SRR LIQUID WASTE PROGRAM: TANK CLOSURE PROGRESS AND FUTURE FOCUS

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Tank Closure and Regulatory Strategies
SRR-CWDA-2016-00096
Mission of SRR

- Safely manage tank waste
- Process waste for compliant storage and disposal
- Remove high level tank waste contents
- Isolation and closure of tanks

Risk Reduction for the State of South Carolina and U.S. DOE

Tank 12 Interior During Grouting
Operational Goals

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

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

SRR Liquid Waste Program
(with current status)

51 Tanks
- 8 grouted & operationally closed
- 4 BWRE complete
- 63% empty or grouted (old style)
- 24% empty (new style)

43 tanks
36 Mgal
264 MCi

Salt waste
9.0 Mgal
treated

Salt waste
4.1 Mgal
treated

Tanks cleaned and operationally closed

<1% radionuclides remain in tanks

Most radionuclides to glass

Poured 4,077 cans of projected 8,170
59.4 million curies immobilized in glass

19.8 Mgal grout dispositioned containing 466 kCi

<1% radionuclides to saltstone

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Operational Goals
- Radionuclides to glass
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Swannan River Site • Aiken, SC • www.SRRremediation.com
Taking the average tank volume (averaged across Type I, II, and IV tanks):

- 8.7 equivalent tanks are operationally closed
- 3.7 are out of service (vapor space above HLLCP)
- 2.8 are empty (available vapor space below HLLCP)
- 8.9 are in continued use
### Type I

1. **Saltcake Tank – Follows Tank 2**
2. **Saltcake Tank – Follows Tank 3**
3. **Saltcake Tank – BWRE Design in Progress**
4. **BWRE Complete - Limited Reuse Approved**
5. **Operationally Closed (December 2013)**
6. **Operationally Closed (December 2013)**
7. **BWRE Complete - Limited Reuse Approved**
8. **BWRE Complete - Limited Reuse Approved**

### Type IV

17. **Operationally Closed (December 1997)**
18. **Operationally Closed (September 2012)**
19. **Operationally Closed (August 2012)**
20. **Operationally Closed (July 1997)**
<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Description</th>
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<tbody>
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<td>Type I</td>
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<td>Saltcake Tank – BWRE Designs in Progress</td>
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<td>Saltcake Tank - BWRE Initiated</td>
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<td>Type II</td>
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<td>BWRE Initiated - Sludge Hub Tank</td>
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<td>Salt Batch Prep</td>
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<td>DWPF Recycle Storage</td>
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<td>Salt Batch Prep</td>
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<td>24</td>
<td>High Caustic Supernate</td>
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</table>
- **April 2016**
  - 70 Days to close
    - Tank 16; 93 Days
    - Tanks 18 & 19; ~150 days
    - Tanks 5 & 6; ~190 days
  - 12 includes 3 weeks of Ground water infiltration fixes

- **Innovation though time**
  - Improved grout distribution
  - Better riser preps
  - When we grout
  - How we move from each pour
  - Better coil fill approaches
  - Changes in annulus and ventilation system fill
Tank Closure Next Steps

- **Reducing prep time**
  - Better isolation techniques
  - Less Riser Preparation
    - 3 or 4, vs.
  - Improved equipment reliability

- **Faster filling**
  - Pump trucks vs. slick line
  - Better grout formulations
    - Flow and strength

- **Safer for people**
  - No slick line reroutes
  - No hose shifts
  - Fewer personnel on tank
  - Less time in cold and heat
    - Tank 16; avg temp 98 degrees with humidity at 80%
Closure Partnership

- A Testament to Communication
  - South Carolina DHEC, EPA, DOE, and SRR

- A Commitment to Understanding
  - LEAN event on regulatory closure process
    - An understanding of technical challenges
    - An understanding of requirements
    - A joint resolution to improve without jeopardizing quality or diligence

- Results Speak for Themselves
  - Tanks 18 & 19: 19 months
  - Tank 6: 16 months
  - Tank 5: 11 months
  - Tank 16: 9 months
  - Tank 12: 6 months

