion of Campaign 3 (May 2013)



[SRR-LWE-2013-00099, G-TRT-H-00046]

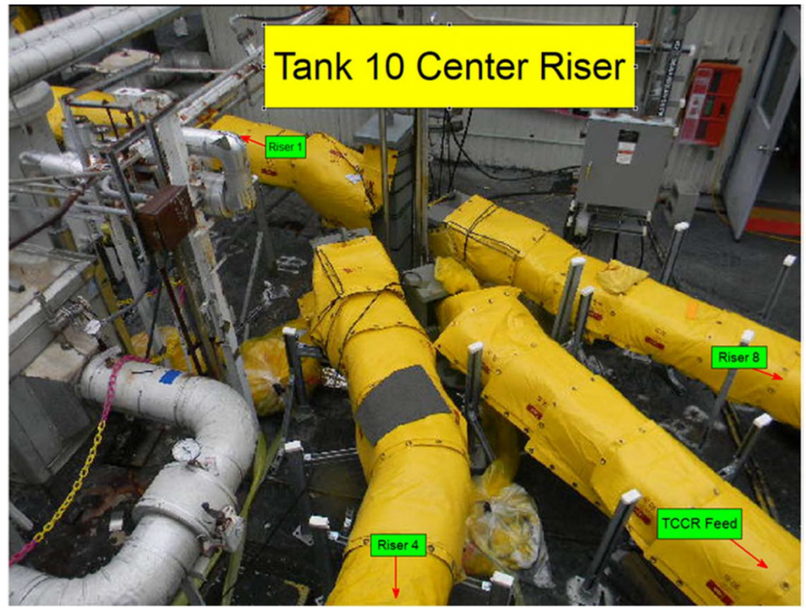
Tank 10 Post Campaign 3

- **Tank 10 was identified to be used as a demonstration tank for the Tank Closure Cesium Removal (TCCR) process**
  - Dissolved salt solution from waste removal activities in Tank 10 would serve as the feed solution for the TCCR demonstration project (i.e., TCCR Unit 1)
  - No additional waste removal post Campaign 3 during design, procurement, installation and testing of the TCCR process equipment
    - *Included equipment installed on Tank 10 to support continued waste removal activities and processing of resulting salt solution through TCCR Unit 1*



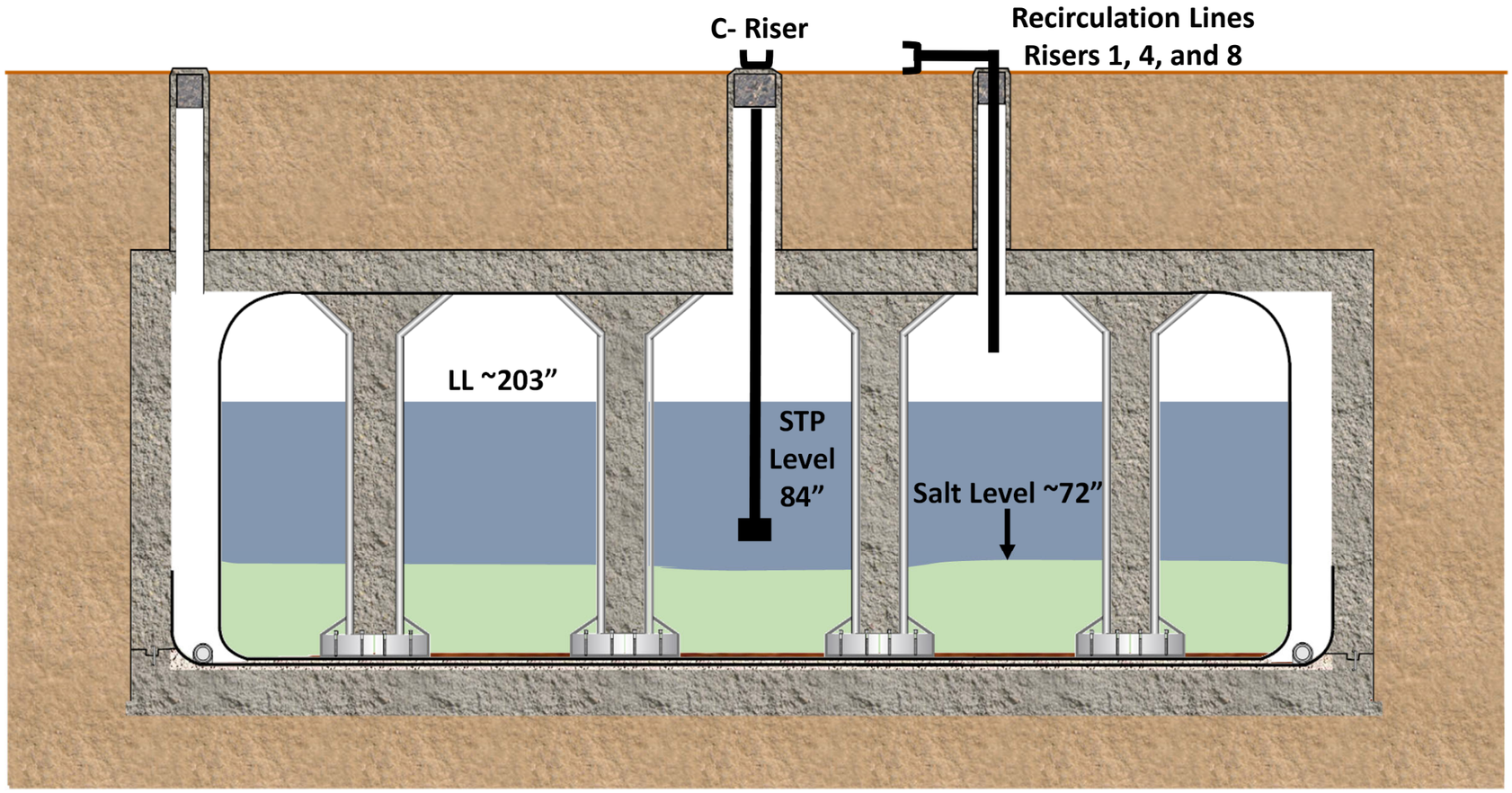
Tank 10 Waste Removal Campaign 4

- **Tank 10 was equipped with an STP and three recirculation lines that allowed for recirculation of the Tank 10 contents through three different risers simultaneously**
- **A typical dissolution batch during Campaign 4 consisted of the following major activities:**
  - Water addition and recirculation
  - Batch sampling and qualification
  - Salt solution processing through TCCR Unit 1
  - Lowering of STP for next batch
- **Restart of waste removal activities in Tank 10 began with the addition of approximately 150K gallons of well water in November 2018**



Tank 10 Waste Removal Campaign 4

At the start of Campaign 4 (November 2018 after water addition)



[G-TRT-H-00161]

Tank 10 Waste Removal Campaign 4

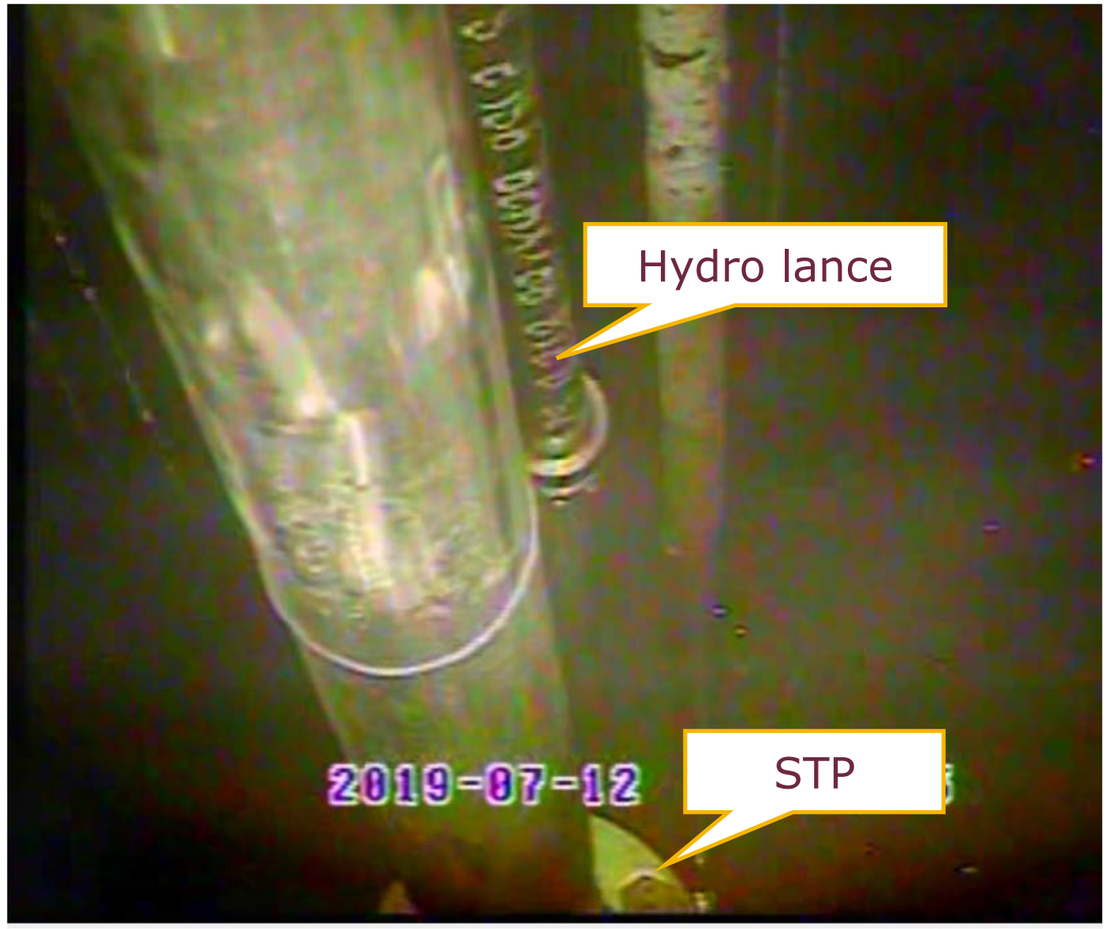
- **Campaign 4 – Batch 1A**
  - After the 150K gallons water addition, the recirculation system was operated for seven days
  - Following recirculation, salt solution was sampled and ~17K gallons of caustic was added (to condition the batch for TCCR processing) and recirculated for an additional four days
  - In February 2019 ~152K gallons of salt solution was transferred out of Tank 10 and processed through TCCR Unit 1
  - Less than expected salt dissolution occurred during this initial dissolution batch when compared with results of Campaign 3
  - It was determined that a relatively insoluble layer containing burkeite – a mineral containing sodium and sulfates – had been reached in Tank 10 impacting saltcake dissolution

Tank 10 Waste Removal Campaign 4

- **Campaign 4 – Batch 2**
  - To compensate for the burkeite, the dissolution strategy was adjusted for Batch 2
  - Batch 2 began with two small additions (~25K gallons) of domestic water in February and March 2019. The liquid in Tank 10 was recirculated after the first addition and restarted after the second
  - Tank 10 recirculation was temporarily stopped, and a density probe was deployed multiple times. Liquid samples were also obtained. Density measurements/sample results indicated slow progress in saltcake/burkeite dissolution
  - Recirculation of the Tank 10 contents continued until the end of April 2019
  - Based on density measurement/sample results which indicated diminishing dissolution progress, the decision was made to move forward with batch qualification and processing prior to adding additional water to Tank 10
  - During June 2019, ~58K gallons of salt solution was transferred out of Tank 10 and processed through TCCR Unit 1

Tank 10 Waste Removal Campaign 4

- **After the completion of Batch 2, preparations to attempt additional saltcake dissolution began in July 2019 with hydro lancing below the Tank 10 STP**
  - Hydro lancing was performed to contact / dissolve saltcake under the burkeite layer and allow for lowering of the STP to potentially improve dissolution rates during recirculation
  - Following hydro lancing, the Tank 10 STP was lowered to ~56” from the tank floor. Two small additions (~25K gallons) of domestic water to Tank 10 were completed. Recirculation of the liquid was performed after each water addition
  - Density readings within Tank 10 indicated the same slow dissolution progress as was seen in Batch 2
  - In August 2019, the STP failed during recirculation operation

