



**Savannah River  
Remediation**

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# ARP/MCU Operating Performance and Lifecycle Enhancements



**Presented to the SRS Citizens Advisory Board  
January 29, 2013**

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SRR-TFO-2012-00092 Rev. 1

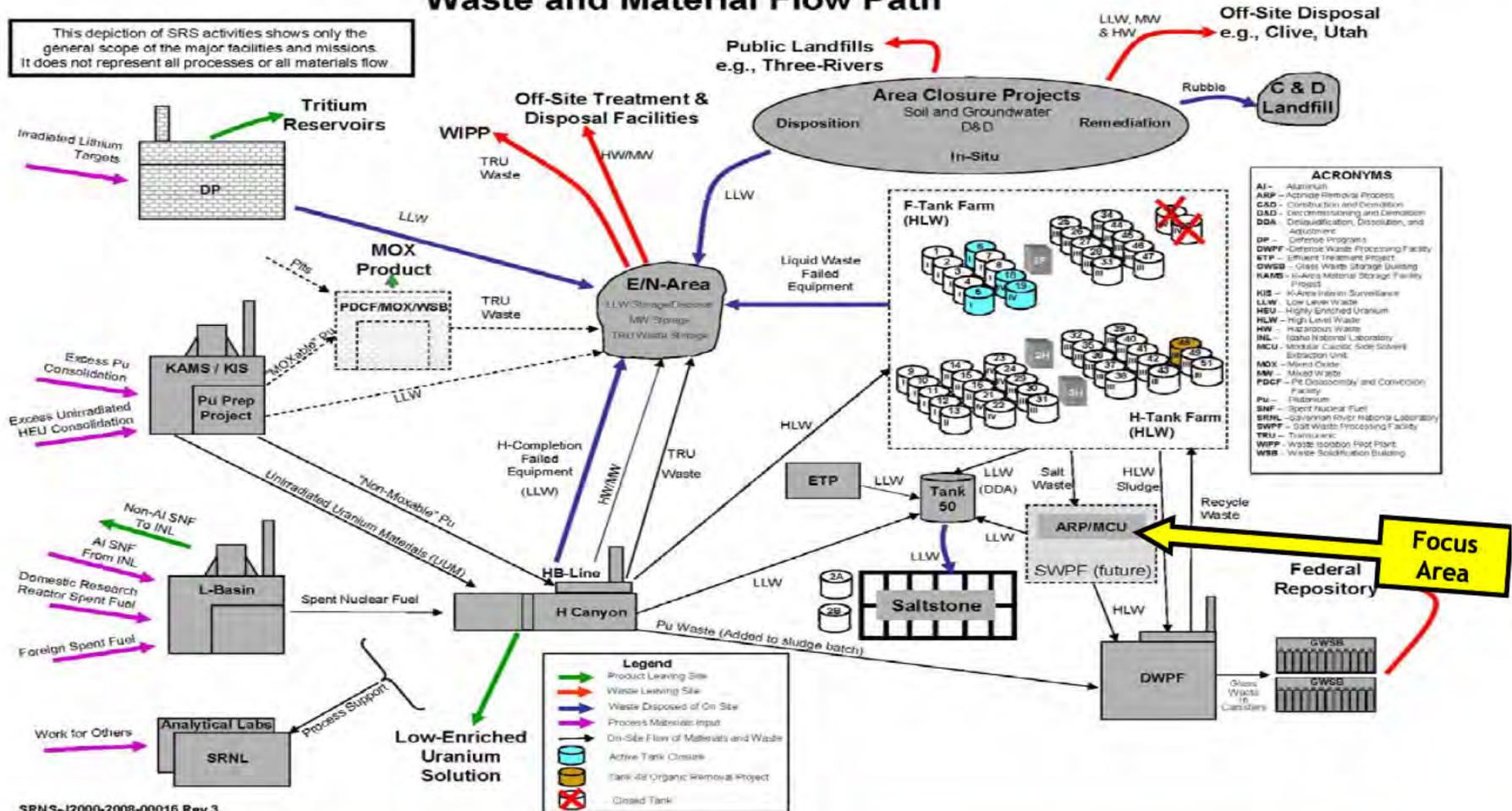
- Update the SRS Citizens Advisory Board regarding:
  - Operating Performance of the “Salt Disposition Project (SDP)”, also known as the “Actinide Removal Process (ARP) / Modular Caustic Side Solvent Extraction Unit (MCU)”
  - Lifecycle Enhancements to the ARP/MCU process

