



U.S. DEPARTMENT OF
ENERGY



SRS Citizens Advisory Board

Liquid Waste System Plan Revision 21

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Purpose

- Present Topic requested by the CAB
- Support other topics to be presented in 2019

Topic 1	Work Plan Item:	Tank Closure Cesium Removal (TCCR) Unit #2
	Description:	Demonstration of ion exchange technology to remove cesium out of salt waste will be executed with a Tank Closure Cesium Removal Unit in FY2019 followed by a feasibility study to determine technical viability and cost effectiveness. From a community perspective, provide recommended prioritization of implementing a second TCCR Unit vs. other perceived needs either within LW or elsewhere.
	Recommendation Deadline:	July 2019

Topic 2	Work Plan Item:	Liquid Waste Operations Update
	Description:	Report status of Liquid Waste facilities and projects to provide information to the public.
	Recommendation Deadline:	January 2020

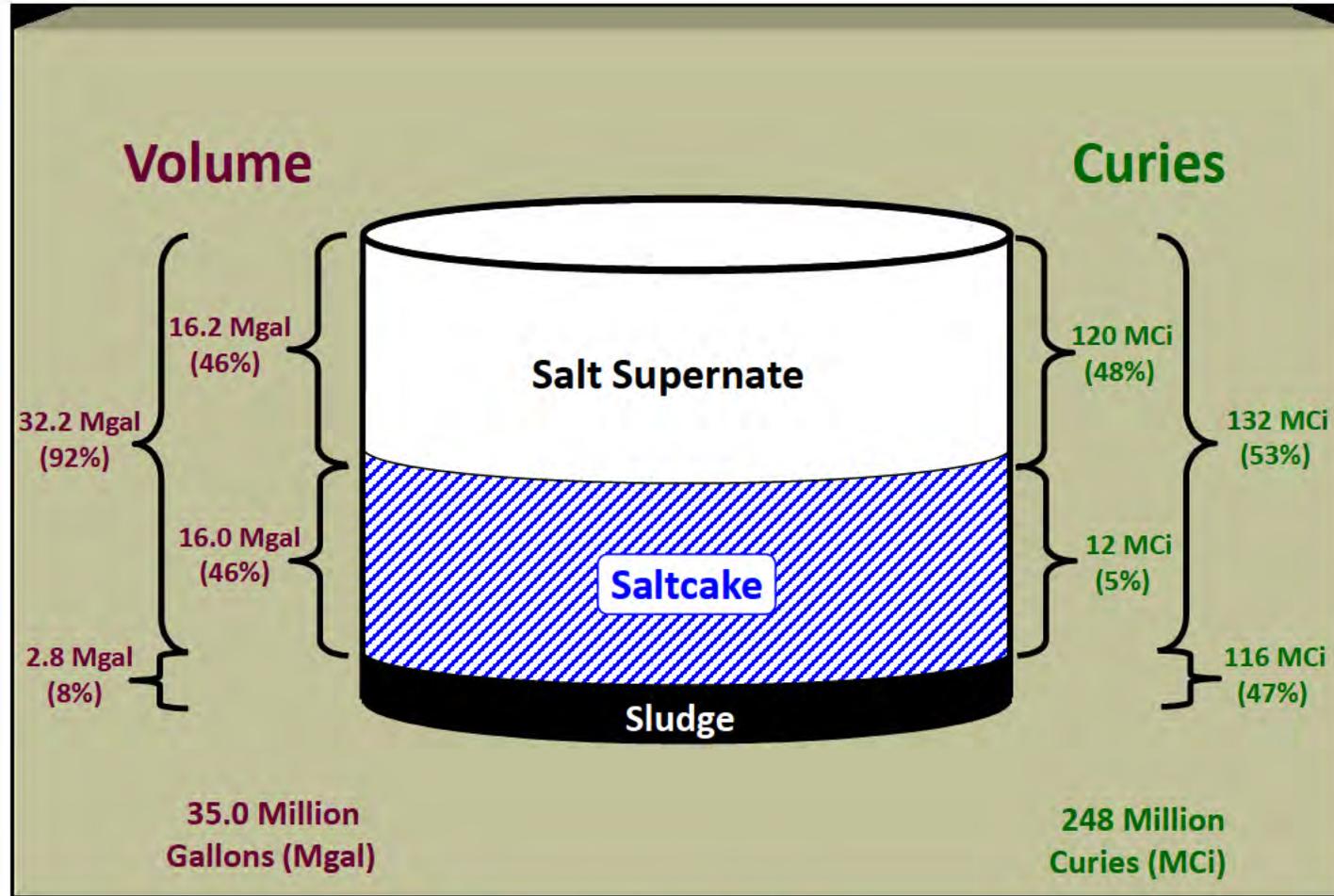
Acronyms

- ARP – Actinide Removal Process
- BWR – Bulk Waste Removal
- D&D – Decontamination and Decommissioning
- DWPF – Defense Waste Processing Facility
- ETP – Effluent Treatment Facility
- FTF – F Tank Farm
- HLW – High Level Waste
- HTF – H Tank Farm
- KCi – thousands of curies
- LLW – Low Level Waste
- LW – Liquid Waste
- MCU – Modular Caustic Side Solvent Extraction Unit
- Mgal – millions of gallons
- SDU – Saltstone Disposal Facility
- SRR – Savannah River Remediation (current Liquid Waste Contractor)
- SWPF – Salt Waste Processing Facility
- TCCR – Tank Closure Cesium Removal

