Department of Energy
High-Level Waste Integration

Ken Picha
Senior Advisor for Environmental Management

Nuclear Waste Technical Review Board Meeting
August 24, 2016
Waste Processing: Treatment and Disposal of Radioactive Waste: Treat ~90 million gallons/500 million curies

Hanford
- 177 Tanks
- 176M curies
- 55M gallons
- ~ 9,700 canisters (projected)

Idaho
- 15 tanks (11 closed);
- 37M curies
- 900K gallons, 4,400m³ calcine

Savannah River Site
- 51 Tanks (8 closed)
- 37M gallons
- 292M curies;
- ~4,100 canisters (2016); ~8,000 (total projected)

West Valley Demonstration Project
- 4 tanks
- ~ 25M curies
- 275 canisters
• Safely store waste in form of liquids, sludges, saltcake and calcine
• Retrieve waste for purposes of pretreatment, treatment, and disposal
• Pretreat alkaline waste (SRS, Hanford and WVDP), typically through a separations process to separate waste into:
  • Low-activity waste stream treated and disposed as low-level waste (LLW) onsite [except offsite disposal at WVDP] (most of volume);
  • High-activity waste stream treated and disposed as high-level waste (HLW) at a geologic repository (most of activity);
• Treat high-activity alkaline waste (SRS, Hanford and WVDP) using vitrification
• Retrieve, treat and dispose remaining acidic liquid wastes at INL for disposal in a geologic repository.
• Retrieve and dispose calcine (INL) directly in its existing form or following alternative preparations for disposal.
• Stabilize tank waste residues intended for in-place closure.
The Tank Waste Program Strategy

- The Tank Waste Program Strategy consists of:
  - Safely storing:
    - over 90 million gallons of radioactive liquid waste at the SRS, Idaho and Hanford
    - 4,400 m³ of radioactive calcine at Idaho
    - 4,100 HLW canisters at SRS and 275 canisters at West Valley
  - Constructing and operating major nuclear facilities to treat and disposition the tanks waste; and
  - Emptying, cleaning and closing waste tanks.
The Radioactive Liquid Waste Challenge: How EM is Making Progress Today

Integrated Waste Treatment Unit – Idaho Falls, ID

- Undergoing Commissioning for Start-up
- Will treat Idaho’s inventory of liquid tank waste – approximately 900,000 gallons

Defense Waste Processing Facility – Aiken, SC

- Began operations in 1996
- Largest operating radioactive waste glassification plant in the world
- Converts waste to solid glass form suitable for long-term storage and disposal
Hanford Direct Feed Low Activity Waste Approach

- SSTs
- DST System
- Tank Farm
- 242-A Evaporator
- AP-Farm
- LAW Facility
- Pretreatment
- HLW Facility
- ETF
- IDF
- New facility to be constructed
- Existing facilities
- WTP Facilities
- Canisters from LAW immobilization

- DST – Double-Shell Tanks
- ETF – Effluent Treatment Facility
- HLW – High-Level Waste
- IDF – Integrated Disposal Facility
- LAW – Low-Activity Waste
- SSTs – Single-Shell Tanks
**SRS Liquid Waste System**

**Legend:**
- ARP: Actinide Removal Process
- DWPF: Defense Waste Processing Facility
- MCU: Modular Caustic Side Solvent Extraction Unit
- SWPF: Salt Waste Processing Facility

### H-Canyon Receipts
- Currently receive ~150 kgal/yr

### Tanks
- **51 Tanks**
  - 8 operationally closed
  - 4 bulk waste removed
  - Old style – 35% of space used
  - New style – 81% of space used

### Operations
- **38 Mgal, 270 million curies**
- **7.3 Mgal treated**
- **3.8 Mgal treated**
- **Projected 8,170, ~4150 to date with 55 million curies immobilized in glass**
- **16 Mgal grout dispositioned containing 0.4 million curies**
- <1% radionuclides remain in tanks

**Recycle**
- **Salt Waste**
- **Radionuclides**
  - >98% radionuclides to glass
  - <1% radionuclides to saltstone

**Glass Waste Storage**
- **119**
- **270 million curies**
  - **Currently receive ~150 kgal/yr**

**Saltstone Disposal Facility**
- SWPF (Construction completed, Undergoing commissioning)

**Legend:**
- ARP: Actinide Removal Process
- DWPF: Defense Waste Processing Facility
- MCU: Modular Caustic Side Solvent Extraction Unit
- SWPF: Salt Waste Processing Facility
In September 2002 DOE completed solidification of ~600,000 gallons of HLW that had been generated by the nation’s only operating commercial nuclear fuel reprocessing plant located near West Valley, New York

- The HLW sludge was vitrified and resulted in ~600 tons of glass; 24 million curies; 275 canisters
- The canisters of vitrified HLW were placed in storage in a shielded cell within the Main Plant Process Building, to await transport to a federal repository

**HLW Canisters**

- 275 stainless steel canisters of vitrified HLW
- 10’ tall, 2’ diameter
- 2,665 R/hr average dose rate
- 1,100 – 7,460 R/hr range
- 5000 lbs average weight
- 90% average fill height
- 3 canisters of decontamination wastes
Technical Approach

• Canisters decontaminated in place in the storage racks
• 5 canisters loaded into an overpack within a shielded cask
• Overpack lid remotely welded
• Cask lid secured and cask transported to the High Level Waste (HLW) Cask Storage Pad
• Canisters:
  – 10’ tall, 2’ diameter (longer neck than WVDP)
  – 304L stainless steel

• HLW canisters are currently stored in Glass Storage Buildings 1 and 2 in concrete reinforced vaults
  – GSB-1 currently stores 2,254 canisters
  – GSB-2 currently has capacity for 2,340 canisters
  – To increase storage capacity, SRS will “double-stack” canisters in GSB-1 thus increasing GSB-1 storage capacity by 2,254 for a total capacity of 6,848 canisters
  – This mitigates the need for additional storage until FY 2026.
Treated Idaho Sodium Bearing Waste

- Treated sodium bearing waste would be loaded into canisters and then the canisters stored in concrete vaults:
  - Canisters are 10’ tall, 26 inches in diameter
  - 304L stainless steel
- 16 canisters per vault
• High-Level Waste canisters
  – 15-foot long, 2-foot diameter
  – 304L stainless steel
• Low-Activity Waste canisters
  – 7-foot long, 4-foot in diameter
  – 304L stainless steel
High Level Waste Integration

• Contractor
  – Leadership transfer between Hanford and SRS tank waste contracts (same lead contractor) to promote integration
  – Technology integration – separations processes, tank integrity, tank retrievals

• DOE Federal
  – Temporary assignments:
    o Participation of construction project personnel from one site as reviewers on project peer reviews at other sites
    o Temporary rotations of staff from one site to another to augment startup and commissioning and share lessons learned
  – Tank Waste Corporate Board:
    o Managers with tank waste responsibilities at Headquarters and the field (SRS, Hanford, Idaho, West Valley Demonstration Project)
    o Key issues:
      o Tank waste infrastructure commonalities
      o Tanks waste technology development
      o Commissioning of tank waste projects
      o Disposition of tank waste