



U.S. DEPARTMENT OF  
**ENERGY**



# Tank Closure Cesium Removal (TCCR) Technology Demonstration Update

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*Status Update*

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# Outline

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- 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

# Tank Closure Cesium Removal

## 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



Shielded Ion Exchange Column  
(Dimensions 12'x5.5' Shielded)

## TCCR Benefits/Opportunities

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- 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

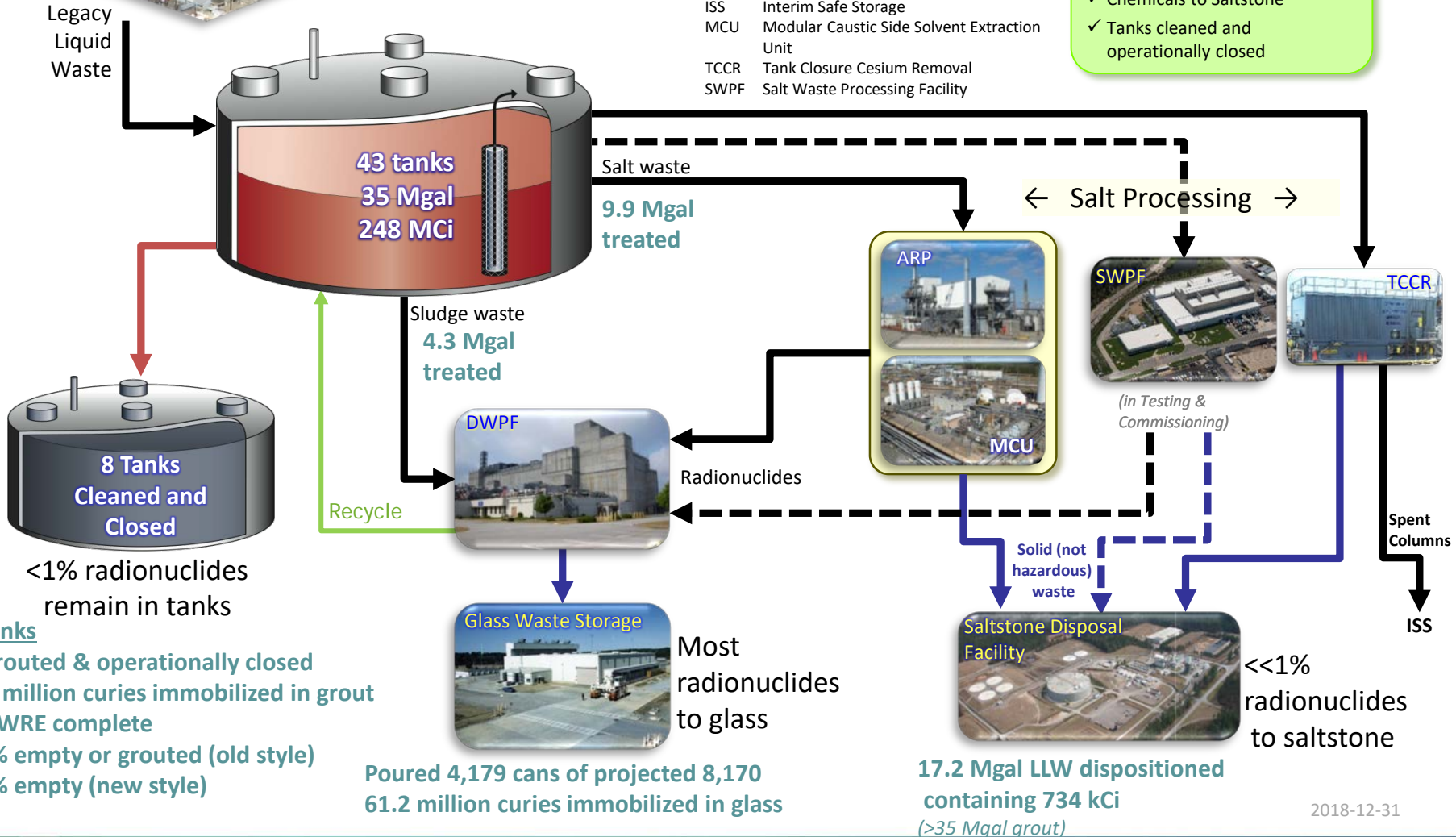


**Legend:**

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)

