FireWater Associates, LLC

DOE Innovative Clean-Up Approaches

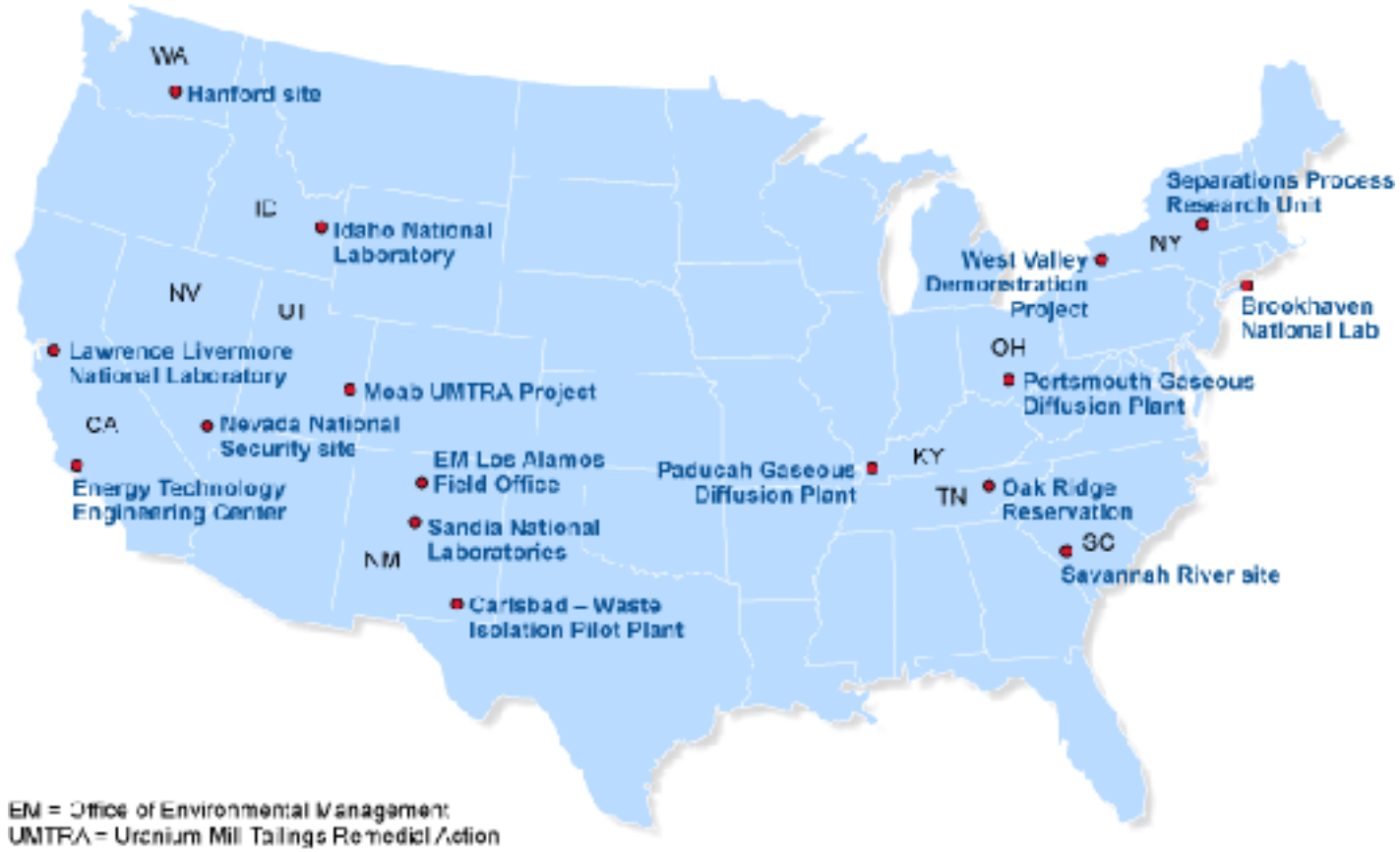
- **UNITECH R3 WORKSHOP**
- **Chicago, IL**
- **JUNE 7, 2019**

