Savannah River Remediation

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Savannah River Site (SRS) Experience with Preparing Salt Batches

Presentation to:
EM Waste Processing Technical Exchange

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Agenda

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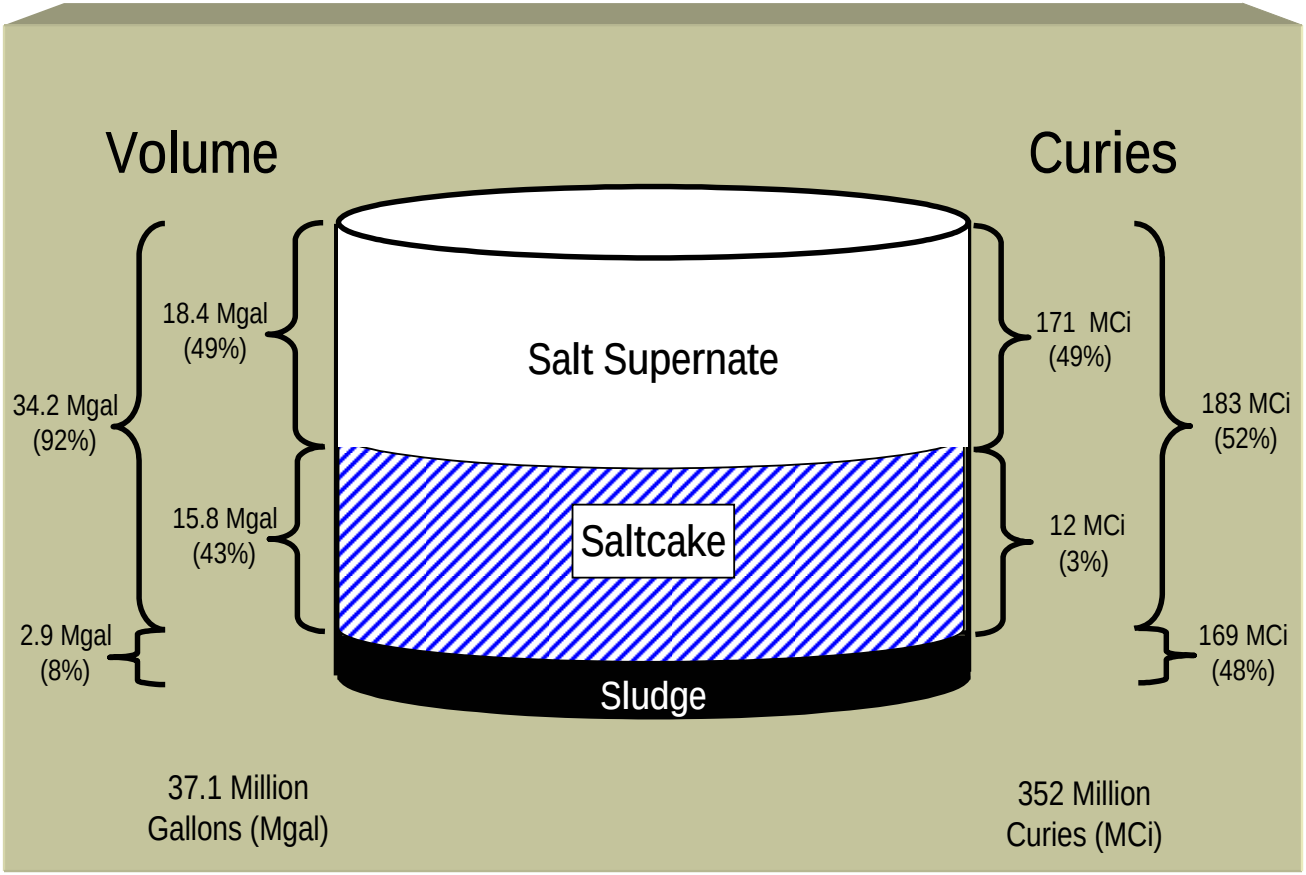
SRS Composite Inventory



