Calcine Disposition Project

Presented To: U.S. Nuclear Waste Technical Review Board

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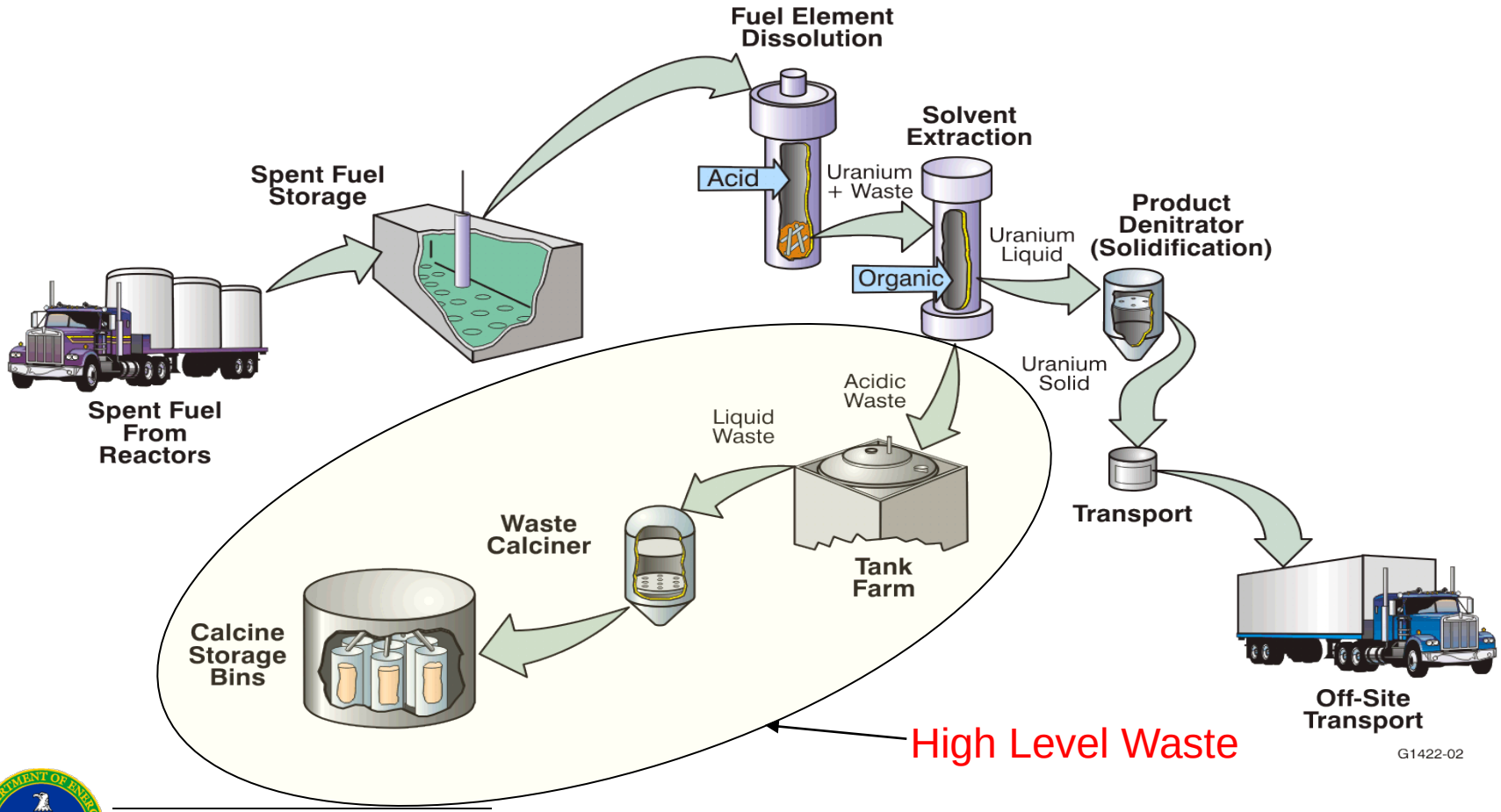
Federal Project Director
Calcine Disposition Project