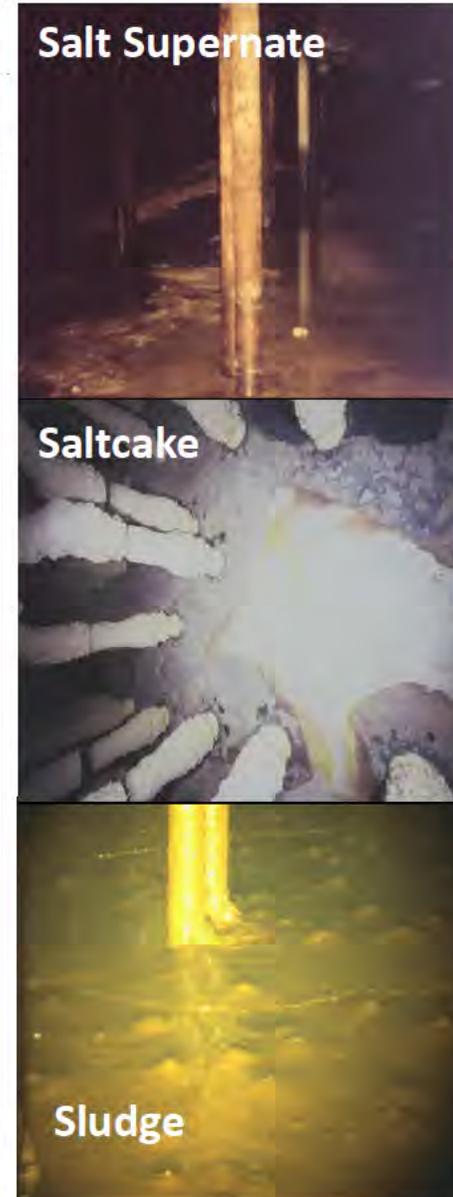
Agenda

- Liquid Waste Overview
- System Planning process
- Inputs for Rev 21
- Results

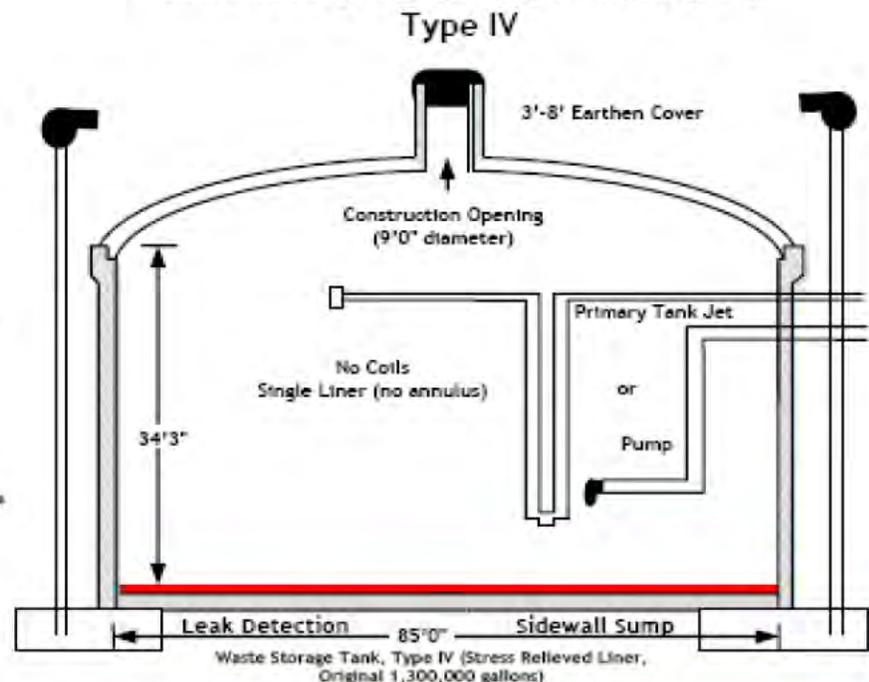
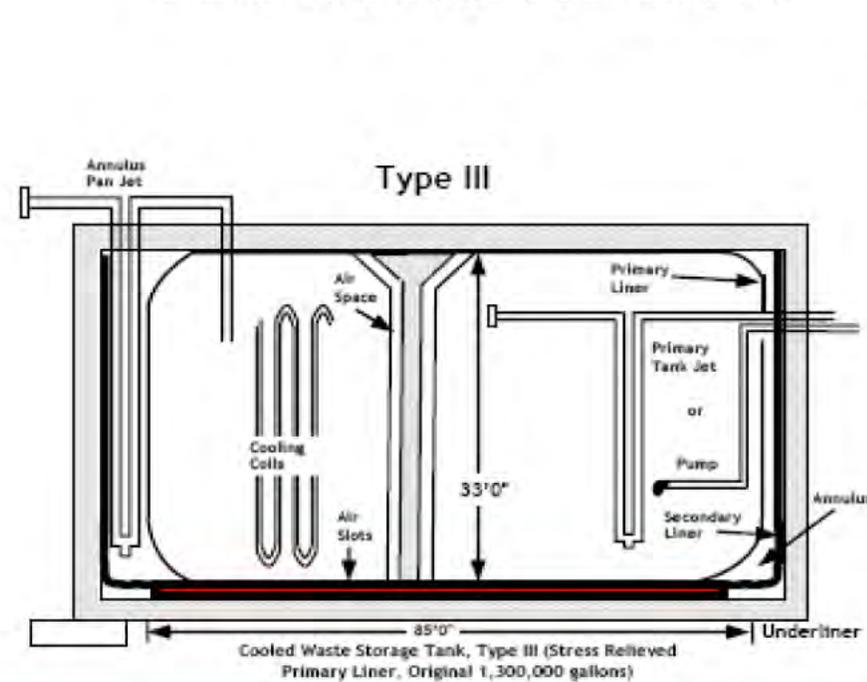
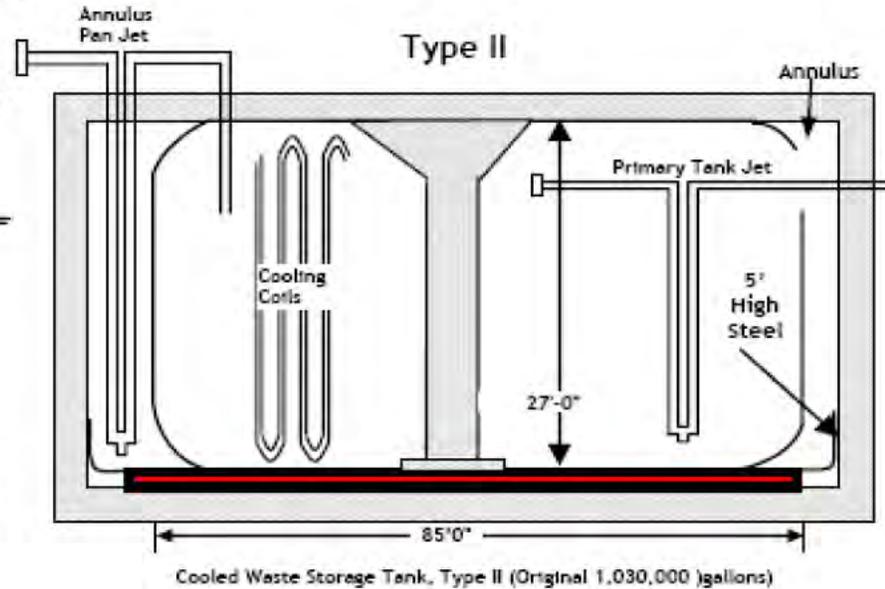
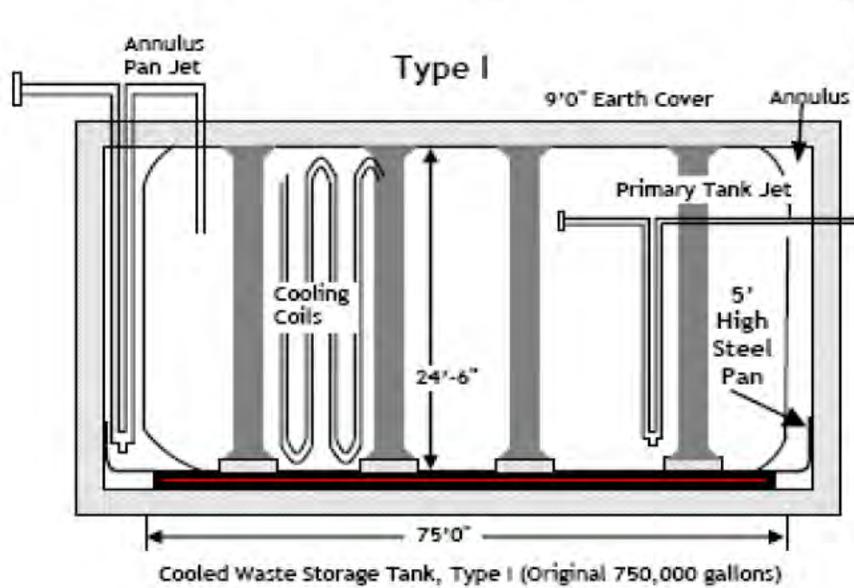
Why Do We Need a Liquid Waste Program?



Inventory values as of 2018-12-31



Waste Storage Tank Types



Waste Tank Under Construction



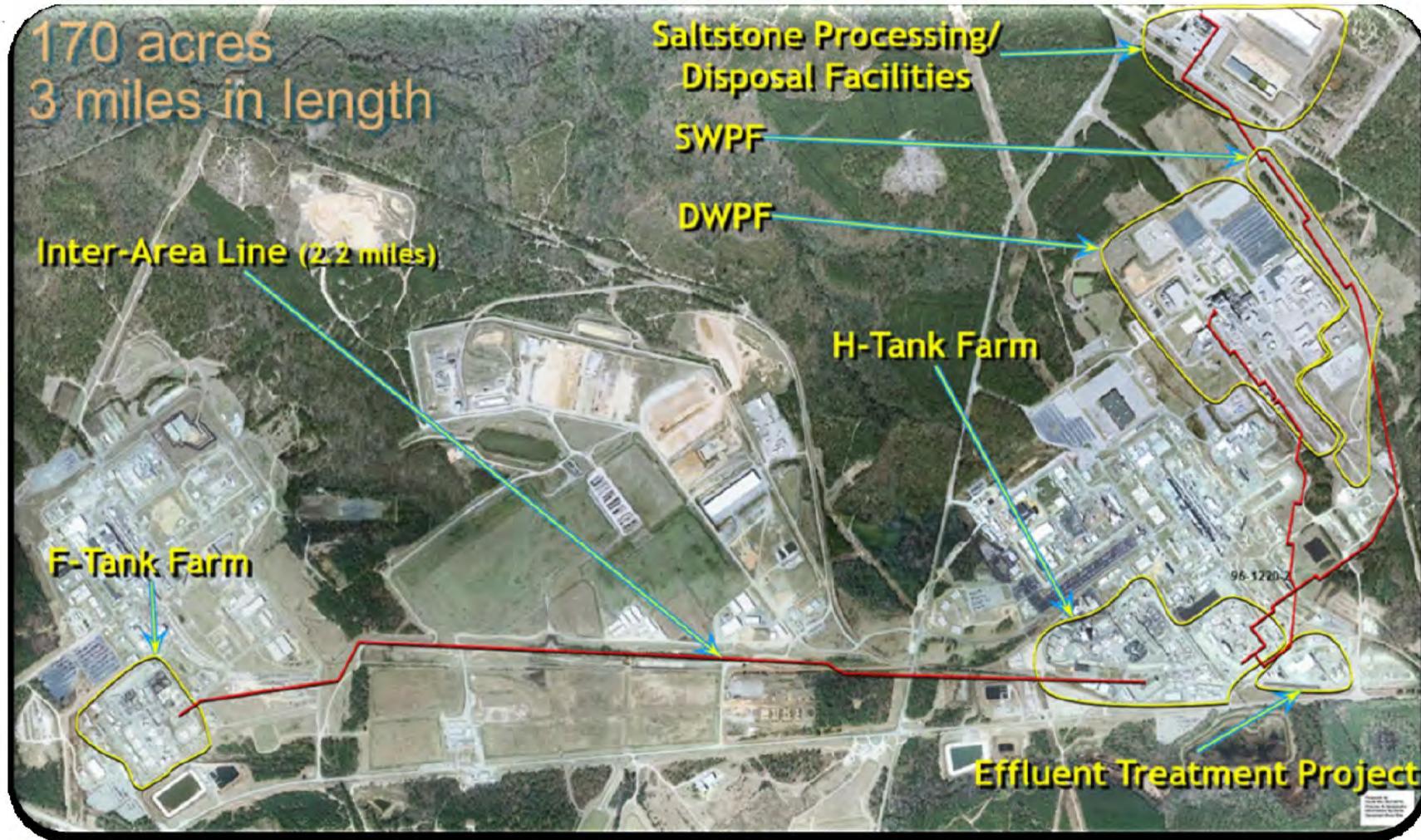
Tanks were built at grade and then backfilled with dirt to provide shielding

Type	Const. Date
I	1951–1953
II	1955–1956
IV	1958–1962
III	1976–1981

F – Tank Farm



Liquid Waste Operations Overview



F Tank Farm

- 22 tanks
- 1 evaporator (2F)

