Savannah River Site Liquid Radioactive Waste Program

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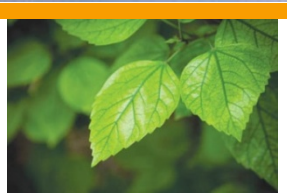


October 14, 2015

Major Elements of Scope

- Liquid Waste Stabilization and Disposition:

  Base Operations of Facilities:

  - Liquid waste storage tanks, evaporators, transfer lines, and associated equipment/facilities
  - Defense Waste Processing Facility
  - Glass Waste Storage Buildings
  - Saltstone Production Facility
  - Saltstone Disposal Units
- Waste Removal from Tanks and Tank Closures
- Construction of additional Saltstone Disposal Units
- Operation of the Salt Waste Processing Facility after facility commissioning, startup, and one year of initial operation
- Liquid Waste Program Support

Agenda

- Liquid Waste Program
- Liquid Waste Facilities
  - Defense Waste Processing Facility and Glass Waste Storage
  - Saltstone Production Facility and Saltstone Disposal Units
  - Actinide Removal Facility/ Modular Caustic Side Solvent Extraction Unit
  - Salt Waste Processing Facility
  - F- and H-Tank Farms
- Liquid Waste Processes
  - Liquid Waste Process Overview
  - Interim Salt Processing
  - Waste Retrieval
  - Salt Waste Processing
  - Tank Closures
- Regulatory Process Drivers
- M&O Interfaces and Government Furnished Services and Items (GFSI)

Liquid Waste Program Operations

"Liquid waste at SRS is the single greatest environmental risk in South Carolina"

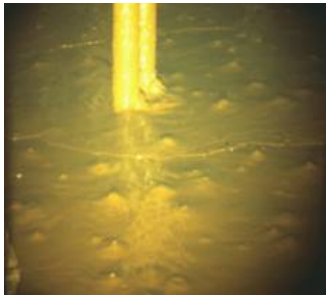
Program focus:

- Safely storing 37 million gallons of radioactive liquid waste
- Operating major nuclear facilities to support H-Canyon missions and to treat and disposition tank waste
  - *Operating interim salt waste processing system*
  - *Vitrifying highly radioactive radionuclides at the Defense Waste Processing Facility (DWPF)*
  - *Disposing low level residuals in Saltstone Disposal Units (SDUs)*
  - *Constructing the Salt Waste Processing Facility (SWPF)*
- Emptying, cleaning and closing waste tanks