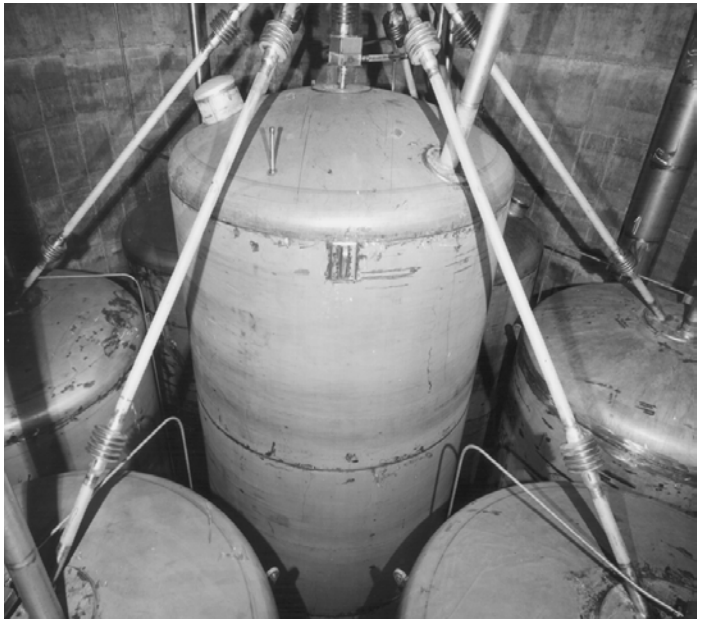
October 17, 2012

Calcine is Solidified First Cycle Raffinate from Former Reprocessing of Spent Nuclear Fuel

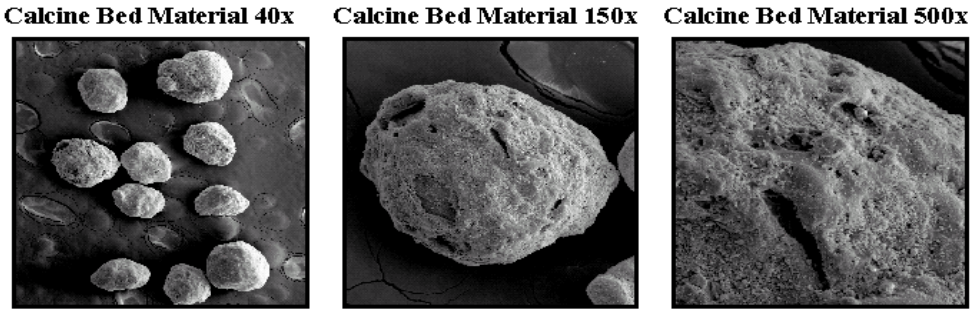


Liquid High Level Waste (HLW) Was Converted to a Solid (Calcine)