- **Renee Echols**
- **President**

Introduction

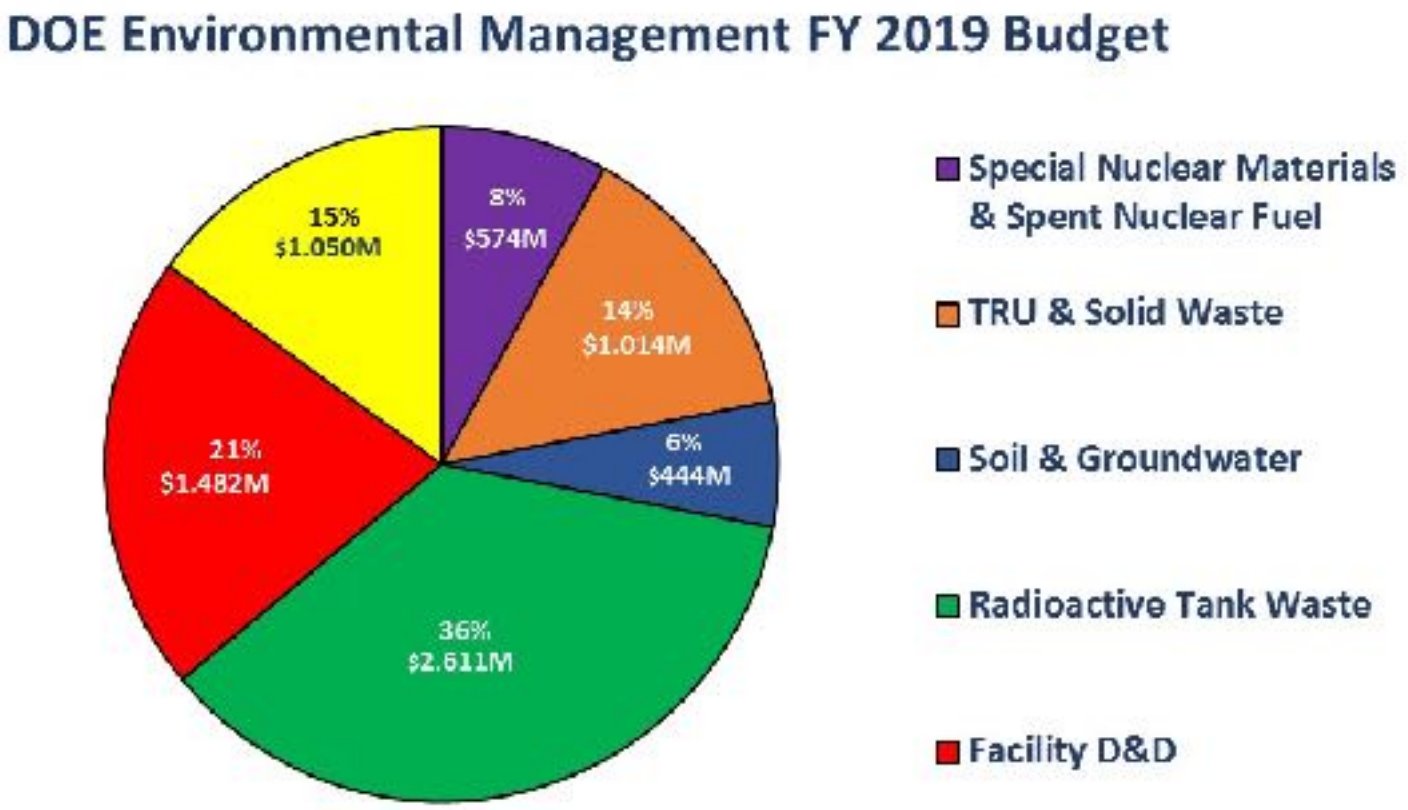
- Firewater is a woman owned small business established in 2009 that provides Radioactive and Hazardous Waste Management, Security Staffing, Project Management, and Transportation Planning to the Nuclear Industry.
- We provide consultation to Department of Energy (DOE) Complex including identifying disposition 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 Sites



Sources: GAO analysis of Department of Energy information; Map Resources (map). | GAO-19-460T

Cleanup Funding



Challenging Waste Streams

- 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)