# Process Overview: Waste and Material Flow

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## Savannah River Site Waste and Material Flow Path

This depiction of SRS activities shows only the general scope of the major facilities and missions. It does not represent all processes or all materials flow.

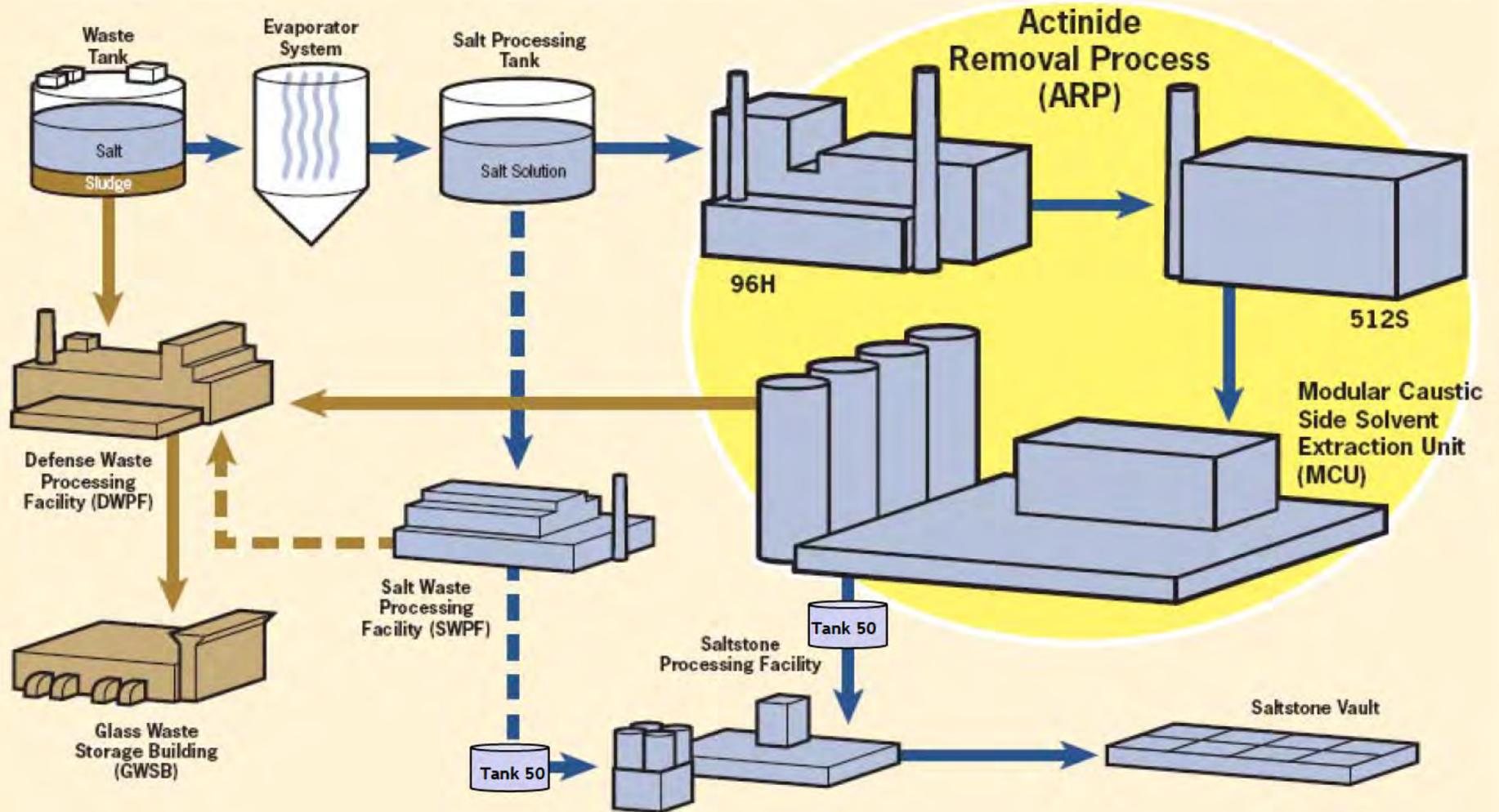


SRNS-J2000-2008-00016 Rev 3.

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- Process Overview
- Mission Timeline
- Integrated Processing Facilities
- Operational Performance
- Lifecycle Enhancements
- Summary

# Process Overview: SRR Salt Disposition

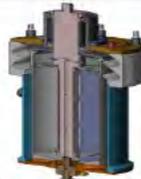


**SRR Mission: Store, Treat and Stabilize Legacy of Radioactive Waste**

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- 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**



**Equipment  
Fabrication / Testing**



**Construct  
Foundation**



**Construct Shielded  
Structures**



**Install Key  
Equipment**

Jan  
2004

Aug  
2004

Nov / Dec  
2004

Jan  
2005

2005

2006



**ARP-96H Cell  
Preparations**



**Complete Saltstone  
Modifications**

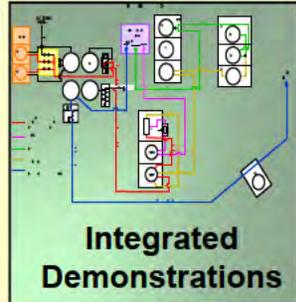


**Tie-in Transfer  
Lines**



**Complete Tank  
50 Modifications**

# ARP/MCU Mission Timeline



Feb / Mar 2007

Jul 2007

Sep 2007

Dec 2007

Jan / Mar 2008

Mar 2008

Apr 2008



# Integrated Processing Facilities



Actinide Removal Process (ARP)



Modular Caustic Side Solvent  
Extraction Unit (MCU)



