



U.S. DEPARTMENT OF  
**ENERGY**

OFFICE OF  
**ENVIRONMENTAL  
MANAGEMENT**

# Idaho's Experience with Tank Waste Management

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**Jack Zimmerman**

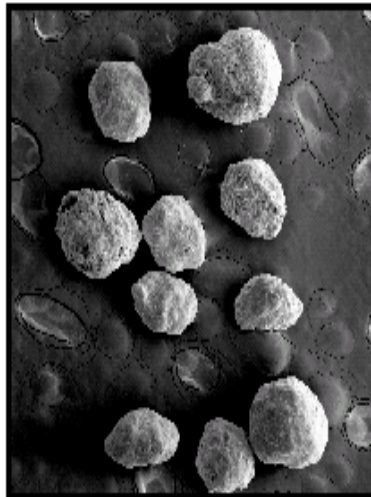
*Deputy Manager*  
Idaho Cleanup Project

**March 8, 2017**

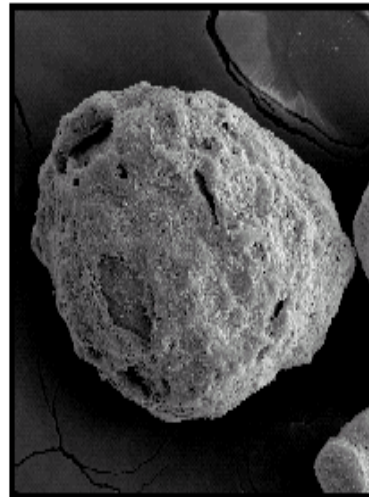
# The Wastes We Manage

- ~ 4,400 cubic meters of calcine (solidified high-level waste from reprocessing).
- ~ 900,000 gallons of liquid sodium-bearing waste (D&D solutions from operations, very small amount of second and third cycle raffinate).