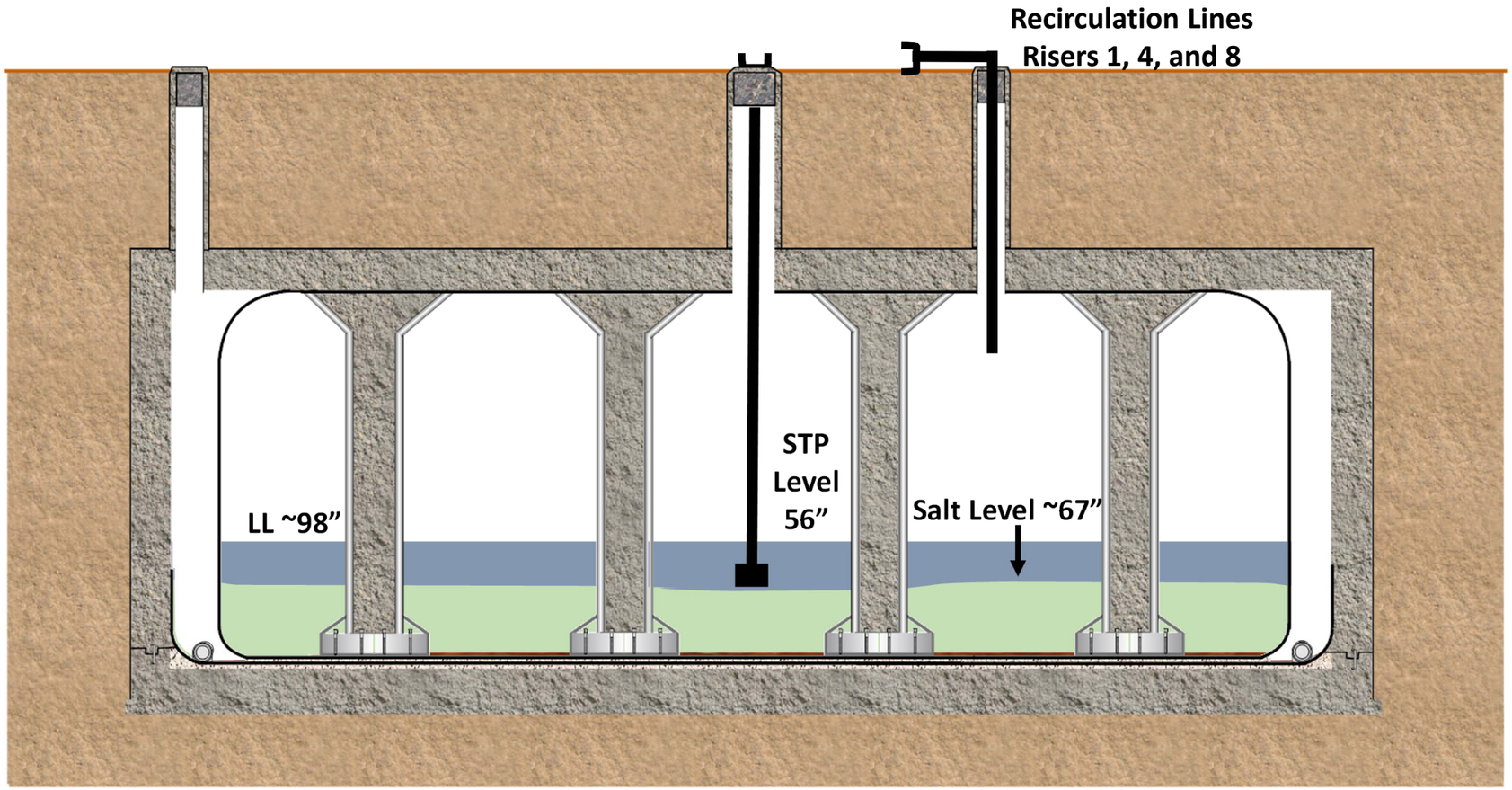


Tank 10 Waste Removal Campaign 4

- **A relatively insoluble layer containing burkeite had been reached in Tank 10 impacting saltcake removal; the saltcake dissolution technique (water addition with recirculation) was no longer efficient or effective**
- **A more robust dissolution technology (e.g., mixing pumps) was required to make any significant progress with waste removal in Tank 10. Tank 10 salt dissolution activities put on hold while design/procurement activities to support installation of Commercial Submersible Mixing Pumps (CSMPs) in Tank 10 continued**
- **The saltcake level measurements indicated varying levels at multiple locations. The average saltcake level prior to Campaign 4 was determined to be ~72”, and the average saltcake level after Campaign level was ~67” [G-TRT-H-00161, G-TRT-H-00233]**
- **Based on measured saltcake levels, Campaign 4 removed approximately five inches of saltcake which equates to approximately 13.5K gallons**
- **The liquid level remained at 98” due to failure of the STP**

Tank 10 Waste Removal Campaign 4

At the completion of Campaign 4 (July 2019)



[G-TRT-H-00233]

Tank 10 Post Campaign 4

- **Additional hydro lancing of the Center Riser was performed to support replacement of the STP**
- **Approximately 166K gallons of salt solution was successfully processed from Tank 10 through TCCR Unit 1**
  - Combination of Tank 10 salt solution remaining after Campaign 4 and salt solution from Tank 9 salt dissolution activities.
- **Design, procurement and installation activities continued for Tank 10 CSMPs**

Tank 10 Waste Removal Campaign 5

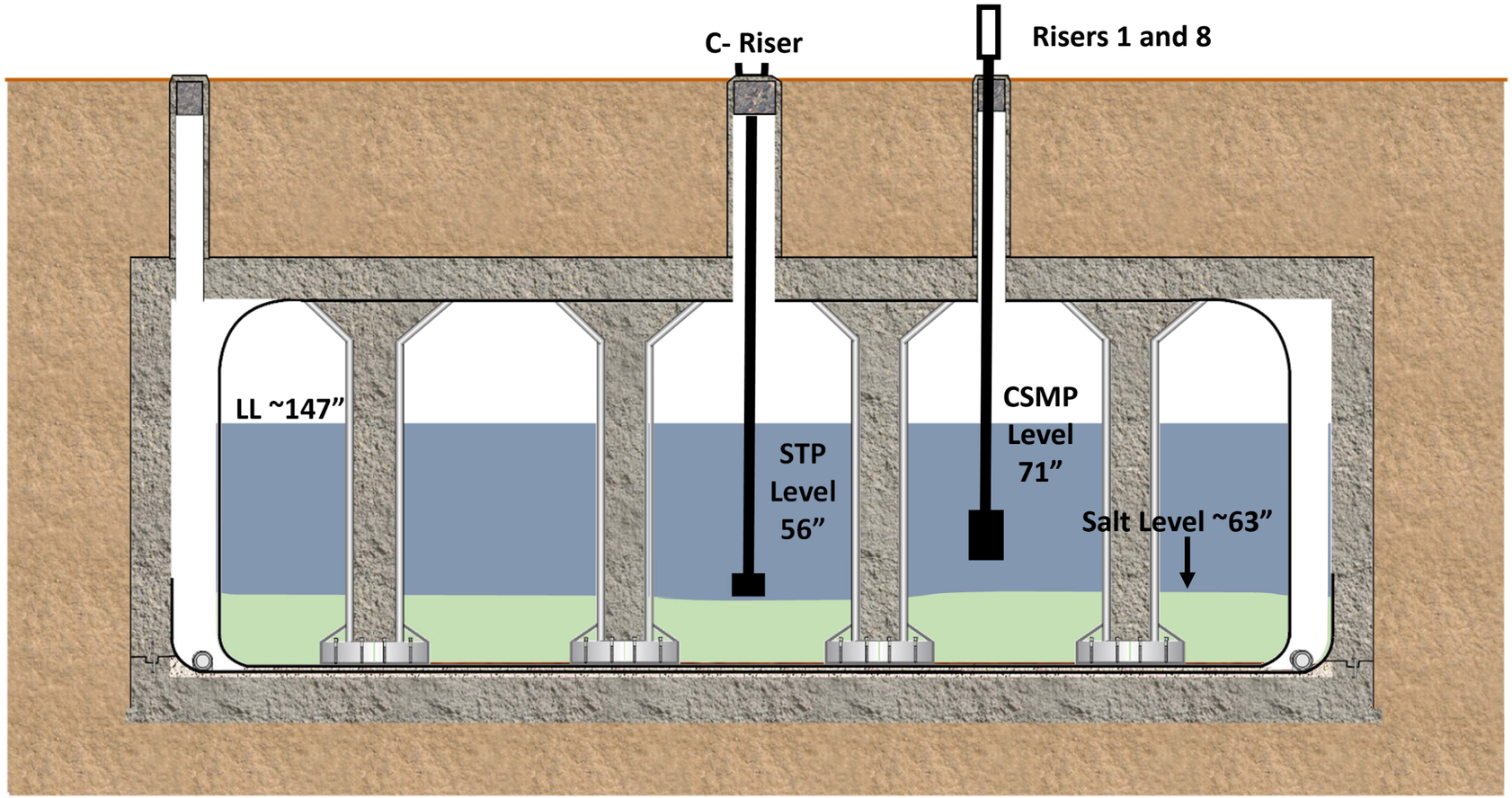
Salt Dissolution Using CSMPs

- Two CSMPs were installed in the tank in 2022 in Risers 1 and 8
- The STP was replaced in July 2023 Salt dissolution activities were resumed in August 2023.
- A third CSMP was installed in September 2023 in Riser 4

Tank 10 Riser 4 CSMP

Tank 10 Waste Removal Campaign 5

At the start of Campaign 5 (August 2023)



Tank 10 Waste Removal Campaign 5

Salt Dissolution Using CSMPs – Campaign 5a

- **Salt dissolution Campaign 5a started in August 2023 using the CSMPs installed in Risers 1 and 8 (suction at 71” from the tank bottom)**
- **CSMPs operated for approximately 6 days**
- **Dissolved salt solution density = 1.4 g/mL indicating very good salt dissolution**
- **Approximately 205K gallons of dissolved salt solution transferred to Tank 11**
- **Transfer terminated due to exposure of salt mound on West wall in Riser 4 (~69”)**

After Campaign 5a Completion

Tank 10 Waste Removal Campaign 5

Salt Dissolution Using CSMPs – Campaign 5b

- CSMPs suction - lowered to 61” from the tank bottom (Risers 1 & 8)
- Salt dissolution Campaign 5b started in September 2023 with the addition of 215K gallons of Domestic Water into Tank 10
- Risers 1 and 8 CSMPs operated for 4.5 days indexed to Riser 4 salt mound
- Dissolved salt solution density = 1.3 g/mL indicating very good salt dissolution
- Approximately 271K gallons of dissolved salt solution were transferred to Tank 11 in October 2023
- Transfer terminated due to exposure of salt mound on West wall in Riser 4 (~69”)

After Campaign 5b Completion

Tank 10 Waste Removal Campaign 5

- **Salt Dissolution Using CSMPs – Campaign 5c**
  - Riser 1 CSMP suction - lowered to 26” from the tank bottom
  - Riser 8 CSMP suction –lowered to ~26” from the tank bottom
  - Salt dissolution Campaign 5c started in November 2023 with the addition of 218K gallons of Domestic Water into Tank 10
  - Risers 1 and 8 CSMPs operated from 11/18-11/24/23 for a total cumulative time of 6.2 days indexed to Riser 4 salt mound (mixing interrupted due to software installation and testing of the Riser 4 CSMP)
    - *Riser 4 CSMP suction at ~53” from the tank bottom*
  - Dissolved salt solution density = 1.13 g/mL indicating salt solution not fully saturated
  - Riser 4 CSMP was started on 12/12/23 and operated for 4 days. After run, the CSMP suction was lowered to ~23”. CSMP was restarted on 12/20/23 and operated for 4.3 days

Tank 10 Waste Removal Campaign 5

- **Salt Dissolution Using CSMPs – Campaign 5c (continuation)**
  - Salt solution density = 1.14 g/mL
  - STP suction lowered to 4” from the tank bottom
  - CSMPs suction lowered (Riser 1 to 16”, Riser 4 to ~13”, Riser 8 to ~16”)
  - The CSMP were operated for 2.5 days in preparation for the Tank 10 to Tank 11 transfer
    - *STP faulted*
      - STP suction raised to 7” from the tank bottom, STP flushed, Variable Frequency Drive bypassed
  - Tank 10 to Tank 11 transfer
    - *Free supernate transfer -1/28/24 -1/29/24 – 270K gallons*
    - *STP suction lowered to 4” from tank bottom*
    - *Interstitial liquid removal transfer – 1/30/24 – 1/31/24 – 40K gallons*
  - Approximately 310K gallons of dissolved salt solution were transferred to Tank 11 in January 2024
  - Visual inspection of primary tank indicate no saltcake remaining in Tank 10
  - No additional sludge/solids accumulation during salt dissolution campaigns