Saltstone Facility



Tank Farm



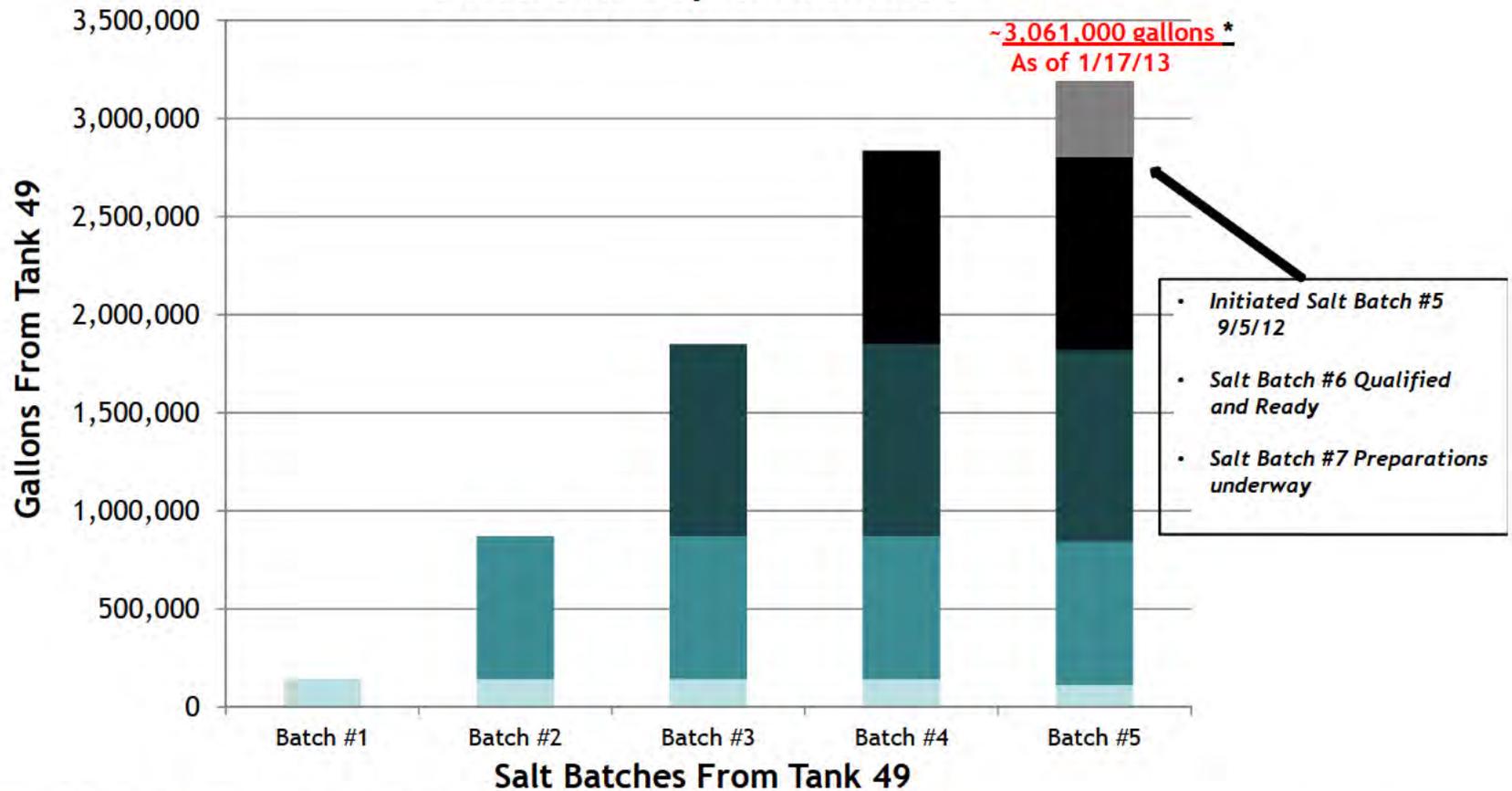
Evaporator



Defense Waste Processing Facility  
(DWPF)

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## Cumulative Gallons of Salt Processed From Tank 49 Since Start-up of ARP/MCU\*



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

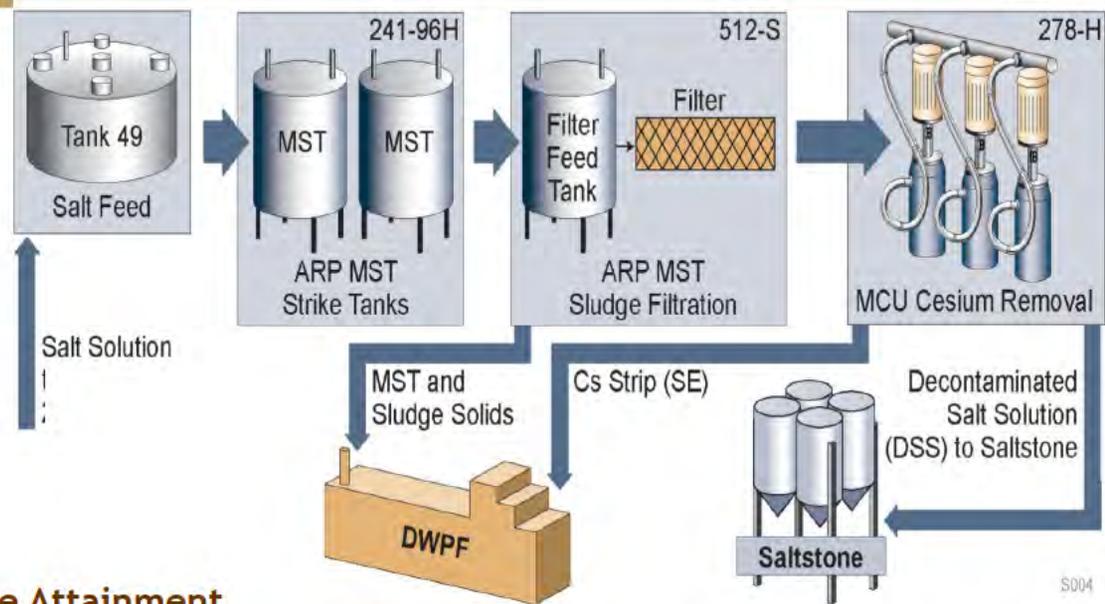
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- Better removal of cesium than the original design basis
- Salt Batch #1: improvements reduced precipitation of solids
- Salt Batch #2: increased salt feed flow rate, reduced ARP process cycle times by more than 50%
- Salt Batch #3: improved solvent 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

