Hanford Reservation Cleanup

Significant EM Science and Technology Contributions

Groundwater contaminated with chromium is seeping into the Columbia River

In-Situ Redox Manipulation

- Creates a chemically altered, effective, in-situ treatment zone that immobilizes chromium in the groundwater before it reaches the river
- Multiple methods for reducing native iron content have been tested including dithionite and microbial reductants
- As the groundwater flows through the treated zone, the reduced iron molecules become sites for the reduction of redox-sensitive metals, radionuclides, and organics
- Replacement for the baseline approach of pump-and-treat
- Projected to decrease costs and increase safety in comparison to this baseline

A Hanford FFA and Consent Order Milestone (M-50-03) required determining the volume of radioactive waste glass which would be prepared for disposal

Enhanced Sludge Washing

- Dissolves large quantities of unwanted, non-rad elements in the sludge that increase immobilized glass volume, reducing amount of waste requiring processing and disposal as HLW, resulting in reduced costs
- Removal of entrained radionuclides for downstream separation and processing
- Removal of salts and minerals which may impact downstream vitrification
- Reduces risks associated with implementation of proposed Hanford baseline treatment system
- Potential LLW volume reduction

Corrosion related failure of waste tank walls can lead to the leakage of radioactive contaminants to the soil and groundwater

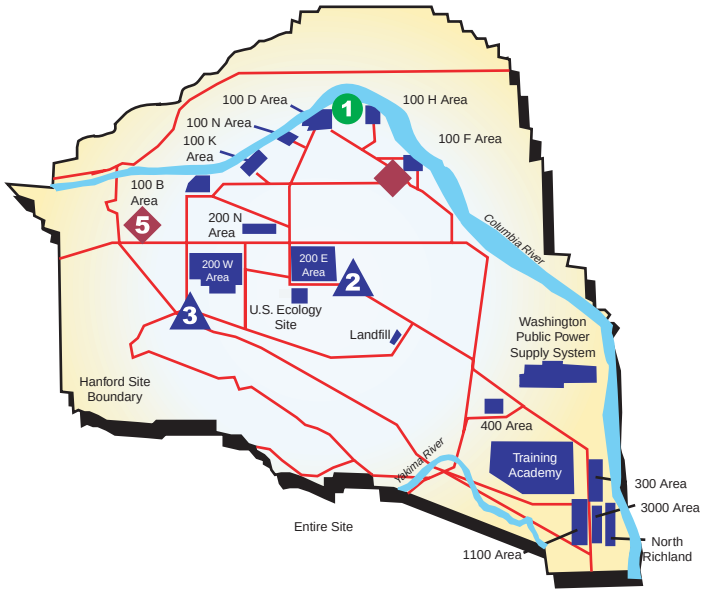
Corrosion Probe

- Measures electrochemical noise to monitor corrosion conditions and determine tank integrity
- Corrosion prevention for these tanks is based on controlling the tank chemistry by adding an inhibitor solution. Inhibitor additions are based on waste sample analysis and can increase waste volume significantly
- Probe was developed to limit the amount of inhibitors added, and to provide continuous, rather than periodic data
- Reduces baseline sampling and laboratory costs, reduces personnel radiation exposure, and minimizes waste volume by not introducing more inhibitor solution than necessary

Treatment of mixed-waste debris which will be generated over the next three decades

Macroencapsulation of Mixed-Waste Debris

- Resulted in significant cost avoidance of $1.3M
- In 2000, 1060 m^3 of waste will be microencapsulated avoiding $8.1M in incineration costs
- This has become baseline at Hanford and will be used for the forecasted mixed-waste volumes



Excess plutonium production reactors require decommissioning

C-Reactor Interim Safe Storage

- Provides interim safe storage of the reactor for up to 75 years
- Current baseline plan includes removal of the reactor core, the fuel examination facility, and the fuel transfer pit
- Field-demonstrated 20 innovative technologies during FY 1997 and FY 1998, with 13 selected for deployment
- Application towards any production reactor or large-scale contaminated facility as a low-cost, environmentally conscious, and practical alternative to immediate full-scale D&D
- Facilities that can benefit include the seven production reactors at Hanford, five reactors at SRS, and commercial nuclear power plants
- Fulfills a ROD recommending Safe Storage of the Hanford production reactors

Excess plutonium production reactors require decommissioning

F/DR Reactor Interim Safe Storage

- In FY 1999, used four technologies from C-Reactor experience
  - Mobile Integrated Temporary Utility System
    - Provides temporary utilities and communication and allows the complete de-energization of existing building power during decommissioning operations resulting in significant reduction in risk to workers
  - Sealed Seam Sack Suits
    - Less cost and handling required compared to the baseline cotton suits
  - Oxy-Gasoline Torch
    - Lower costs and increased cutting speed compared to baseline oxy-acetylene torch
  - Compact Subsurface Soil Investigation System
    - Can be used in confined areas where truck-mounted units cannot access

Processing facilities require determination of final disposition

Canyon Disposition Initiative

- Determines ultimate disposition of Hanford chemical processing facilities
- Strong partnering across EM and with stakeholders
- Potential cost avoidance of $1.1B
  - Remote Characterization Platform (Andros Robot)
    - Configured to carry a variety of characterization equipment (radiation sensors, video cameras sampling devices), remote operation minimizes exposure and health risks to workers in high-radiation areas or confined spaces
  - Non-Intrusive Liquid Level Detection System (Infrared)
    - Detects liquids in vessels and pipes without physically opening them, thereby reducing risk for workers during measurements
  - 3-D Visual and Gamma Ray Imaging
    - Provides 3-D rendering to accurately locate radiation sources