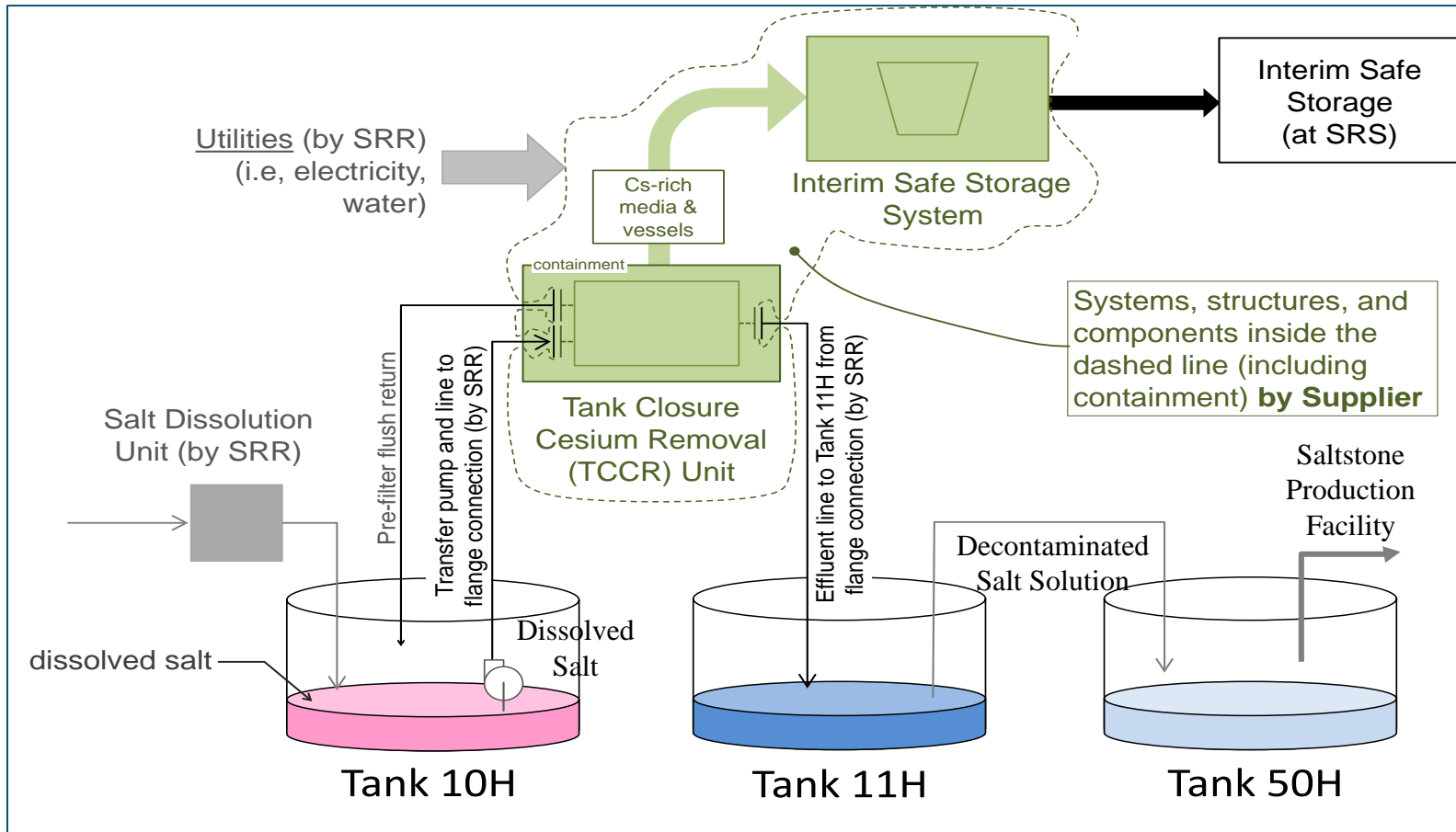
Poured 4,179 cans of projected 8,170  
61.2 million curies immobilized in glass

