Integrated Salt Waste Processing at the Savannah River Site

Presented to:
South Carolina Governor’s Nuclear Advisory Council
April 9, 2015
SRR Liquid Waste Program (with current status)

Legacy Liquid Waste
43 tanks, 37 Mgal, 268 MCi

Tanks Cleaned and Closed
<1% radionuclides remain in tanks

51 Tanks
- 6 grouted & closed
- 2 cleaned
- 6 BWRE complete
- 65% empty (old style)
- 21% empty (new style)

Salt waste: 8.1 Mgal treated

Sludge waste: 3.9 Mgal treated

Salt Processing

DWPF

Glass Waste Storage
Most Radionuclides to glass
Poured 3,961 cans of projected 8,582
57 million curies immobilized in glass

Radionuclides

ARP

MCU

Saltstone Disposal Facility
17.3 Mgal grout dispositioned containing 433 kCi

Solid (not hazardous) waste

<<1% radionuclides to saltstone

Acronyms:
ARP Actinide Removal Process
BWRE Bulk Waste Removal Efforts
DWPF Defense Waste Processing Facility
MCU Modular Caustic Side Solvent Extraction Unit
SCIX Small Column Ion Exchange
SWPF Salt Waste Processing Facility

2015-04-01
SWPF Integration To-Go Scope

- DWPF Modifications
- Alternate Reductant
- Lab Waste Handling
- Strip Effluent Mix Tank – Slurry Mix Evaporator
- Dry Frit

Blend Tanks (Tanks 21 & 49)

- Complete Effluent Treatment Hold Tank

West Transfer Line Modifications

- Salt Solution Receipt Tanks
- Enhance Low Activity Waste Disposition

SWPF
SWPF Integration Work Completed-to-date

• Designed and built a ~114K liter (30K gal.) waste concentrate hold tank and cell for the Effluent Treatment Facility (ETF)
• Fabricated and installed two ~227K liter (60K gal.) salt solution receipt tanks at Saltstone Production Facility (SPF)
• Designed transfer lines to/from SWPF
• Designed and procured engineered equipment for blend and feed tanks and DWPF modifications
• Issued conceptual design to allow ARP/MCU to operate post transfer tie-in scope
• Identified opportunity to reduce tie in outage 4-5 months
SWPF - Influenuts and Effluents

**Tank 49 Blend and Feed**
- Provide raw salt solution (RSS) feed for SWPF
- Equip one existing tank (Tank 21) with blending capability
- Equip one existing tank (Tank 49) as the SWPF Feed Tank
- Provides transfer piping for RSS transfers to SWPF
- **Scheduled completion September 2015**

**Salt Solution Receipt Tanks (SSRTs)**
- Dual ~227K liter (60K gal.) receipt tanks to allow salt processing to continue during short Saltstone Processing Facility (SPF) outages
- Supports increased DSS throughput from SWPF
- Improves operational flexibility
- **In Progress**

**East and West Transfer Lines**
- Tie-ins of new underground SWPF piping to existing Liquid Waste piping
- East Transfer Line Tie-in to provide path from SWPF to Tank 50H
- West Transfer Line tie-ins provide path between SWPF, HTF, and DWPF
- Significant outage to execute scope

**DWPF Modifications**
- Allow receipt of high activity effluent streams from SWPF
- Expanding glass composition to support MST Strikes at SWPF
- Complete Consolidated Hazards and Documented Safety Analyses
- Temperature interlock and automated shut off of key equipment within 511-S
### SWPF - Influent and Effluents

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Details</th>
</tr>
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<tbody>
<tr>
<td><strong>DWPF Alternate Reductant Flowsheet</strong></td>
<td></td>
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<tr>
<td>Scope: Nitric-Glycolic Research, Safety Basis Documents, and supporting plant</td>
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<tr>
<td>infrastructure modifications</td>
<td></td>
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<tr>
<td>Eliminate hazards with formic acid, (i.e., Emergency Preparedness; reduces</td>
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<tr>
<td>functional classification of Safety Significant equipment)</td>
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<tr>
<td>Improves DWPF operational flexibility for increased influents</td>
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<tr>
<td><strong>DWPF Dry Frit Modification</strong></td>
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<tr>
<td>Modifies facility to deliver dry process Frit</td>
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<tr>
<td>Reduces amount of recycle water going from DWPF to tank farm</td>
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<td>Feasibility studies completed</td>
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<tr>
<td>Designs have been developed</td>
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<tr>
<td>Through wall pilot penetrations complete</td>
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<td>Scheduled to resume scope in FY16</td>
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<tr>
<td><strong>Laboratory Waste Handling</strong></td>
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<tr>
<td>Improve method to remove higher curie waste and equipment from DWPF shielded cells</td>
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<tr>
<td>Approved design input documents and issued Preliminary Material Handling Diagram for</td>
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<td>lab modifications to reduce dose rates</td>
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<tr>
<td>Performed waste characterization calculation for future waste</td>
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<tr>
<td>Scheduled to complete in FY16</td>
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<tr>
<td><strong>Strip Effluent Feed Tank to Slurry Mixer Evaporator</strong></td>
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<tr>
<td>Allows Strip Effluent to be dispositioned in both the Sludge Receipt &amp; Adjustment</td>
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<tr>
<td>Tank and Slurry Mixer Evaporator</td>
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<tr>
<td>Finalize bench scale testing</td>
<td></td>
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<tr>
<td>Complete Consolidated Hazards and Documented Safety Analyses (DSA)</td>
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<tr>
<td>Perform facility modifications by end of FY16</td>
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Supporting Scope

