U.S. DEPARTMENT OF ENERGY

US Department of Energy (DOE), Experience and Strategic Lessons Learned from Decommissioning and Remediation of Large Nuclear Legacy Sites

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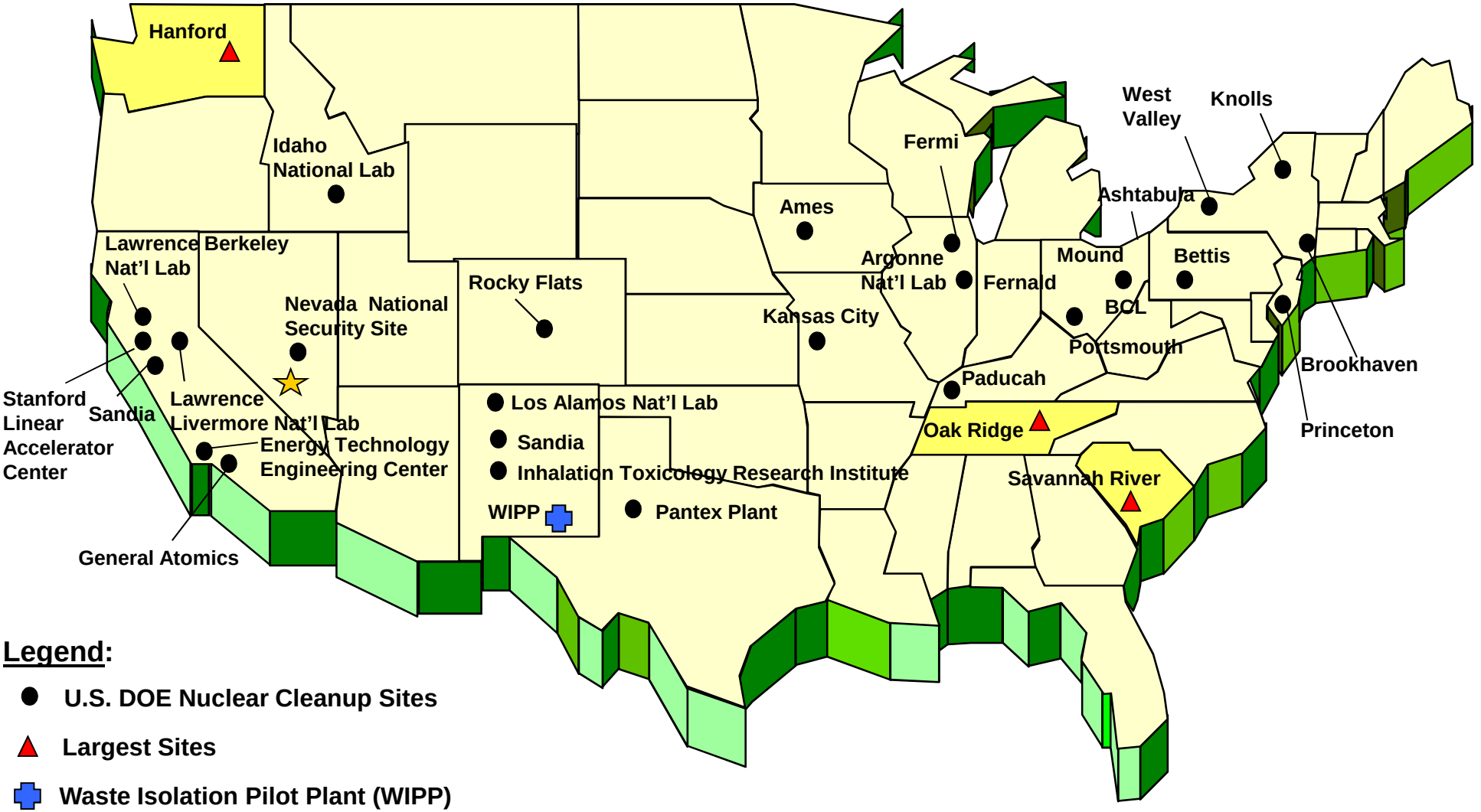
Introduction

- In 1989, DOE established EM to solve technically challenging risks posed by world's largest nuclear cleanup program.
- After years of focusing on managing the most urgent risks, EM has begun transitioning from primarily a characterization and stabilization program to an active cleanup and closure program
- Although much progress has been made, some completion dates extend past 2050.
- DOE Efforts will continue to require facing management challenges, technological leaps, and billions of dollars a year for several more decades.