Tank 10 Waste Removal Campaign 5

Primary Tank Post-Campaign 5

Note: Approximately five inches of liquid present at the completion

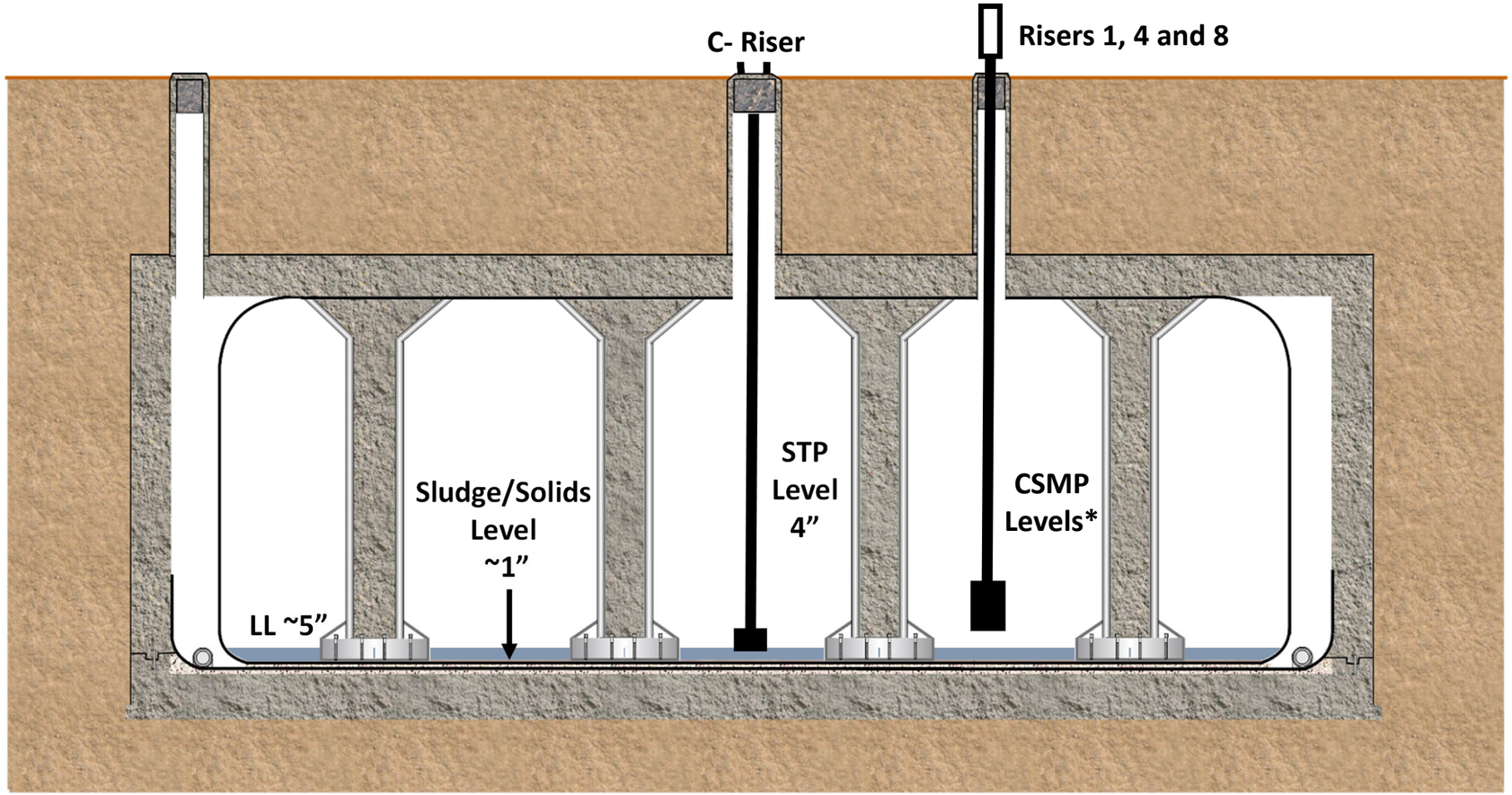
Tank 10 Waste Removal Campaign 5

- **Primary Tank Post-Campaign 5**

Note: Approximately five inches of liquid present at the completion

Tank 10 Waste Removal Campaign 5

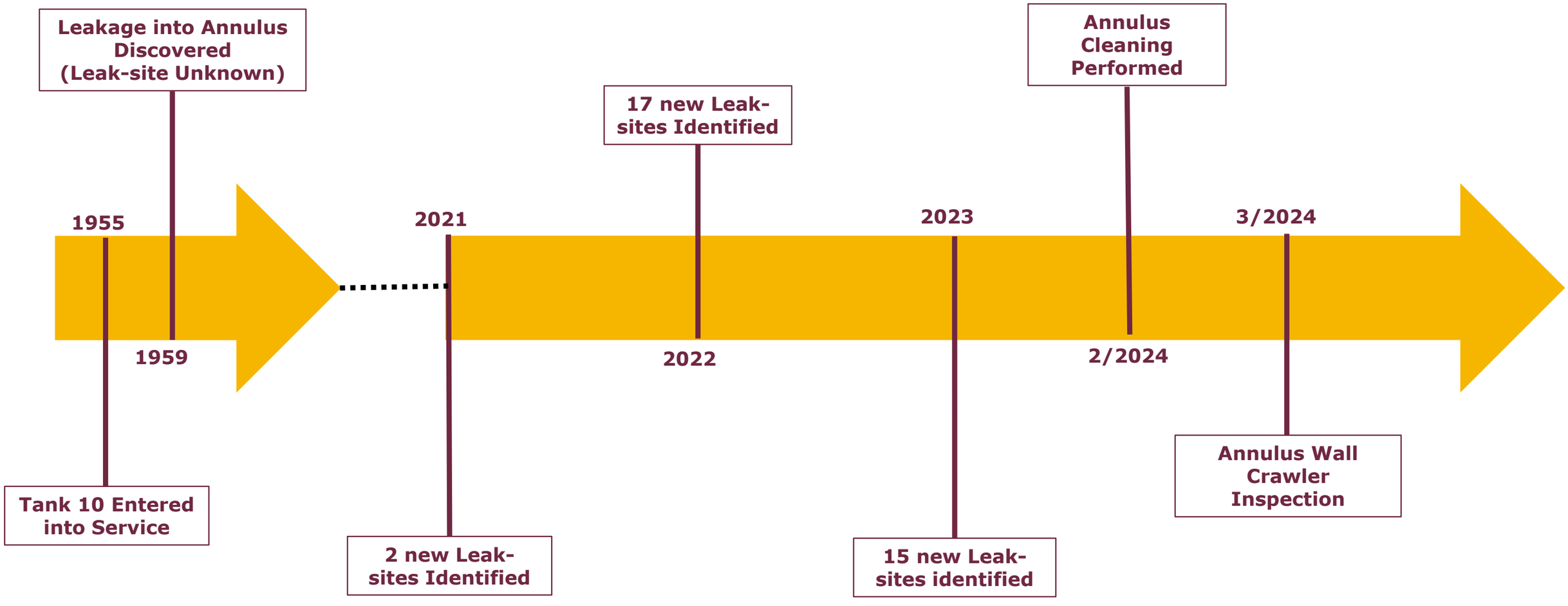
At the completion of Campaign 5 (January 2024)



***All CSMPs as low as possible given internal tank obstructions.**

Riser 1 = ~16”
Riser 4 = ~13”
Riser 8 = ~16”

Tank 10 Annulus Historical Timeline

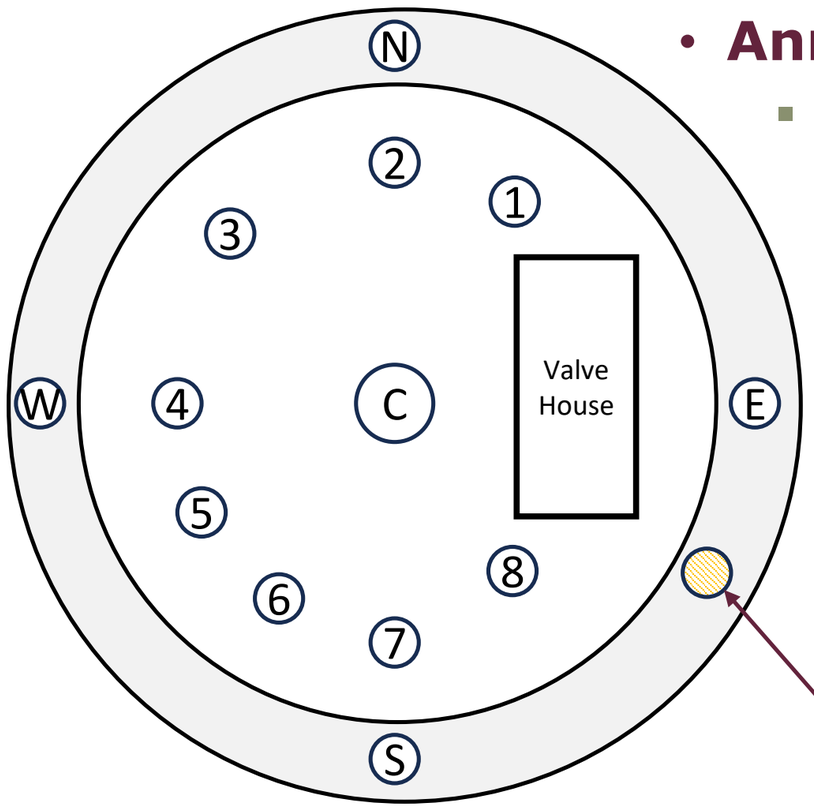


Tank 10 Annulus Inspection / Leak History through 2023

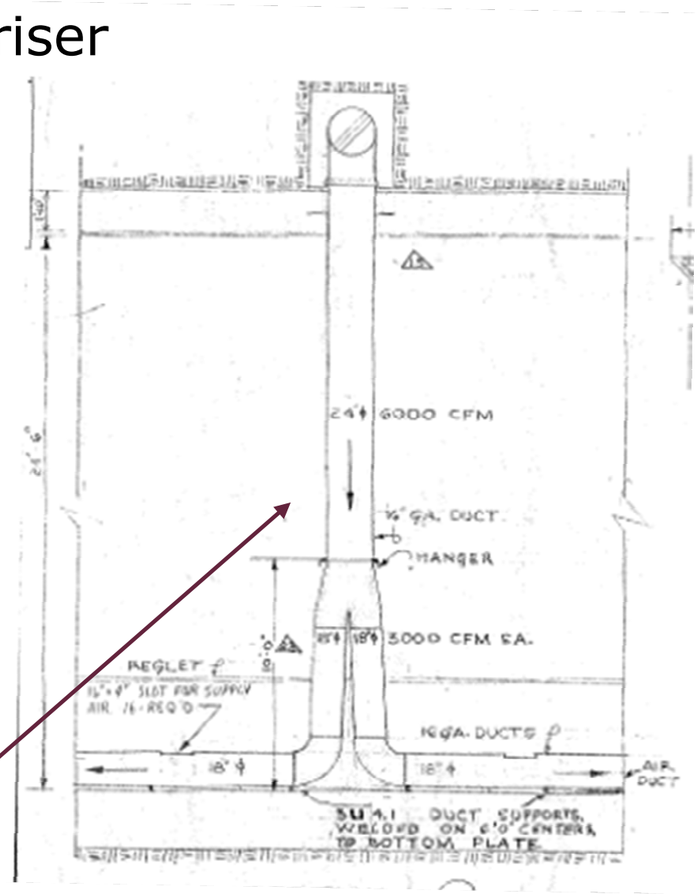
- **Through 2023, a total of thirty-five leak-sites documented**
  - Camera access restricted to North, East and West annulus risers
  - South riser inaccessible due to installed steam jet
- **Approximately seven to eight inches of salt waste in the annulus pan (2,800 - 3,200 gallons @~400 gallons/inch + salt nodule volume) prior to annulus cleaning activities**

Tank 10 – Riser Access

- **Primary access**
  - Eight 24-inch risers
  - One 42-inch central riser
- **Annulus access**
  - Four 24-inch risers



Vertical Dehumidification Duct



Tank 10 Annulus Pre-Cleaning

East Riser Before

West Riser Before

Salt Nodules on Primary Tank Wall

Annulus Floor

Tank 10 Annulus Pre-Cleaning

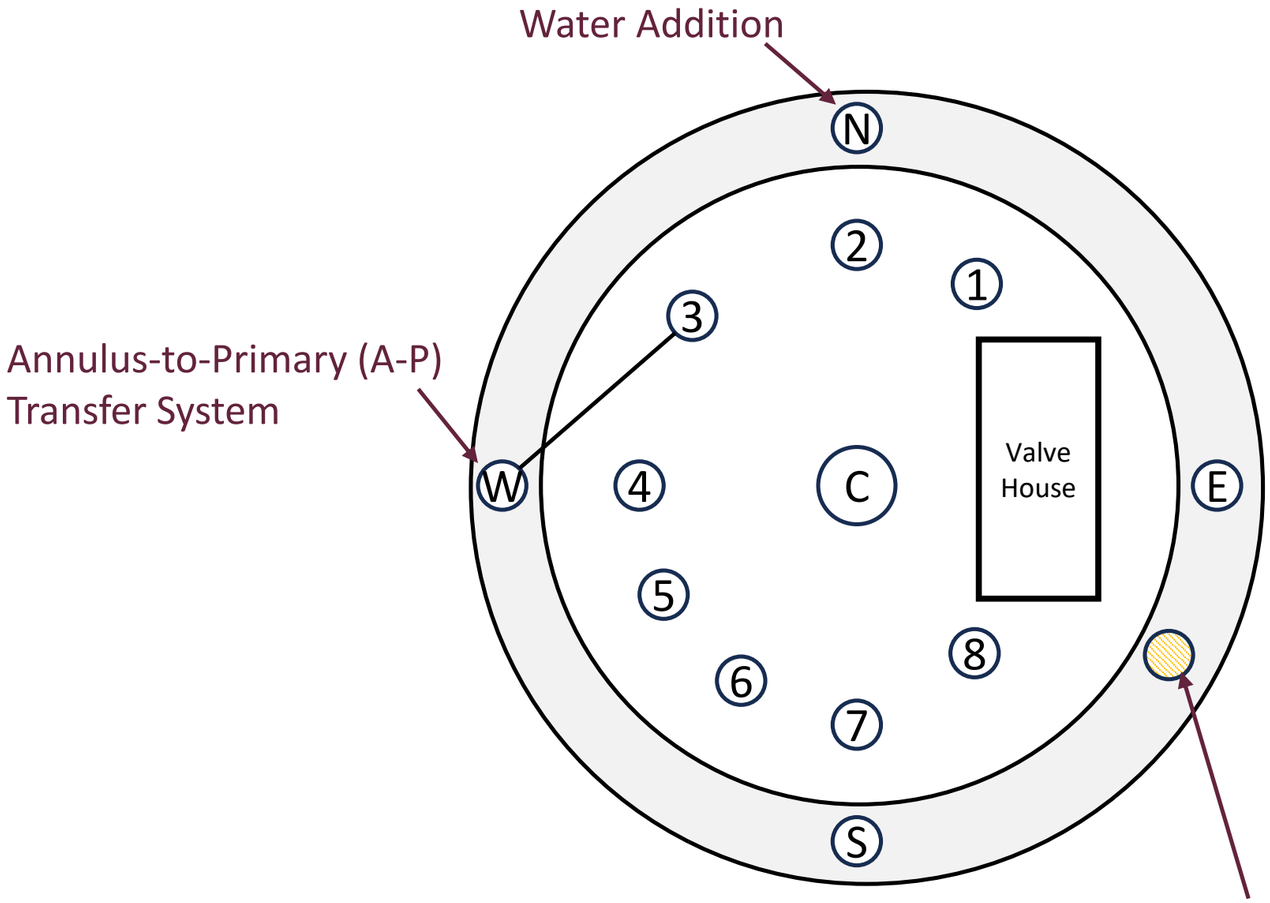
North Riser Before

South Riser Before*

*Steam jet removed to support annulus inspections

- Portion of annulus previously not inspected
- Conditions of primary tank wall and annulus pan similar to other riser locations previously inspected
- Thirteen new leak-sites identified bringing total to forty-eight documented sites [SRMC-LWE-2024-00015]

Annulus Cleaning



- **Batch #1**
  - 5,000 gallons of water added into the annulus via water addition downcomer
  - Liquid level within the annulus after water addition – fifteen inches
    - *Salt in annulus pan submerged*
  - six-day soak period
  - Liquid level in the annulus after A-P transfer – five inches
- **Batch #2**
  - 5,000 gallons of water added into the annulus via water addition downcomer
  - Liquid level within the annulus after water addition – eighteen inches
  - seven-day soak period
  - Liquid level in the annulus after A-P transfer – six inches