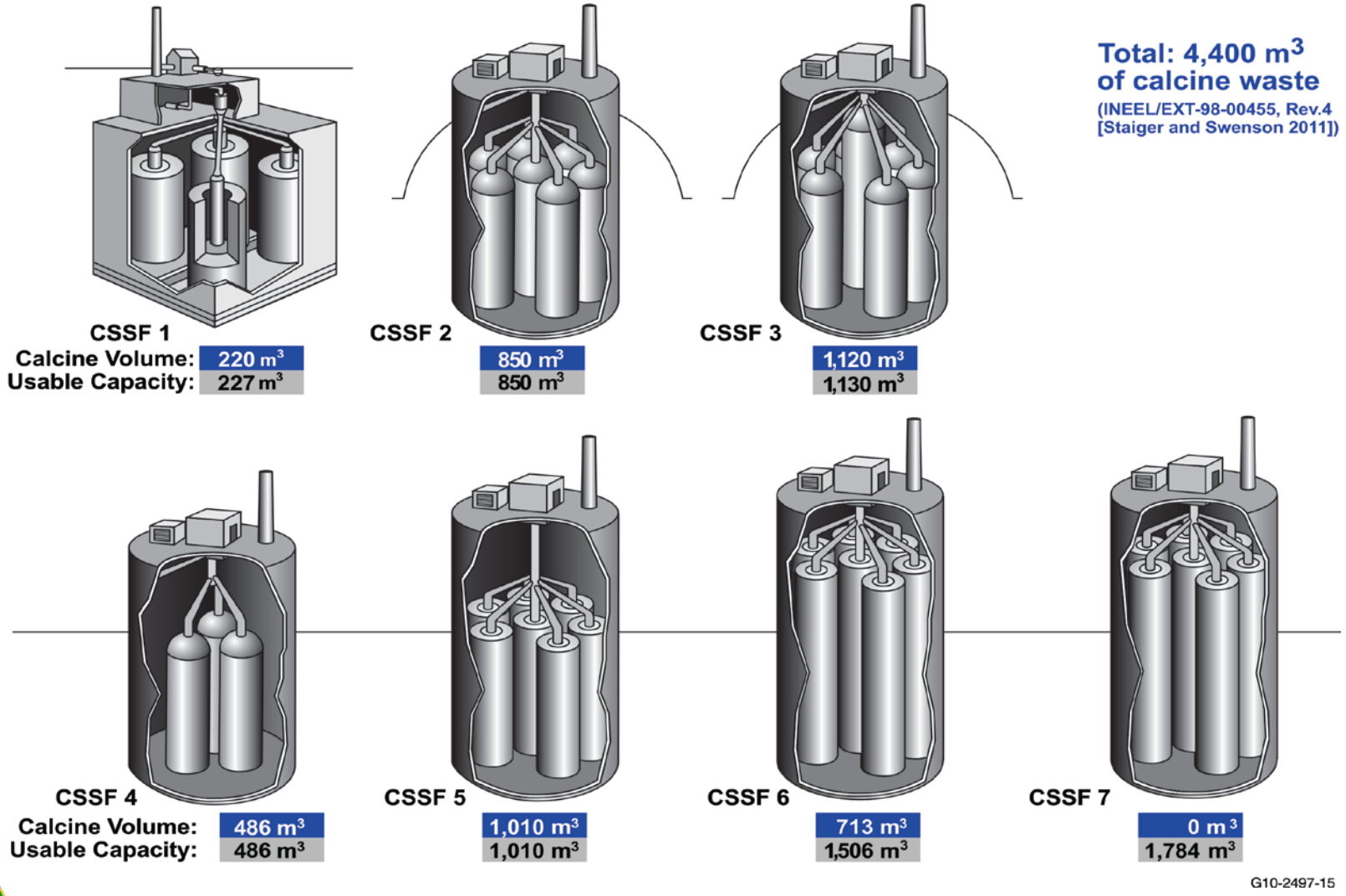
- Calcine is HLW by source-based definition
  - Results from reprocessing spent nuclear fuel (ended in 1992)
  - Also classified as mixed waste due to listed waste and characteristic hazardous waste constituents
- Accomplished 7 to 1 volume reduction
  - 8M gallons of liquid to 4,400 cubic meters of granular solid
- Calcine is a small granular solid with an average particle size of 0.3 mm



CSSF 3 cylindrical bins



Calcine Solids Storage Facility *(RCRA Permitted)*



Calcine Solids Storage Facility

Calcine Disposition Project Scope

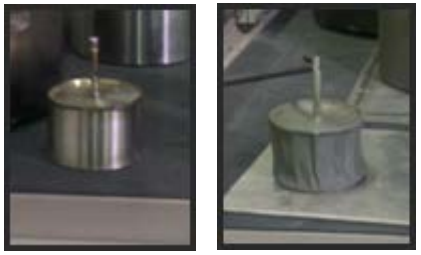
- Design and construct processing facility using existing facility (Integrated Waste Treatment Unit) to the maximum extent practical
- Retrieve and transport 4,400 cubic meters of calcine from current storage in the Calcine Solids Storage Facilities
- Treat calcine to meet revised LDR requirement
- Package resultant treated waste form in canisters
- Ship for disposition or storage outside of Idaho

Calcine Disposition Project Milestones

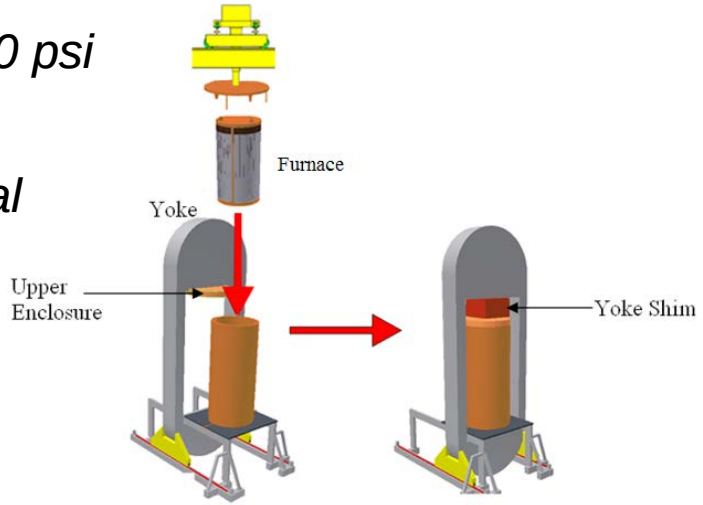
- Critical Decision (CD)-0 (Approve Mission Need) was signed June 29, 2007
- An amended Record of Decision (ROD) selecting Hot Isostatic Pressing (HIP) treatment technology was issued by DOE on December 23, 2009, meeting the December 31, 2009, milestone in the Idaho Settlement Agreement and the Idaho Site Treatment Plan
- Submittal of a RCRA Part B permit application for the Calcine Disposition Project by December 1, 2012
- Submit Site Treatment Plan Schedule by December 31, 2012 to include:
  - Procure contracts
  - Initiate construction
  - Conduct systems testing
  - Commence operations
- All calcine must be road ready in compliance with the Idaho Settlement Agreement by December 31, 2035