The U.S. Department of Energy's Cleanup Sites



Legend:

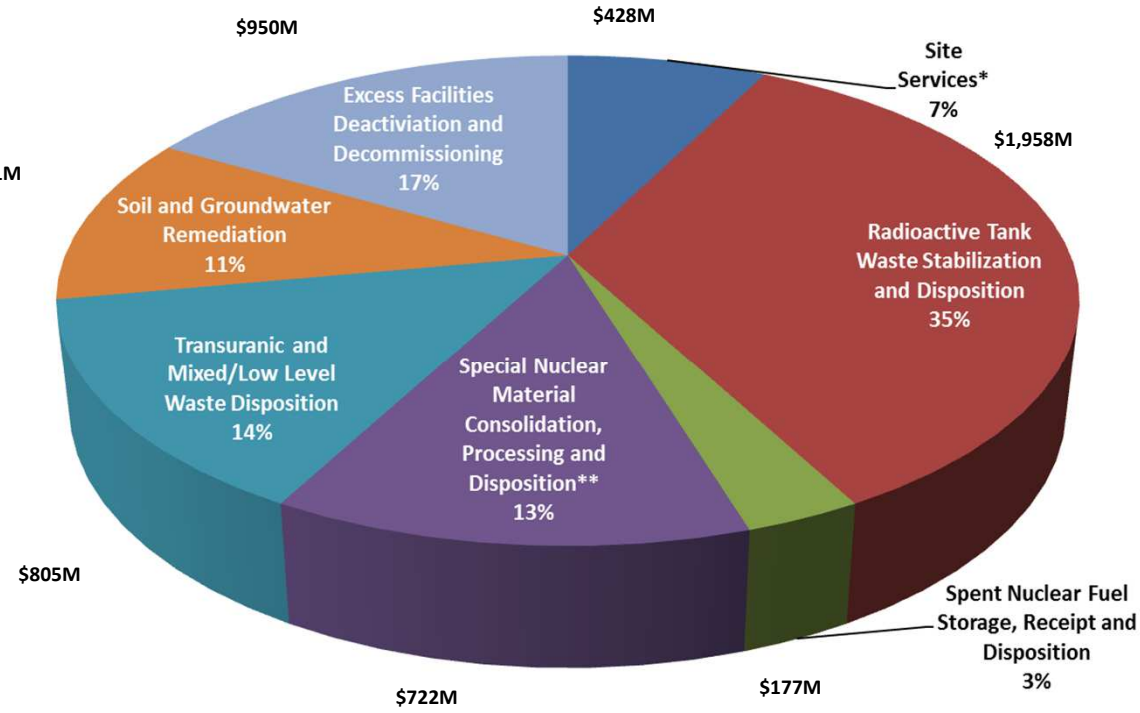
- U.S. DOE Nuclear Cleanup Sites
- Largest Sites
- Waste Isolation Pilot Plant (WIPP)
- Yucca Mountain Repository

Mission of DOE-EM Program

Maintain a safe, secure, and compliant posture in the EM complex

- Radioactive tank waste stabilization, treatment, and disposal
- Spent (used) nuclear fuel storage, receipt, and disposition
- Special nuclear material consolidation, processing, and disposition
- Transuranic and mixed/low-level waste disposition
- Soil and groundwater remediation
- Excess facilities deactivation and decommissioning (D&D)