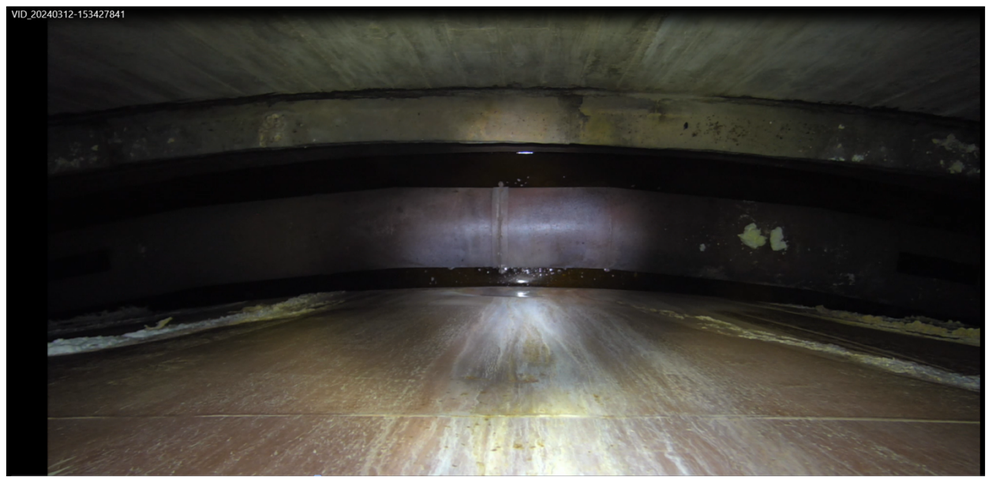
Tank 10 Annulus Cleaning

East Riser Before/After

West Riser Before/After

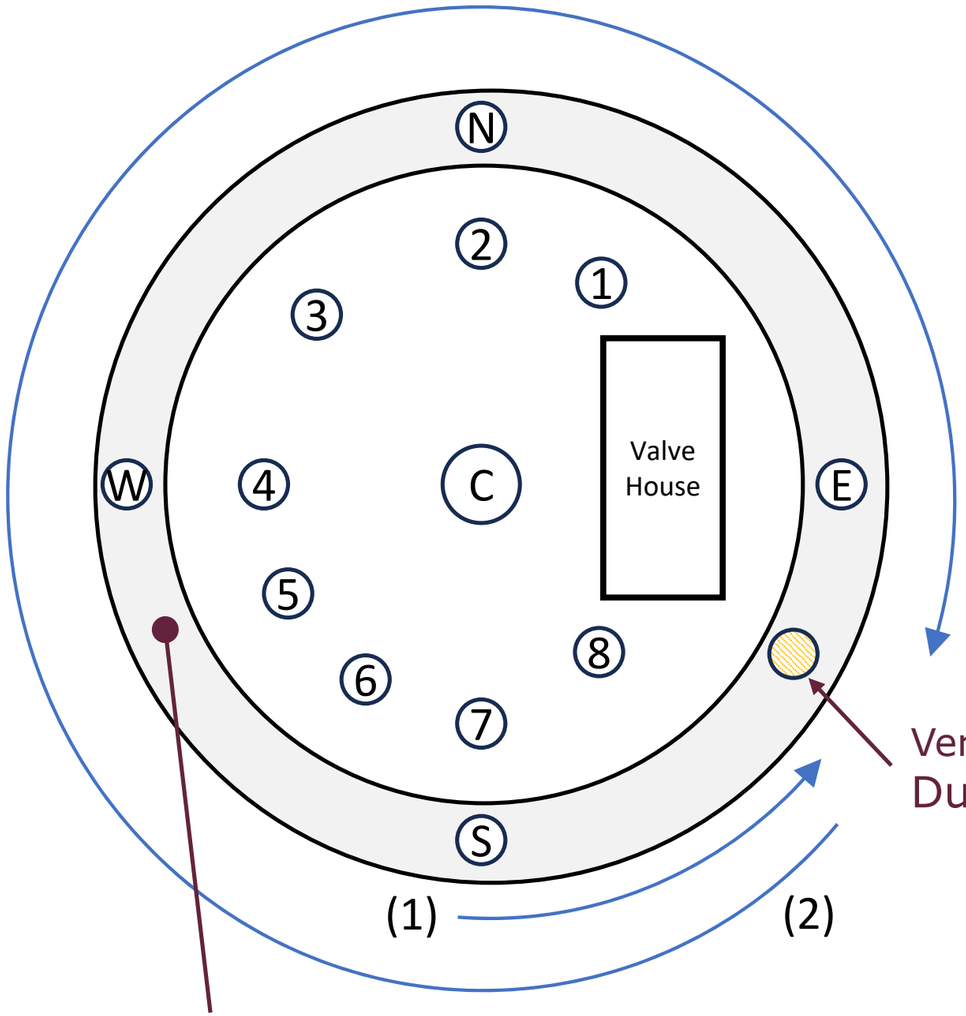
Tank 10 Annulus Cleaning

South Riser Before/After



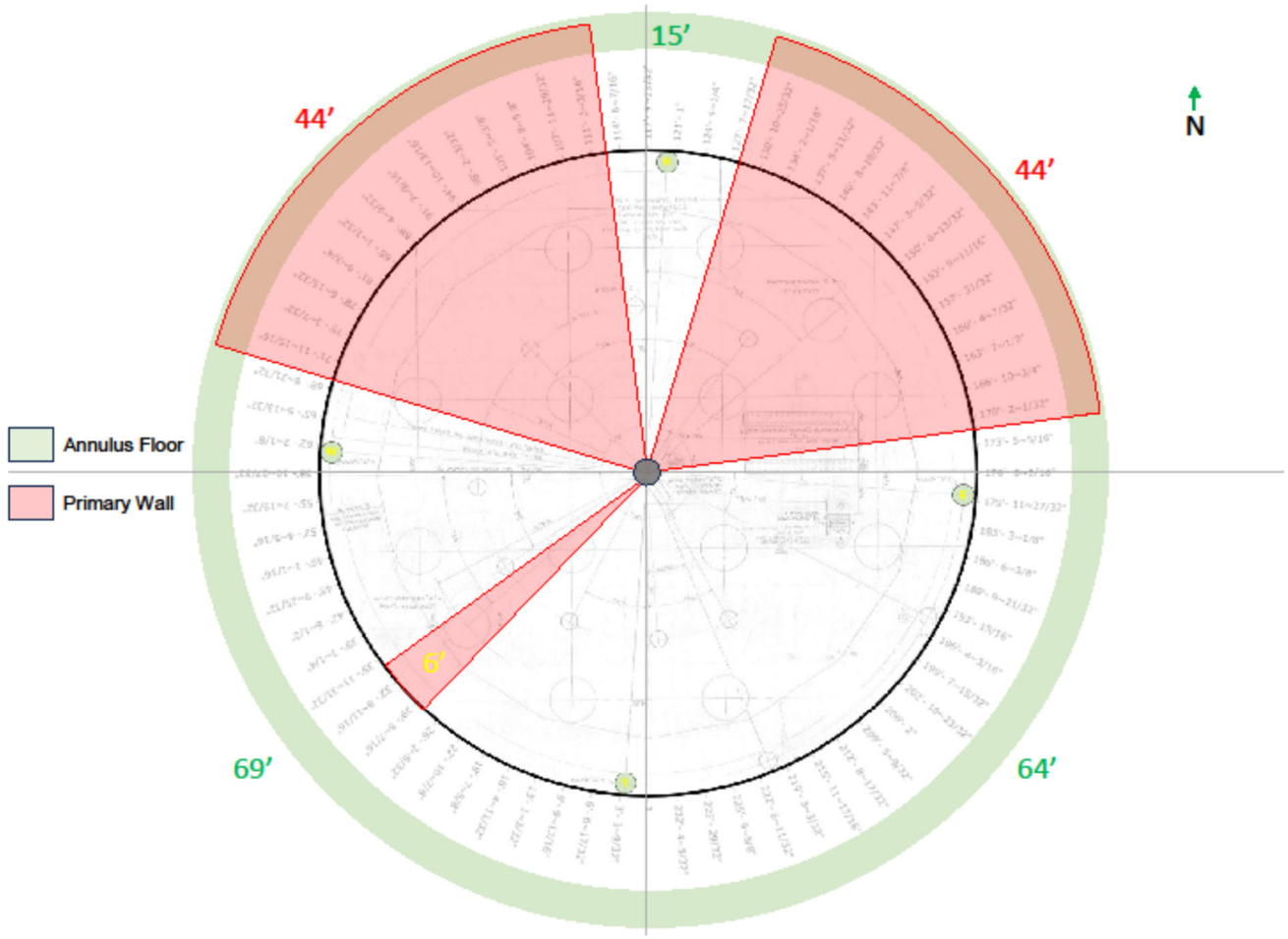
North Riser Before/After

Magnetic Crawler Inspection Plan



- **Deploy crawler in South riser**
- **(1) Drive counter-clockwise to vertical dehumidification duct**
  - Crawler successfully reached dehumidification duct
- **(2) Return to South riser and continue clockwise to other side of dehumidification duct**
  - Crawler returned past South riser but became dislodged from primary tank wall prior to reaching wall area visible from the West riser
- **Additional new annulus area inspected by crawler increased total (cameras + crawler) to approximately sixty percent**
  - Additional twenty-five new leak-sites identified by crawler inspection brings total to seventy-three [U-ESR-H-00234]
  - Conditions of primary tank wall and annulus pan similar to riser locations previously inspected
- **Attempts to recover magnetic crawler were unsuccessful**
  - Several attempts over a couple days to recover by pulling on tether were not able to move crawler

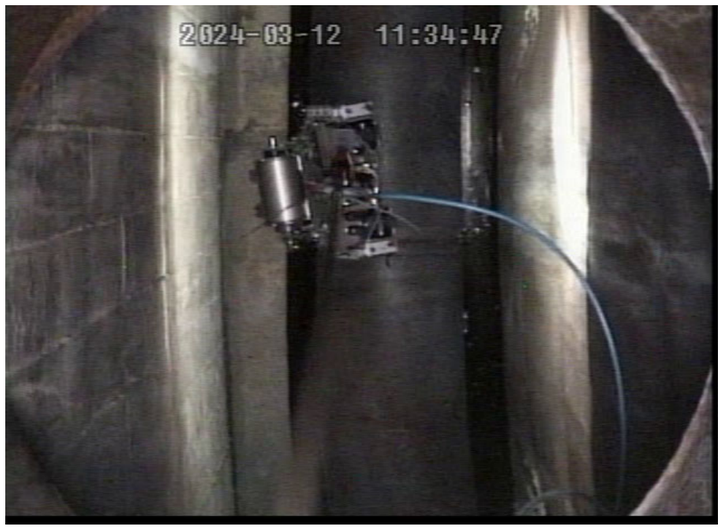
Annulus Inspection

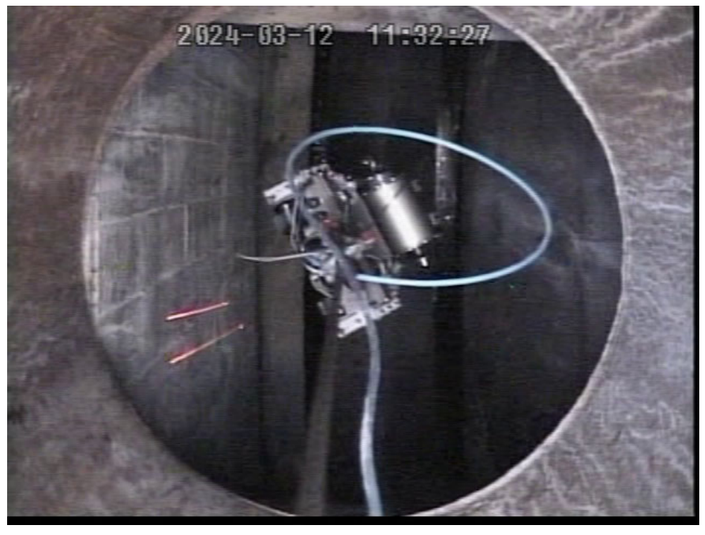


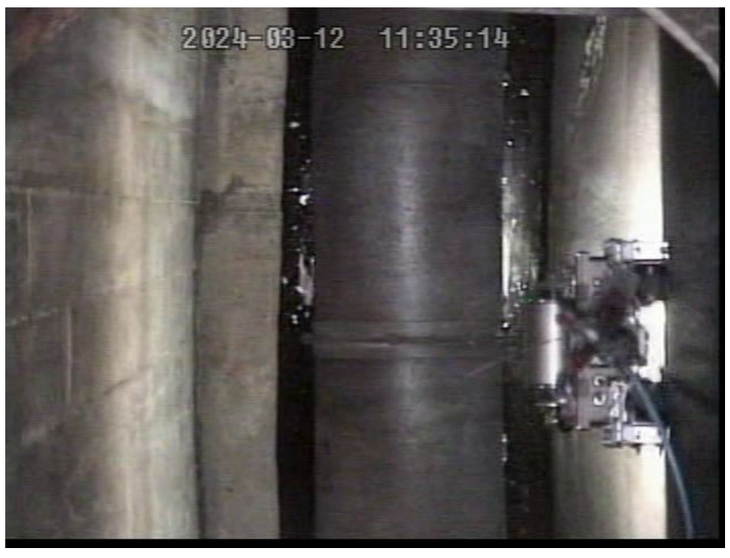
Estimated Coverage Areas
(Cameras + Crawler)