- **MCU Continued Operations**
  - Conceptual Design inputs complete
    - Allowing MCU to operate until SWPF Hot Commissioning
  - DOE-SR, DOE-HQ and SCDHEC have been briefed and acknowledge increased salt production and reduced outage time
  - Dependent on “No MST Strikes” or “Large Tank Strike”
  - Design to commence in Q3FY15, with plan to execute scope in Q1FY17

- **Enhanced Low Activity Waste Disposition**
  - Dry Feed Modifications
    - Pre-Mix Mods
    - Silo Mods
    - Spares
  - Balance of Plant Modifications
    - Lighting
    - Lightening Upgrades
    - Air Compressors

Dry Feed Weather Protection

Screw Feeder

Saltstone Air Compressors
SRR SWPF Integration Support Overview Schedule

### SWPF Scope
- SWPF Construction
  - Construction Complete
  - Cold Commissioning

### SWPF Integration Scope
- **Tank Farms**
  - ARP/MCU Design
  - East Transfer Line & MCU Piping Mods
  - West Transfer Line Non-Intrusive Work
  - SWPF Tie-in Outage
  - Intrusive Work ARP/MCU Operations
  - DWPF Boric Acid Modification
  - DWPF/SWPF NGS Outage
  - NGS Operations

- **DWPF**
  - Tank 49 Transfer Pipe
  - Blend Tank 21
  - Feed Tank 49
  - Sludge Batch 8
  - Sludge Batch 9
  - Alternate Redundant
  - No outage required
  - Begin using Alt. Red. with SB9
  - Phase II R&D
  - DSA/TSR & WACs
  - SEFT to SME
  - Dry Frit Addition Design/Fab
  - Simulate Testing
  - CHA/DSA/TSR
  - Laboratory Waste Handling
  - Design Input/Design Modification
  - SPF Acquire Staff & Install Trailers
  - 2 shifts Staff 24/7
  - Train Staff
  - SPF Dry Feed Modifications
  - PreMix Mods, Silo Mods, & Spares
  - SPF Balance of Plant Modifications
  - Lighting, Lightning Upgrades & COPCO Compressor

- **SDU6 Construction**
  - SDU7 Site Prep
  - SDU6 Filling
  - SDU7 Construction w/ BOP
  - SDU7 Filling

- **Assumptions**
  - First planned SWPF outage is for NGS outage
  - Design Authority & Safety Basis resources are available
  - SWPF Tie-in Outage will not be delayed, if SWPF startup is delayed
  - MCU/ARP not currently planned to operate after SWPF startup
  - SWPF Li Project Dates are based on DOE inputs/Assumptions to LLWSP F20
  - Current SWPF Tie-in outage is 9 months 22 days with opportunities to reduced per LEAN Rapid Improvement Event
  - DWPF Melter will not be replaced during SWPF Outage

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Legend:
- **Brown**: Parsons Scope
- **Blue**: SWPF Scope
- **Gray**: SWPF Outage Needed
Tank Space Needs to Support SWPF

### Required Processing to Support SWPF at Capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity (Mgal)</th>
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<tbody>
<tr>
<td>FY15</td>
<td>1.4 Mgal</td>
</tr>
<tr>
<td>FY16</td>
<td>1.5 Mgal</td>
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<tr>
<td>FY17</td>
<td>1.8 Mgal</td>
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<tr>
<td>FY18</td>
<td>1.5 Mgal</td>
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<tr>
<td>FY19</td>
<td>4.4 Mgal</td>
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<tr>
<td>FY20</td>
<td>5.8 Mgal</td>
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**Diagram:***
- **Feed Tank:** Tank 49
- **Blend Tanks:**
  - Tank 21
  - Tank 26
  - Tank 34
- **Hub Tanks:**
  - Tank 23
  - Tank 35
  - Tank 27
  - Tank 28
  - Tank 25

**Legend:**
- Available today feeding ARP/MCU
- Made available by increased ARP/MCU processing
- Made available by increased ARP/MCU processing and 2 years of SWPF Operations

**Notes:**
- 1-year gap

**Text:**
- Need for Year 1 of SWPF Operations
- Need for Year 2 of SWPF Operations and Beyond
Integration Summary

• The Salt Disposition Integration scope enhances the existing Liquid Waste systems at SRS to seamlessly integrate with SWPF operations, while maintaining Salt Processing capability via ARP/MCU

• Significant work will continue into FY 2018 in preparation for SWPF startup

• The SDI scopes support:
  – SWPF project design, construction startup, and radioactive operations
  – Increased throughput related to SWPF processes