Inventory values as of 2010-06-30

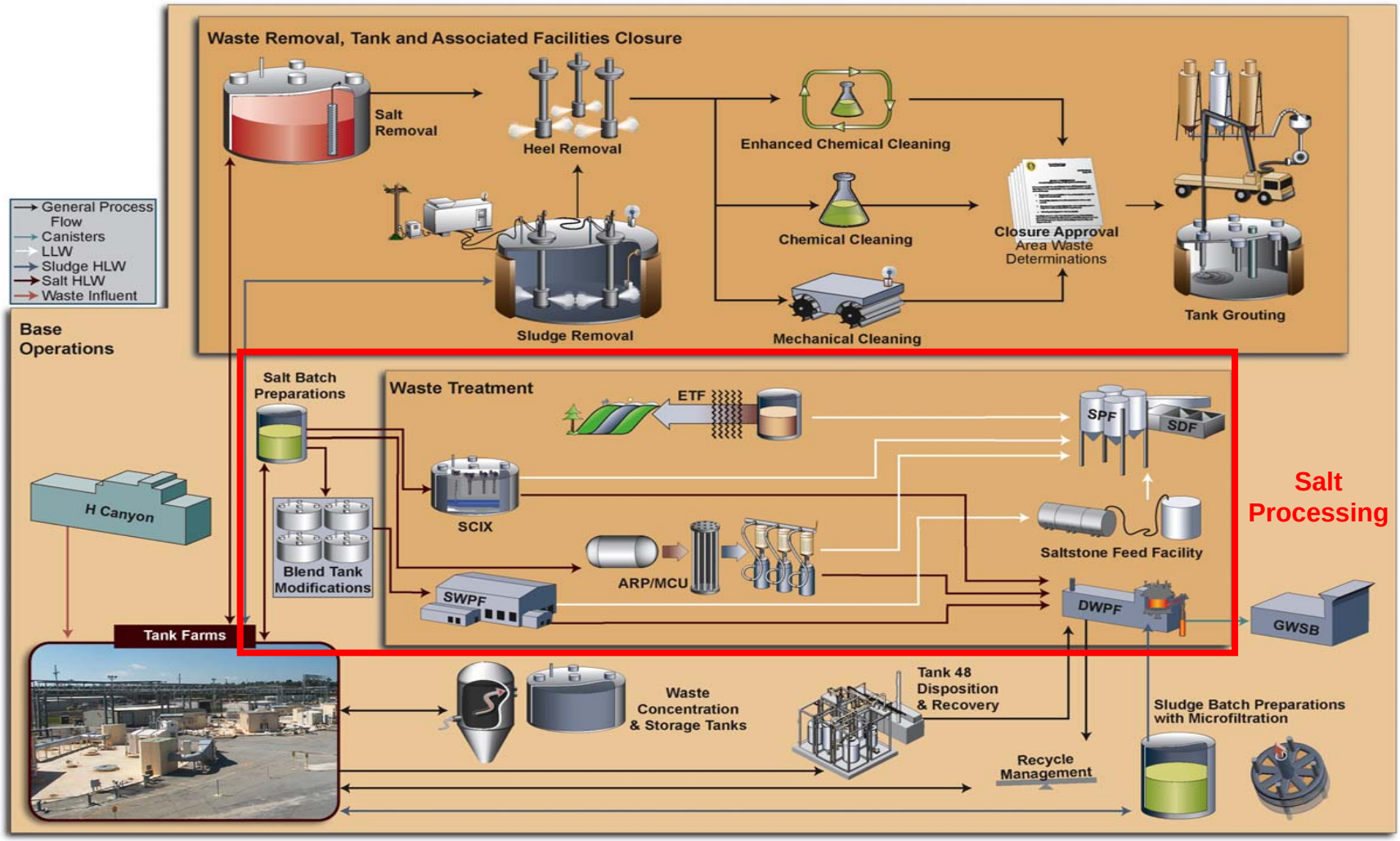
Salt Processing

- Plan is to process salt solution using a two phase, four-part process
  - 1st phase involves two parts to treat lower activity waste
    - Deliquification, Dissolution, and Adjustment (DDA)
      - Processing of minimal amount of low activity salt waste from Tk41
      - DDA is complete
    - Actinide Removal Process / Modular Caustic Side Solvent Extraction Unit (ARP / MCU)
      - ISDP – Interim Salt Disposition Project
      - Processing additional salt waste from 2H evaporator (concentrated liquor) and Tk25 / Tk41 dissolved salt solution
      - Next generation solvent will be used at MCU starting ~February 2012
  - 2nd and longer-term phase involves separation and processing of remainder (and by far majority) of salt waste
    - Small Column Ion Exchange (SCIX)
    - Salt Waste Processing Facility (SWPF)

Salt Processing (continued)

- Currently processing salt solution using ARP / MCU
  - Four batches prepared to date; three qualified
    - Qualification of fourth batch in progress
- ARP / MCU, SCIX, and SWPF batches
  - Documented in Salt Batch Plan and Liquid Waste System Plan
    - Support waste removal / sludge processing efforts
    - Meet salt processing facility feed specifications
    - Beneficially reuse existing waste

SRS Liquid Waste System



Background

- Tk49 is the feed tank to ARP / MCU facilities
- Salt batch must be qualified prior to transfer to ARP / MCU
- Qualification includes (among others)
  - Demonstration of compliance with Waste Acceptance Criteria (WAC) for 3 facilities
    - Tank Farm
    - Defense Waste Processing Facility (DWPF)
    - Saltstone Production Facility (SPF)
  - Hazard Category validation
  - Decontamination Factor (DF) demonstration
    - For cesium, strontium, and actinides