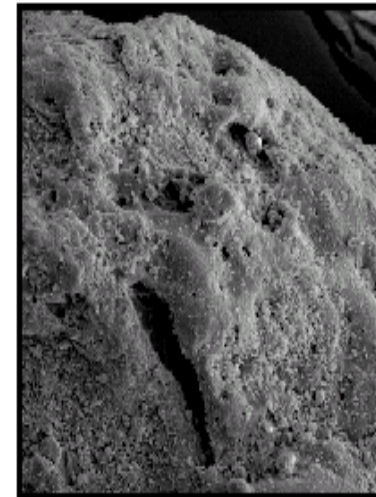
Calcine Bed Material 40x



Calcine Bed Material 150x



Calcine Bed Material 500x

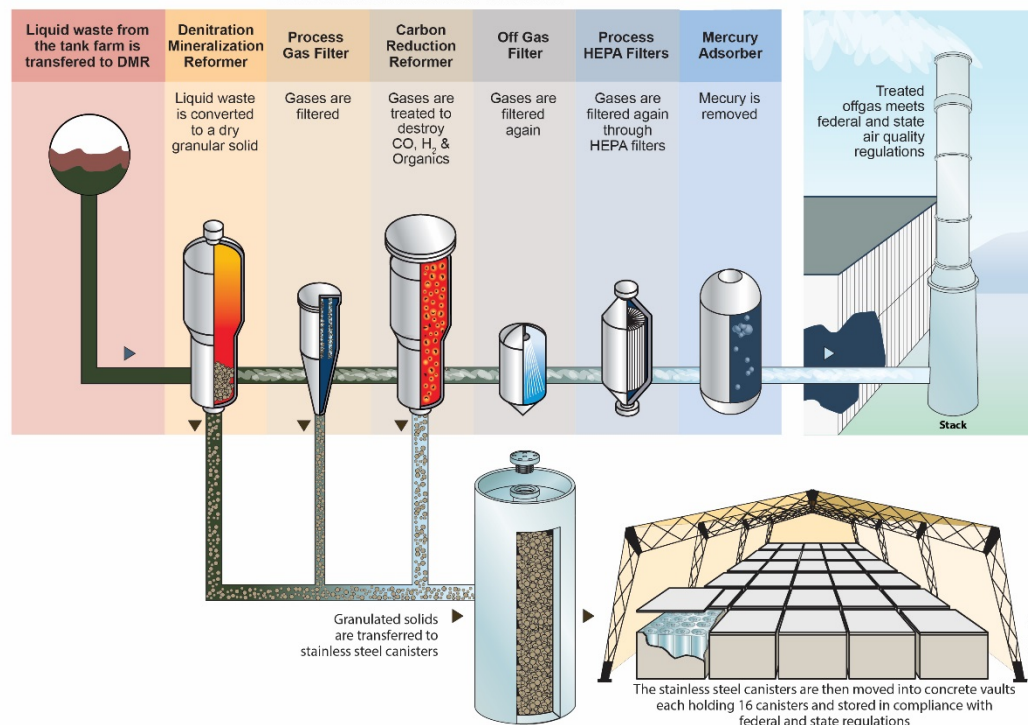


# Regulatory Framework

- Idaho Settlement Agreement: Establishes Milestones for High-Level Waste Treatment.
- Site Treatment Plan: Establishes Milestones, Including Interim Steps, for Treatment of Mixed Waste.
- Notice of Noncompliance/Consent Order: Establishes Milestones for Treatment of Sodium Bearing Liquid Waste/Tank Farm Cease Use.