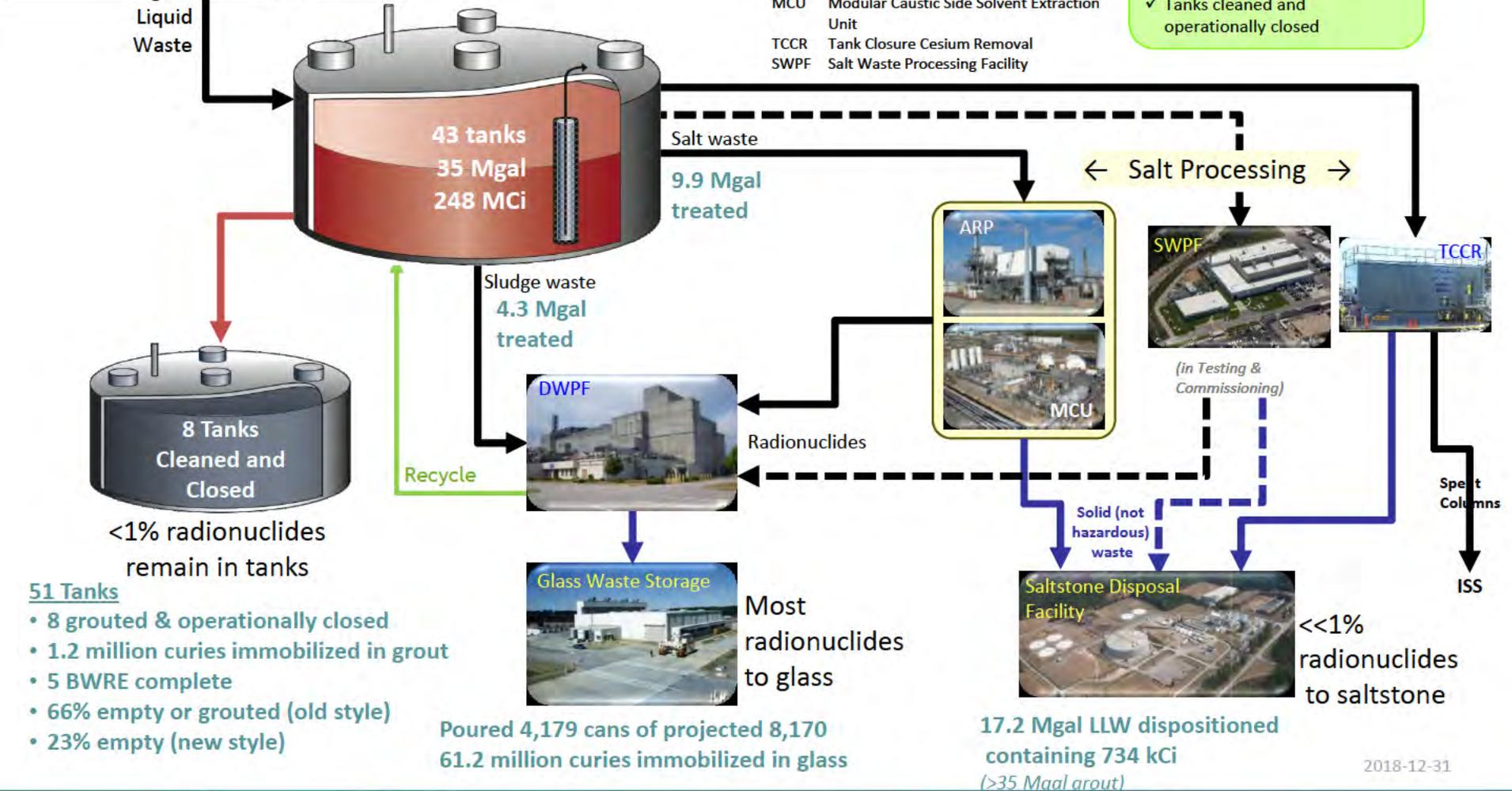
Inter-Area Line(2.2 miles)

- Pump pits at each end
- Diversion boxes at each end and
- at high point in the middle

H Tank Farm

- 29 tanks
- 2 evaporators (2H & 3H)
- Volume reduction and pre-treatment occurs in H Area

SRS Liquid Waste Program



Legend:

ARP	Actinide Removal Process
BWRE	Bulk Waste Removal Efforts
DWPF	Defense Waste Processing Facility
ISS	Interim Safe Storage
MCU	Modular Caustic Side Solvent Extraction Unit
TCCR	Tank Closure Cesium Removal
SWPF	Salt Waste Processing Facility

Operational Goals

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

- 51 Tanks**
- 8 grouted & operationally closed
 - 1.2 million curies immobilized in grout
 - 5 BWRE complete
 - 66% empty or grouted (old style)
 - 23% empty (new style)

Glass Waste Storage

Most radionuclides to glass

Poured 4,179 cans of projected 8,170
61.2 million curies immobilized in glass

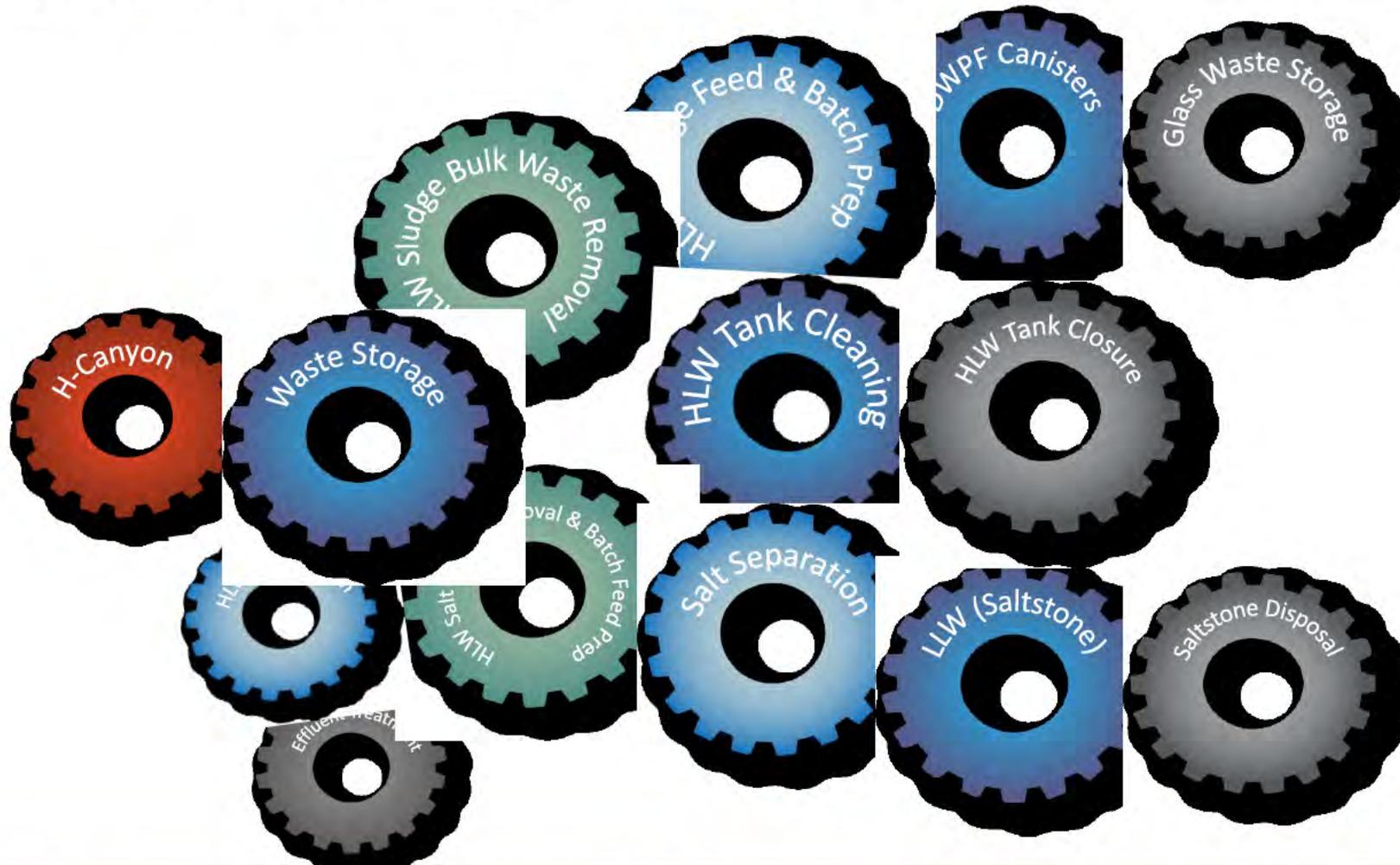
Saltstone Disposal Facility

17.2 Mgal LLW disposed containing 734 kCi
(>35 Mgal grout)

<<1% radionuclides to saltstone

2018-12-31

Liquid Waste Program Integration



Safe storage, treatment, and disposition of SRS liquid waste requires synchronization of several highly interdependent nuclear facilities and chemical operations

