Tank Closure Cesium Removal (TCCCR) Technology
Demonstration Update

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Status Update
May 7, 2019
Outline

- TCCR Drivers, Benefits and Opportunities
- TCCR Process Diagram, Layout and Photos
- Technology Demonstration Objectives
- Timeline
- Technology Demonstration - Baseline Plan for Waste Removal Campaigns
  - Campaign 1
  - Campaign 2
  - Moving Forward
Project Drivers

- Address the Dispute Resolution Agreement with the State of South Carolina, dated October 31, 2016
- Achieve completion of Tank 10 Bulk Waste Removal Efforts under the Federal Facility Agreement (FFA)
- Commitment to extend TCCR treatment to Tank 9 under FFA
TCCR Benefits/Opportunities

• Supplement salt waste treatment and accelerate waste removal from old style tanks.

• Demonstrates deployment of modularized, targeted treatment capability.

• Capability to treat unfavorable waste streams anticipated at the end of the program, in lieu of SWPF.
  – Could eliminate DWPF recycle returns to the Tank Farm.

• Applicability to other DOE complex sites.
  – Hanford is pursuing Tank Side Cesium Removal (TSCR)
SRS Liquid Waste Program

Legend:
- ARP: Actinide Removal Process
- BWRE: Bulk Waste Removal Efforts
- DWPF: Defense Waste Processing Facility
- ISS: Interim Safe Storage
- MCU: Modular Caustic Side Solvent Extraction Unit
- TCCR: Tank Closure Cesium Removal
- SWPF: Salt Waste Processing Facility

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

51 Tanks
- 8 grouted & operationally closed
- 1.2 million curies immobilized in grout
- 5 BWRE complete
- 66% empty or grouted (old style)
- 23% empty (new style)

Poured 4,179 cans of projected 8,170
61.2 million curies immobilized in glass

17.2 Mgal LLW dispositioned containing 734 kCi
(<35 Mgal grout)

<1% radionuclides remain in tanks

Most radionuclides to glass

<<1% radionuclides to saltstone

Salt waste

Salt Processing

8 Tanks Cleaned and Closed

<1% radionuclides remain in tanks

43 tanks
35 Mgal
248 MCi

4.3 Mgal treated

2018-12-31
TCCR Unit 1: Conceptual Process Diagram

- **Utilities (by SRR)** (i.e., electricity, water)
- **Salt Dissolution Unit (by SRR)**
- **Pre-filter flush return**
- **Transfer pump and line to flange connection (by SRR)**

**TCCR Concept – Tank 10 Demonstration Operations Diagram**

- **Tank 10H**: Dissolved Salt
- **Tank 11H**: Interim Safe Storage System
- **Tank 50H**: Saltstone Production Facility

**Key Processes**
- **Cs-rich media & vessels**: Interim Safe Storage System
- **Systems, structures, and components inside the dashed line (including containment)** by Supplier
- **Pre-filter flush return**
- **Decontaminated Salt Solution**
H-Area Tank Farm TCCCR Unit 1 Layout
TCCR Process & Ventilation Skids
TCCR Transfer Lines

View of Transfer Lines at TCCR

View of Transfer Lines at Tank 10
Interim Safe Storage (ISS)
Technology Demonstration Objectives

- Treat approx 750 kgal (~0.16 Ci/gal) from Tank 10.
- Each IX Column will be loaded with approx 25k Curies.
- Demonstrate a decontamination factor ≥ 1000.
- Gather actual processing data during treatment:
  - Effectiveness of pre-filtration
  - Variations in processing rate
  - Measurement of real rad rates
  - Optimize feed control strategy
- Evaluate technical feasibility and economic efficiency report by September 30, 2019 for continued operations and additional TCCR.
  - Decontamination Factor
  - Worker and public safety, Compliance with applicable regulations
  - Ability to result in beneficial (accelerated) liquid waste disposition
### TCCR (Tank 10) Project Timeline