INEEL Site Cleanup

Significant EM Science and Technology Contributions

1 Accelerated cleanup of chlorinated solvents in groundwater

Enhanced In-Situ Bioremediation

- Significantly reduces remediation time from 30 to 15 years
- Lower risk to workers and environment
- Significant savings expected over current best method, which is pump and treat

2 Sampling adding minimal groundwater waste burden

Micropurge Sampling

- Decreases waste generation for treatment and disposal by 95% over baseline
- Savings of approximately $1.0M over 30 years with investment costs recovered in three years

3 Mapping contaminant migration paths

Advanced Tensiometer

- Shows likely contaminant flow above Snake River Plain Aquifer
- Key to developing mitigation strategies
- Usable beyond DOE, e.g., to farmland above Ogallala Aquifer

4 Calciner permitting and operation

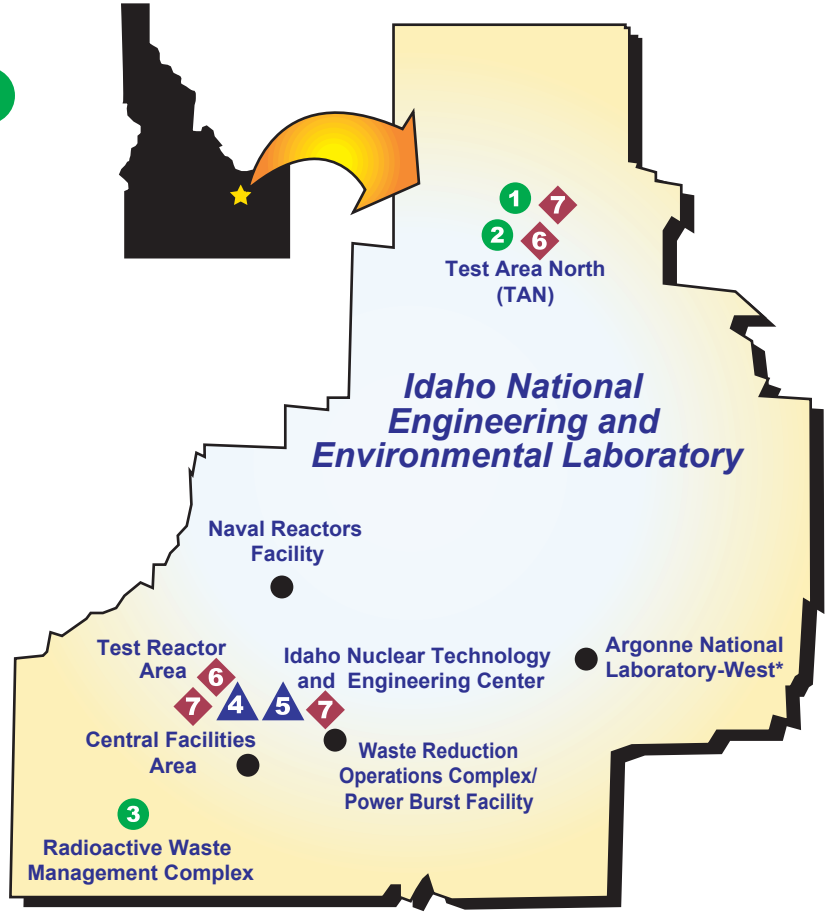
New Waste Calcining Facility
Off-Gas Sampling

- Enabled continued processing of high-level waste by the New Waste Calcining Facility (NWCF) in 1999
- First real-time comprehensive stack analysis of chemical contaminants complemented known radionuclide analysis and allowed validation of site risk assessment

5 Idaho Consent Order requirements for characterization of high-level waste tanks

Light Duty Utility Arm System

- Combined robotic and sampling technologies
- Supports waste removal and closure of tanks above aquifer
- Met tank RCRA characterization requirements
- Key to developing site tank farm closure plan



* - Reports to Chicago Field Office

- Subsurface Contaminants Focus Area
- Tanks Focus Area
- Mixed Waste Focus Area
- Deactivation & Decommissioning Focus Area

6 Deactivation & Decommissioning meeting requirements of the site Comprehensive Facility and Land Use Plan

Many technologies used for characterization, D&D, disposal, and worker safety

- Reduced worker exposure and risk
- Enhanced worker productivity
- Improved and more complete facility inspection
- Lowered overall cost hence increased scope possible at level budget
- Examples of innovative technologies tested in the Large-Scale Demonstration and Deployment Project:
  - Soft-Sided Containers
    - Holds more than four times the amount of conventional waste boxes
    - Easier to load and substantially decreases void space minimizing future subsidence in disposal facility
    - Technology use saved $350K in FY 1999 and their 10 year projected cost savings on INEEL D&D projects is $2M
    - This is baseline at the site
  - Remote Underwater Characterization System
    - RUCS is a remotely operated submersible vehicle system, designed to provide visual and gamma radiation characterization
    - Saves labor and reduces potential exposure and contamination
  - Oxy-Gasoline Torch
    - Less expensive to operate, more effective at cutting, and produces less slag
    - Reduces risk to workers
    - 37% cost benefit over baseline, exposure time greatly reduced
    - This is baseline at the site

7 Provide improved worker safety during extreme work conditions

Personal Ice Cooling System

- Significantly increases productivity and reduces cost
- Fits under the workers Personal Protective Equipment (PPE)
- Ice-cooled tap water keeps workers cool
- Projected ten year savings is $3.8M