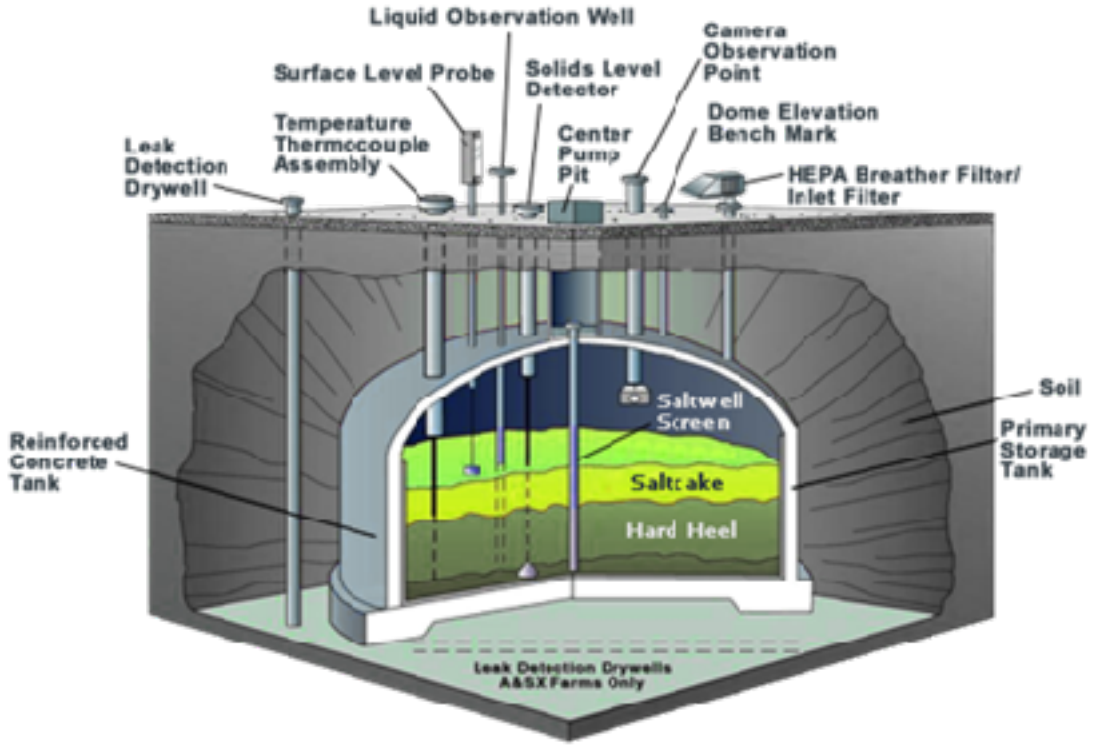
Tank Wastes

- 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.

