ORNL TRU Waste Processing Center

Tank Waste Processing
Supernate (SN) Processing System

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EnergX LLC
**ORNL TRU Waste Processing Center**

Waste Concentration Using Evaporator

1. **Vapor stream exhausted to main ventilation system**
2. **Vapor stream superheated and HEPA-filtered**
3. Evaporator
   - Exhaust Blower
4. Supernate Pump and Evaporator Discharge Pump circulate waste between selected tank and evaporator during concentration.
5. Supernate Pump
6. Supernate Tank
7. Evaporator Concentrates Waste
8. Evaporator Discharge Pump

**Images:**
- photographs of the ORNL TRU Waste Processing Center equipment, including evaporators, pumps, and ventilation systems.
Tank Sampling/ Transfer To Dryer

- Tank Sampled
- Isolok Sampler
- Supernate Pump
- Statistical Process Control
  - Supernate Pump Transfers Wastes From Selected Tank To Dryer

Rotary Dryer

Supernate Tank
Dryer Schematic
EORNL TRU Waste Processing Center

Waste Drying/ Transfer To Shipping Cask

Rotary Dryer

Metasilicate Hopper

Metasilicate Addition

Waste Form Gravity Fed to Cask Liner Via Waste Chute
Supernate Bay Door

Cask & Liner Placed on Bogie to Receive Dryer Discharge

Ship To NTS
Final Waste Form Attributes

- Zero bleed water at any time
- Low dose rate (1 R/hr on contact, much lower than 2004 Supernate campaign)
- Robust/solid monolith that is remote handled, high alpha LLW
- Non-hazardous at “Point of Generation”
## SN Score Card

<table>
<thead>
<tr>
<th>Average Burial Volume &amp; Vol. Reduction for 2004 ORNL SN Campaign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting Volume of SN (cubic meters)</td>
</tr>
<tr>
<td>Starting Volume of SN (cubic feet)</td>
</tr>
<tr>
<td>SN LLW Liners buried at NTS</td>
</tr>
<tr>
<td>NTS assigned burial volume (cubic feet per liner)</td>
</tr>
<tr>
<td>Actual waste volume (cubic feet per liner)</td>
</tr>
<tr>
<td>Actual waste volume (cubic feet)</td>
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<tr>
<td>SN Burial Volume 1st Campaign (cubic feet)</td>
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<td>Volume Reduction (starting vol./actual waste vol.)</td>
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ORNL MVST Sludge (SL)

Solidification Project Overview

Vol. XV Baseline – Olde History relative to re-bid

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**CIP**

Approx. 180 nano Ci TRU/g of waste Tank W-35 has sludge mixing capability
Mobilized Sludge Volume:
Approx. 1,700,000 gal.
15,000,000 lbs

**MVST**

Avg. 700 nano Ci TRU/g of waste Avg. 70 mg Hg/Kg of wet sludge Total Sludge Volume:
Approx. 350,000 gal.

**TWPC**

SL Solidification & Disposal as LLW Processing Overview

20,000,000 lbs Dry Blend Grout

70-80 nano Ci TRU/g of solidified waste <0.025 ppm Hg by TCLP

2,200 LLW Liners

Big Liner
External Vol. (cf) 208
Waste Vol. (cf) 150
Waste Mass (lbs) 17,500

Small Liner
External Vol. (cf) 170
Waste Vol. (cf) 130
Waste Mass (lbs) 15,200

DOT Type A Cask
Ship 10 Per Week to NTS

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Point of Generation “Non-Hazardous”
Process Risk

- Lowest process risk
- Mature and established technology
- Reliable SN equipment, with minor modifications
TWPC Approach to Process Control: Reduces Analytical Turn-around

\[ y = 0.1967x + 4650.7 \]
\[ R^2 = 0.9261 \]

ORNL Sludge Total TRU vs. Gross Alpha
<table>
<thead>
<tr>
<th>Grout Recipe</th>
<th>BFS</th>
<th>Flyash</th>
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<tbody>
<tr>
<td><strong>EnergX proprietary recipe</strong>  &lt;br&gt; Confirmed by bench testing MVST SL</td>
<td>Reduced setting rate to extend “work” time</td>
<td>Improves fluidity of grout – particle morphology</td>
</tr>
<tr>
<td>45% Fly Ash (Class F)  &lt;br&gt; 45% Blast Furnace Slag  &lt;br&gt; 10% Portland Cement</td>
<td>Lower heat of hydration</td>
<td>Reduces cure temperature</td>
</tr>
<tr>
<td><strong>SN Monolith Blend:</strong>  &lt;br&gt; Portland Cement, BFS, Flyash, and Fumed Silica</td>
<td>Lower diffusion and permeability rates</td>
<td>Consumes excess caustic</td>
</tr>
</tbody>
</table>
Process Control

• “Big Batch/CIP Tank” – simpler characterization
  – Validated Process Control Program (PCP)
  – Confirmatory bench scale testing for each Tank Batch
  – Monolith with no free liquid
  – Mass ratio control via SL metering and SA weight

• Visual observation (camera) of mixing and LLW filling ensures grout consistency
NuVision (AEA) Tank Mobilization Systems
- Equipment On Site

BVEST
W-Tank System

SL Mobilization
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Questions

242 A Evaporator

F Tank Farm