Tank and Vault Drying System Operation and Results

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One Project. One Team. One Goal.
WVDP Tank Farm Background

- HLW retrieved and vitrified into 275 canisters between 1996 and 2002
- Over 90% of remaining residual liquid removed and processed in 2003
- 25,700 gallons remained in four underground tanks at the end of 2010, prior to starting the T&VDS

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WVDP Underground Tanks

- Two large carbon steel tanks: 8D-1 and 8D-2 760,000 gallons each
- Two small stainless steel tanks: 8D-3 and 8D-4 14,300 gallons each
- Tanks enclosed within underground concrete vaults
- Active tank ventilation provided by the Permanent Ventilation System (PVS)
WVDP Tank Farm Issues

- Decisions on Tank Farm Closure have not yet been made and may extend until 2020
- Groundwater infiltrates the vaults: cracks, joints and penetrations
  - Corrosive environment to tank exteriors
  - Periodic pumping and treatment required
- Underground ventilation line breached
  - Groundwater pumping required to avoid adding water into the tanks
- Tanks are approaching their 50-year design life with increasing potential for leaks
Tank Farm Interim Solution

• Installation of a Tank & Vault Drying System
  – Evaporate residual waste liquids in the four tanks
    – no liquids to leak
  – Evaporate groundwater in the vaults - eliminates the need to pump vault liquid
  – Reduces the humidity inside and outside the tanks to greatly reduce tank corrosion
  – Tank life prolonged to better accommodate any of the closure alternatives

• Does not preclude any Environmental Impact Statement closure alternative
Tank & Vault Drying System Basics

- Inject very dry air into the tanks and vaults
- The dry air forces out the saturated air that existed before system operation
- The dry air picks up moisture from
  - Wetted surfaces
  - Standing liquids
- Exhaust the moist air from the tanks and vaults
  - Vault exhaust air is recirculated through the air dryer
  - Tank exhaust air is routed to the existing HEPA-filtered ventilation system and up the stack
- Desiccant dryer reactivation air is directed to the ventilation system
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Tank & Vault Drying System Schematic

Dry Air to Other Large Tank/Vault

Dry Air to Tanks 8D-3 and 8D-4 & Vault

Humid Air to PVS Inlet Plenum

Desiccant Dehumidifier

Dry Air Inlet to Vault

Dry Air Inlet to Tank

Vault Exhaust Lines Insulated and Heat Traced

Moist Vault Air From Other Vaults

Moist Tank Air To Existing Permanent Ventilation System Via Replaced Underground Header

Moist Air From Other Tanks

Ambient Air

Filter

Condensate to Ground

Refrig Dryer

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Tank & Vault Drying System Schematic
Tank & Vault Drying System Layout

Scale:

5 meters

Blue - Dry Air Supply
Red - Wet Air Return
Results from 18 Months of Operation

• Tank volume reduction from January 4, 2011 to June 30, 2012
  
  – Tank 8D-2
    • Decreased from 4,270 gallons to 1,890 gallons (limit of level indicator) on March 28, 2011 – average 28.7 gallons/day
    • Based on projections, should have been dry in June 2011

  – Tank 8D-1
    • Decreased from 14,000 gallons to 3,810 gallons (limit of level indicator) on August 12, 2012 - average 46.2 gallons/day
    • Based on projections and relative humidity readings, should have been dry in November 2011
Results from 18 Months of Operation

Tank 8D-1 and 8D-2 “18-Month” Levels (inches on level indicator)

Red 8D-1 Tank  Green 8D-2 Tank
Results from 18 Months of Operation

• Tank volume reduction from January 4, 2011 to February 8, 2012, when dry air supply to these tanks was stopped to start preparations for Tank 8D-4 characterization
  – Tank 8D-3
    • Decreased from 1,560 gallons to 1,000 gallons - average 1.4 gallons/day [922 gallons present on July 1, 2012]
  – Tank 8D-4
    • Decreased from 5,870 gallons to 5,400 gallons - average 1.2 gallons/day [5,370 gallons present on July 1, 2012]
• Drying of Tank 8D-3 resumed on June 12, 2012
• Drying of Tank 8D-4 resumed on July 11, 2012
Results from 18 Months of Operation

Tank 8D-3 and 8D-4 “18-Month” Levels (inches on level indicator)
Results from 18 Months of Operation

• 25,700 gallons remained in the four underground tanks before operation of Tank & Vault Drying System

• Total liquid evaporation for all four tanks from January 4, 2011 to June 30, 2012
  – Measured: greater than 13,700 gallons (53%)
  – Measured and projected: 19,400 gallons (75%)

Photo of Tank 8D-1 Bottom
Results from 18 Months of Operation

• 8D-1 and 8D-2 pan and vault level reduction (based on level indicator readings)

Tank 8D-1
• Pan decreased from 4.5 to < 0.2 inches
• Vault decreased from 2.6 to < 0.5 inches

Tank 8D-2 (pan pumped once in mid-March, 2011)
• Pan decreased from 8.6 to 0 inches
• Vault decreased from 9.4 to ≤ 1.3 inches
Results from 18 Months of Operation

8D-1 and 8D-2 Pan & Vault “18-Month” Levels (inches on level indicator)
Results from 18 Months of Operation

- **8D-3/8D-4 Vault Level Reduction**
  - Level decreased from 21.2 to ~0 inches
  - The 21.2-inch level corresponds to a 4-inch liquid level over the vault floor
  - The ~0 level corresponds to liquid below the level indicator in the vault floor sump
  - Greater than 1,140 gallons of vault liquid evaporated

- **8D-3/4 Vault Relative Humidity**
  - Decreased from >80% to ~20%

- **8D-3/4 Tank Relative Humidity**
  - Decreased from >90% to ~40% with dry air supply
  - Increased from 60% to ~100% RH after dry air supply was temporarily suspended on February 8, 2012 for sampling
Results from 18 Months of Operation

• 8D-1 and 8D-2 tank and vault relative humidity reduction

  – Tank 8D-1
    • Tank decreased from ~100% to ~20% RH
    • Vault decreased from ~90% to ~30% RH

  – Tank 8D-2
    • Tank decreased from ~100% to 30-70% RH
    • Vault decreased from >90% to ~30% RH
    • Excessive tank outside air infiltration is preventing a lower tank RH; efforts to reduce infiltration continue
Results from 18 Months of Operation

Tank, Vault and Dryer Outlet Relative Humidities (%)
Past Month Relative Humidities

Tank, Vault and Dryer Outlet Relative Humidities (%)

Red 8D-3/4 Vault
Yellow 8D-2 Vault
Magenta 8D-2 Tank
Green 8D-1 Vault
Navy 8D-1 Tank
Sky Blue 8D-3 & 4 Tanks
Orange Dryer Outlet
Summary of Operations

• Eliminated the need to pump liquids from vaults and pans
• Evaporated heel liquids from Tanks 8D-1 and 8D-2
• Tank 8D-1 pan should be dry with minimal liquid in its vault
• Tank 8D-2 pan should be dry with its vault level slowly decreasing
• Evaporated all liquid from 8D-3 and 8D-4 vault
• Approximately 500 gallons evaporated each from Tank 8D-3 and Tank 8D-4
• Tank and vault relative humidity reduced
Long-Term System Operations

- Continue to monitor system operation and reduce air infiltration as necessary, especially into Tank 8D-2
- Readjust individual air flows as the tanks and vaults dry out using the variable speed drive on the dry air supply fan and branch valves
- When the tanks and vaults dry, in-line HEPA filters will capture any particulate that may be exhausted