FY 2013 Budget Request - $5.65B



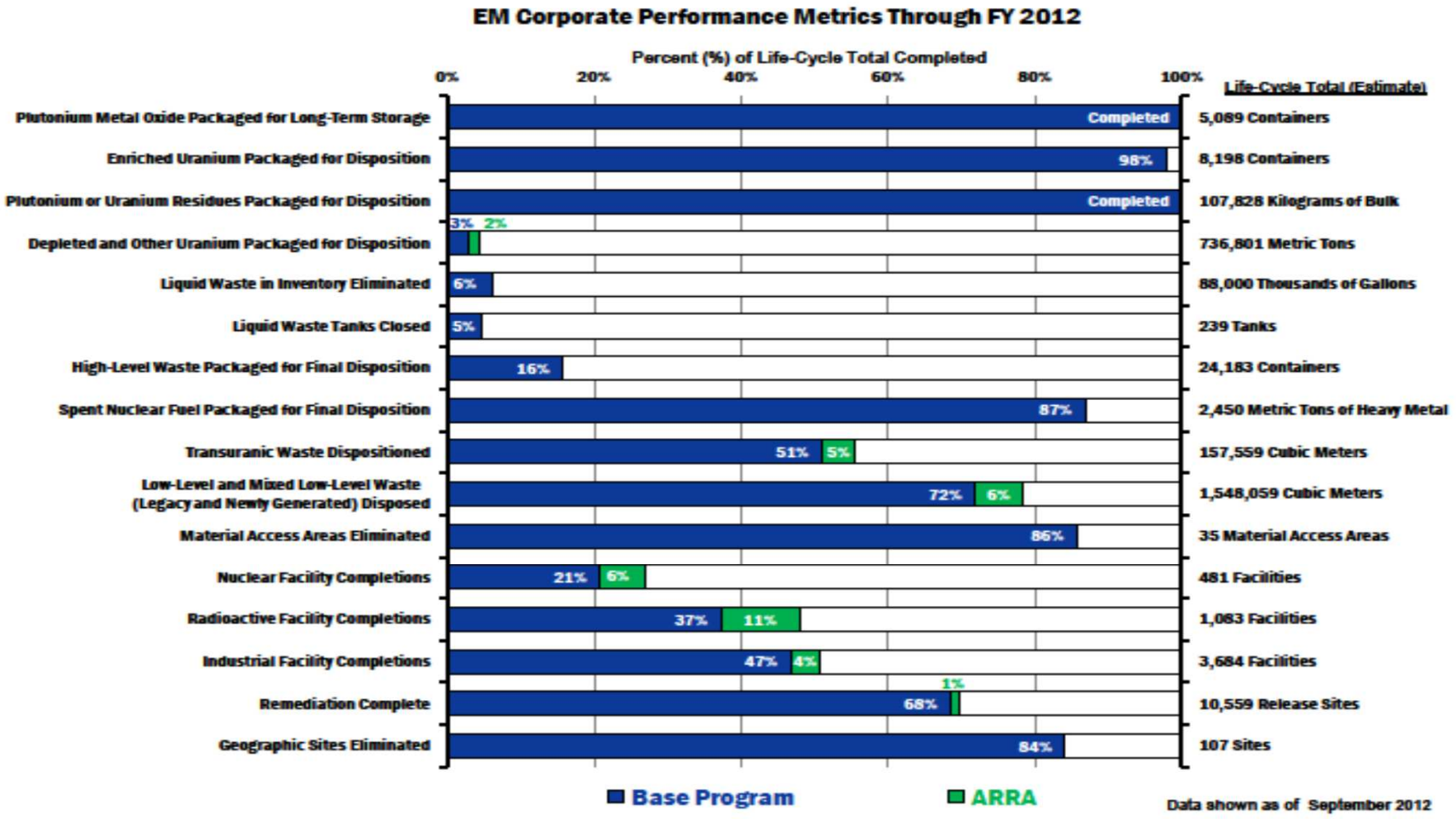
*** Includes Program Direction, Program Support, TDD, Post Closure Administration and Community and Regulatory Support**