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



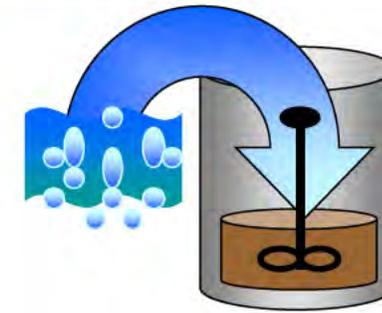
16 Older Style
27 New Style



8 Closed Tanks (Older Style)

51 Total

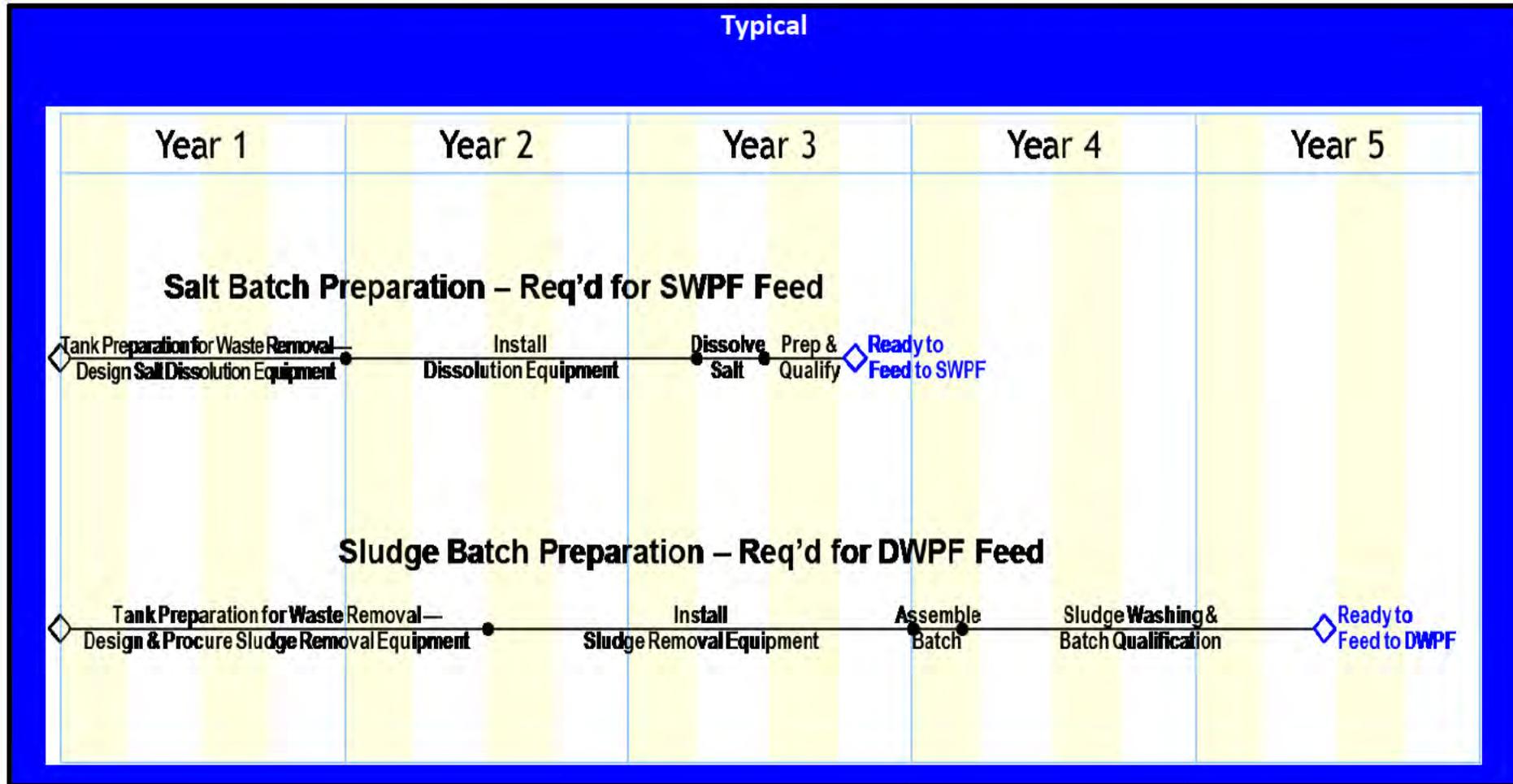
Removing Waste from Tanks



Water and Liquid Waste

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

SWPF and DWPF Feed Preparation

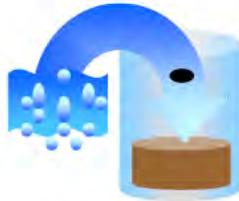


Sludge Processing



Immobilize Waste for Disposal

Removing Sludge Waste from Tanks



Water and Liquid Waste

Defense Waste Processing Facility

- World's largest vitrification plant
- Entire 35 million gallons of waste awaiting disposition has about 248 million Curies of radioactivity
- Almost all radioactivity from waste dispositioned via DWPF
 - Over 61 million Curies to date
- Over 4,180 canisters filled since 1996



Interim Storage of Canisters

- DWPF Glass Waste Storage Buildings (GWSB)
 - *Seismically qualified underground concrete vaults*
 - *Designed for safe interim storage*
- Existing storage capacity increased by 2,262 positions with Canister Double Stacking in GWSB#1
 - *Total Storage Capacity: 6864*
 - *Total Positions Double Stacked to date: 553*
 - *Total Positions available: 2706*
- Modular storage concept being considered for remaining cans ~2029



Salt Waste Processing

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



Interim Salt Processing Facilities

Modular Caustic Side Solvent Extraction Unit (MCU)



Actinide Removal Process

- Actinide Removal Process/Modular Caustic Side Solvent Extraction Unit operational since April 2008
- Remove actinides, Strontium and Cesium (Cs-137) from salt waste
- Nominal operating capacity 1.5 Mgal/yr
- 6.9 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

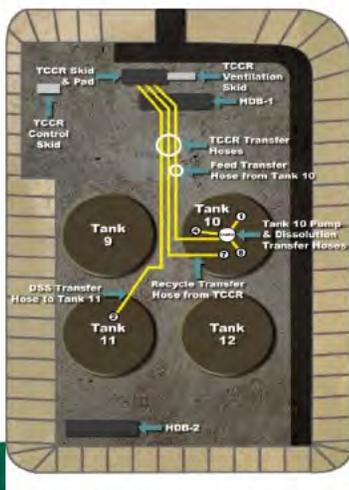
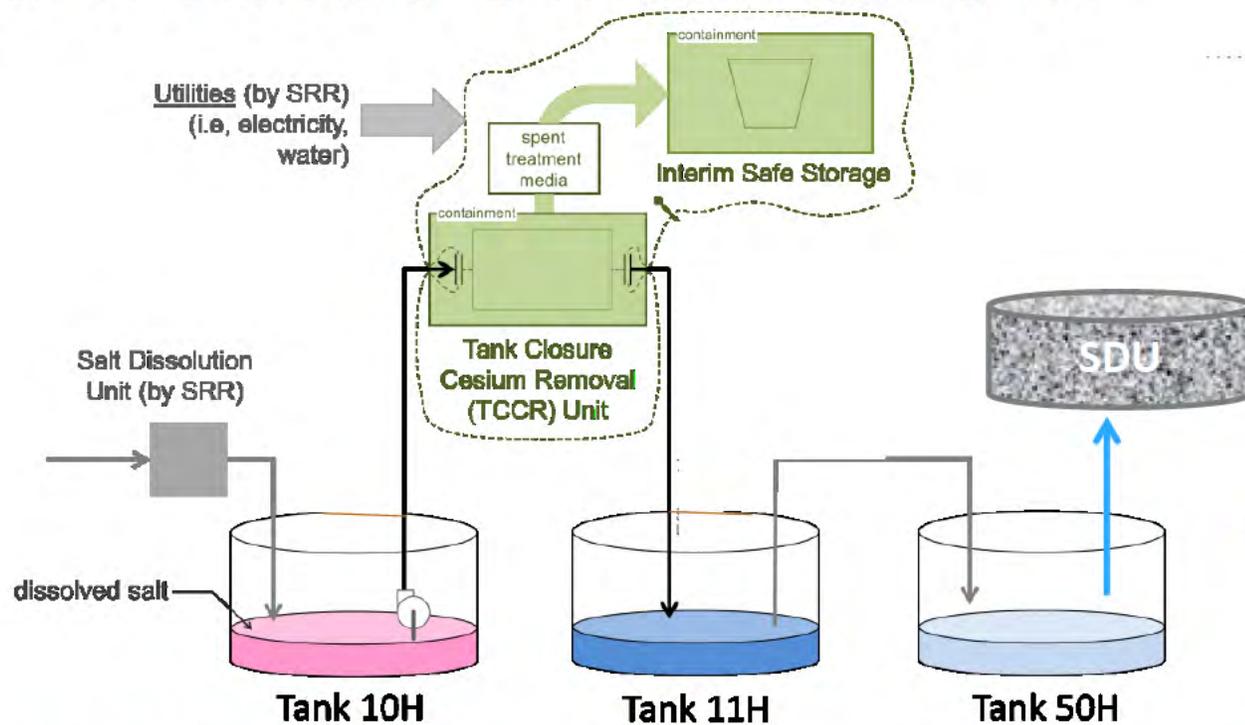


Constructed by Parsons

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
- Commissioning and Startup testing in progress

Tank Closure Cesium Removal



Saltstone

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 over 12.3 Mgal of low-level radioactive liquid salt wastes into grout (21.8 Mgal) containing approximately 470 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
- Completed construction 3rd generation SDU-6