Safely Stored Canisters

Salt Supernate

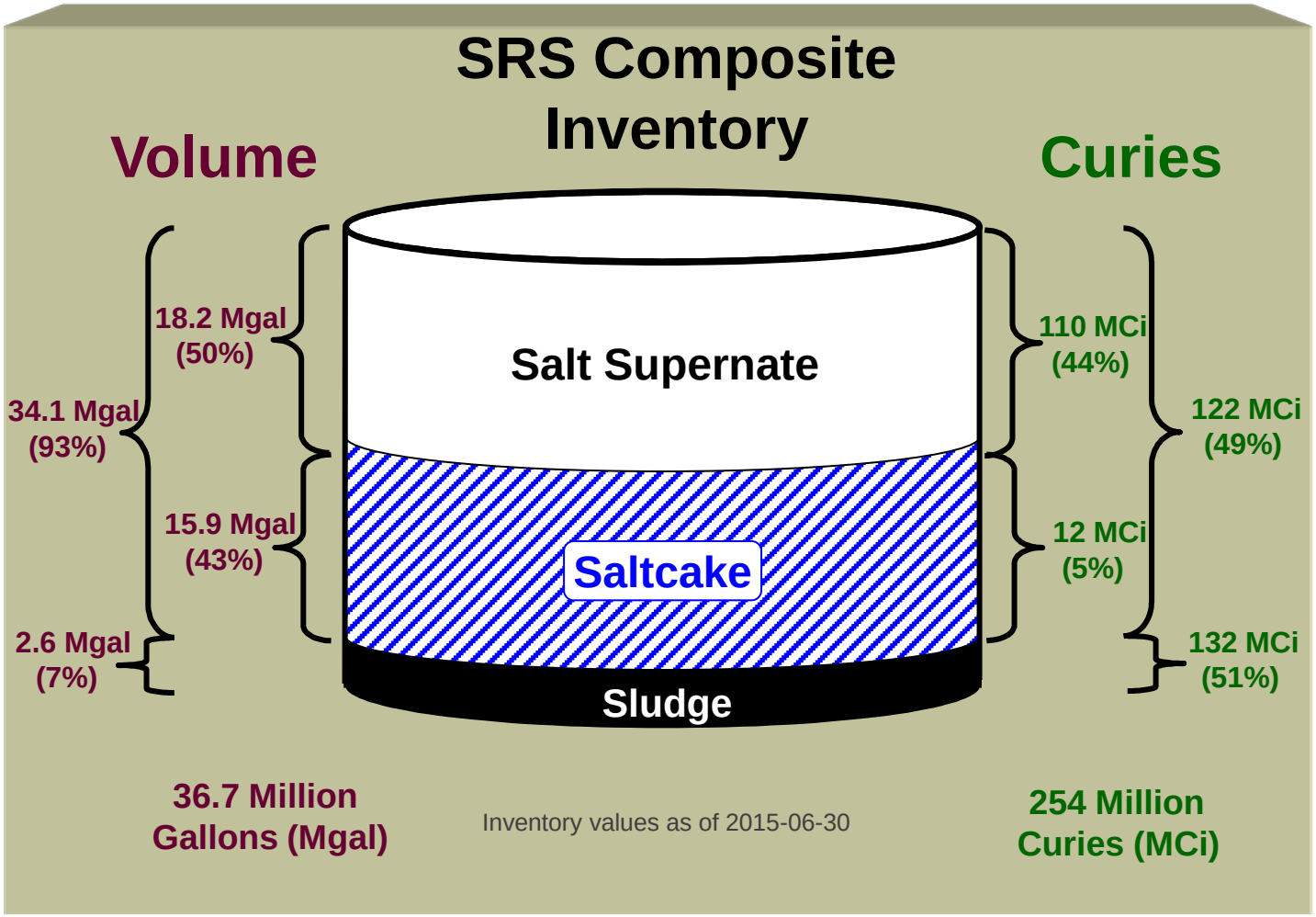
Saltcake

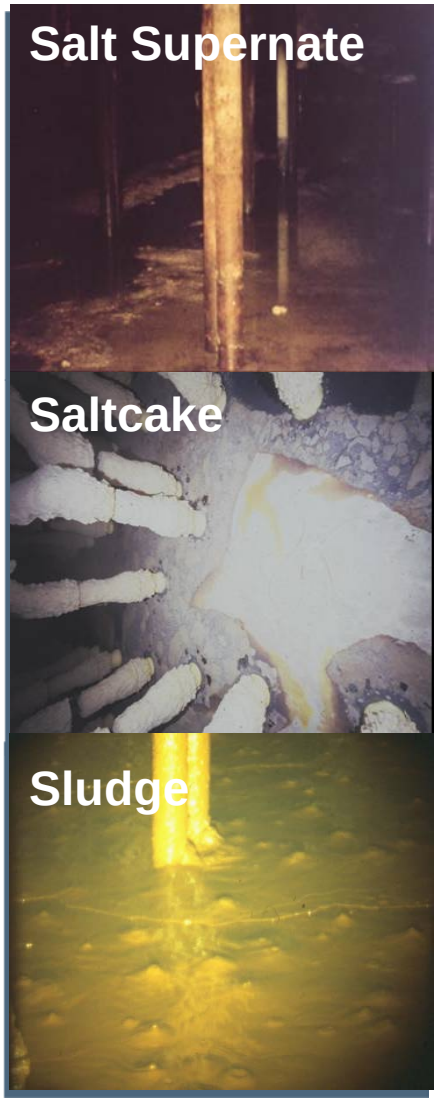


Sludge

DWPF and Liquid Waste Video

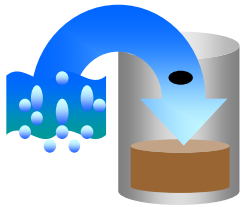
Why Do We Need a Liquid Waste Program?





Key Liquid Waste Facilities

Removing Sludge Waste from Tanks



Water and Liquid Waste

Immobilize Waste for Disposal

Defense Waste Processing Facility

- World's largest vitrification plant
- Entire 37 million gallons of waste awaiting disposition has about 254 million Curies of radioactivity
- Almost all radioactivity from waste dispositioned via DWPF
  - *Over 56 million Curies to date*
- Over 3,970 canisters filled since 1996

Interim Storage of Canisters

- DWPF Glass Waste Storage Buildings (GWSB)
  - *Seismically qualified underground concrete vaults*
  - *Designed for safe interim storage*
- Approaching capacity of existing storage
  - *GWSB 1 is full (contains 2,244 canisters)*
  - *GWSB 2 contains 1,717 canisters (2,339 capacity) as of 9/30.*
- Canister Double Stacking in GWSB#1
- Modular storage concept being considered for remaining cans ~2026

Key Liquid Waste Facilities

Saltstone Production Facility

- **Vast majority of waste volume from tanks – but little radioactivity – left in SC**
- **Curies left in SC are treated for disposal at the Saltstone Production Facility**
  - *Salt solution stabilized by mixing with cement, flyash and slag*
  - *Resulting grout mixture mechanically pumped into concrete Saltstone Disposal Units (SDUs)*
- **Safely processed 8.5 Mgal of low-level radioactive liquid salt wastes to date containing approximately 457 KCi of radioactivity**

Saltstone Disposal Facility

- **Engineered low level waste disposal facility**
- **Grout is non-leaching and has low water permeability**
- **Initial 12-cell rectangular vault (Vault 4) filled**
- **Saltstone Disposal Unit (SDU) -2 – modern watertight design – now full**
- **SDU 3 and 5 completed and being filled**
- **Currently constructing 3rd generation SDU-6**

SDU-2

Future SDUs

Saltstone Disposal Facility

Key Liquid Waste Facilities

Modular Caustic Side Solvent Extraction Unit (MCU)

Actinide Removal Process

- Actinide Removal Process/Modular Caustic Side Solvent Extraction Unit operational since 2008
- Remove actinides, Strontium and Cesium (Cs-137) from salt waste
- Nominal operating capacity >1.5 Mgal/yr
- Over 5.3 million gallons treated to date
- Decontamination and throughput exceed initial expectations
- Completed service life extension program
- Completed installation of Next Generation Cesium Solvent in late 2014
- Providing operating experience for SWPF startup and initial operations