Tank 10 Annulus Inspection

Crawler Deployment



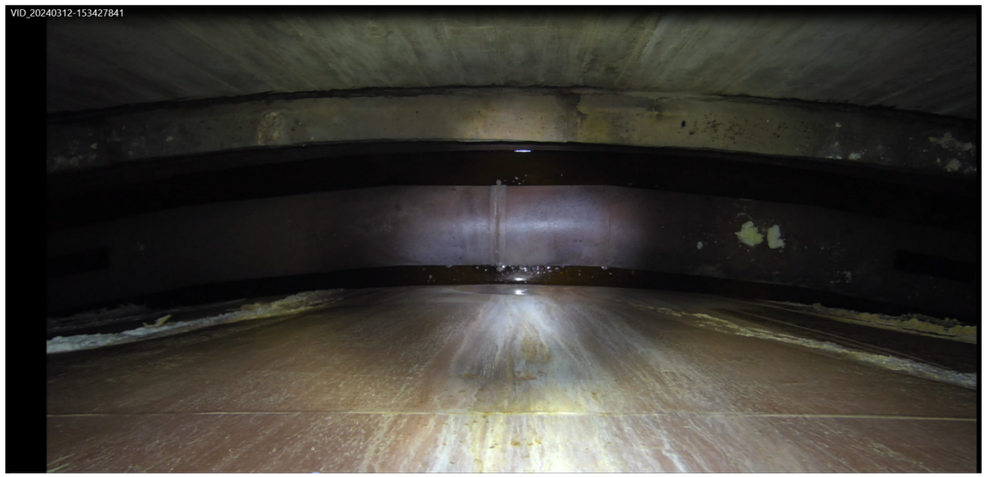




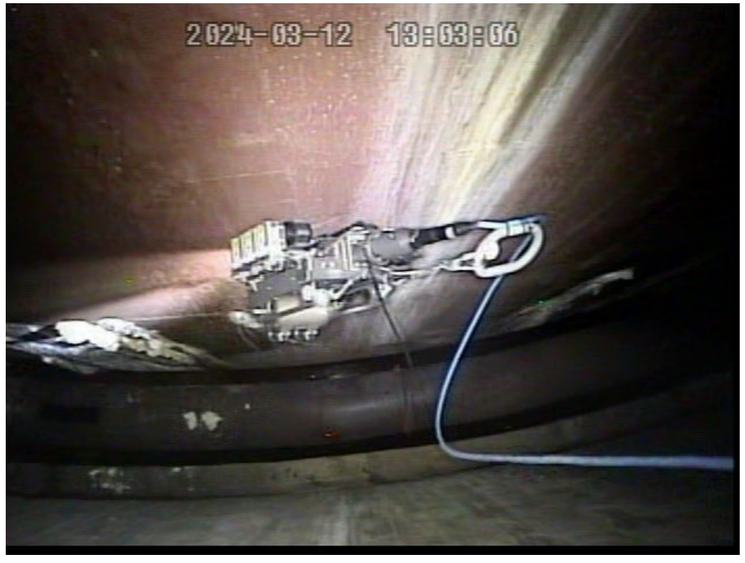
Tank 10 Annulus Inspection

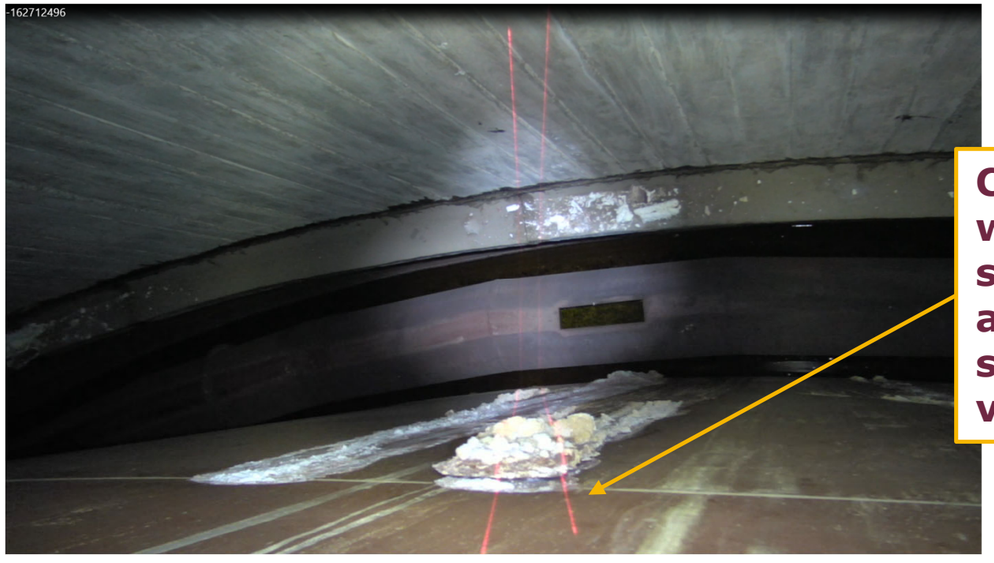
Crawler Below South Riser

Annulus Camera



Crawler Camera

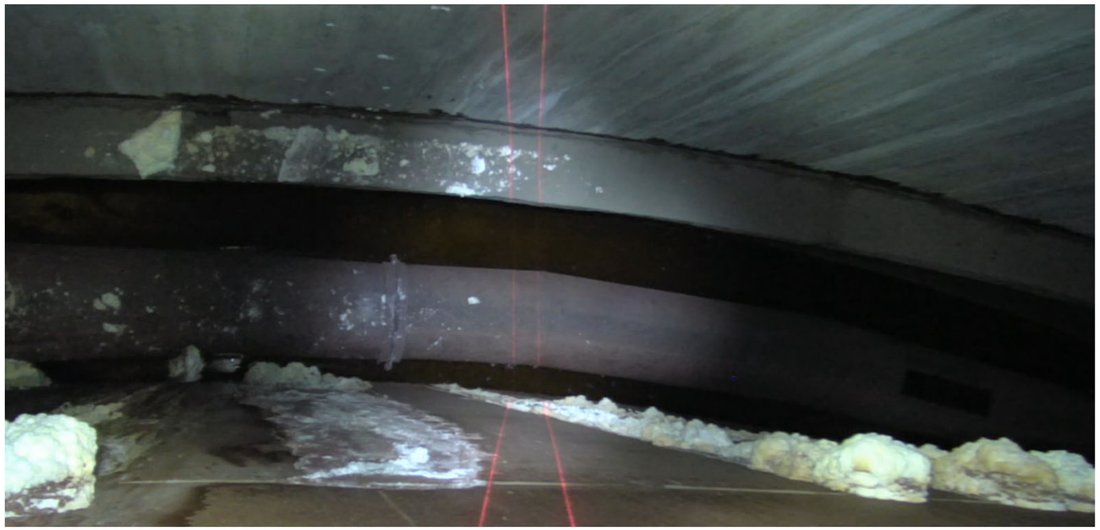


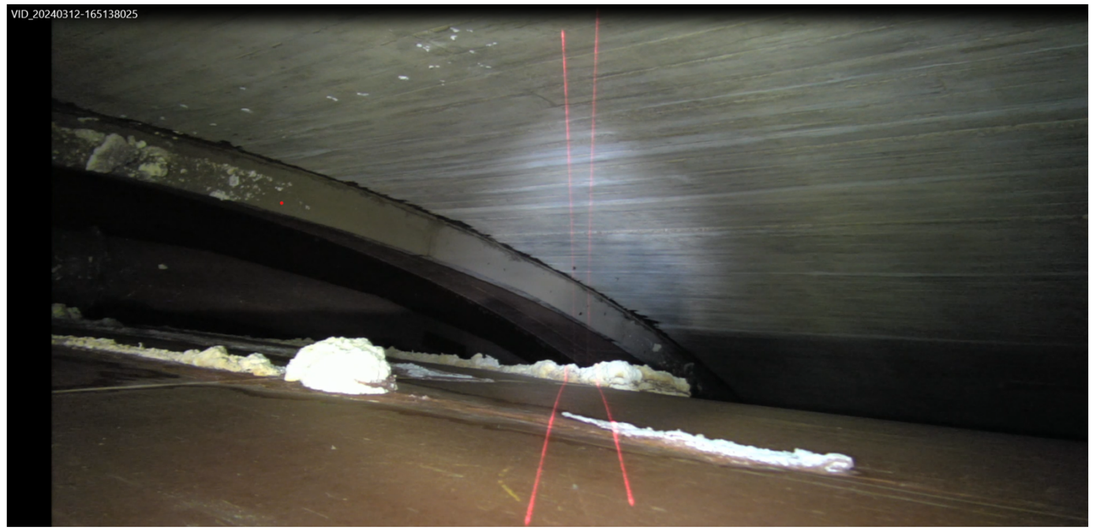


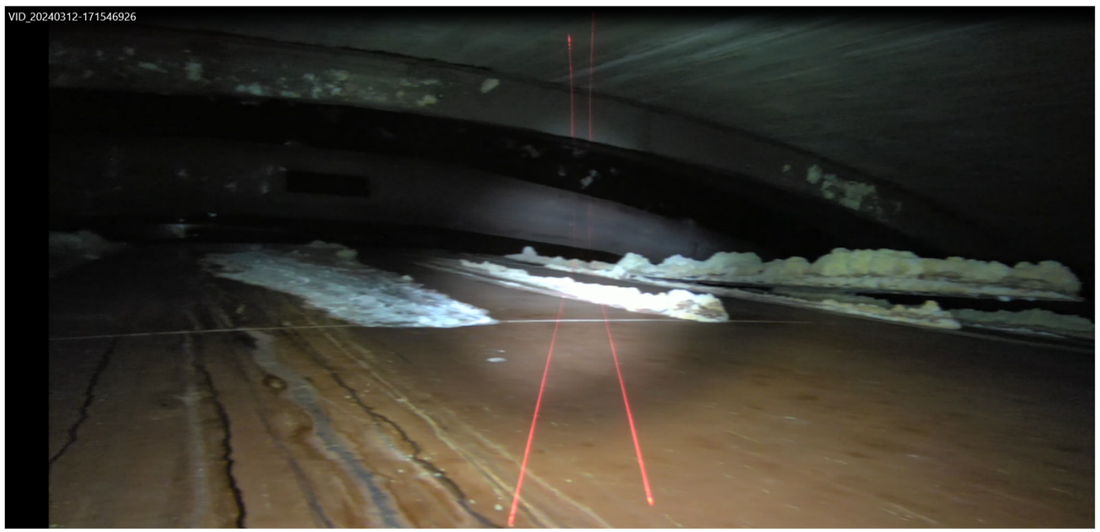
Crawler equipped with two lasers spaced at 2.75” apart to help support salt nodule volume estimates