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**Notes:**
- **100% Design Complete (6/2017):**
- **Feasibility Milestone:** (09/30/19)
- **BWRE Complete Milestone:** (11/30/19)
- **Start Ops:** (01/2019)
- **DSA Submission:** (08/2018)
- **BOP Design Complete (07/2017):**
- **BOP Installation:**
- **BOP Design Complete:** (07/2017)
- **Safety Basis Development:**
- **Feasibility Study:**
- **Progress/Complete:**
- **SRR Activity:**
- **Westinghouse Activity:**

**Dates:**
- **11/30/19:** BWRE Complete Milestone
- **09/30/19:** Feasibility Milestone
- **01/31/19:** BWRE Start Milestone
- **08/2018:** DSA Submission
- **02/2018:** FAT Complete
- **01/2019:** Start Ops
Schedule Notes for Each Campaign:

- Specific gravity of salt solution will be monitored during recirculation to ensure minimum target value is achieved. Duration of recirculation period may vary between campaigns. Later campaigns may require longer recirculation times.
- Tank conditions will be monitored during suspension of CST coupon in Tank 10H to verify tank temperature remains within assumed range.
- After suspension in Tank 10H, CST sample will be transported to SRNL for analysis.
- Results of sample analysis will be compared against DSA assumptions prior to initiating TCCR operations. Schedule shown assumes analysis within required limits and no additional adjustments necessary.
- TCCR processing assumes 5 gpm nominal processing rate.

Assumed Campaign Details

Add Water / Recirculate Tank 10 Contents
- 10-days

Suspend CST Coupon in Tank 10
- 10-days

Sample Analysis @ SRNL
- 21-days

Proceed with Processing?

TCCR Processing
- 14-days

Total Cycle = 55 days
Technology Demonstration Status – Campaign 1

• Early Start - Campaign 1 started 11/8/18 by adding ~ 150 kgal water, recirculated for 10 days & deployed CST samples
  – Analysis indicated low sodium concentration and batch remediation required to increase sodium
  – Confirmed presence of a low solubility salt layer in the tank (e.g., burkeite)
  – High calcium content

• Batch remediation completed by adding 5 tankers of sodium hydroxide – Batch 1A
  – CST coupon re-deployed and accepted (within DSA requirements)

• Operations began January 16th, 2019 and completed on February 15th
  – Indicated Decontamination Factor over 5000 for 1st batch

• Takeaways
  – The TCCR equipment functioned as designed
  – No operational stoppages due to TCCR equipment issues
  – Modify salt dissolution plan for the burkeite
    • Prior experience removing burkeite from Tank 4
  – Reduce calcium content by using domestic water
Technology Demonstration Status – Campaign 2

• Modified salt dissolution path forward accommodate burkeite
  – Smaller batch size (3 – 25 kgal) with recirculation between water adds
• Initiated Campaign 2 on 2/23/19 by adding ~ 25 kgal water and recirculated
• Added an additional 25 kgal water on 3/6/19 and recirculated
  – Did not add a 3rd 25kgal micro-batch
• Density measurements taken 3/12; 3/21; 3/25; 4/3; 4/15 and 4/22 indicating continual, but slow progress in salt/burkeite dissolution
• Final density check planned for 4/26 and CST coupons will be deployed
• Expectations
  – The TCCR equipment will continue to function as designed
  – Continued similar decontamination factors
  – Campaign 2 feed stream more favorable than Campaign 1
Technology Demonstration Status – Moving Forward

- Dissolution rates for Campaign 3 expected to be similar to Campaign 2
- Continue to dissolve salt/burkeite
  - Smaller batch size with incremental water additions and recirculation
- Future campaigns will be adjusted based on Campaign 3 progress
- Plan to return to larger campaigns after burkeite is removed to dissolve remaining salt if feasible
- It is expected the TCCR IXCs will achieve a point of inefficiency with future campaigns
- Tank 9 salt waste will be transferred to Tank 10, qualified for TCCR and processed – known as TCCR-1A
- TCCR Unit 2 Conceptual planning to be conducted in FY19