17.2 Mgal LLW disposed containing 734 kCi  
(>35 Mgal grout)

<<1% radionuclides to saltstone

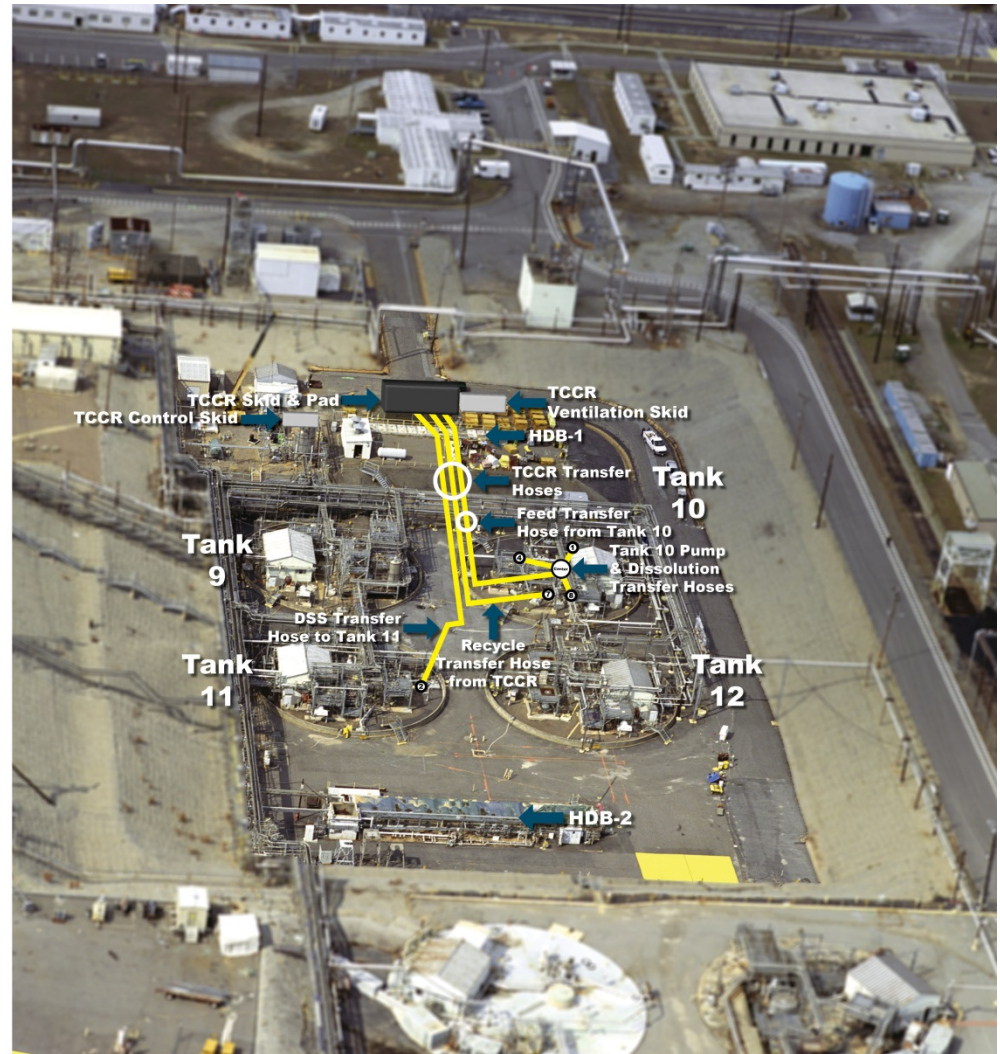