# Status of Tank Wastes

IWTU Treatment Process Overview



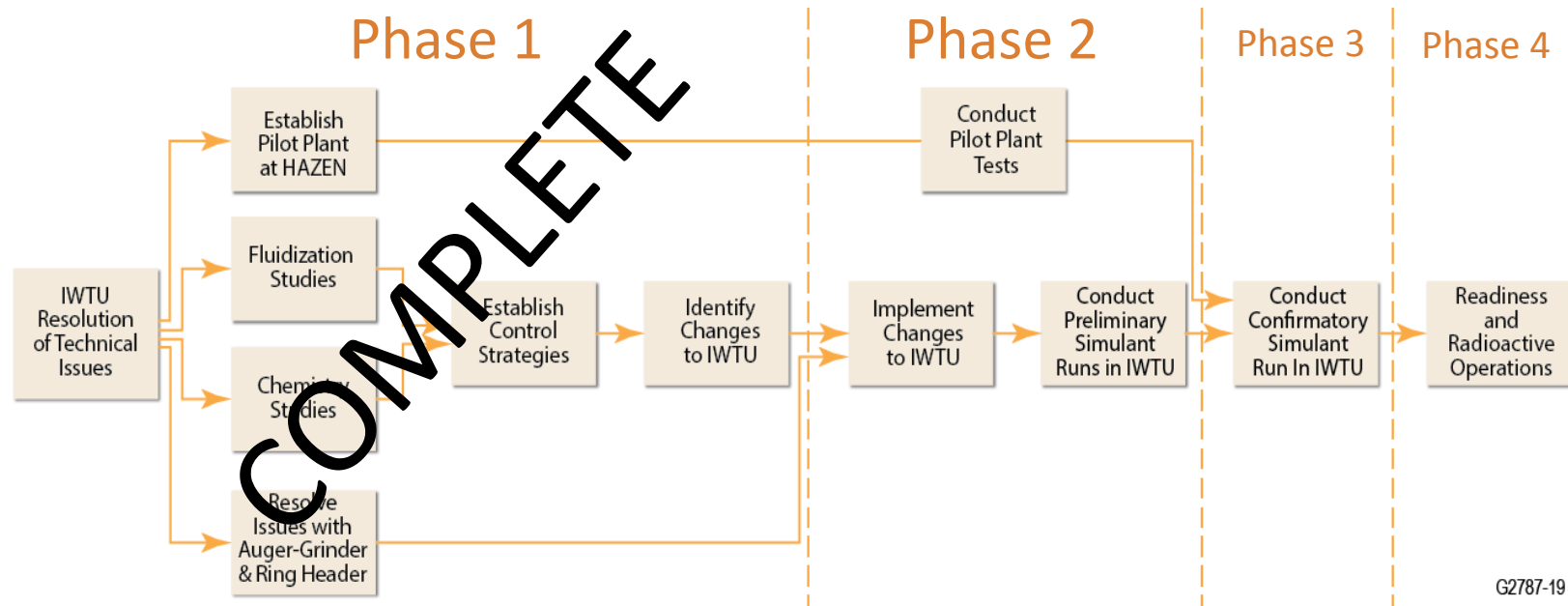
## Sodium Bearing Waste

- Integrated Waste Treatment Unit designed and constructed.
- Original date to complete treatment of waste was Dec. 31, 2012. (ISA/NON/CO)
- Renegotiated date to begin treatment by Sept. 30, 2016.
- Fluor Idaho came on board as contractor in June 2016.





# Fluor Idaho IWTU Phased Approach



- Phase 1 completed in October 2016
- Simulant demonstration run planned for 20 days.
  - Focused on auger-grinder performance testing.

## Overall Phase 1 Observations

Based on input from the Phase 1 Technical Review Group and tests completed to date, the challenges encountered at IWTU can be broken down into two distinct areas:

- Chemical/physical – mainly associated with the fluidization process and wall scale in the Denitration Mineralization Reformer.
- Mechanical/equipment – in relation to the auger-grinder and ring header.



## Phase 1 Results on Chemical/Physical Challenges

- Fluidization studies in conjunction with chemistry studies (on product and scale) identified modifications and process changes to improve fluidization, stabilize process control and address slow waste feed conversion to product.
- Particle size control is critical for stable operations.
- Waste feed droplet studies complete. Results to be evaluated regarding optimal waste feed rate for adequate product conversion.

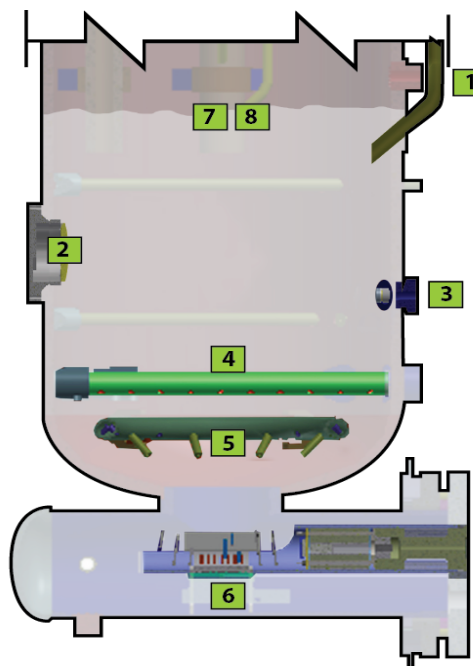




# Causes and Solutions from Phase 1 Analysis

Wall Scale	
Observation	Wall Scale
Impact	Build-up of Scale Deposits
Root Cause	Slow Conversion of Feed
Solution	Reduce the Feed Rate Use all Three Waste Feed Injectors Increase DMR Operating Temp Increased DMR Bed Depth
<b>3</b>	<b>7</b> <b>8</b>

Formation of Sandcastles	
Observation	Sandcastles / Agglomerations
Impact	Temperature and Fluidization Instabilities
Root Cause	Slow Conversion of Waste Feed Insufficient Fluidization Insufficient Particle Size Control
Solution	Refine Fluidization Strategy Modify Fluidizing Gas Rails Implement Seeding Control Requires Manway Access Insure sufficient CO <sub>2</sub>
<b>1</b> <b>2</b> <b>3</b> <b>4</b>	<b>5</b>



DMR Instabilities	
Observation	Temperature Excursions
Impact	Instabilities, Shutdowns
Root Cause	Defluidization Channeling of Gases Wall Scale
Solution	Refine Fluidization Strategy Modify Fluidizing Gas Rails Implement Particle Size Control
<b>1</b> <b>4</b> <b>5</b> <b>7</b>	<b>8</b>

Ring Header Damage	
Observation	Erosion of Ring Header
Impact	Breach Would Defluidize DMR
Root Cause	Jet from Fluidizing Gas Rails
Solution	Modify Fluidizing Gas Rails Replace Ring Header Requires Manway Access
<b>2</b> <b>4</b> <b>5</b>	