Future Salt Waste Treatment Capability

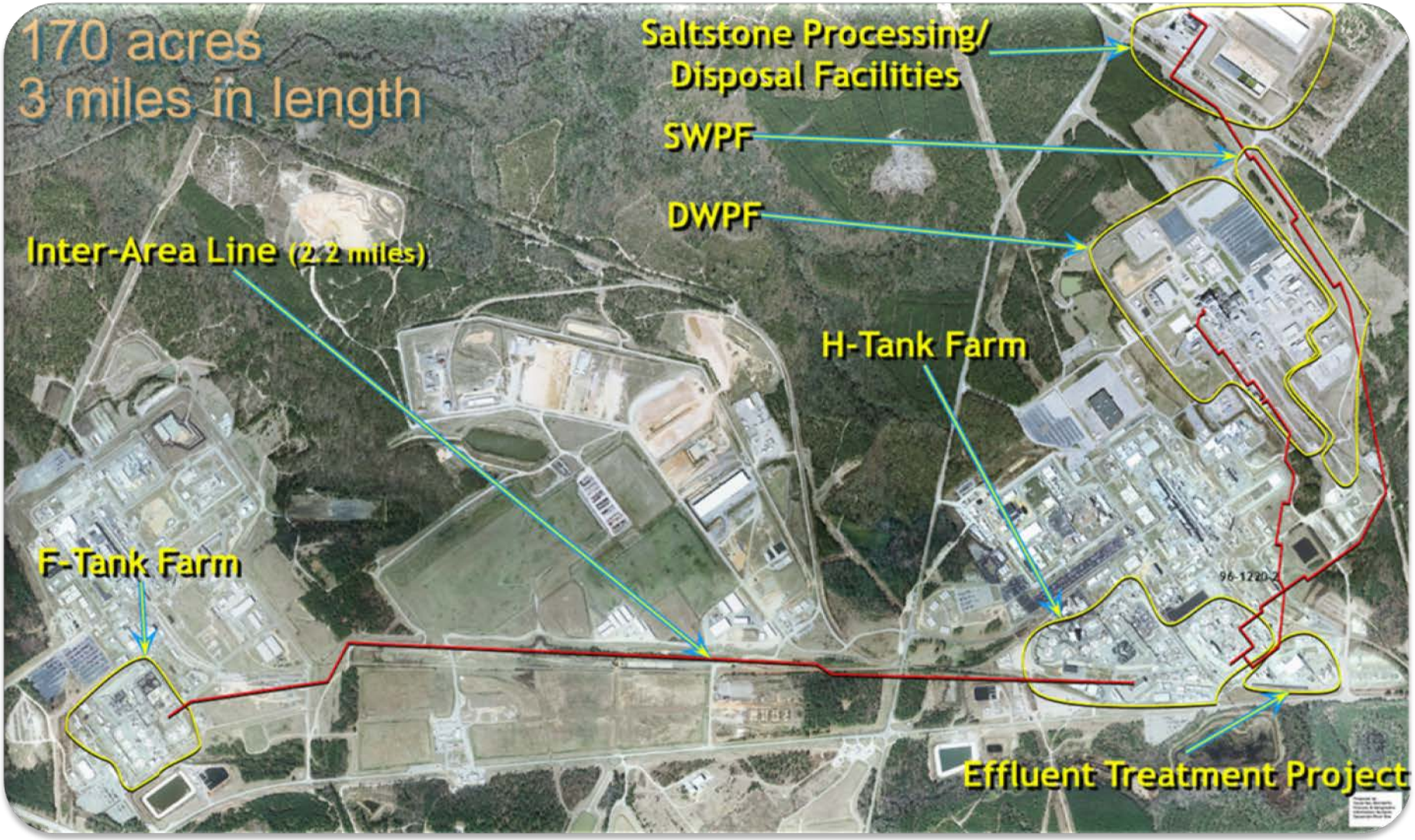
Salt Waste Processing Facility

Constructed by Parsons

This critical facility will:

- Reduce radioactive waste volume requiring vitrification
- Utilize the same actinide and cesium removal unit processes as Interim Salt Processing Facilities
- Ultimately process over 90% of Tank Farm liquid radioactive waste
- Currently developing system infrastructure to support startup and operations

Liquid Waste Facilities



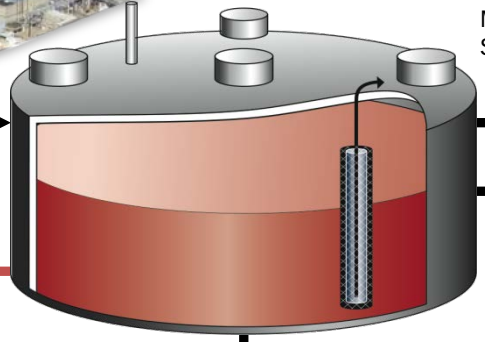
F – Tank Farm

H – Tank Farm

SRR Liquid Waste Program

Legacy Liquid Waste

43 tanks
37 Mgal
254 MCi



Legend:

ARP	Actinide Removal Process
BWRE	Bulk Waste Removal Efforts
DWPF	Defense Waste Processing Facility
MCU	Modular Caustic Side Solvent Extraction Unit
SWPF	Salt Waste Processing Facility

Operational Goals
- ✓Radionuclides to glass
- ✓Chemicals to Saltstone
- ✓Tanks cleaned and operationally closed

Salt waste
8.5 Mgal treated

Sludge waste
3.9 Mgal treated

Salt Processing

SWPF
(under construction)

<1% radionuclides remain in tanks

Radionuclides

Solid (not hazardous) waste

Most radionuclides to glass

<<1% radionuclides to saltstone

51 Tanks
- **7* grouted & operationally closed**
- **2 heel removal complete**
- **6 BWRE complete**
- **64% empty (old style)**
- **20% empty (new style)**

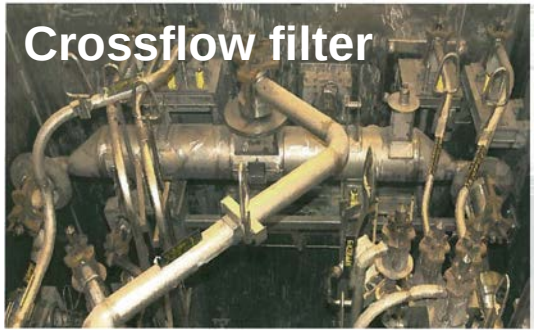
*** One tank closed 9/22/15**

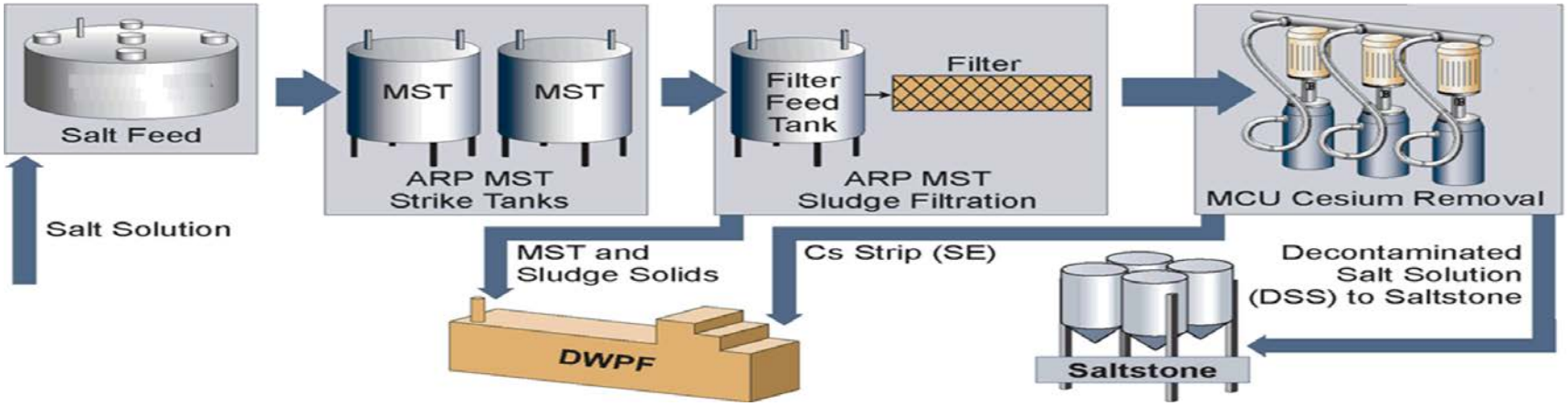
Poured 3,967 cans of projected 8,582
57 million curies immobilized in glass

17.3 Mgal grout dispositioned containing 457 kCi

As of 6/30/15

Interim Salt Disposition (ARP-MCU)





Waste Retrieval

- Processing 1.0 gallon of settled sludge increases new style tank inventory by 1.3 gallons.
- One tank full of saltcake (1.3 million gallons) dissolves into more than 3 tanks full of dissolved salt.

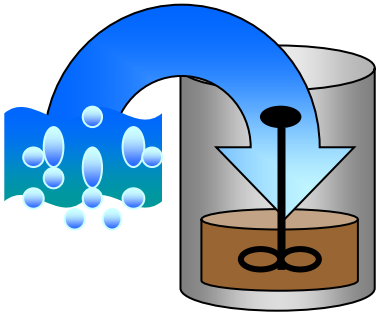
Storing Waste

16 Old Style
27 New Style

7 Closed Tanks (Old Style)
1 in closure process (Old Style)

51 Total

Removing Waste from Tanks



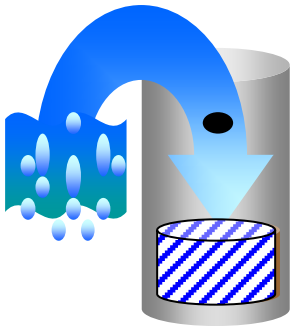
Water and Liquid Waste

Is focused on the Old Style Tanks first as space in new style tanks allows.

