ARP/MCU Operating Performance and Lifecycle Enhancements

Presented to the SRS Citizens Advisory Board
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Purpose

• Update the SRS Citizens Advisory Board regarding:

  - Operating Performance of the “Salt Disposition Project (SDP)”, also known as the “Actinide Removal Process (ARP) / Modular Caustic Side Solvent Extraction Unit (MCU)”

  - Lifecycle Enhancements to the ARP/MCU process
Agenda

- Process Overview
- Mission Timeline
- Integrated Processing Facilities
- Operational Performance
- Lifecycle Enhancements
- Summary
Process Overview: SRR Salt Disposition

SRR Mission: Store, Treat and Stabilize Legacy of Radioactive Waste
Process Overview: ARP/MCU Mission

- Process to Pretreat Salt Solution for Disposal:
  - Remove Actinides and Strontium through the Actinide Removal Process (ARP)
  - Remove Cesium with the Modular Caustic Side Solvent Extraction Unit (MCU)
- Extend Operational Life-Mitigate Impact of Delay in SWPF Start-up:
  - Implement Life Extension Modifications (complete)
  - Deploy the MCU-Next Generation Solvent in 2013
- Provide Operational Experience for the Salt Processing Program:
  - Process Chemistry
  - Equipment Reliability
  - Operational/Maintenance Experience and Lessons Learned
ARP/MCU Mission Timeline

**DOE Directs New Technology**

**Perform Excavation**

- **Initiate Site Preparations**
  - Jan 2004
- **Equipment Fabrication / Testing**
  - Aug 2004
  - Nov / Dec 2004
- **Construct Foundation**
  - Jan 2005
- **Construct Shielded Structures**
  - 2005
  - Tie-in Transfer Lines
- **Install Key Equipment**
  - 2006
  - Complete Tank 50 Modifications

- **ARP-96H Cell Preparations**
- **Complete Saltstone Modifications**
ARP/MCU Mission Timeline

- Complete Start Up Testing
- Integrated Demonstrations
- Cold Runs Complete
- Conduct Management Self Assessment
- Final Operational Readiness
- Initiate Salt Processing
- Conduct Operational Readiness Reviews

- Feb/Mar 2007
- Jul 2007
- Sep 2007
- Dec 2007
- Jan/Mar 2008
- Mar 2008
- Apr 2008
Cumulative Gallons of Salt Processed From Tank 49
Since Start-up of ARP/MCU*

-3,061,000 gallons *  
As of 1/17/13

Gallons From Tank 49

<table>
<thead>
<tr>
<th>Salt Batches From Tank 49</th>
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<tbody>
<tr>
<td>Batch #1</td>
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<td>Batch #2</td>
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<td>Batch #3</td>
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<td>Batch #4</td>
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<td>Batch #5</td>
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- Initiated Salt Batch #5  
  9/5/12
- Salt Batch #6 Qualified  
  and Ready
- Salt Batch #7 Preparations  
  underway

* Note: In addition to ~2,800,000 gallons of De-liquidification, Dissolution, and Adjustment (DDA)
Operational Performance

- Better removal of cesium than the original design basis
- **Salt Batch #1**: improvements reduced precipitation of solids
- **Salt Batch #2**: increased salt feed flow rate, reduced ARP process cycle times by more than 50%
- **Salt Batch #3**: improved solvent monitoring, controls and process performance, reduced salt batch preparation cycle-time
- **Salt Batch #4**: improved the instantaneous salt feed flow rate by more than 2X, restored “used” solvent performance, increased process attainment, set processing records
- **Salt Batch #5**: Continuing to optimize the process and increase process attainment
Objectives:

- Extend salt processing capability until the Salt Waste Processing Facility (SWPF) starts up:
  - Replace high risk equipment
  - Improve equipment reliability and maintainability
  - Improve process operations and attainment
  - Life-cycle savings

Increase Attainment

Optimize the Process Flow-sheet

Upgrade Key Process Pumps to Improve Reliability

Modify Equipment to Facilitate Routine Maintenance

Rebuild MCU Centrifugal Contactors (Cesium Removal)

Improve Equipment Monitoring & Diagnostic Capability

Increase Preventative Maintenance

Procure Spare Parts & Equipment

ARP - Actinide Removal Process
Cs - Cesium
DWPF - Defense Waste Processing Facility
MST - Monosodium Titanate (Used for Actinide Removal)
MCU - Modular Caustic-Side Solvent Extraction Unit
SE - Strip Effluent (Concentrated cesium stream from MCU)
Lifecycle Enhancements: Contactor Cross Section
DOE is pursuing the development of a modified extractant (MaxCalix) which is more soluble in an improved 4 component solvent.

A significant amount of research, development, and testing has been completed (ORNL, SRNL, MCU, SWPF)

The new solvent improves organic-aqueous phase separation in the process (more efficient and equipment neutral)

Testing results show significant improvement in the removal of cesium.

Sets the stage for potential increased throughput (with some system modifications)

Initiate scheduled outage (in 2013) to implement the MCU “Next Generation Solvent”.
Summary

• The ARP/MCU process continues to provide successful interim salt processing since start-up in 4/08:
  - Helps reduce the lifecycle of the Salt Processing Program
  - Helps bridge the gap until the Salt Waste Processing Facility starts up
  - Enables continued optimization of the process flow-sheet
  - Provides valuable process, equipment and operational experience for the Salt Processing Program.

• The Lifecycle Enhancements sets the stage for extended ARP/MCU operations

• Implementation of the MCU-“Next Generation Solvent” will:
  - Provide a lower curie cesium waste stream to Saltstone for the extended life of MCU.
  - Provide valuable experience to support implementation and subsequent lifecycle savings for the Salt Processing Program.