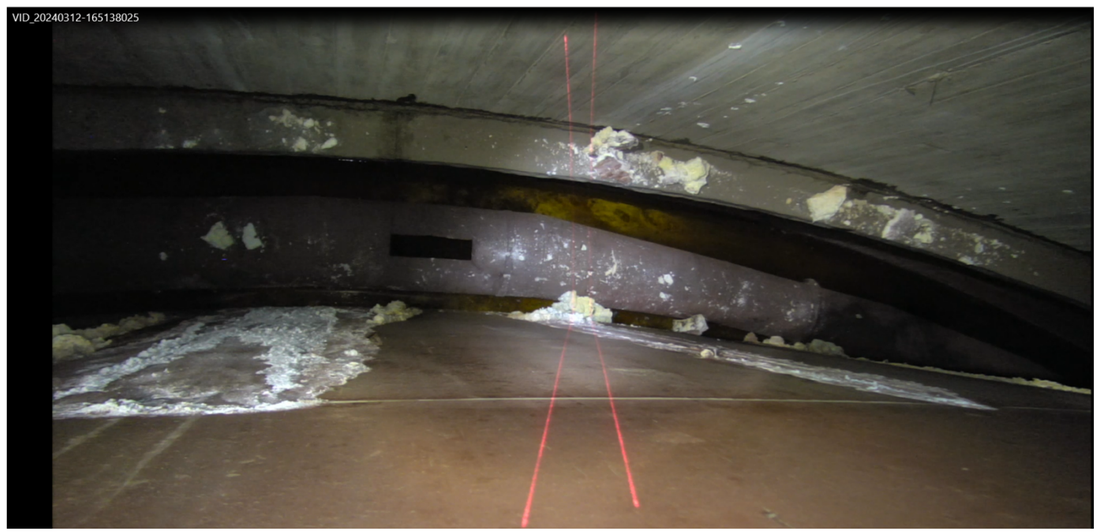
Tank 10 Annulus Inspection

Crawler Camera View SW Quadrant



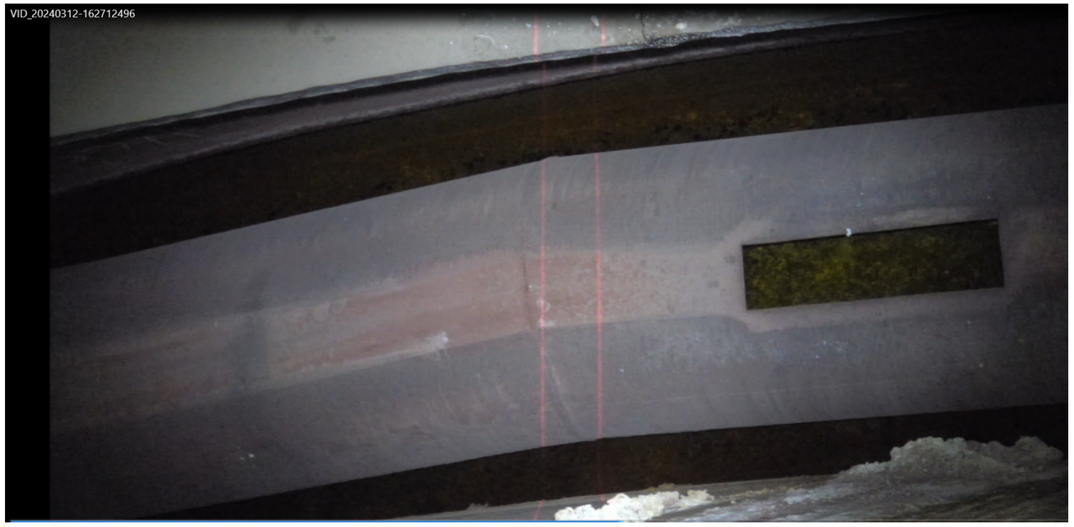


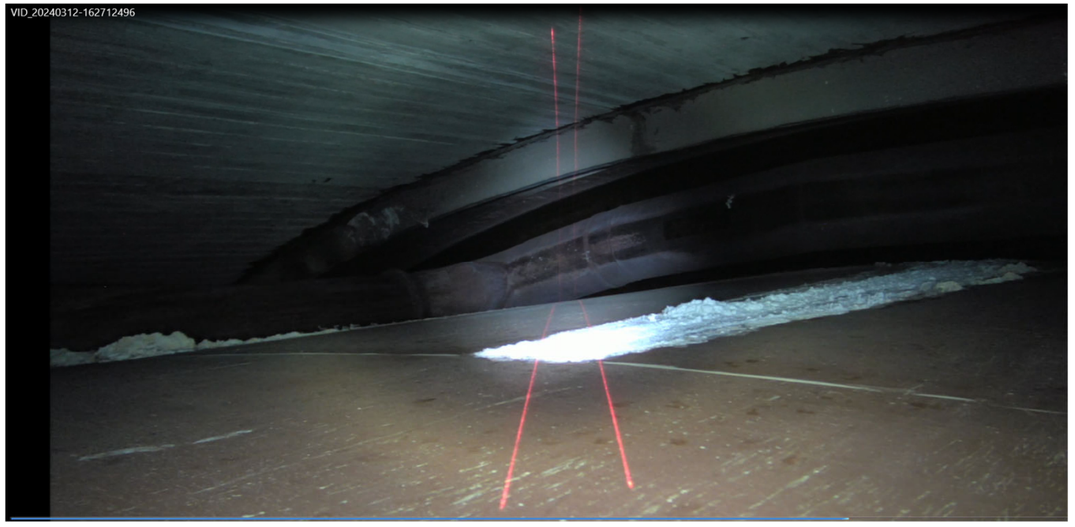


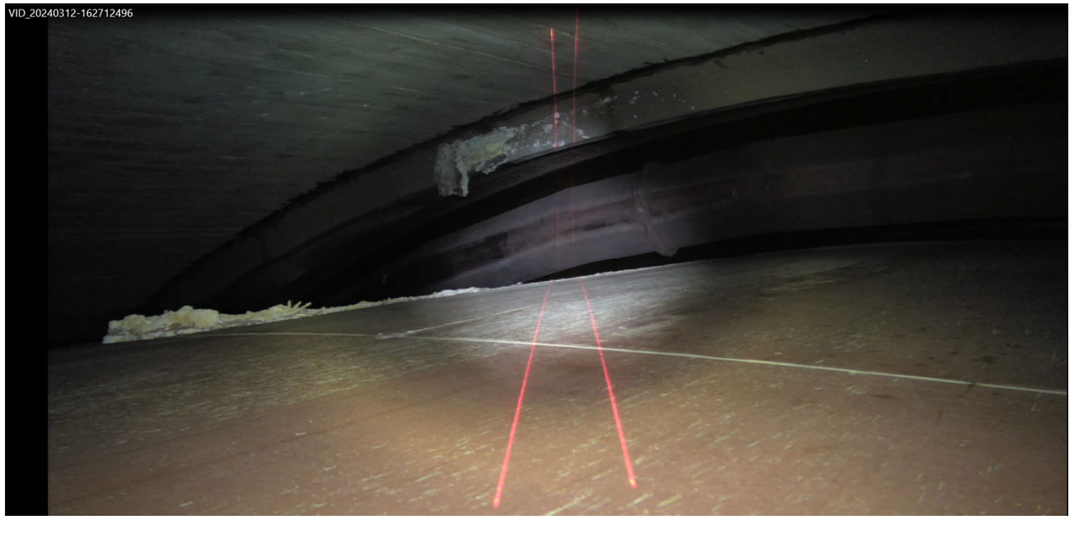


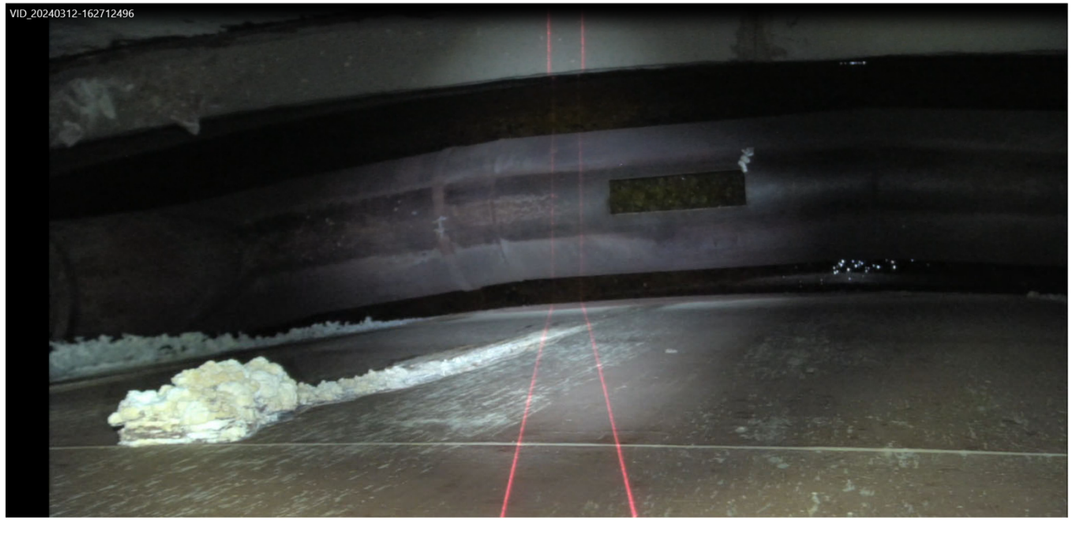
Tank 10 Annulus Inspection

Crawler Camera View SE Quadrant





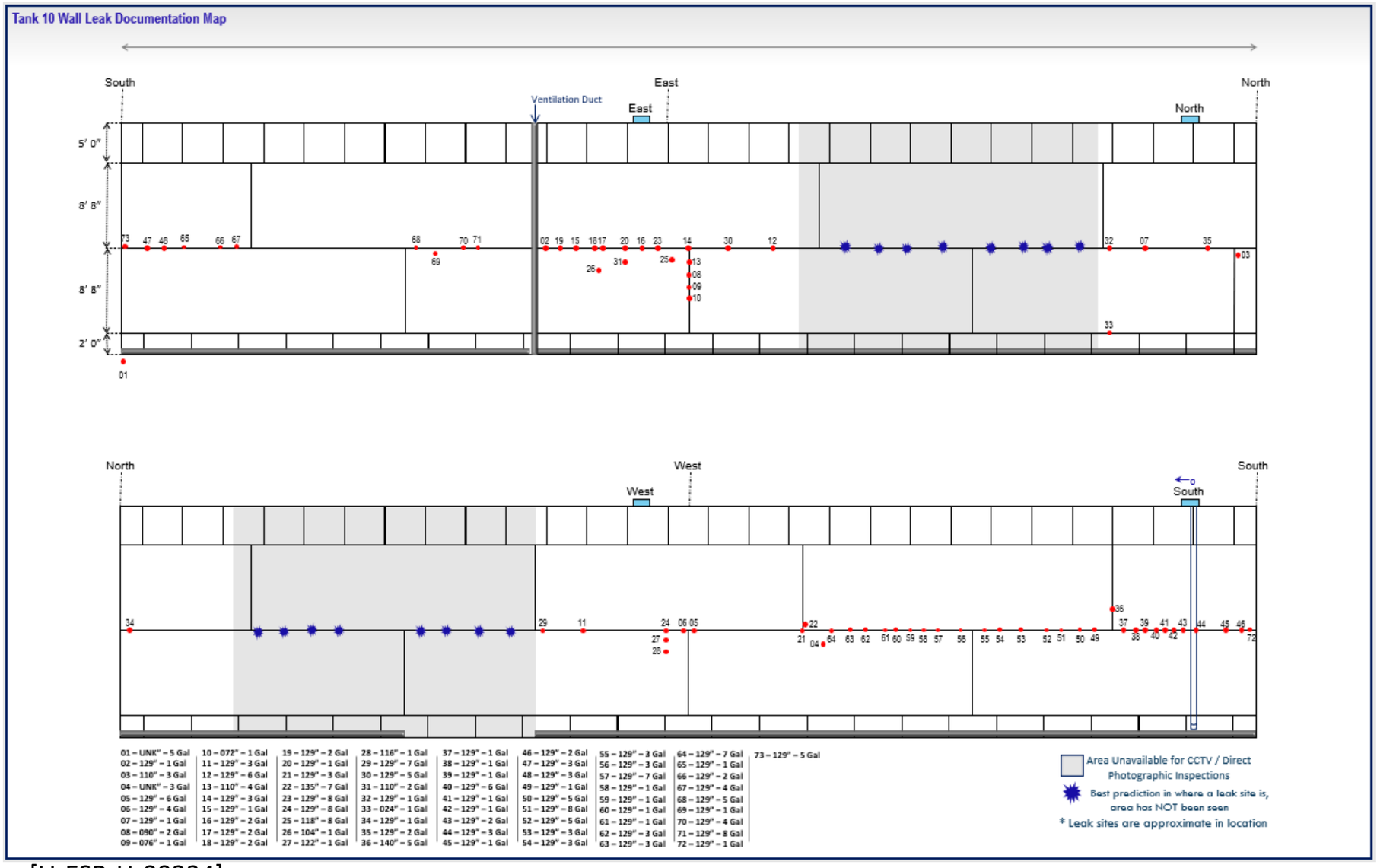




Tank 10 Annulus Inspection

- **Inspected areas of Tank 10 annulus show conditions similar throughout both before and after annulus cleaning**
  - Inspection of annular pan cleaning effectiveness consistent in all inspected areas
    - *Based on the fact that water reached all inspected areas of the annular pan (i.e., portions of all four quadrants) no reason to believe uninspected areas would not have similar results*
  - Primary wall conditions in newly inspected areas consistent with previously inspected areas
    - *Uninspected areas would not be expected to have considerably higher number of leak-sites (volume associated with salt nodules) than what has been inspected*
  - Based on estimated volume of salt nodules in inspected portions of the annulus, and projecting out to entire annulus, annulus salt waste volume is estimated to be <400 gallons

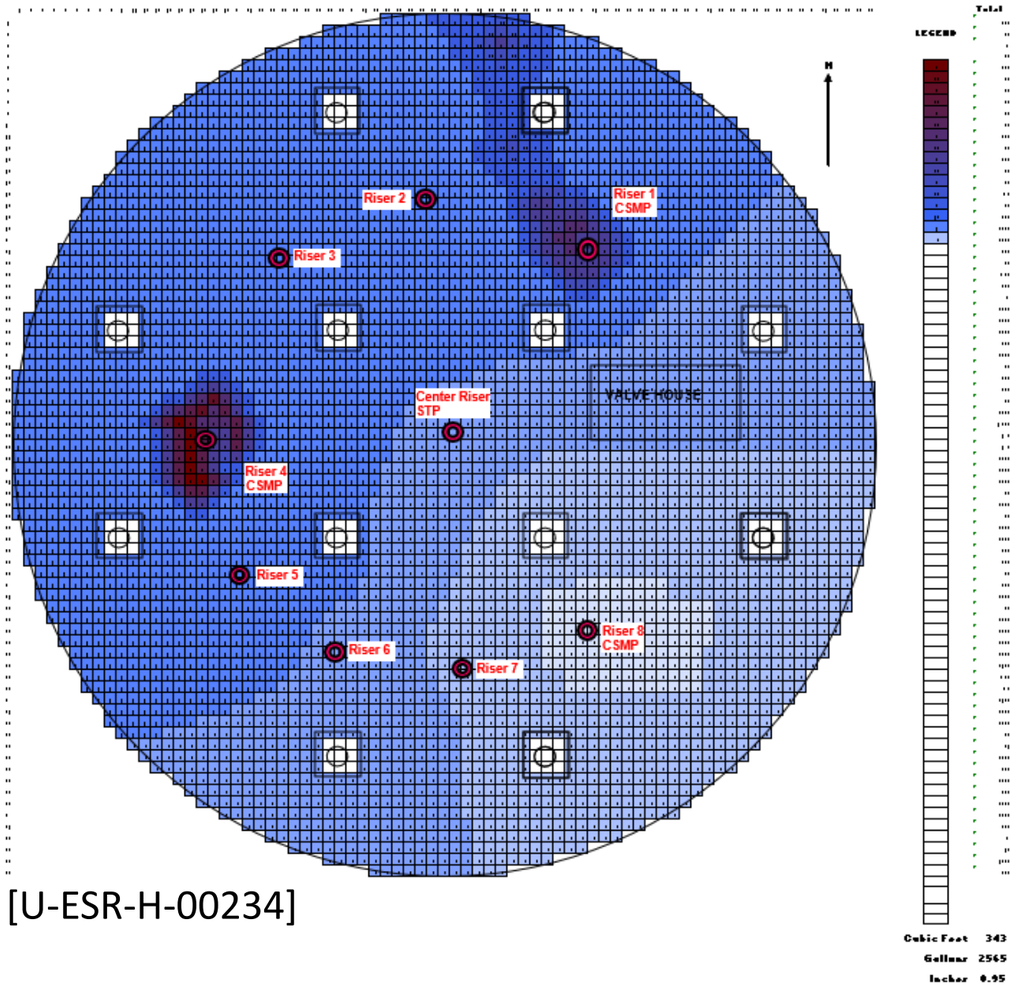
Tank 10 Annulus Inspection



[U-ESR-H-00234]

Tank 10 Primary Tank Inspection

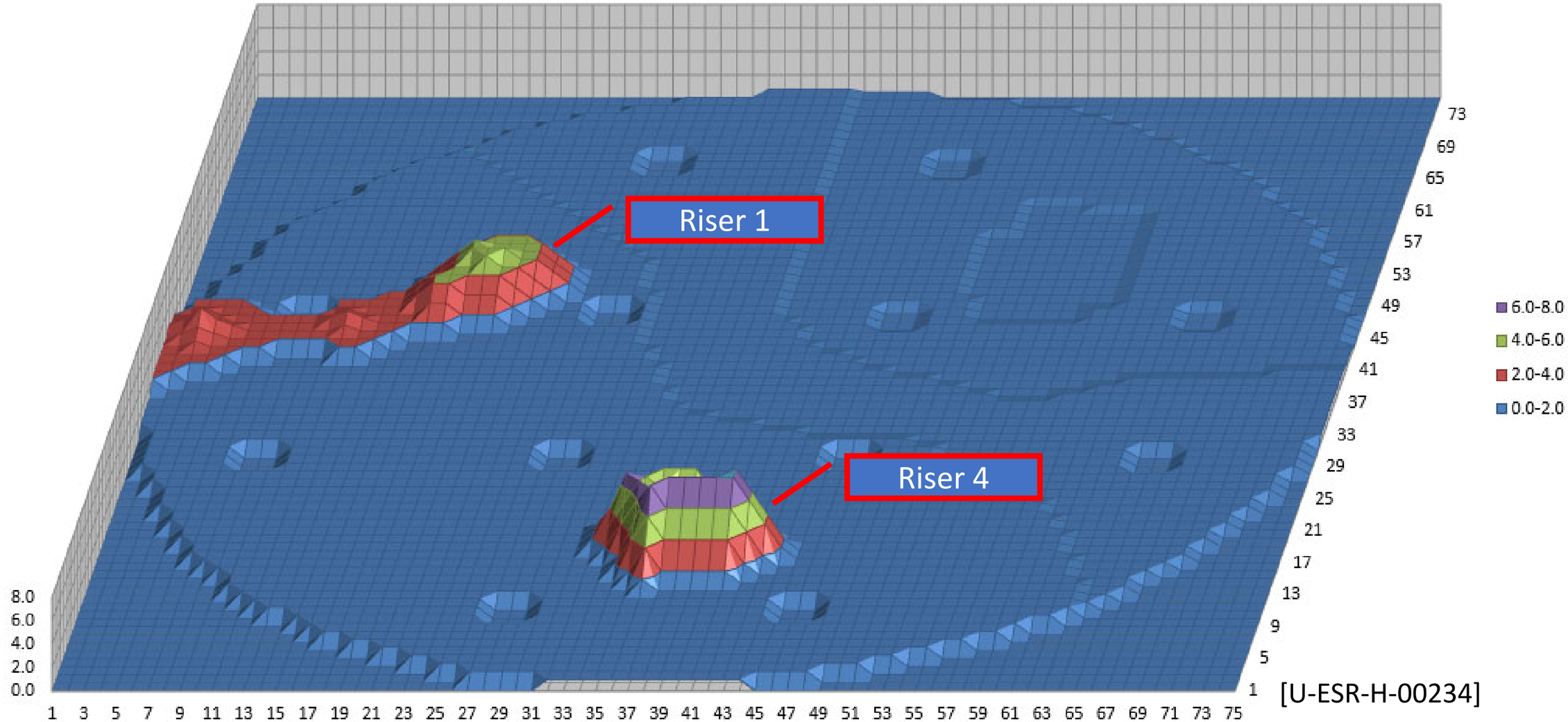
- **After annulus cleaning campaigns, Tank 10 primary tank pumped down using installed STP. Approximately 5 inches liquid remaining**
- **Estimated residual solids volume <3,000 gallons**



[U-ESR-H-00234]

Tank 10 Primary Tank (Current)

- **3-D Mound Representation**



[U-ESR-H-00234]

Tank 10 Primary Tank (Current)

Center Riser

Tank 10 Primary Tank (Current)

Camera facing west (towards Riser 4) from Center Riser

NE quadrant (facing South of Riser 1 CSMP)

Tank 10 Primary Tank (Current)

Camera facing East (towards tank wall)

Camera facing East

Tank 10 Primary Tank (Current)

Riser 1 CSMP (NE quadrant)

Tank 10 Primary Tank (Current)

Riser 4 CSMP (NW quadrant)

Tank 10 Primary Tank (Current)

Riser 8 CSMP (SE quadrant)

Overall Cleaning Results

Maximum Waste Volume (gal)	726,000
Maximum Solids Volume (gal)	65,040
Maximum Salt Volume (gal)	504,060
Total Salt Remaining (gal)	< 400[1]
Total Solids Remaining (gal)	< 3,000[2]
Total Waste Remaining (gal)	< 3,400[3]

[1] Based on a preliminary estimate of the salt remaining in the annulus. Final volume determination will be included in the Closure Module.
[2] Based on a preliminary estimate of the solids remaining in the primary. Final volume determination will be included in the Closure Module.
[3] Based on a preliminary estimate of the primary plus annulus. Final volume determination will be included in the Closure Module.