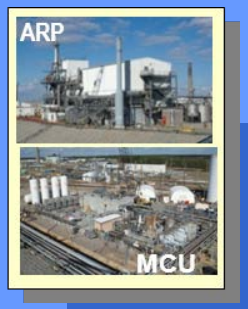
Salt Waste Processing

The vast majority of radioactivity from salt waste is sent to the DWPF

Removing Salt Waste from Tanks



Water and Liquid Waste



Interim (ARP/MCU)

Salt Waste Processing

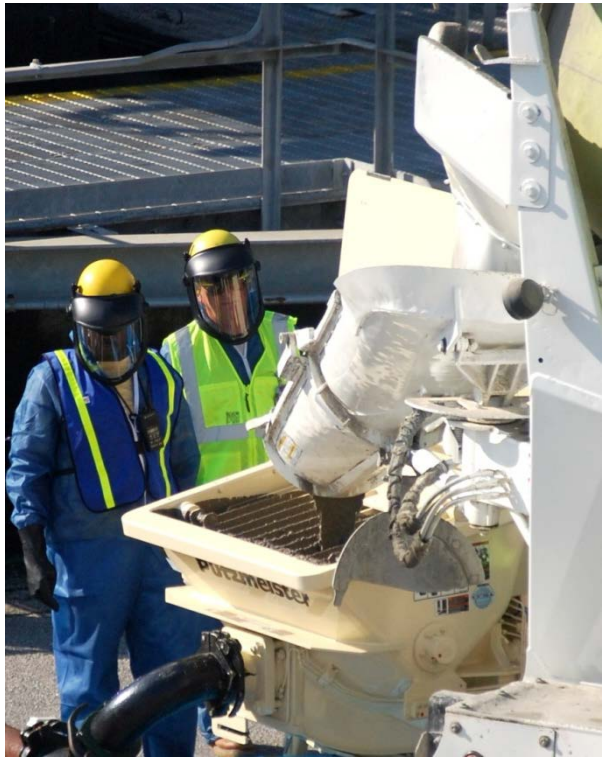
•SWPF (Future)

Saltstone Facility

Over 99% of the volume is sent to Saltstone for disposal in concrete cells

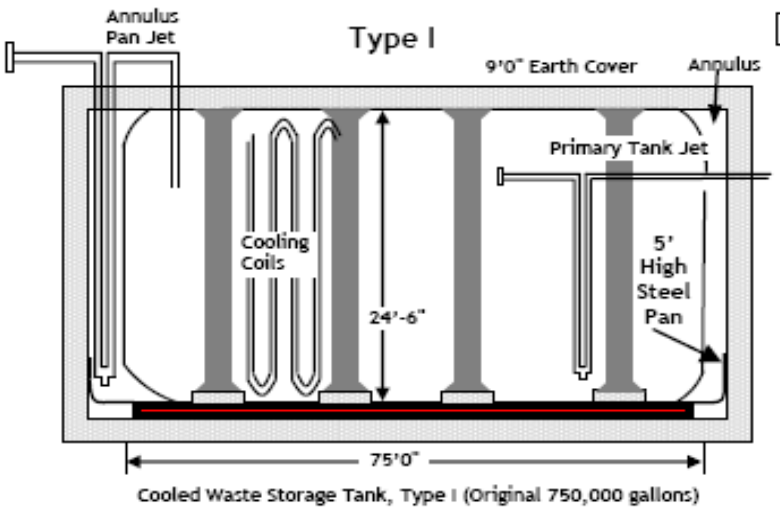
Tank Closure

- All tanks will be emptied of waste, cleaned and closed
- Removal and closure of 24 “Old Style” tanks driven by Federal Facility Agreement (FFA)
- Tanks 17 and 20 closed in 1997
- Tanks 18 and 19 were closed in 2012
  - *Working with regulators and stakeholders, completed ahead of FFA milestone*
- Tanks 5 and 6 were closed in 2013, well ahead of 2015 FFA milestone
- Tank 16 closed 9/22/15
- Tank 12 in process

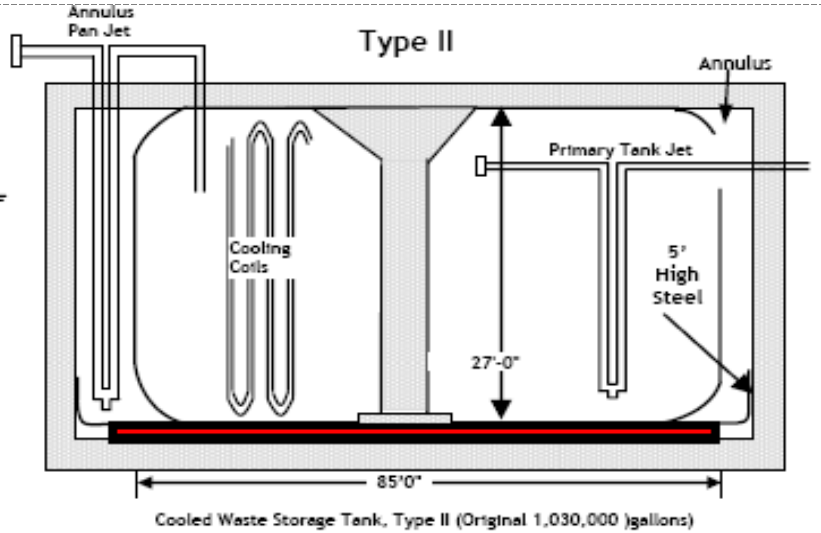


Pouring grout into SRS waste tanks (April 2012)