  - Nuclear Criticality Safety Evaluation (NCSE) compliance

Background (continued)

- ARP / MCU facilities are shutdown while salt batch is prepared / qualified in Tk49

- 1,122,616 gallons of salt solution processed via ARP / MCU to date
  - ISDP Salt Batch 1: 142,000 gallons
  - ISDP Salt Batch 2: 729,441 gallons
  - ISDP Salt Batch 3: 251,175 gallons

ISDP Salt Batch 1

- ISDP Salt Batch 1 consisted of
  - Tk49 heel (Tk41 dissolved salt solution)
  - Tk23 supernate
- Two sets of samples obtained to accelerate qualification process
  - Batch qualification sample obtained from Tk49 after all additions were made
  - NCSE sample obtained from Tk49 after 43 days of settling
    - NCSE required salt solution in Tk49 to have an Eq. U-235 fissile mass ≤ a single subcritical U-235 (eq) mass accumulated within ARP / MCU boundary
- ARP / MCU downtime of ~3 months due to salt batch preparation / qualification process

ISDP Salt Batch 1 (continued)

- Team established to identify opportunities to streamline salt feed preparation process to decrease cost and schedule
  - Moving sample point of compliance upstream of feed tank to source tanks provided largest opportunity for schedule improvement
    - This recommendation was implemented for ISDP Salt Batch 2 and future batches
  - Other recommendations made by the team were not implemented for ISDP Salt Batch 2

ISDP Salt Batch 2

- ISDP Salt Batch 2 consisted of
  - Tk49 heel (ISDP Salt Batch 1)
  - Tk25 / Tk41 dissolved salt solution (via Tk41)
  - Tk22 (DWPF recycle)
  - Caustic
- Qualification samples obtained from source tanks (Tk22 and Tk41) to accelerate qualification process
  - Samples combined in lab with a Tk49 ISDP Salt Batch 1 sample based on blend calculation (for volumes)
- Caustic added to Tk49 to prevent precipitation of solids

ISDP Salt Batch 2 (continued)