Total Percent Waste Removed Greater than 99.5%

Consolidated General Closure Plan

Based on the characteristics and estimated volume of the waste remaining in Tank 10, performance objectives are expected to be met.

- **Anticipate that concentration values in the groundwater for HTF will be below the Maximum Contaminant Level (MCL) values for all the non-radiological inorganic constituents listed in Table 9.2-1 of the CGCP**
- **Anticipate that concentration values in the groundwater for HTF will be below the MCL values for radionuclides consistent with the State Primary Drinking Water Regulations including:**
  - 4 mrem/yr dose for beta- and gamma-emitting nuclides
  - 15 picocuries per liter (pCi/L) for alpha-emitting nuclides (including Ra-226 but excluding radon and uranium)
  - 5 pCi/L for radium (Ra-226 plus Ra-228)
  - 30 micrograms per liter (µg/L) of uranium

Radiation Dose Perspective

- **Anticipate that the peak dose from Tank 10 alone will be <2 mrem/year during both the 1,000 year and 10,000-year periods after HTF closure***
  - Tank 10 is not a significant contributor to the peak dose in the HTF Performance Assessment
    - *Tank 10 peak dose is not anticipated to coincide with timing and location of overall peak dose within HTF*
- **To put this radiological dose into perspective**
  - Per NCRP-160, the average annual dose to a person in the United States is approximately 620 mrem primarily from:
    - *Approximately 310 mrem from naturally occurring background*
    - *Approximately 300 mrem from medical procedures*
  - An individual flying a transcontinental roundtrip from New York to Los Angeles will receive approximately 5 mrem during these flights
  - Individuals living in Denver, Colorado will receive greater than 1,000 mrem each year due to the higher natural, terrestrial, and cosmic radiation levels in that area.

*Based on a preliminary estimate of the volume. Final inventories will be included in the Closure Module.

Additional Removal Options

- **Additional mixing campaigns**
  - Each new mixing campaign requires approximately 200k gallons of water be added to Tank 10 to allow for mixing pump operation, creating additional new waste
    - *Additional new waste must be handled within the Liquid Waste System which is already challenged by available tank space to support Salt Batch compilation/qualification and Sludge Batch compilation/qualification necessary to feed Salt Waste Processing Facility (SWPF) and the Defense Waste Processing Facility (DWPF), respectively*
    - *Additional new waste must be processed through SWPF then subsequently DWPF or the Saltstone Production Facility (SPF), resulting in additional costs and impacts (i.e., extension) to the Liquid Waste System life-cycle*
  - Each new mixing campaign would divert resources (i.e., funding and personnel) from other Liquid Waste System risk reduction activities
    - *e.g., impact ongoing waste removal activities in Tanks 9 and 11 which are also located in the water table*
  - Level of additional waste removal uncertain, but even removing the majority of the remaining material, if possible, would have a minimal impact on final performance objective concentrations and doses

Additional Removal Options

- **Chemical Cleaning**
  - Any chemical cleaning campaign would require approximately 200k gallons of water/chemicals be added to Tank 10 to allow for mixing pump operation, creating additional new waste
    - *Additional new waste must be handled within the Liquid Waste System which is already challenged by available tank space to support Salt Batch compilation/qualification and Sludge Batch compilation/qualification necessary to feed SWPF and DWPF, respectively*
    - *Additional new waste must be processed through SWPF then subsequently DWPF or SPF, resulting in additional costs and impacts (i.e., extension) to the Liquid Waste System life-cycle*
  - Each chemical cleaning campaign would divert resources (i.e., funding and personnel) from other Liquid Waste System risk reduction activities
    - *e.g., impact ongoing waste removal activities in Tanks 9 and 11 which are also located in the water table*
  - Level of additional waste removal uncertain, but even removing the majority of the remaining material, if possible, would have a minimal impact on final performance objective concentrations and doses
    - *Low-Temperature Aluminum Dissolution anticipated to have minimal impact due to low Aluminum content expected in Tank 10 solids*
    - *Bulk Oxalic Acid Cleaning would have additional adverse impact of introduction of additional oxalates into the system*

Additional Removal Options

- **Vacuum Technology**
  - Proven Mantis technology that was utilized in Tanks 18 and 19 cannot be deployed due to in-tank obstructions
  - Alternate technology utilizing a smaller robotic platform with vacuum capability would require considerable development
    - *Very limited applicability at the time due to mobility around and over in-tank obstacles and associated tether management*
    - *Any water added to support removal, if required, would result in new waste and have same impact as previously described for additional mixing campaigns and chemical cleaning*
    - *Development/deployment of a new vacuum technology would divert resources (i.e., funding and personnel) from other Liquid Waste System risk reduction activities*
  - Level of additional waste removal uncertain, but even removing the majority of the remaining material, if possible, would have a minimal impact on final performance objective concentrations and doses

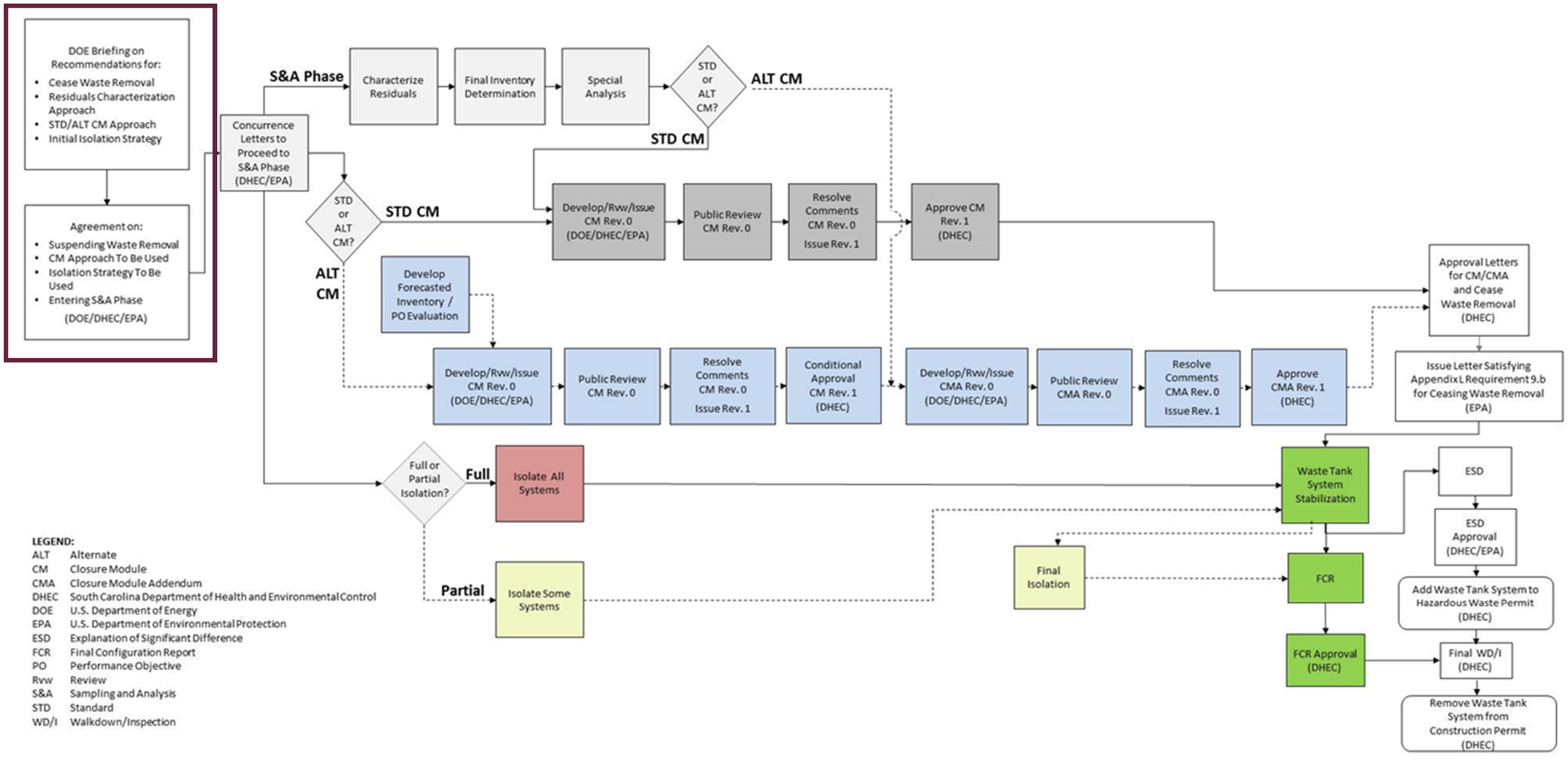
Additional Removal Options

- **Additional annulus waste removal**
  - Based on results from annulus inspections and limited amount of material that may be remaining on the annulus pan floor or in the ventilation duct, additional water addition/removal campaigns would be expected to have minimal impact on additional waste removal while generating additional new waste into the Liquid Waste system
  - Removal of remaining salt nodules located on the exterior of the primary tank wall would require additional development of a methodology to equip one of the current magnetic crawlers, or purchase of potential alternate crawler technology, with the capability to dissolve/dislodge the salt nodules thereby moving the material to the floor of the annulus for subsequent removal
    - *Likely require entry into multiple, if not all, annulus risers*
    - *Development/deployment of a retrofitted/new crawler would divert resources (i.e., funding and personnel) from other Liquid Waste System risk reduction activities*
    - *Spraying alone, without deployment utilizing a crawler, would have limited access to the surface of the primary tank wall*
    - *Material would need to be transferred out of the annulus, and subsequently out of the primary tank, introducing additional new waste into the rest of the Liquid Waste System*
  - Doses/concentrations associated with waste remaining within the annulus of Tank 10 are expected to contribute just a small portion to the overall doses/concentrations associated with all the waste remaining within the tank.
    - *Removing even the majority of the remaining material within the annulus, if possible, would have a minimal impact on final performance objective concentrations and doses*
    - *Uncertainty associated with uninspected areas of the annulus, and potential impacts on the ability to meet performance objectives will be provided as part of the quantitative assessment included in the Closure Module covering Tank 10*

Summary

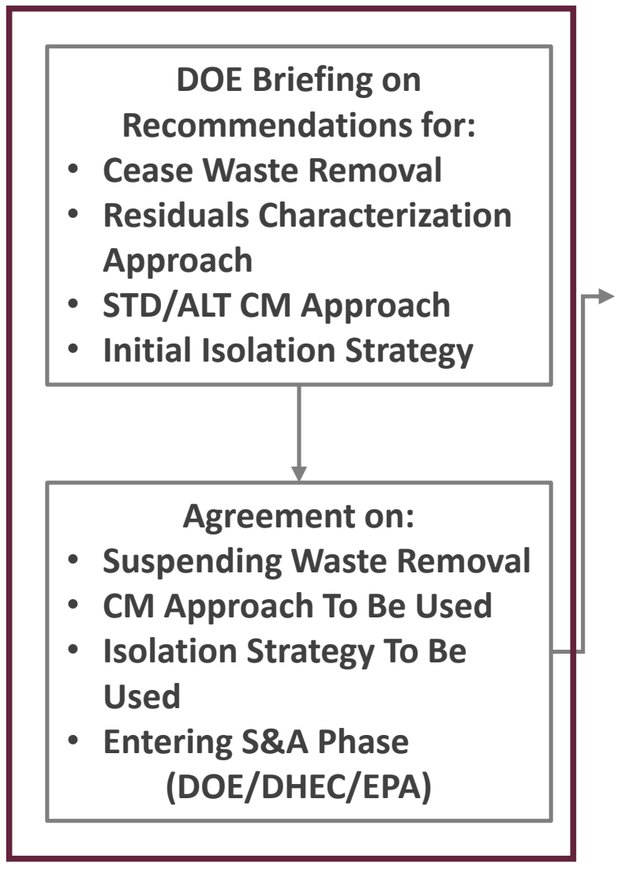
- **Over 99% of the waste volume in Tank 10 has been removed**
- **A qualitative assessment indicates that the CGCP performance objectives will not be challenged**
- **Tank 10 is not a significant contributor to doses in HTF Performance Assessment and additional waste removal would have minimal impact on estimated doses/performance objectives**
- **Additional waste removal activities in Tank 10 would have a negative impact on other Liquid Waste System risk reduction activities**
- **A quantitative assessment utilizing final residual waste volumes and results of sampling and analysis will be included in the Closure Module covering Tank 10**
- **A formal discussion on the "practicability" of additional waste removal will be included in the Closure Module covering Tank 10**