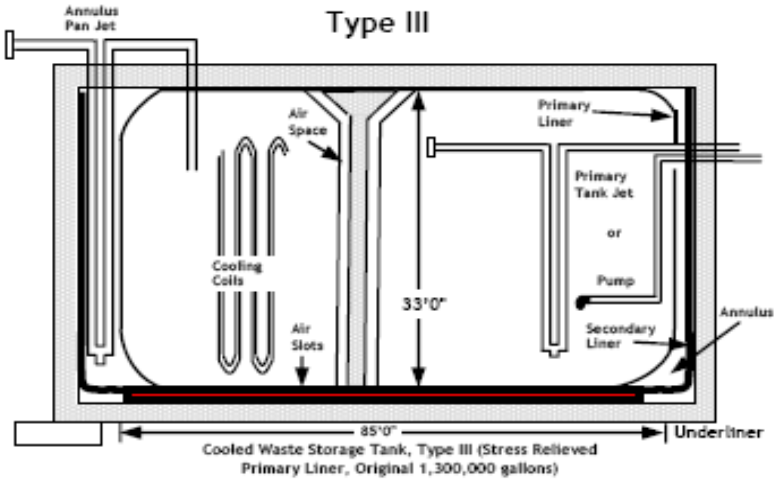
Waste Storage Tank Types



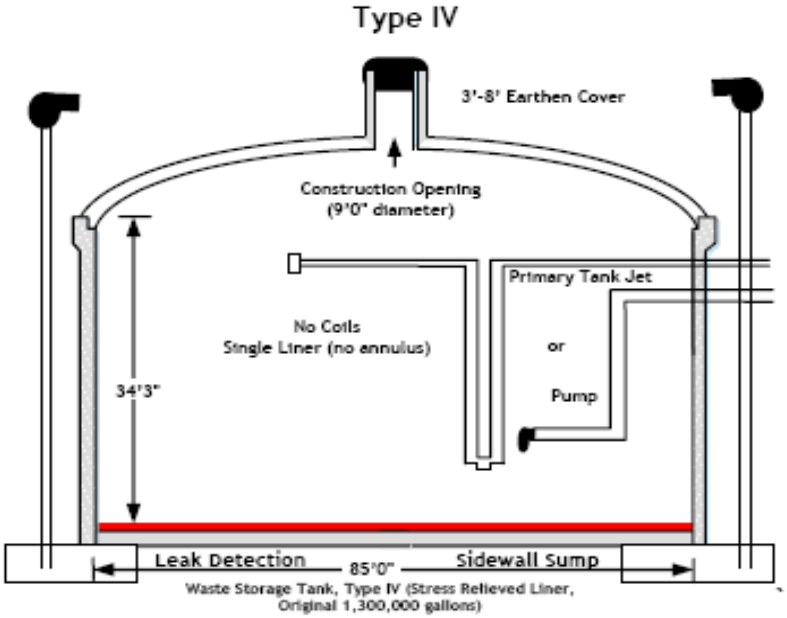
Cooled Waste Storage Tank, Type I (Original 750,000 gallons)



Cooled Waste Storage Tank, Type II (Original 1,030,000)gallons)

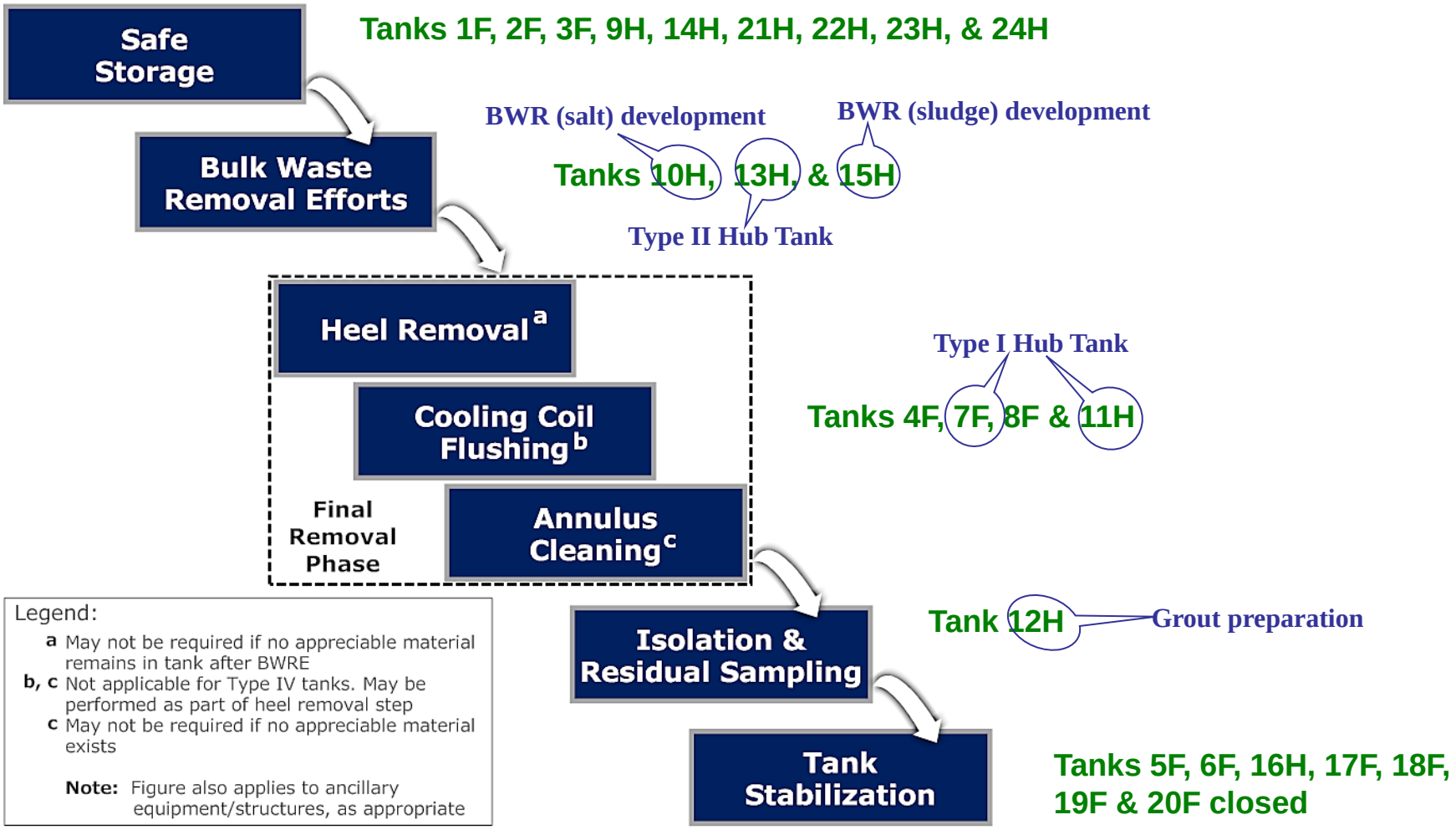


Cooled Waste Storage Tank, Type III (Stress Relieved Primary Liner, Original 1,300,000 gallons)