- NCSE sample obtained from Tk49 after 38 days of settling
  - NCSE required salt solution in Tk49 to have an Eq. U-235 fissile mass ≤ a single subcritical U-235 (eq) mass accumulated within ARP / MCU boundary
- ARP / MCU downtime of ~3 months due to salt batch preparation / qualification process
  - Some downtime attributed to equipment failure
- Six Sigma Process Improvement Project (PIP) sponsored by Savannah River Remediation management
  - Goal was to reduce downtime by 50%
  - Recommendations implemented in support of ISDP Salt Batch 3 preparation / qualification effort

ISDP Salt Batch 3

- ISDP Salt Batch 3 consisted of
  - Tk49 heel (ISDP Salt Batch 2)
  - Tk21 (DWPF recycle)
  - Tk23 (Tk25 / Tk41 dissolved salt solution)
  - Tk24 concentrated salt solution
  - Caustic
- Qualification samples obtained from source tanks (Tk21, Tk23, and Tk24) to accelerate qualification process
  - Samples combined in lab with a Tk49 ISDP Salt Batch 2 sample based on blend calculation (for volumes)

ISDP Salt Batch 3 (continued)

- Impacting improvements
  - NCSE revised to credit enrichment vs. fissile mass controls
    - Allowed samples from source tanks (vs. feed tank) to be used to demonstrate compliance
      - Nuclear Criticality Safety Assessment used range of transfer / heel volumes
    - No settling required in Tk49 prior to processing salt batch in ARP / MCU
  - Tk21 utilized as a blend tank
    - Qualification based on blend using source tank sample analytical results and projected ISDP Salt Batch 2 heel
      - Two cases evaluated and most conservative used
    - Confirmatory sample used to validate the blend
  - ARP / MCU downtime due to salt batch preparation / qualification reduced

ISDP Salt Batch 3 (continued)

- Caustic added to Tk49 to prevent solids precipitation
- ARP / MCU downtime reduced to ~1 month
  - Time required to transfer qualified salt solution from Tk21 to Tk49
  - Time required to add caustic to Tk49
  - Time required to mix the salt batch in Tk49
  - Time required to obtain confirmatory sample

ISDP Salt Batch 4

- ISDP Salt Batch 4 will consist of
  - Tk49 heel (ISDP Salt Batch 3)
  - Tk21 (ISDP Salt Batch 3 without Tk49 heel)
  - Tk23 (Tk25 / Tk41 dissolved salt solution)
  - Tk24 (concentrated salt solution + DWPF recycle in Tk22)
  - Caustic
- Caustic added to Tk21 (vs. Tk49) to prevent solids precipitation
  - Added prior to obtaining qualification sample
  - Reduces ARP / MCU downtime due to salt batch preparation / qualification

ISDP Salt Batch 4 (continued)

- Qualification sample obtained from Tk21 (Blend tank)
  - Minimizes analytical time and number of analysis
  - Samples combined in lab with a Tk49 ISDP Salt Batch 3 sample based on blend calculation (for volumes)
  - Will be used to demonstrate compliance with NCSE (enrichment control)
- ARP / MCU downtime projected to be reduced to less than 1 month
  - Time required to transfer qualified salt solution from Tk21 to Tk49
  - Time required to mix the salt batch in Tk49
  - Time required to obtain confirmatory sample

Future Salt Batches

- Future salt batches to be processed through ARP / MCU are expected to use same strategy as that used for ISDP Salt Batch 4
  - Other potential improvements are being evaluated
  - DWPF recycle used to dissolve salt (vs. inhibited water)
    - Beneficially reuses recycle and reduces waste generation
- Sampling and qualification strategy for future SCIX batches is in progress
- Sampling and qualification strategy for future SWPF batches documented in a Waste Compliance Plan

Summary

- DWPF recycle used for salt dissolution (vs. inhibited water)
- ARP / MCU downtime due to salt batch preparation / qualification reduced by
  - Batches prepared and qualified in a blend tank vs. feed tank
  - Caustic (if required) added to blend tank
  - New criticality safety strategy implemented
    - Enrichment vs. fissile mass controls
- Additional opportunities under evaluation

QUESTIONS?