- In Field Regulatory Presence a Key
Before You Close: The Hard Part

- **Bulk Waste Retrieval Efforts (BWRE)**
  - The major effort to remove residual salt cake and sludge
  - Longest and most expensive part of the process in closure
  - Tanks are not uniform and present different challenges
  - Require extensive disassembly and removal (D&R)
    - Old pumps, failed equipment, ventilation systems, electrical and transfer systems, valves, piping, etc.
  - Require extensive design and construction
    - New pumps, agitators, injection and recirculation systems, reinforcement, electrical supply and control systems, piping, hoses, valves, etc.
  - Compliance with all operational, acceptance, and nuclear safety requirements
    - It is high level waste and it must be dispositioned compliantly

- **Heel Removal**
  - All the stuff that is left at the bottom of the garbage can
    - Hard salts and sludges, metals and debris
BWRE Preparations

D&R: Pipes, Pumps, and the Rest

Construction with New
Choose the Motive Force

- **Pumps, Pumps, Pumps**
  - Slurry Pumps
  - Submersible Mixing Pumps
  - Commercial Submersible Mixing Pumps
  - Recirculation Pumps
  - Transfer Pumps
  - Transfer Jets
  - Hooper Jet Pumps

- **Inject and Agitate for Salt Dissolution**

- **Entrain and slurry solids**

- **Goal to Reduce Heel Removal Efforts**
  - Chemical cleaning slows system

CSMP Assembly and Install
- Designed with intent to get to the bottom: 4 SMPs = ~ 1600 Hp

Tank 15 to 13 Retrieval System
Tank 13 Scope
- D&R Riser 6
- Install transfer line & supports
- Install transfer pump
- Replace failed SMP in Riser 2A
- Replace failed SMPs in Risers 4, and 8

Riser 3
- D&R mixing pump
- D&R steel
- Remove interferences
- Install Rotek® assemblies
- Install new steel
- Install SMP

Riser 4
- D&R mixing pump
- D&R spray chamber
- Install new steel

Riser 4A
- D&R transfer line
- Install Rotek® assemblies
- Install new steel
- Install SMP

Riser 7
- D&R failed transfer pump
- D&R valvebox
- Install new transfer pump
- Install transfer line & supports

Riser 8
- D&R spray chamber
- Install Rotek® assemblies
- Install SMP

Riser 2
- D&R spray chamber
- Install Rotek® assemblies
- Install SMP

Transfer Pump Location
SMP Location
Supernate Recycle
Sludge Slurry
Tank 26 Sludge Removal

CSMPs

Transfer Pump

CSMPs
Construction Field Work Complete

Legend:
- **CSMP** - Commercial Submersible Mixing Pump
- **STP** - Submersible Transfer Pump

- CSMP Installed
- D&R Completed
- Transfer Jet D&R Completed and Transfer Pump Installed
- CSMP Installed
- CSMP Installed
Time and Cost

- Efficient BWRE with the End in Mind
  - Preparing tanks to reduce heel removal and isolation time
  - Right tools used at the right time
  - Innovation at the right time
  - Reducing cost and improving predictability
  - Tank moving directly to closure

SMP Riser with Steel Reinforcement: ~$2.2M/Riser

CSMP Riser: ~$600K/Riser
New Systems Coming On Line

- **Salt Waste Processing Facility**
  - Key to improved waste processing
  - Capacity transformation for the liquid waste system

- **Salt Waste Disposal Units**
  - SWPF drives capacity changes
  - Faster disposal capability
  - Lower unit cost for disposal

Salt Disposal Unit (SDU) 6: $32M Gallon Capacity
Additional Technology Application

- **Tank Closure Cesium Removal (TCCR)**
  - At-tank mobile processing
  - Supplemental treatment capacity
  - Adaptable for mobile strike capability and targeted processing/treatment
  - Modular, adaptive capability for unfavorable waste streams
  - Commercial supply model

- **Demonstration in spring 2018**
  - In design phase
  - System delivery in 9/17
  - Tank Mods in progress
Tank Closure Focus

Safe And Reliable Operations
Supporting Safe Integration of SWPF into LWP
Preparing Tanks for Efficient Feed Delivery
Improving Closure Efficiency
Meeting State and DOE Tank Closure Goals
Reducing Risk to South Carolina
It’s a Jungle Out There