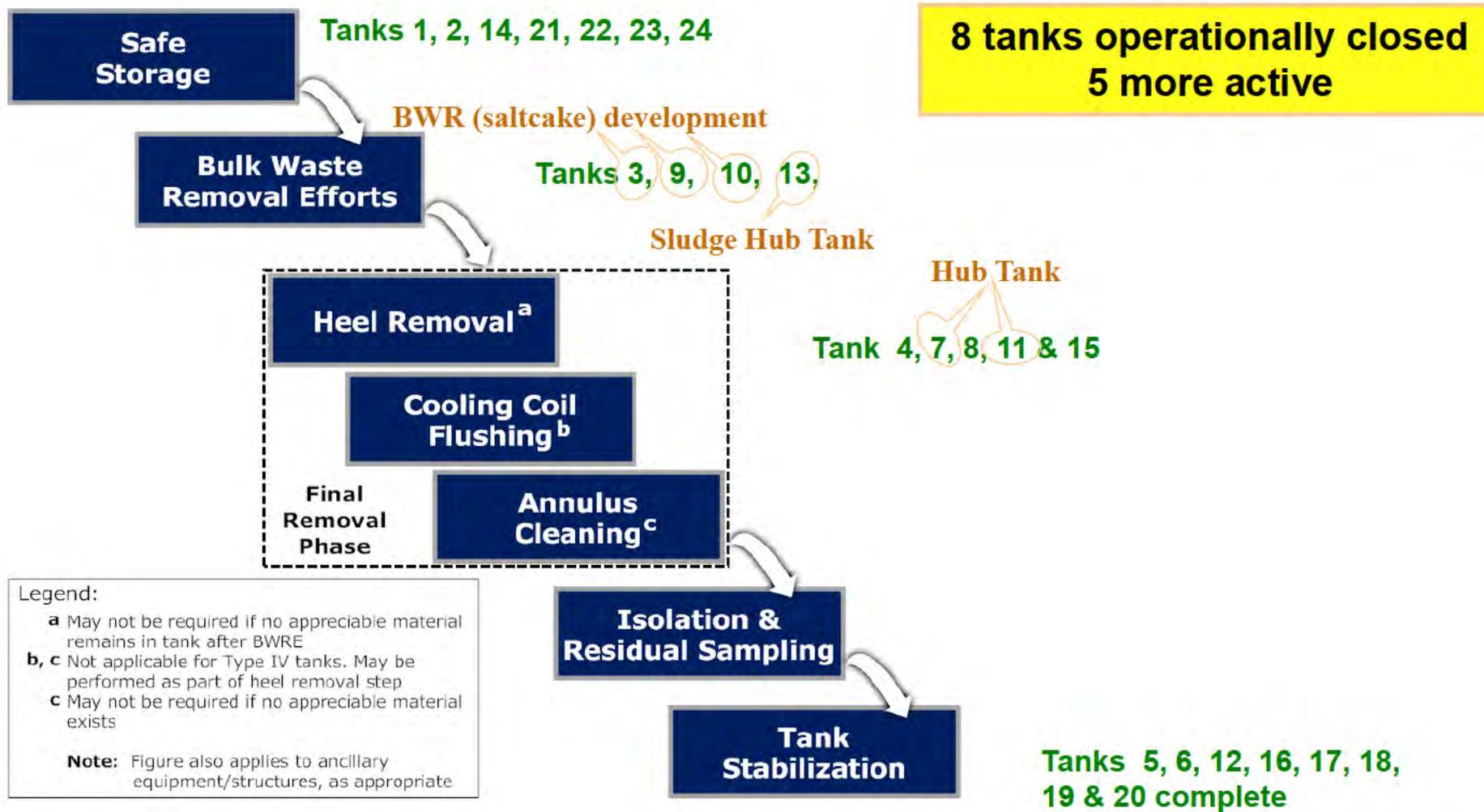


Saltstone Disposal Unit 6 – Complete

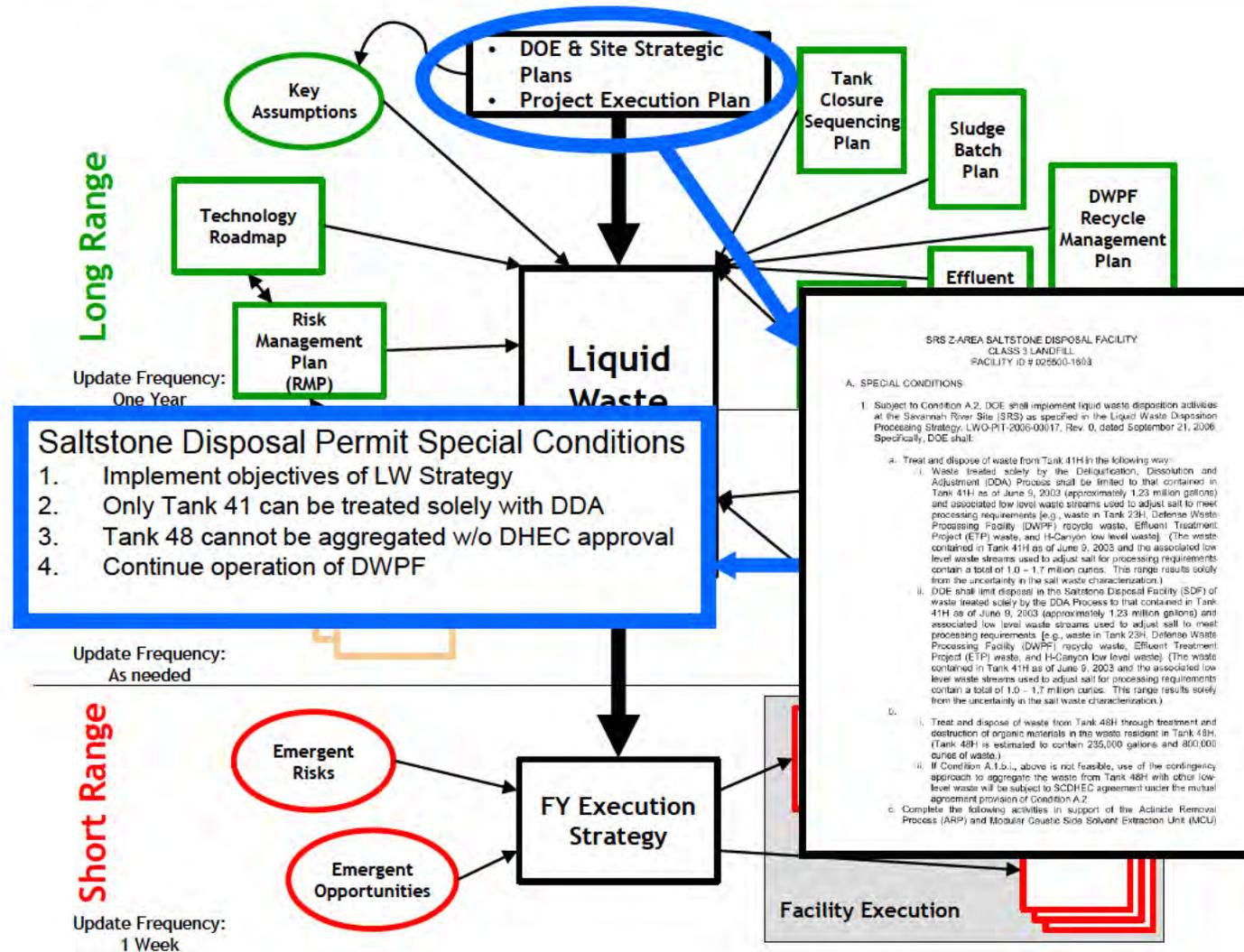


Completion of SDU 6 construction, which cost \$120 million, comes in 18 months ahead of the target schedule and more than \$20 million under the target cost