Figure 11.4-1 in CGCP



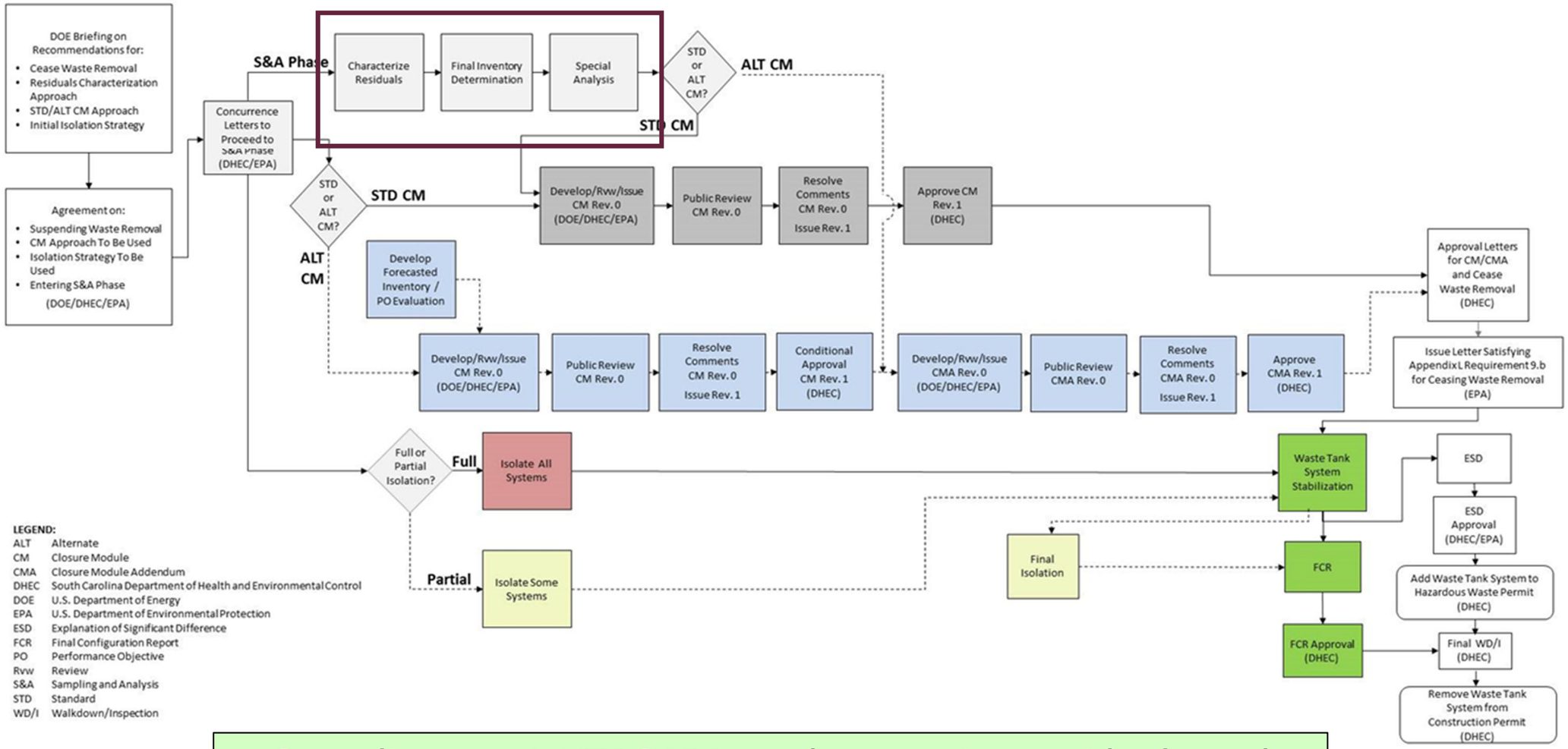
The process outlined in the CGCP to be followed to ultimately result in the operational closure of waste tank systems and ancillary structures

Recommendations



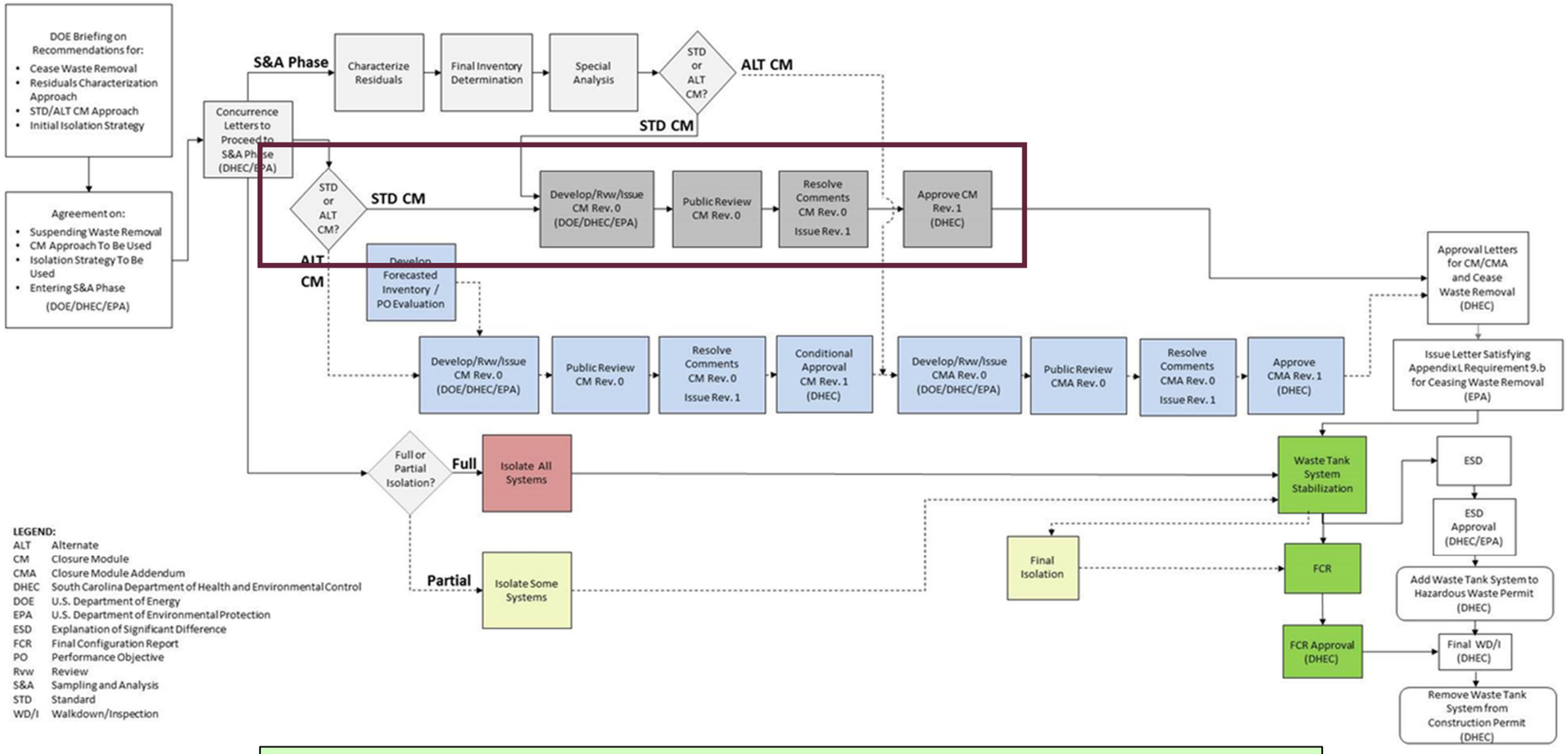
1. **Suspending waste removal activities and enter the Sampling and Analysis phase.**
   - Sampling and analysis to be performed per the LWTRSAPP
2. **DOE will draft a Closure Module using the *Standard Closure Module* Approach**
   - Current plans to issue one Closure Module covering Tanks 9, 10 and 11.
3. **The Closure Module will include appropriate isolation and stabilization provisions using the *Partial Isolation* approach**

Residuals Characterization Approach



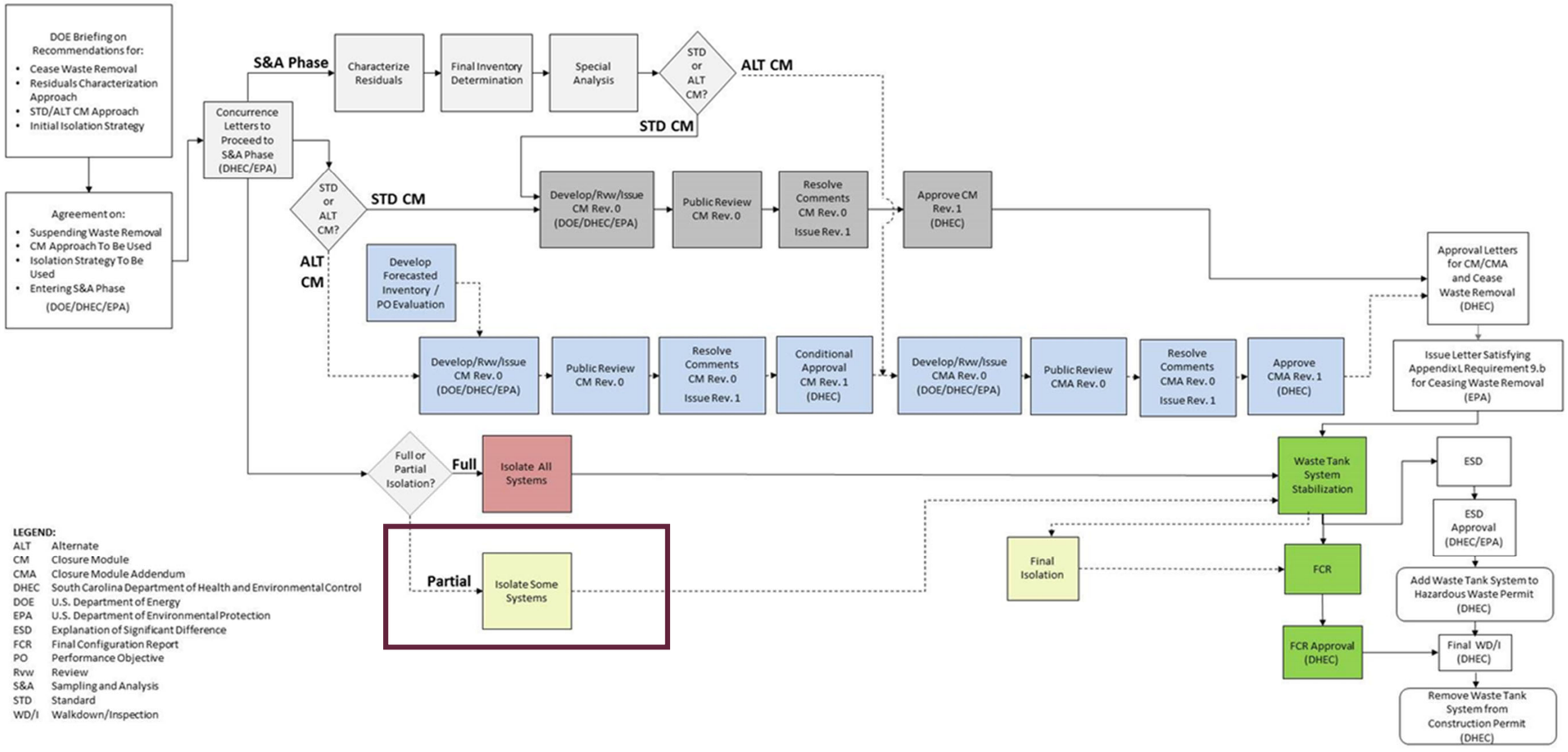
Sampling per LWTRSAPP to characterize residuals and assign final residual inventories

Closure Module Path Forward



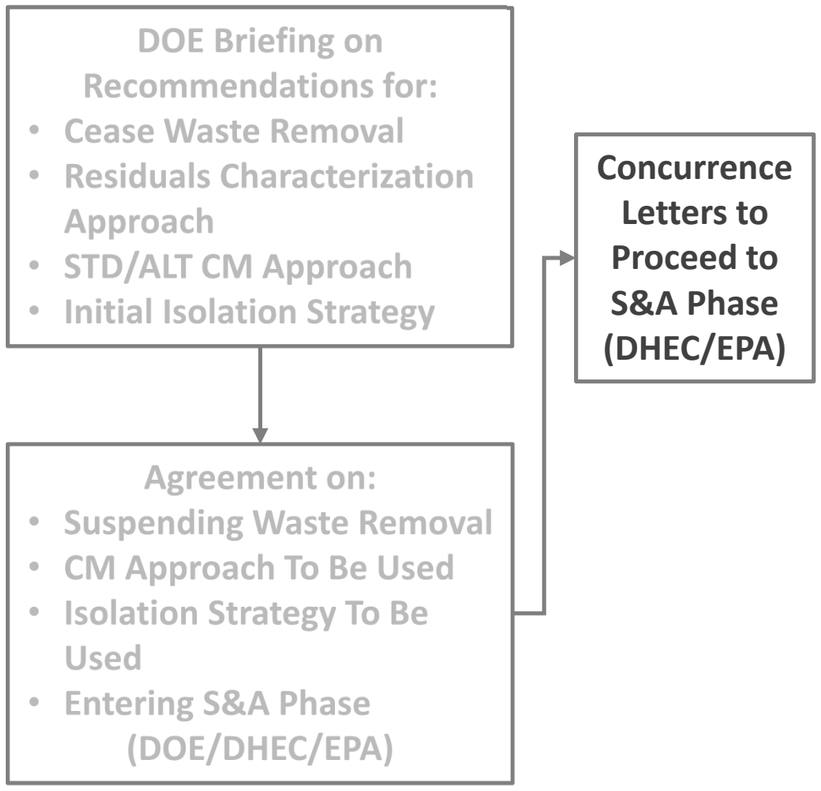
The *Standard Closure Module Approach*, as described in the CGCP, will be utilized

Isolation Path Forward



The *Partial Isolation Approach*, as described in the CGCP, will be utilized

Requested Action



The three agencies agree that, based upon the described qualitative assessment, there is reasonable assurance that it is appropriate to suspend waste removal activities and enter the Sampling and Analysis phase of the operational closure process for Tank 10.

Next Steps

- **DOE will forward a letter to SCDHEC and EPA formally requesting concurrence to proceed to the Sampling and Analysis phase in Tank 10**
  - This presentation will be attached as a primary reference
  - The requested action is a non-binding preliminary decision based on the qualitative information available at this time and presented today
- **DOE and the Liquid Waste Contractor will proceed in developing the regulatory documentation necessary to operationally close Tank 10**
  - DOE will coordinate with SCDHEC and EPA to establish a schedule for the development, review and approval of the Closure Module consistent with the approach described in the CGCP
    - *Initial focus on Tank 10 information*
    - *Tank 9 and Tank 11 information to follow as waste removal progresses within those tanks*

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