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## 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)

S004



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# Lifecycle Enhancements: MCU Process

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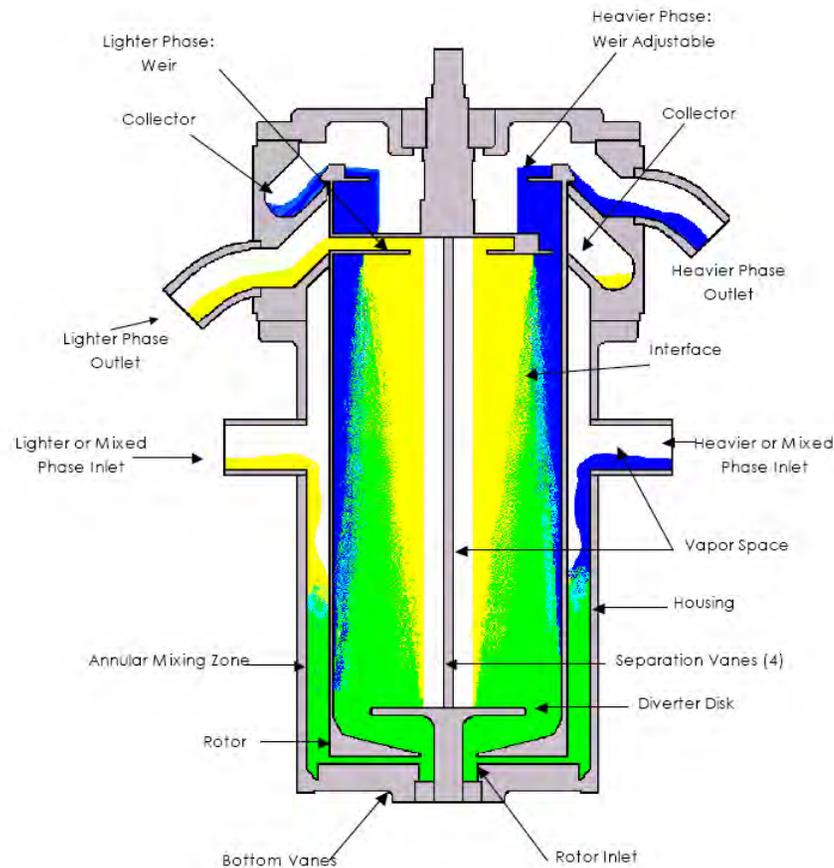
# Lifecycle Enhancements: MCU Contactors

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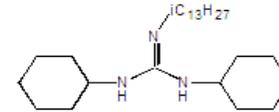
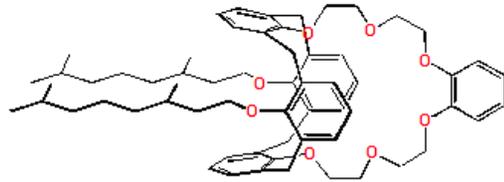
# Lifecycle Enhancements: Contactor Cross Section

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**MaxCalix**



**Guanidine**

- 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” .

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- 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.