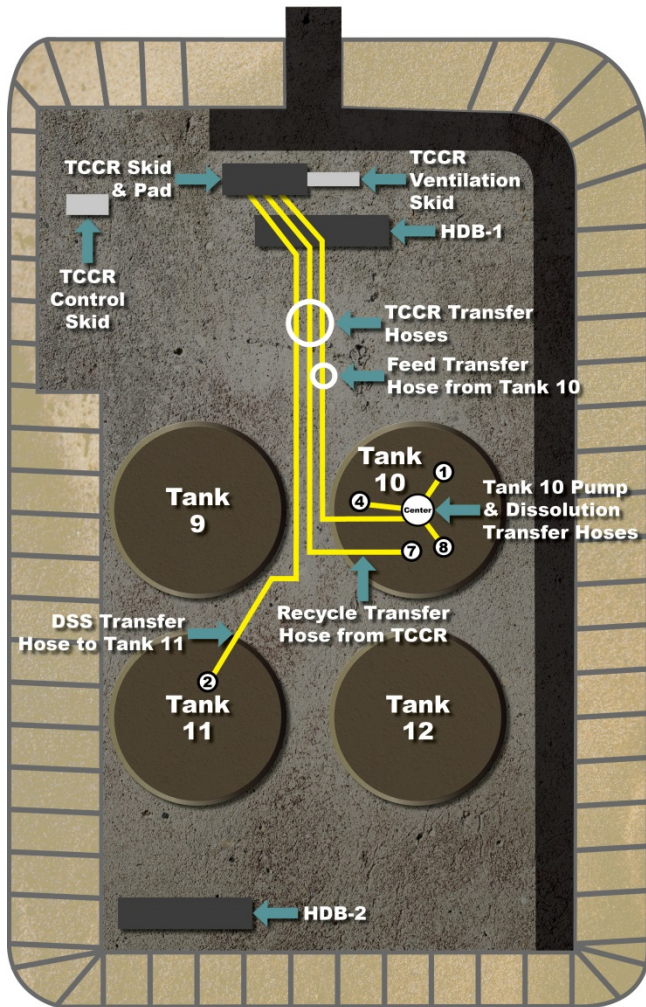
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# TCCR Unit 1: Conceptual Process Diagram