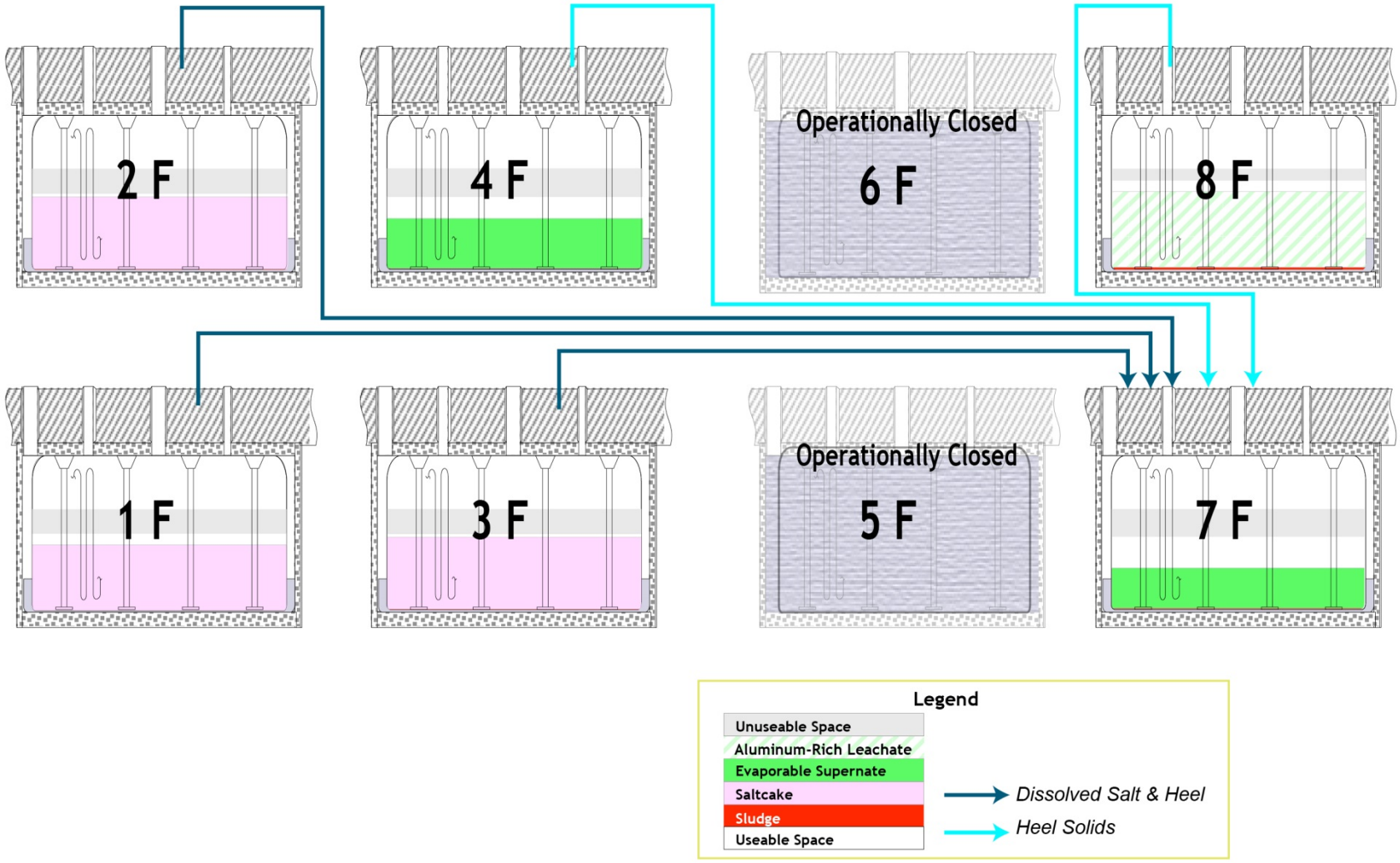


Waste Storage Tank, Type IV (Stress Relieved Liner, Original 1,300,000 gallons)