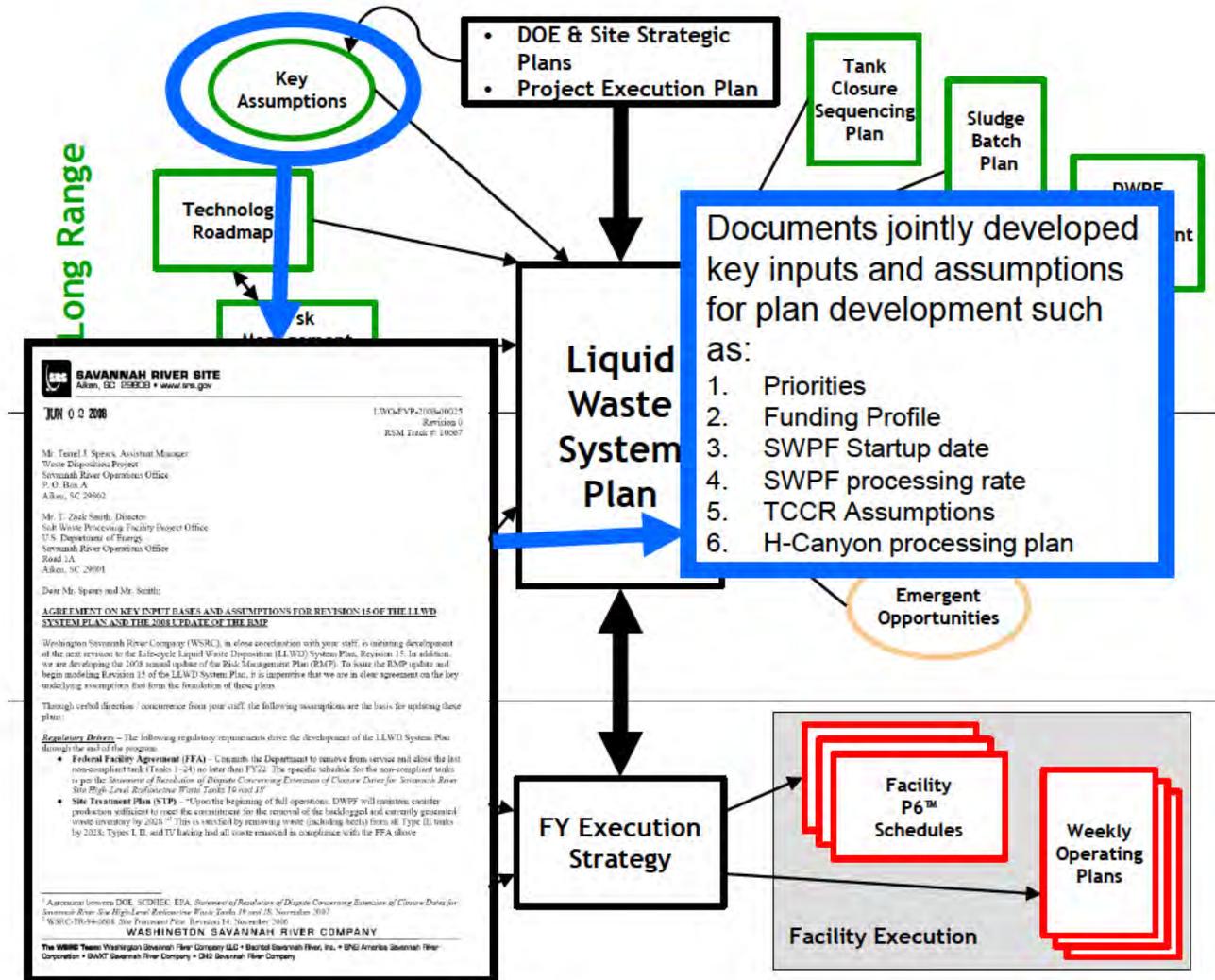
Tank Closure Progression



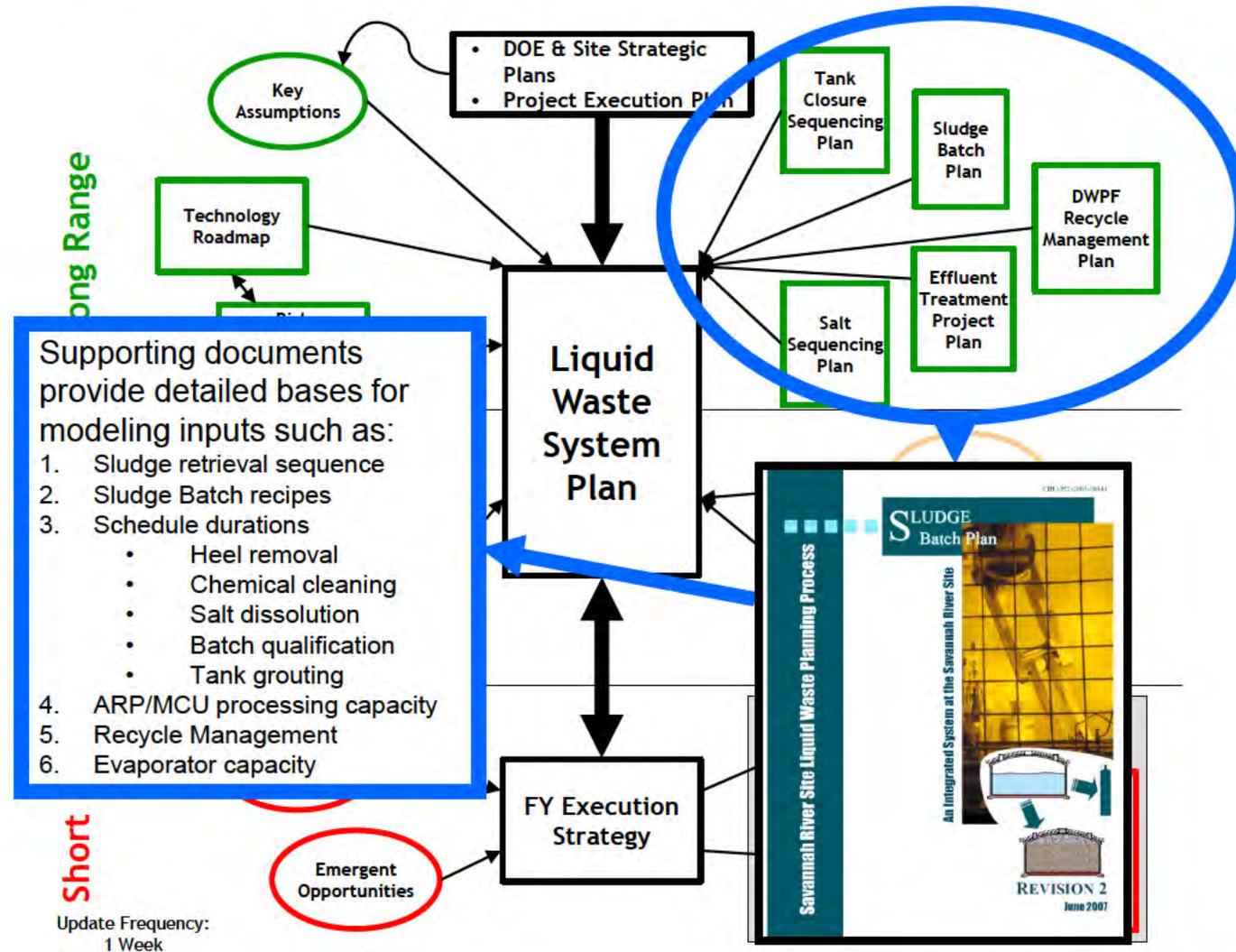
Liquid Waste System Planning



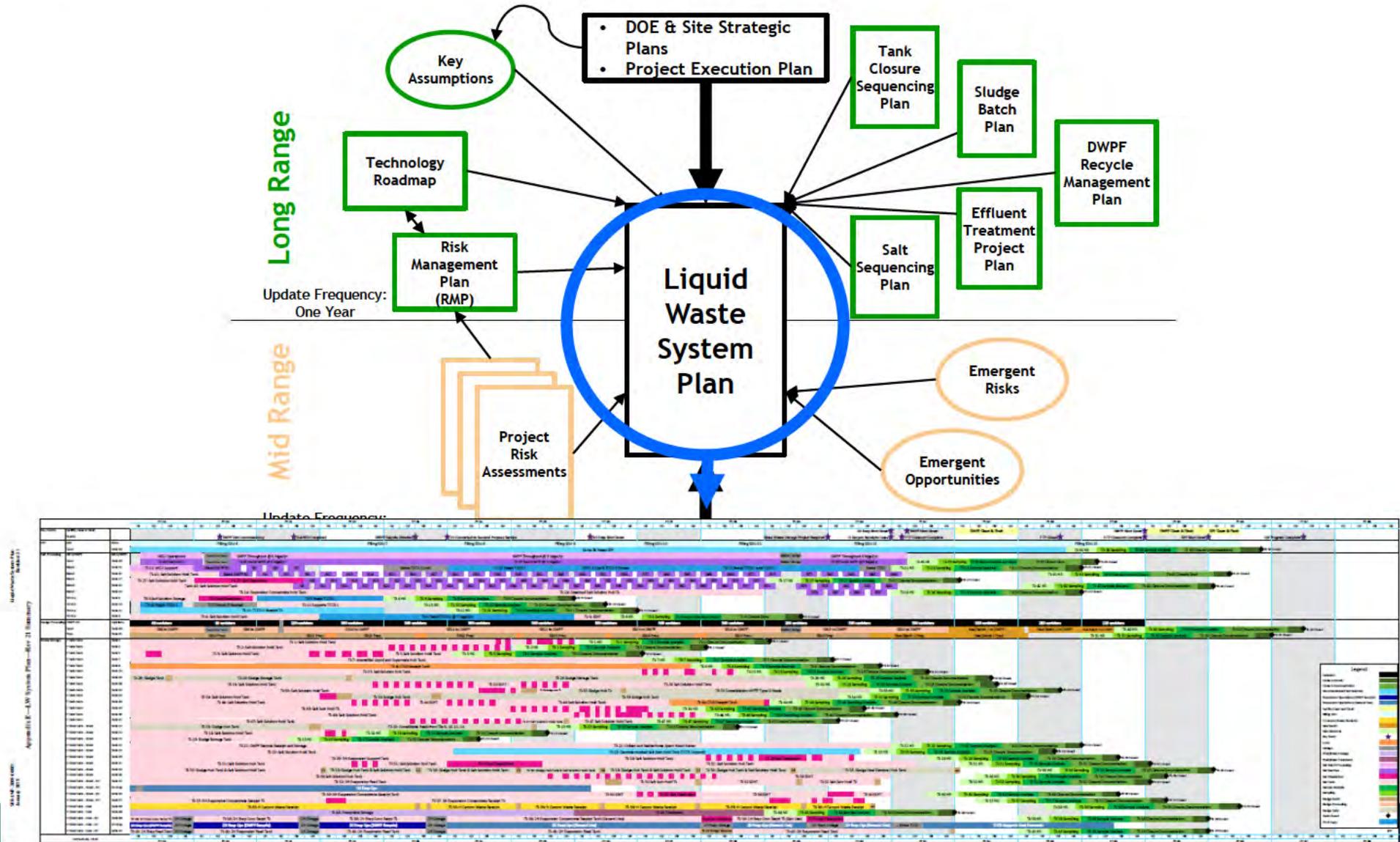
Liquid Waste System Planning



Liquid Waste System Planning



Liquid Waste System Planning



System Planning

Changes to System Plans are driven by:

