FireWater Associates, LLC

DOE Innovative Clean-Up Approaches

- UNITECH R3 WORKSHOP
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Introduction

• Firewater is a woman owned small business established in 2009 that provides Radioactive and Hazardous Waste Management, Security Staffing, Project Management, and Transportation Planning to the Nuclear Industry.

• We provide consultation to Department of Energy (DOE) Complex including identifying disposition pathways for low-level, mixed low-level, transuranic and high-level waste streams.

• DOE EM budget in 2019 = $7.2B with its overall liability at over $300B and growing. Most legacy cost are associated with cleanup and waste disposition.

• This discussion centers around innovative disposition approaches that also provide cost savings to the government.
DOE Environmental Management FY 2019 Budget

- Special Nuclear Materials & Spent Nuclear Fuel: 15% ($1.050M)
- TRU & Solid Waste: 21% ($1.482M)
- Soil & Groundwater: 14% ($1.014M)
- Radioactive Tank Waste: 8% ($574M)
- Facility D&D: 6% ($444M)
- Total: 100% ($4.611M)
DOE generates large volumes of wastes from weapons production and nuclear energy research.

Many waste streams are legacy wastes (decades old) and have radioactive and hazardous constituents that pose challenges for compliant transport, treatment and/or disposal.

Many different challenges but largest costs include:
- Tank wastes (LLW being managed as HLW)
- Mercury contaminated wastes
- Reactive metals (Sodium and/or NaK)
• DOE Hanford Site in WA State occupies over 500 square miles.
• Largest single financial liability to DOE EM (billions annually).
• Wastes, by-product of weapons production operations, have been stored in 177 large underground tanks for decades.
• 56 million gallons of waste in three forms:
  • Sludges and Saltcake - approx. 10%,
  • Liquid (supernate) – approx. 90%.
• 80% or more may be LLW/MLLW vs HLW.
• Current regulatory requirement is to vitrify all.
The Tank Farms
A 200 Area Aerial Overview

200 West Area
200 East Area

Waste Treatment and Immobilization Plant

Single-Shell Tank Farm
Double-Shell Tank Farm
Hanford Tank Types

Single-Shell Tank

Double-Shell Tank
DOE’s Current Plan

- DOE’s agreement with the State of WA requires all 56M gallons to be vitrified into a borosilicate glass form.

- Bechtel National has been contracted to design, build and start up the Waste Treatment and Immobilization Plant (WTP) and ancillary facilities.

- Multi-billion dollar project will deploy first-of-a-kind separation and vitrification technologies in 4 major facilities and 20 support facilities.

- *May only be necessary for less than 20% of wastes.*
• A commercial team has developed alternative treatment for portion of 80% of tank wastes that is undergoing testing:
  • System retrieves and decontaminates tank waste by filtration to remove suspended solids (Strontium and transuranics).
  • Uses ion-exchange to reduce Cs-137 major dose contributor.
  • Allows waste to be managed as LLW vs HLW.
  • Commercial treatment, transport and disposal provides most cost effective way to manage.
• Y-12 Nuclear Weapons Complex in Oak Ridge, TN used Hg in lithium isotope separation (COLEX process) for nuclear weapons production.
• Four former use buildings (1.8 million ft²) have Hg along with other hazardous and radioactive contaminants within or surrounding the facilities.
• Mercury represents largest environmental liability at Oak Ridge.
• Buildings are deteriorating and will undergo D&D within the next 5 years.
Challenges for D&D

- 24 million lbs. brought to Y-12 from 1950 – 1963:
- ~ 1.3 million lbs. unaccounted for:
  - Air ~ 51,000 lbs.
  - Water ~ 240,000 lbs.
  - Soils / Sediments – Unknown
  - Building spills ~ 325,000 lbs.
  - Process systems ~ 60,000 lbs.
- D&D must be address large quantities of Hg, difficult to detect in situ and pose threat to workers and the environment.
DOE’s Current Plan

• Strategic planning, disposal facility development, and regulatory discussion establishing waste disposal acceptance.

• Technology Development addressing characterization, decontamination, personnel protection, and waste acceptance.

• In field D&D testing of technologies.

• Installation of water treatment facility to stop Hg from entering surface waters prior to D&D.

• Sequential D&D of buildings for contamination control.
Innovative Technology Testing

• DOE is testing technologies to address Hg challenge for D&D – mechanical removal, ice blasting, and debris fogging.

• More testing is planned for characterization, waste treatment, health and safety concerns (e.g., Unitech PPE and 3M respiratory protection).
• Reactive metals, in limited quantity and accessible configuration, have been treated by simple deactivation methods.

• DOE sites have large volumes of bulk Na (Hanford Fast Flux Reactor) and sodium contained in problematic configurations.

• Safe disposition of contaminated sodium requires new innovative approaches.
• Partnership between Perma-Fix and Veolia is testing a high temperature process to safely deactivate reactive metals and place into a glass matrix.
Summary

- Government onsite solutions take decades and billions and thus innovation is imperative.
- Government is working with Commercial industry to develop new methodologies to reduce the financial liability of site clean-up
- Industry groups such as EFCOG provide a mechanism for DOE sites to share information on innovative approaches.