TCCR Concept – Tank 10 Demonstration Operations Diagram

# H-Area Tank Farm TCCR Unit 1 Layout



# TCCR Process & Ventilation Skids





# TCCR Transfer Lines



View of  
Transfer Lines  
at TCCR



View of  
Transfer Lines  
at Tank 10

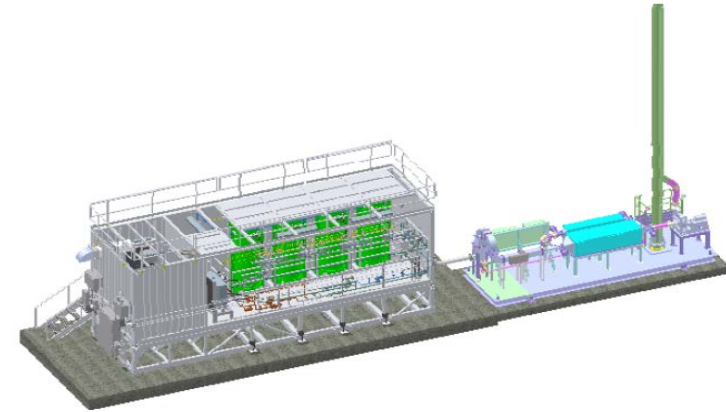


# Interim Safe Storage (ISS)



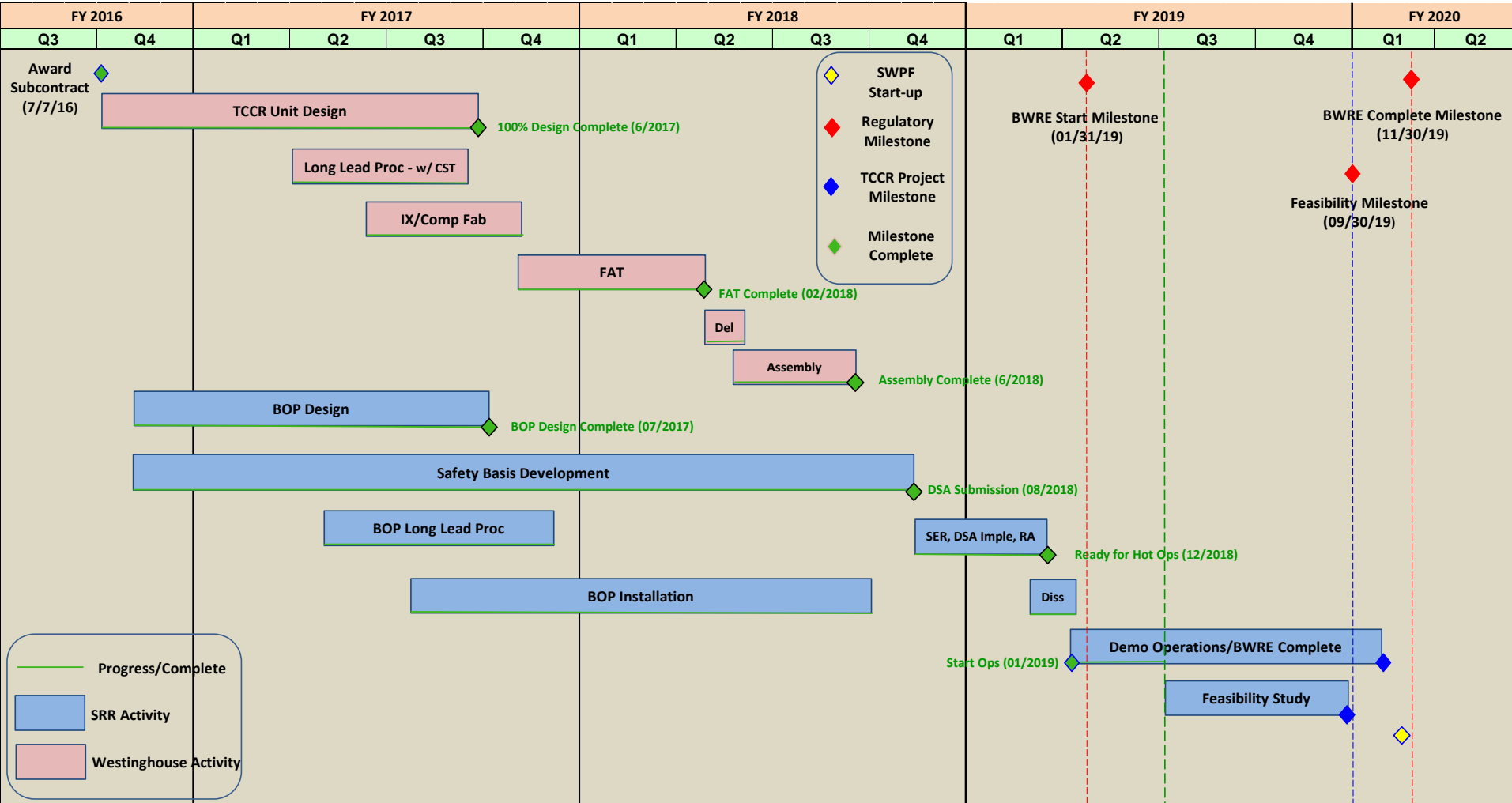
# Technology Demonstration Objectives

- 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  $\geq 1000$ .**
- **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