Tank Closure Progression

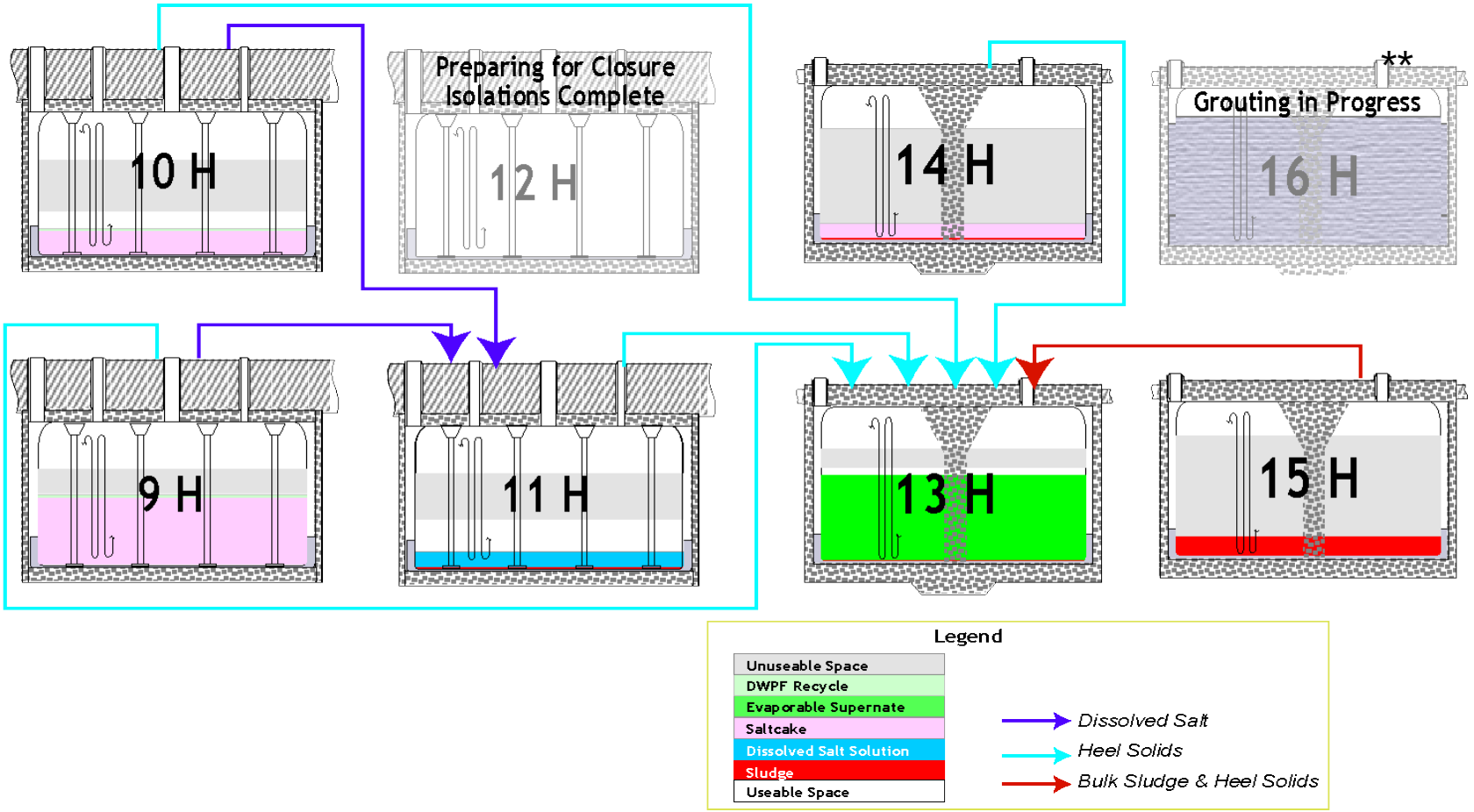


Current Salt Processing in F-Tank Farm –Tanks 1-8 F



Not to scale

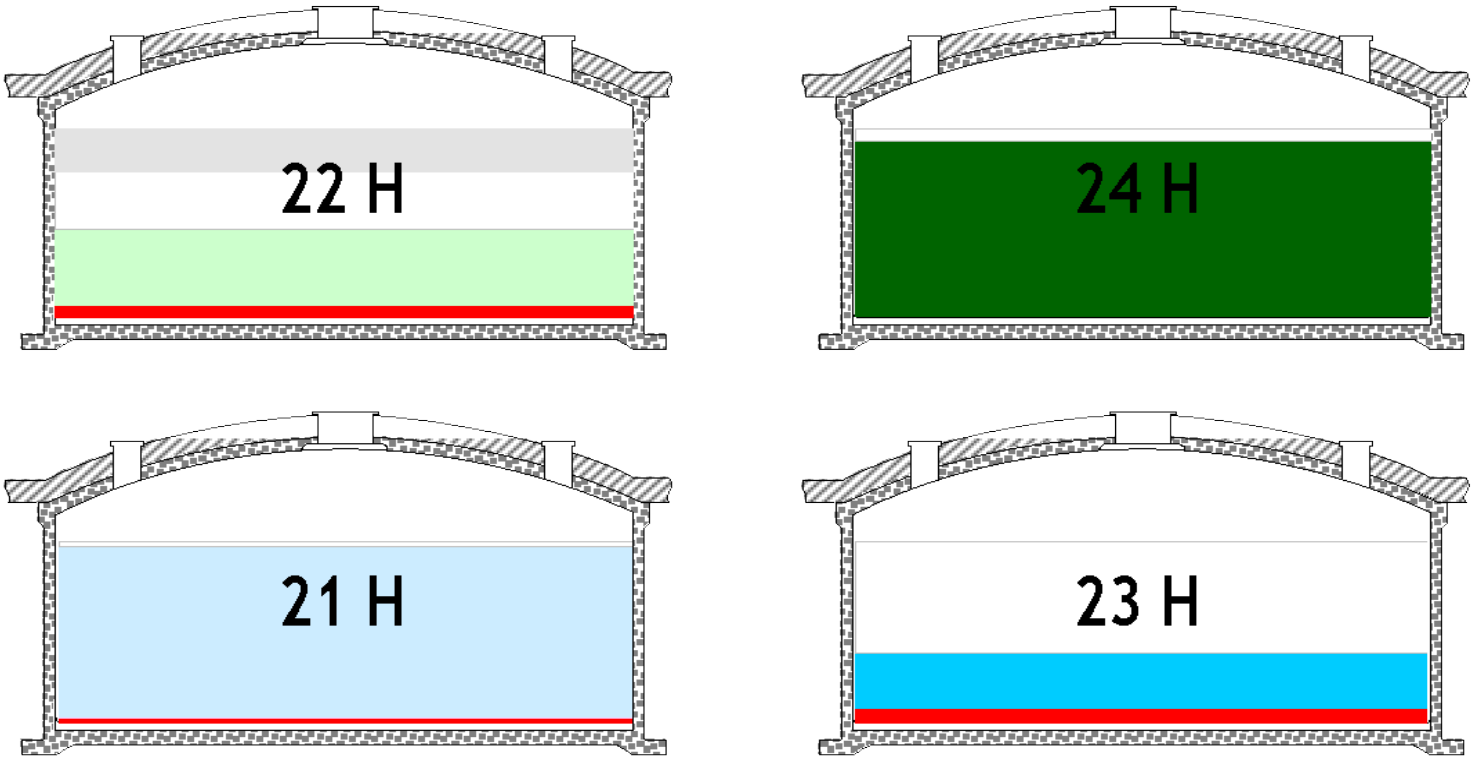
Current Salt Processing in H-Tank Farm –Tanks 9-16 H