- Advances in Technology
 - Increased utilization of Tank Closure Cesium Removal (TCCR) – slide 13
- Change in Sequencing
 - SWPF Startup date - slide 12
- Acceleration Opportunities
 - SWPF processing rate - slide 12
- Funding Adjustments – slide 10
- Changes to Regulatory Agreements
 - e.g., Dispute Resolution Agreement
- Realization of Risks/Equipment Failures
 - The 3H evaporator pot failed requiring repair
 - Melter #2 reached its end of life
 - Improved understanding of flammable gas generation has resulted in additional (more restrictive) controls in DWPF, the Tank Farms, and for Saltstone Disposal Units (SDUs)

Key Inputs

1. Priorities
2. Funding Profile
3. SWPF Startup date
4. SWPF processing rate
5. TCCR Assumptions
6. H-Canyon processing plan

Priorities for Rev 21

- Continual safe storage of liquid waste in tanks and vitrified canisters in storage.
- Complete LW System operational closure
- Complete operational closure of F Tank Farm
- Process liquid salt waste (e.g., dissolved salt solution, supernate) in FY16 through FY22 in accordance with the SCDHEC “*Agreement*”
- Remove the bulk of the waste in the Older Style H-Tank Farm tanks in the water table (i.e., Tanks 9, 10, 13, 14).
- Complete operational closure of the 1F Evaporator by the end of FY23.

Funding Assumptions for Rev 21

- FY19 funding is per the approved budget appropriation
- FY20 and beyond are determined by modeling

SWPF Assumptions (Revision 21)

- Hot Commissioning in March 2020
- First year (twelve months) of operations begins May 2020
- SWPF processes 6 Mgal during first 12 months of operations
- Next Generation Solvent is deployed after the first year of operations
- SWPF processes at a rate of 9 Mgal/year beginning in the second year of operations

Note: ARP/MCU will operate until 5 months prior to the SWPF Hot Commissioning date

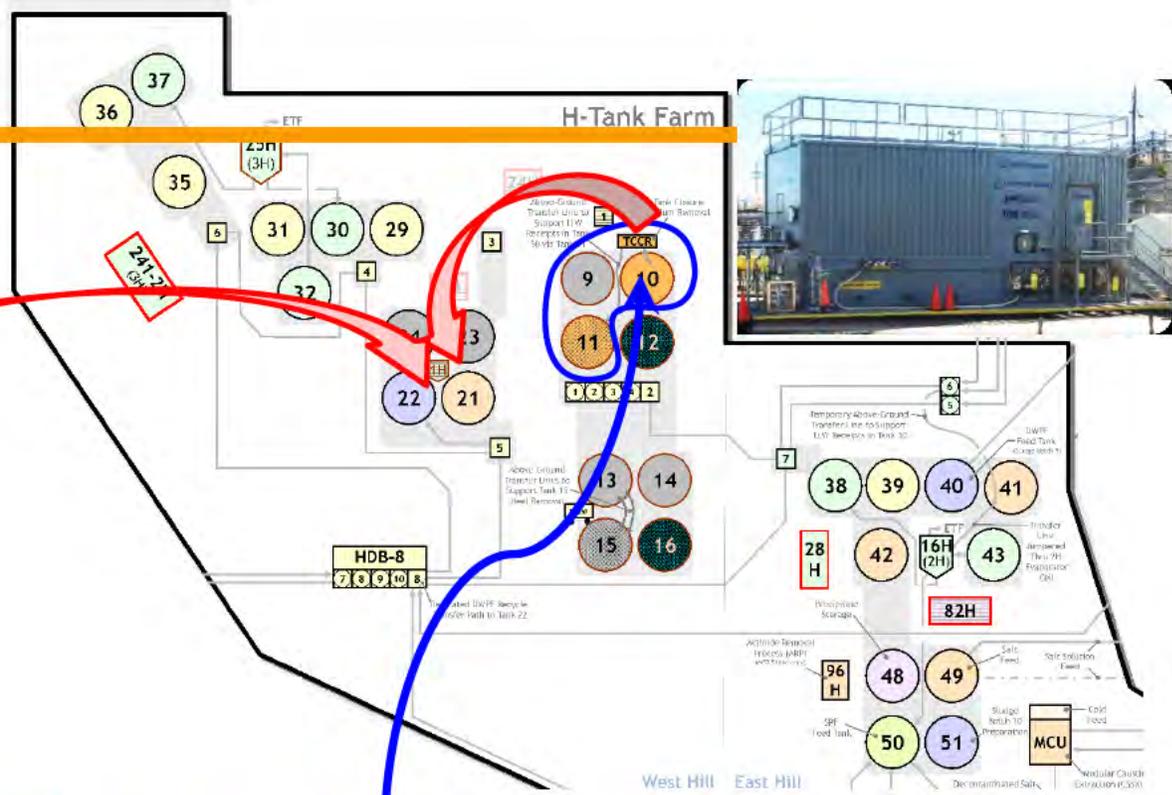
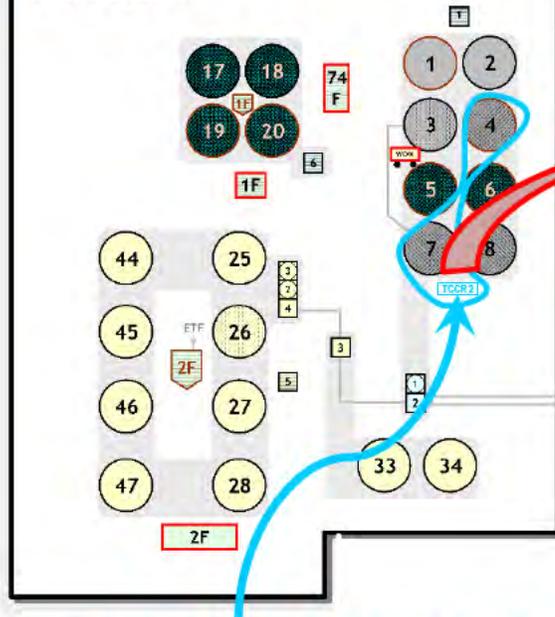
SWPF Assumptions (Revision 20 vs. Revision 21)

	Revision 20	Revision 21
ARP/MCU Shutdown Date	September 2018	November 2019*
Start of First Year of Operations	December 2018	March 2020
Processing Rate (1st Year)	4.6 Mgal/yr	6 Mgal/yr
Processing Rate (2nd Year)	7.2 Mgal/yr	9 Mgal/yr
Processing Rate (3rd Year)	7.2 Mgal/yr	9 Mgal/yr
Processing Rate (4th Year)	9 Mgal/yr	9 Mgal/yr
NGS Operations Starting	January 2022	May 2021
NGS Transition Outage	3 months	Not required

* Last 2 months of ARP/MCU operations at reduced capacity for flushing

TCCR Assumptions

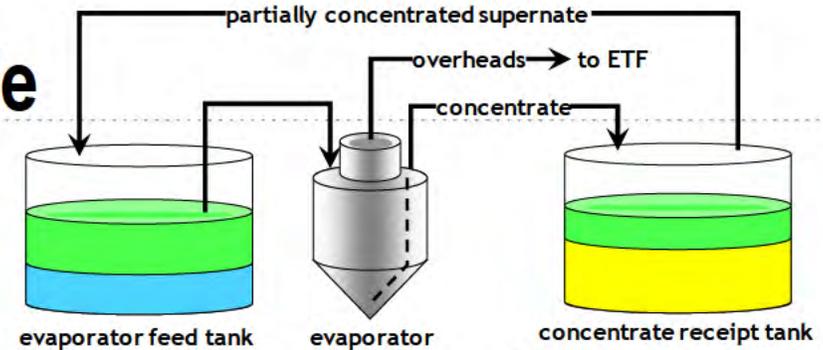
F-Tank Farm



- A second TCCR (Unit #2) will be purchased and deployed in F-Tank Farm (FTF) and will begin processing dissolved salt on 10/1/21 at a rate of 1 Mgal/year
- Once processing of FTF salt is completed, TCCR Unit #2 will be relocated to Tank 21 H-Tank Farm in FY26 and will continue processing dissolved salt at a rate of 1 Mgal/year

- The TCCR demonstration processing Tank 10 dissolved salt will be successful
- The current TCCR Unit #1 will be used to process dissolved salt from Tank 9 beginning 10/1/20
- After processing Tank 9 dissolved salt, TCCR Unit #1 will be relocated to Tank 21 in FY23 and will continue processing dissolved salt at a rate of 1 Mgal/year

Evaporators and DWPF Recycle



- 3H Evaporator continues to operate as-is performing general purpose evaporation
 - DWPF recycle is diverted from the Tank Farm to ETP in April 2023
 - 3H is shutdown in FY26
- 2H is converted to general purpose evaporation in FY24
 - After salt processing is completed (FY30), one of the TCCRs is moved to HTF East Hill to process wash water from Tank 51 to Tank 50 enabling shutdown of 2H evaporator