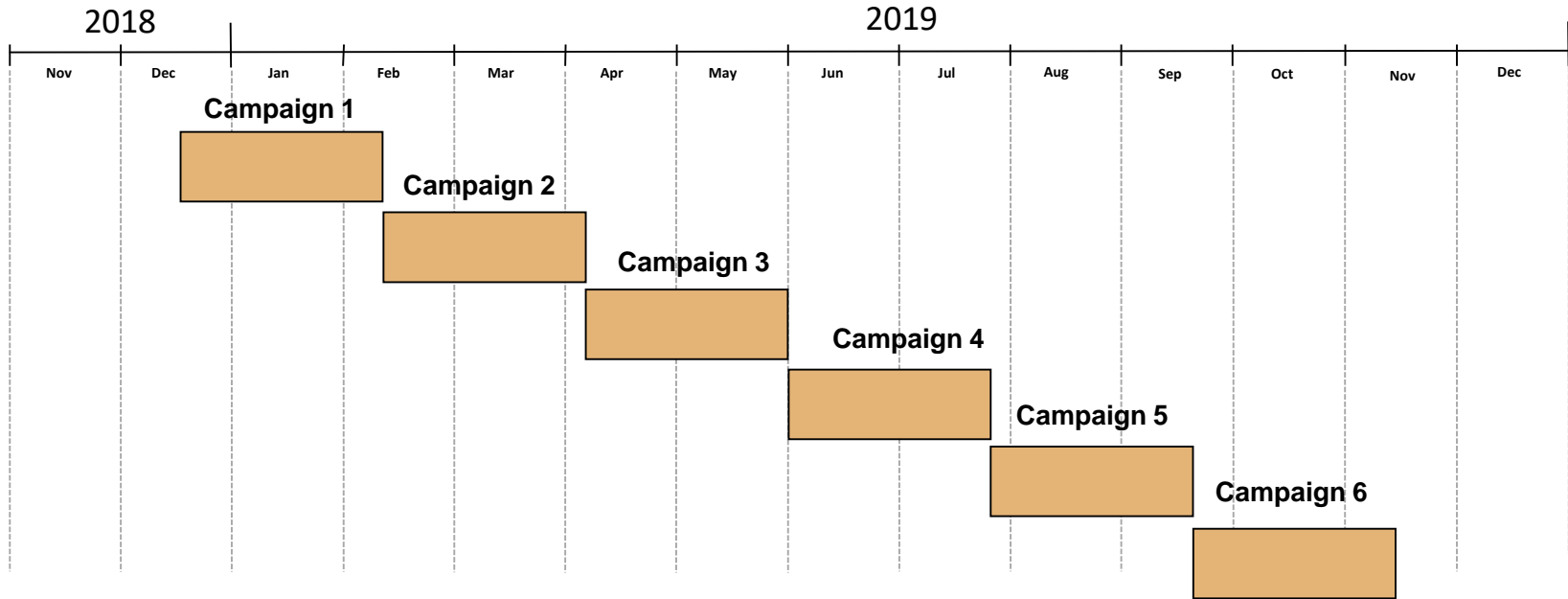


TCCR Module Enclosure Assembly  
(Enclosure Dimensions 40'x10')

# TCCR (Tank 10) Project Timeline

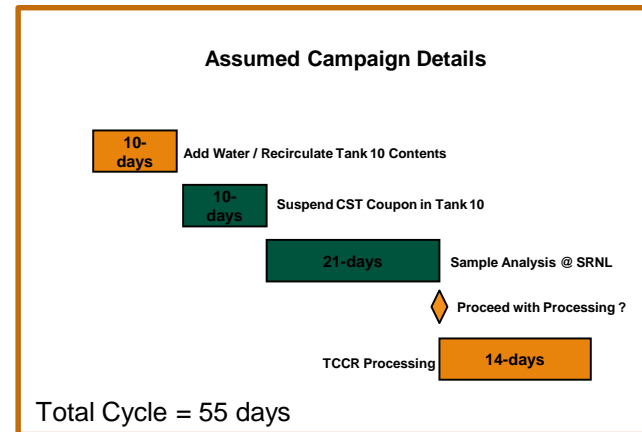


# Technology Demonstration - Baseline Plan for Waste Removal Campaigns



## 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.



# Technology Demonstration Status – Campaign 1

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- **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 16<sup>th</sup>, 2019 and completed on February 15<sup>th</sup>**
  - Indicated Decontamination Factor over 5000 for 1<sup>st</sup> 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

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- **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 3<sup>rd</sup> 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

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- 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