**Tank 16H grouting complete after preparation of drawing

Not to scale

Current Salt Processing in F-Tank Farm –Tanks 21-24 F



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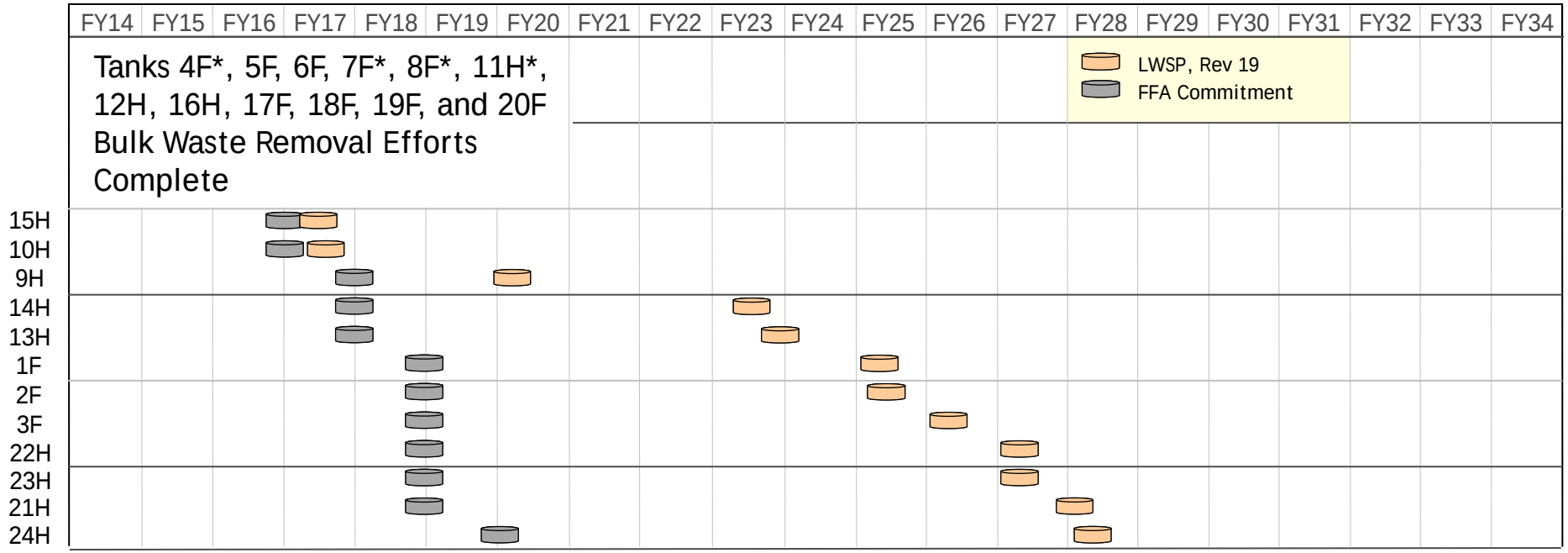
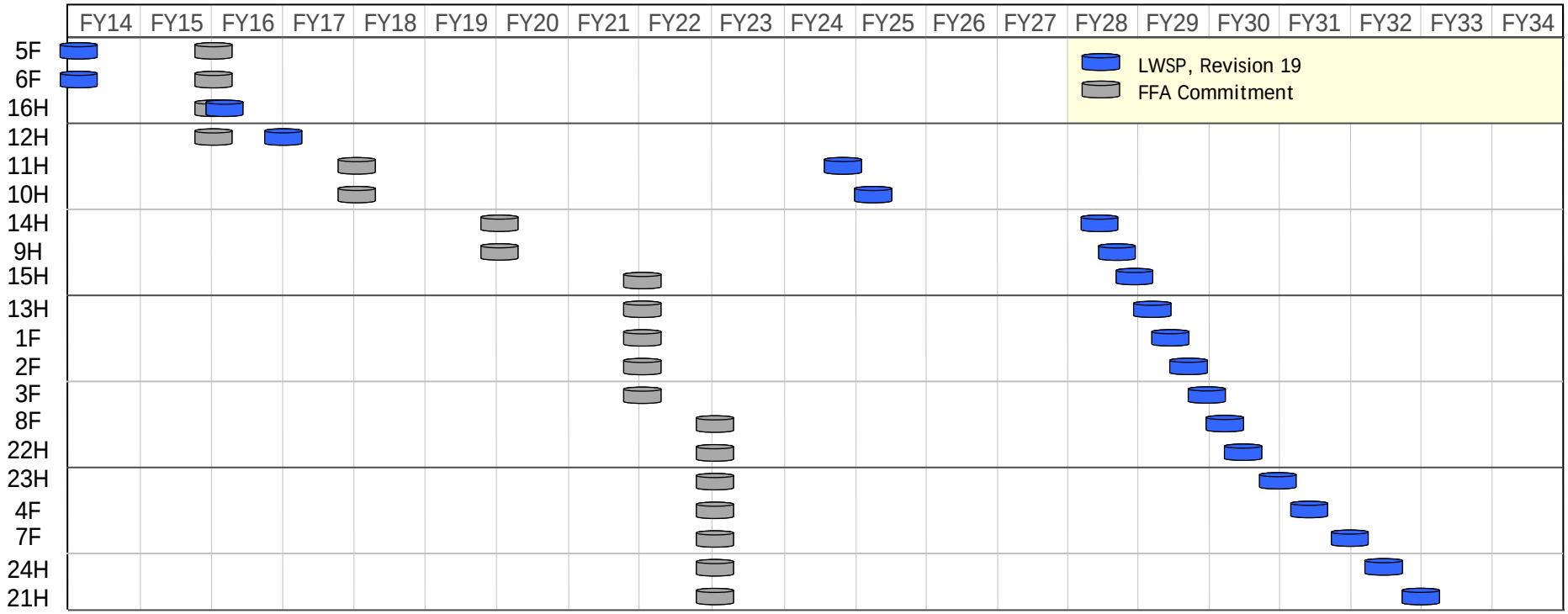
Bulk Waste Removal Efforts Complete



Tank Removal from Service



Regulatory Process Drivers

- Closure process addresses several purposes
  - Savannah River Site Treatment Plan
  - DOE Order 435.1 Waste Management
  - National Environmental Policy Act (Federal)
  - Section 3116 of 2005 National Defense Authorization Act (applies to SC and ID only)
  - Savannah River Site Federal Facility Agreement
  - SC Pollution Control Act/Wastewater Regulations
    - Industrial Waste Water Permits
    - Landfill Permits
  - Part of cleanup decision under
    - Resource Conservation and Recovery Act (State)
    - Comprehensive Environmental Response, Compensation and Liability Act (Federal/State)

M&O Interfaces

- LW Contractor receives waste from M&O Contractor managed processes
- The following are provided through the M&O Contractor either as part of their contract or charged to the LW Contract – specifics TBD
  - Personnel Security – Security Badging provided by the M&O
  - Site Technical Training Services – e.g. General Employee Training, RadWorker, etc – provided by the M&O site training
  - Utilities including water sewer, gas, steam provided via the M&O and some are metered (charged) to the LW Contractor
  - Emergency Management and Services including fire and emergency response, Emergency Preparedness & Medical
  - Mail Services & Records Management
  - Analytical Services performed by SRNL, the Central Laboratory, etc. (optional)
  - Dosimetry Services
  - Network and Information Systems including Cyber Security and telephones
  - Geotechnical services
  - Physical Security Systems including barricades, and perimeter fences
- GFSI includes use of Government controlled data systems for tracking and reporting, SRS computing infrastructure and software applications, permits from regulatory agencies, products and services from other site entities

Long Term Vision

- Safest Operation within the Complex
  - Continuing improvements in operational practices consistent with a Nuclear Safety Culture and ISMS Principles
  - Upgraded safety basis consistent with the latest DOE directives and methodologies
- Maximized Salt Waste Processing
  - Seamless integration of Salt Waste Processing Facility into Liquid Waste System
  - Innovative approaches to salt processing, e.g., at-tank cesium removal
- Increased / Sustained Waste Stabilization
  - New or different applications of technologies to accelerate processing
  - Application of new ideas to aging Liquid Waste infrastructure
  - Continuity of skilled resources and maintenance of knowledge base in aging workforce
- Expedited isolation and/or closure of old style tanks or groups of tanks

Acronyms

- ARP – Actinide Removal Process
- BWRE – Bulk waste Removal Efforts
- DSS – Decontaminated Salt Solution
- DWPF – Defense Waste Processing Facility
- FFA – Federal Facility Agreement
- GFSI – Government Furnished Services and Items
- GWSB – Glass Waste Storage Building
- ISMS – Integrated Safety Management Systems
- LW – Liquid Waste
- LWSP – Liquid Waste System Plan
- MCU – Modular Caustic Side Solvent Extraction Unit
- M & O – Management and Operating
- MST – Monosodium Titanate
- SDU – Saltstone Disposal Unit
- SRNL – Savannah River National Laboratory
- SRS – Savannah River Site
- SWPF – Salt Waste Processing Facility