Hot Isostatic Pressing

- *HIP in commercial use since 1941*
  - *Commercial temperatures to 2,550 degrees C and pressures to 60,000 psi*
- *Technology consists of a pressure vessel containing an electrically heated furnace.*
- *Components are placed in a sealed can inside the furnace and isostatically pressed with argon gas to maximum density*
- *Temperature range for Calcine treatment 1,050-1,200 °C*
- *Pressure range for Calcine treatment 7,200-15,000 psi*
- *Produces glass-ceramic waste form*
- *Results in large life-cycle cost savings through final disposition*
- *Volume reduction expected to be 40% to 60%*

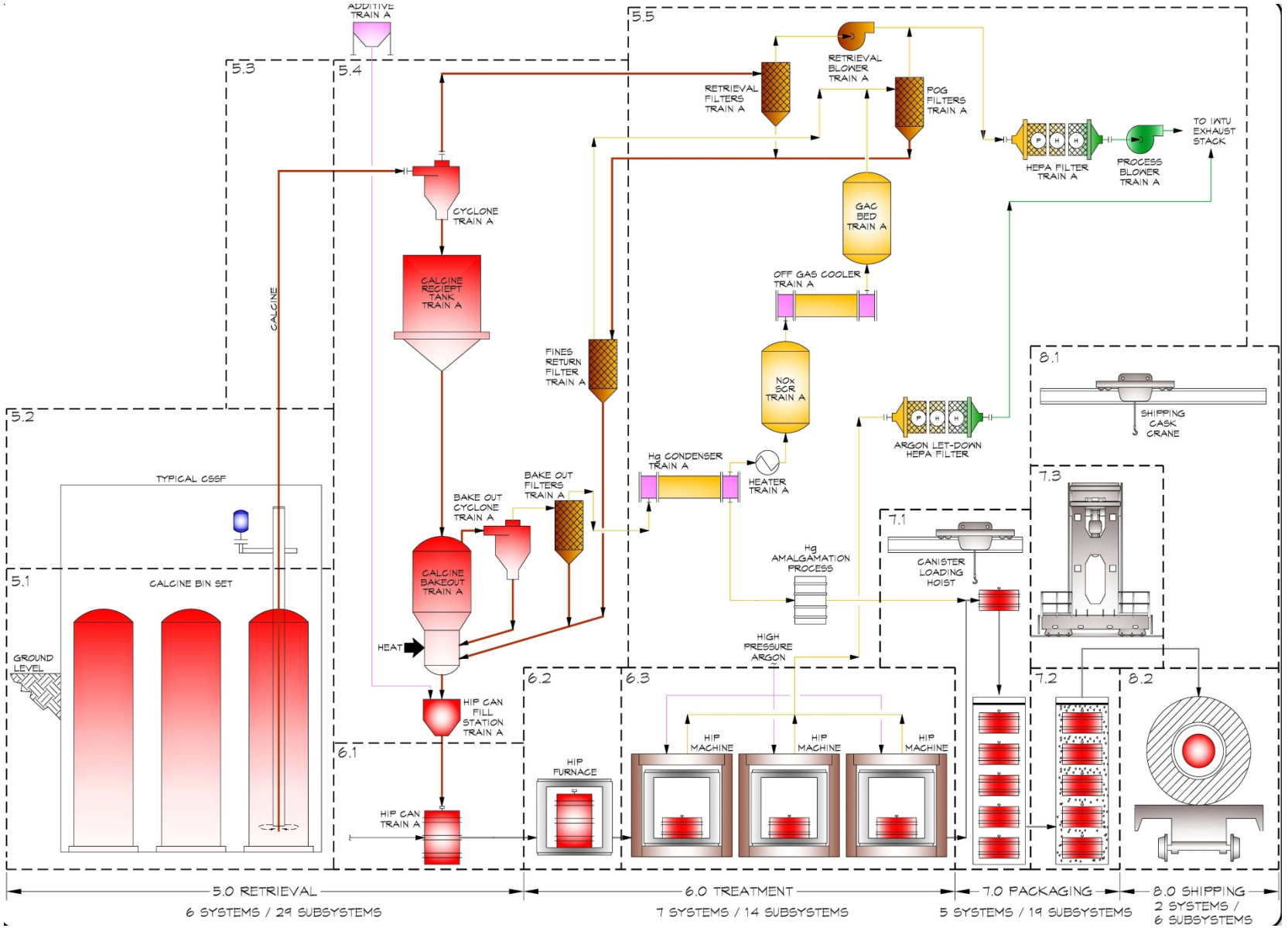


Lab Scale HIP Can Testing Before and After (AVURE June 2011)



HIP Machine Loading Sequence

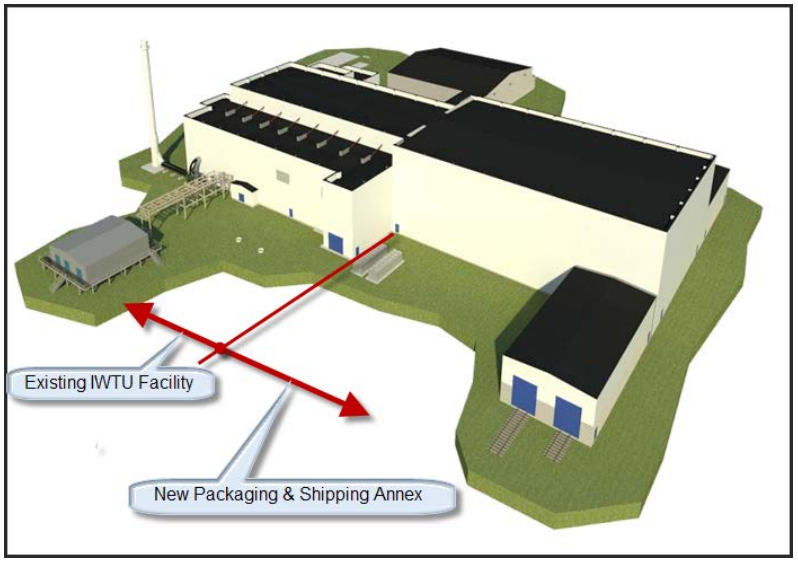
HIP Treatment Process Flow Diagram



IWTU Facility

Facility Overview

- *Fully utilizes existing IWTU PC-3 cells for HIP machines*
- *Re-uses the existing IWTU canister fill cells for HIP Can fill*
- *Calcine Surge (day) storage and bake-out cell within IWTU footprint*
- *Packaging and shipping located in new east annex*



PERSPECTIVE VIEW OF EXISTING IWTU WITH EAST ANNEX

SECTION VIEW OF IWTU'S PROCESSING CELLS

Calcine Disposition Project Status

- Completed HIP can qualification tests up through ½ scale can (20 inches tall by 30 inches in diameter)
- Completed nine lab scale waste-form tests
- Completed furnace filter tests
- Completed HIP can profile testing
- Commenced HIP can modeling tests
- Completed design at a level to support submittal of RCRA Permit
  - 45 system & facility design descriptions
  - 1060 drawings
- Completed material balance for process
- Completed and validated calcine inventory and composition data base

Recent Project Reviews

- *Consortium for Risk Evaluation with Stakeholder Participation (CRESP) – May 2011*
  - *Purpose - carry out an independent technical review regarding the planned implementation of hot isostatic pressing (HIP) for treatment of calcine waste, and the potential for cold-crucible induction melting to be a back up treatment technology as a project risk reduction strategy*
  - *Conclusion - HIP processing of calcine should be pursued and that vitrification to produce both a borosilicate glass or glass ceramic should be pursued as an alternative.*
- *Environmental Management -Technical Evaluation Group (EM-TEG) – July 2011*
  - *Purpose - determine the level of technology maturation development and if this would support a project CD-1, and identify project risk.*
  - *Conclusion - the HIP process is the most attractive approach for processing INL calcine waste; however, identified two risks in regards to waste acceptance of the glass-ceramic waste form*