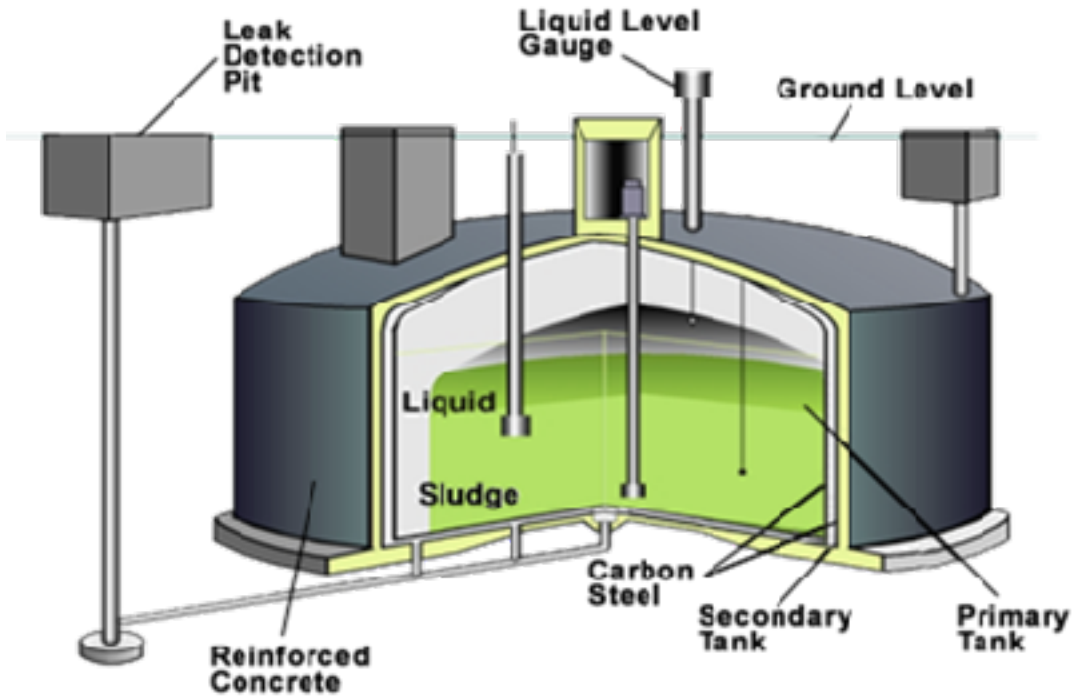

The Tank Farms
A 200 Area Aerial Overview
200 West Area
200 East Area
SX
S
SY
U
TX
TY
T
BX
BY
B
C
A
AW
AY
AX
AZ
AN
AP
Waste Treatment and Immobilization Plant
Single-Shell Tank Farm
Double-Shell Tank Farm

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.***

Innovative Alternative Treatment

- 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.

Mercury Contaminated Facilities

- 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 ft^2) 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.

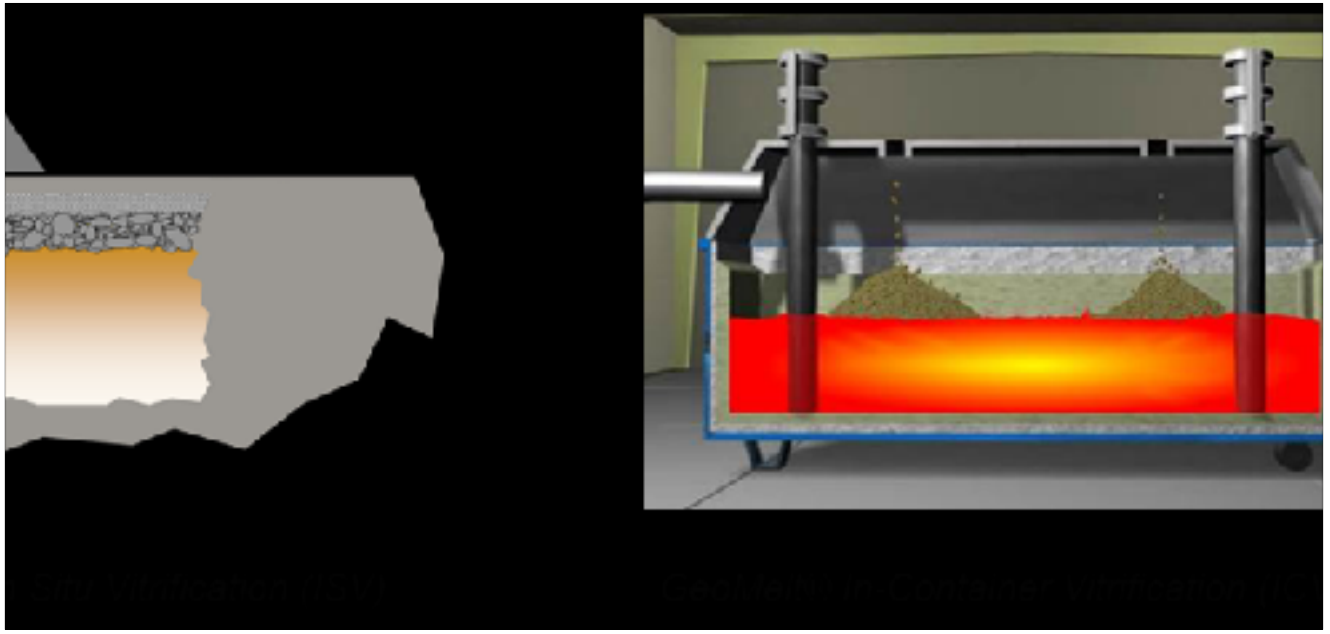
Innovative Technology Testing

- 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

- 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.

Innovative Treatment for Reactive Metals



- 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.