Auger Grinder Failure	
Observation	Auger-Grinder Locked Up
Impact	Inability to Transfer Product Results in Plant Shutdown
Root Cause	Build-up on Rotating Parts Insufficient Mechanical Design Lack of Adequate Purge
Solution	Auger Grinder Root Cause Analysis Industry Expert Consultant Extensive Prototype Testing Improved Purge Gas Strategy Improve Mechanical Design Recovery Capability
<b>6</b>	

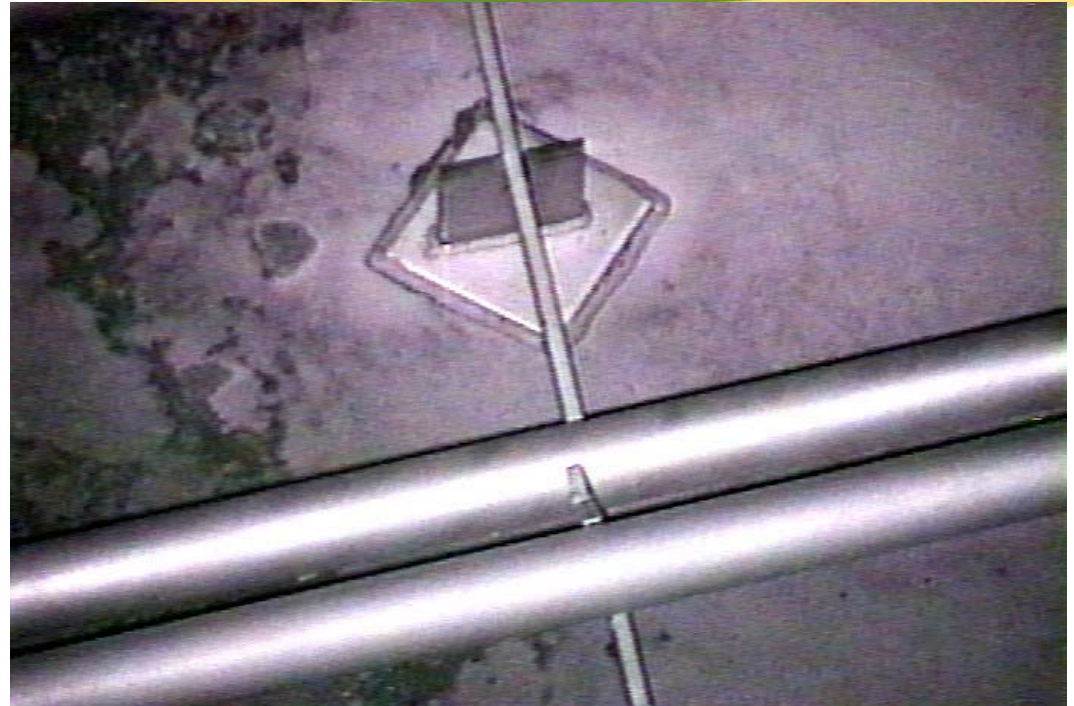
DMR Modifications	
<b>1</b>	Seeding Size Control
<b>2</b>	Manway
<b>3</b>	Waste Feed Injector
<b>4</b>	Fluidizing Rails
<b>5</b>	Ring Header
<b>6</b>	Auger-Grinder
<b>7</b>	Increase DMR Temperature
<b>8</b>	Increase Bed Height

G2787-10 Rev5



# Tank Closure

- Idaho has cleaned and closed 11 of 15 liquid waste storage tanks on site – seven 300,000-gallon tanks, four 50,000-gallon tanks.
- The tanks were closed using a risk-based closure approach. Waste was pumped out to the heel, then a wash ball was used to rinse out as much waste as possible. Finally, grout was poured to displace as much remaining liquid as possible.
- The tanks were filled with grout as the final step of closure.
- Four tanks remain in use (one is kept empty as a spare), and they will be closed once the remaining waste is treated in IWTU.



Inside of a high-level waste tank after cleaning.