Other Inputs

H-Canyon

- Continues to send waste to H- Tank Farm through FY30

Tank 48

- Technology Development (FY21 - FY22)
- Technology Deployment (FY23 - FY25)
- Treatment of Waste (FY26 - FY28)
- Heel Treatment and Closure (FY29 - FY31)

DWPF

- Canister production rate synchronized to salt processing rate

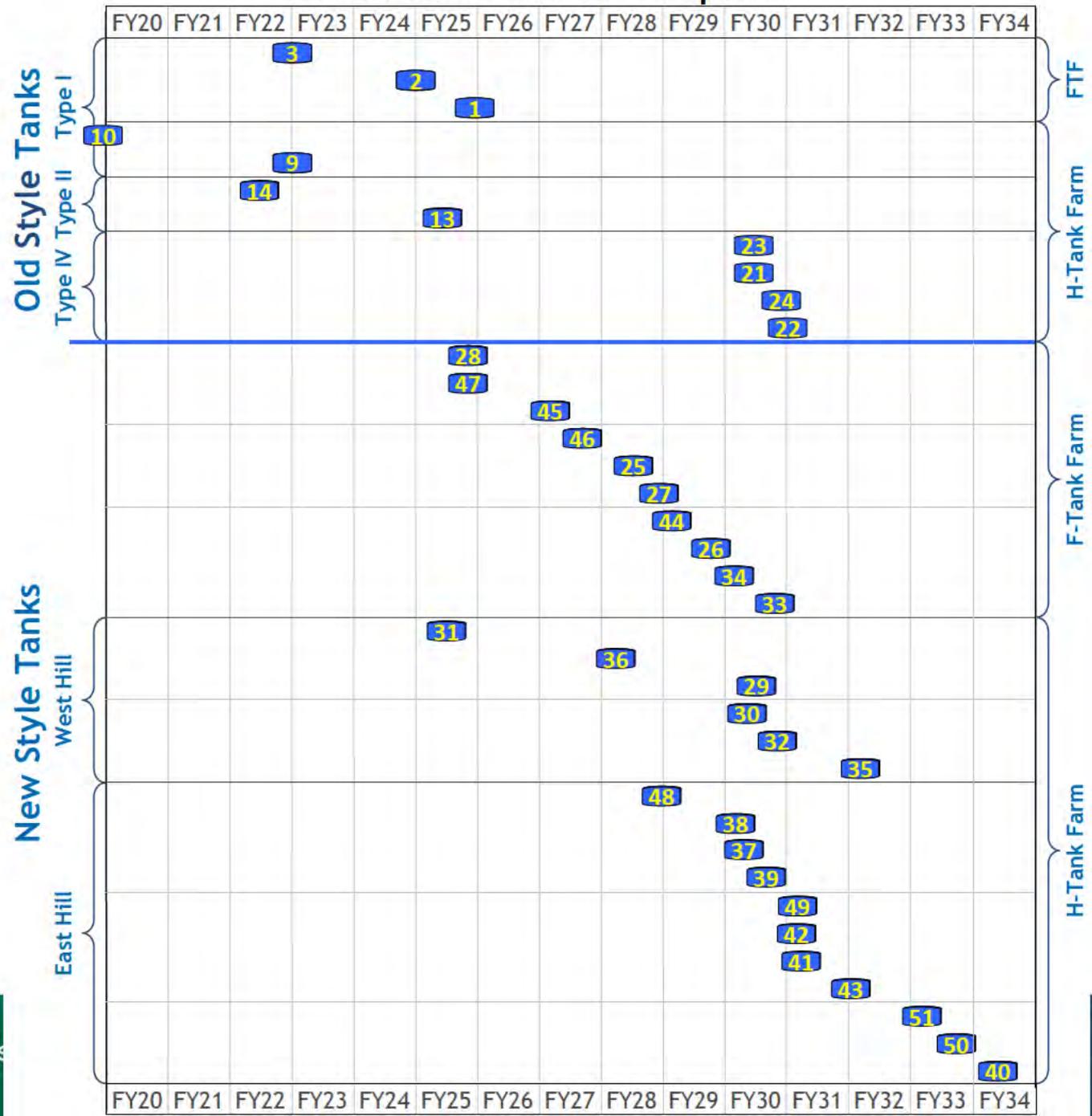
Results

- F-Tank Farm waste removal complete and inter-area line cut in December 2030
- SWPF Operations complete December 2030
- F-Tank Farm operationally closed June 2033
- H-Tank Farm waste removal complete September 2034
- DWPF waste processing complete September 2034
- 44 of 51 tanks operationally closed by September 2035
- Last tank operationally closed/Program complete March 2037

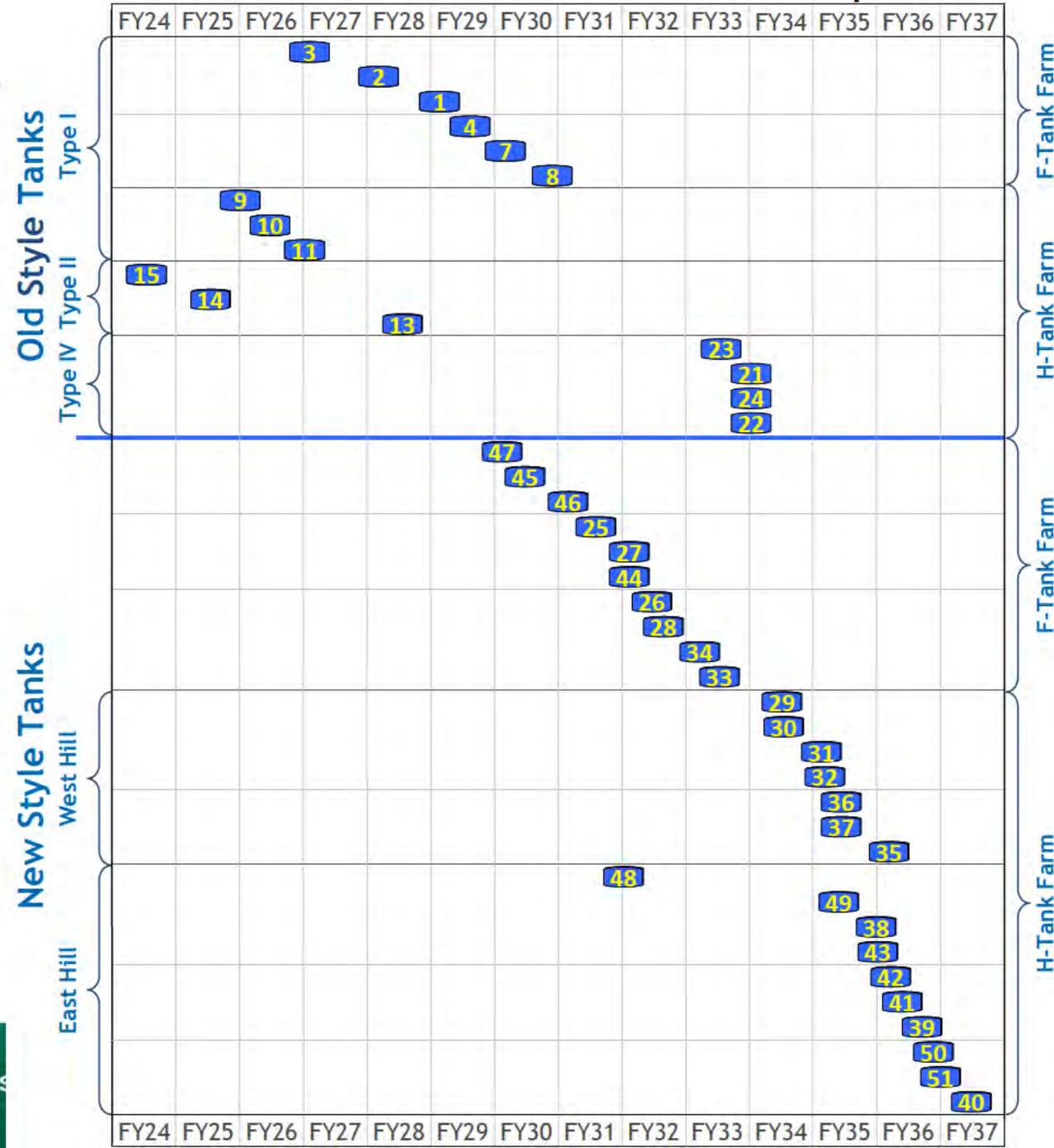
Results – Comparison to Revision 20

Parameter	Rev 20, Case 1	Rev 21,
Date SWPF begins hot commissioning	Dec 2018	March 2020
Date last LW facility turned over to D&D	2041	2037
Final Type I and II tanks complete operational closure	2033	2030
Complete bulk sludge treatment	2031	2031
Complete bulk salt treatment	2032	2031
Complete heel treatment	2036	2034
TCCR for supplemental salt waste treatment	1 unit	2 units
Next generation solvent for increased SWPF throughput	Jan 2022	May 2021
Total number of canisters produced	8,170	8,121
Year supplemental canister storage required to be ready	2029	2030
Radionuclides (curies) dispositioned in SDF within the amended <i>SRS LW Strategy</i>	Yes	Yes
Total number of SDUs	14	13

Bulk Waste Removal Complete



Tank Removal from Service – Grout Complete



Questions