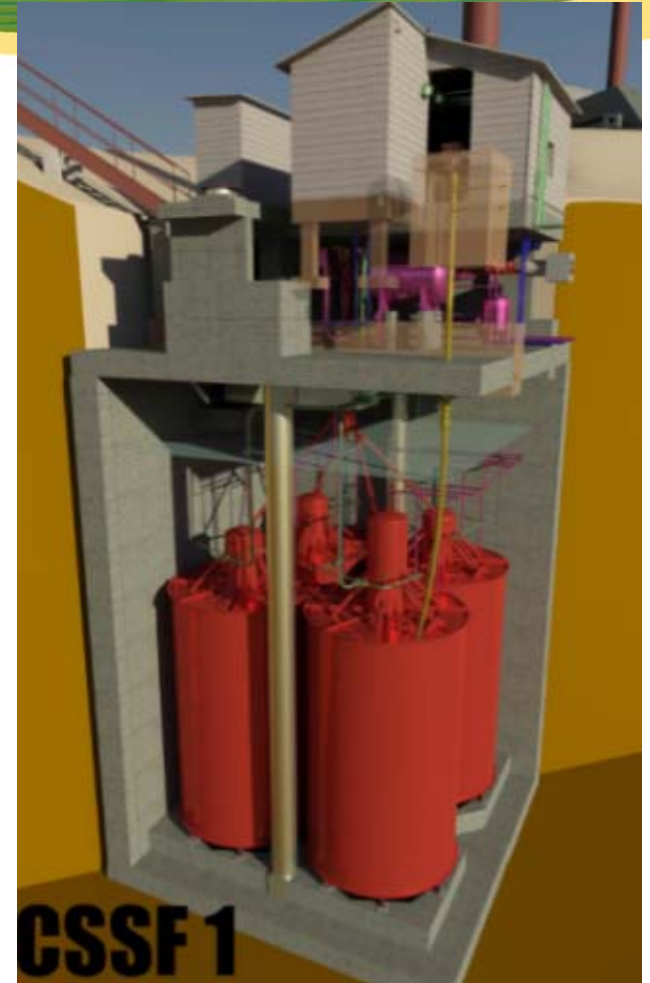
# Calcine Waste Status

## Regulatory Drivers:

- Idaho Settlement Agreement states: “DOE shall treat all high-level waste currently at (INL) so that it is ready to be moved out of Idaho for disposal by a target date of 2035.”
- Penalty: inability to bring in DOE-owned spent nuclear fuel for storage or research purposes until in compliance.
- Site Treatment Plan Milestones: procure contracts for treatment facility by Sept. 30, 2019; conduct system testing by March 31, 2023; commence operations by March 31, 2024.
- STP Penalties: \$10,000 per day/per violation.

## Current Treatment Approach:

- NEPA Record of Decision selected hot isostatic press as treatment option (Dec. 23, 2009).



Bin Set 1 contains about 220 cubic meters of calcine.

# Calcine Disposition Project Baseline Scope



Calcine storage facilities ("bin sets")

- Design and construct processing system using the Integrated Waste Treatment Unit facility to the maximum extent practical.
- Retrieve calcine from bin sets and process using hot isostatic processing technology.
- Package treated waste in canisters.
- Ship off-site or place canisters in interim storage pending off-site shipment for disposition.

- Current project TPC cost range is \$0.9 billion to \$2.0 billion.
- Critical Decision-0 approved April 17, 2007.
- Analysis of Alternatives Results and Recommendations: waste processing highly dependent upon disposition path; defer waste processing decisions until disposition path is known.
- Retrieval common element for all processing options – progress can be made in advance of processing and disposition decisions to address retrieval risks.



# Stakeholders

- State of Idaho: Governor and Attorney General are signatories to Idaho Settlement Agreement.
- Idaho Department of Environmental Quality: Regulators for RCRA-regulated waste.
- Shoshone-Bannock Tribes: Affected Tribes with whom we have a Government-to-Government relationship.
- INL Citizens Advisory Board: Independent board that provides EM with advice on cleanup Issues.
- Local Communities: impacted economically and environmentally.
- Special Interest Groups: Snake River Alliance, Partnership for Science and Technology, etc., comment on DOE approaches, inform the public, advocate for specific positions.