**** Includes Safeguards and Security**

Approach to Completion of EM Mission

- **Program Management Effectiveness - Continue to enhance management systems, improve cleanup and waste disposition approaches, and develop new technologies**
- **Acquisition Management – Continue to transition to performance-based contracts**
- **Project Management – "Best-in-Class" project management to ensure projects remain on schedule and within budget**

Bringing us closure to our destination …



Risk-informed Decision Making

- **Manage environmental contamination and waste in a manner that optimizes, balances protection of human health and the environment and cost effectiveness for current and future generations**

- **Will be necessary to leave residual waste in place**
  - **Allows for natural attenuation**
  - **Integrates stewardship into holistic, life-cycle management options**
  - **Requires further development of predictive modeling and visualization, and monitoring and sensor technologies**
  - **Recognizes U.S. Government's long term commitment to monitoring and other institutional controls**

Savannah River Tank 5 Heel Removal
(Tank Interior)

Natural attenuation of uranium contamination at the 300 area , Hanford site

Discovering Sustainable Solutions

- **U.S. Executive Order 13514 requires federal agencies to establish an integrated strategy towards sustainability and to make reduction of greenhouse gas emissions a priority for federal agencies.**

- **EM's approach to meeting Executive Order 13514 goals is**
  - **Accelerated D&D of high energy consuming excess facilities (e.g., Portsmouth, West Valley and ETTP)**
  - **Ensure EM sites have robust energy management programs**
  - **Promote In Situ Decommissioning and green remediation, where appropriate**

- **Several EM sites have successfully implemented energy reduction efforts.**

Community Involvement

- **EM's success hinges on its collaboration with affected state, local, tribal governments, and local citizen groups.**

- **EM supports national intergovernmental organizations and citizen groups through grants and cooperative agreements.**

- **Bases for EM processes include:**
  - **Early public and tribal involvement**
  - **Communication**
  - **Coordination among multiple regulators**
  - **Transparency and confidence in risk ranking methodology**
  - **Enhance involvement in EM and regulatory decisions**

Regulatory Compliance

OSHA Occupational Safety and Health Administration www.osha.gov

Department of Transportation United States of America

United States Environmental Protection Agency

Hanford Federal Facility Agreement and Consent Order

Tri-Party Agreement

- External regulators include U.S. Environmental Protection Agency; State environmental and health regulatory agencies; and Department of Transportation.
- EM is responsible for evaluating regulatory options for compliance with environmental statutes, regulations (RCRA and CERCLA), and agreements.
- EM self regulates radioactive waste management; DOE Order 435.1, guidance and technical standards set forth the requirements

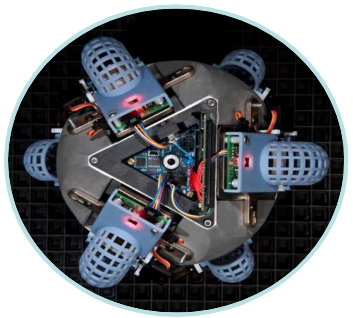
The State of Idaho, through the Attorney General, and Governor Philip E. Batt in his official capacity; the Department of Energy, through the General Counsel and Assistant Secretary for Environmental Management; and the Department of the Navy, through the General Counsel and Director, Naval Nuclear Propulsion Program, hereby agree on this 16th day of October, 1995, to the following terms and conditions to fully resolve all issues in the actions Public Service Co. of Colorado v. Batt, No. CV 91-0035-S-EJL (D. Id.) and United States v. Batt, No. CV-91-0065-S-EJL (D. Id.):

Science and Technological Advancement

EM's Approach to Science and Technology Advancement:

- Reduce technical and safety risk while maximizing regulatory compliance
- Improve existing technologies to take advantage of advances in science and engineering
- Develop new technologies to overcome intractable technical barriers
- Identify insertion points for technology advances or new technologies to maintain momentum of cleaning progress



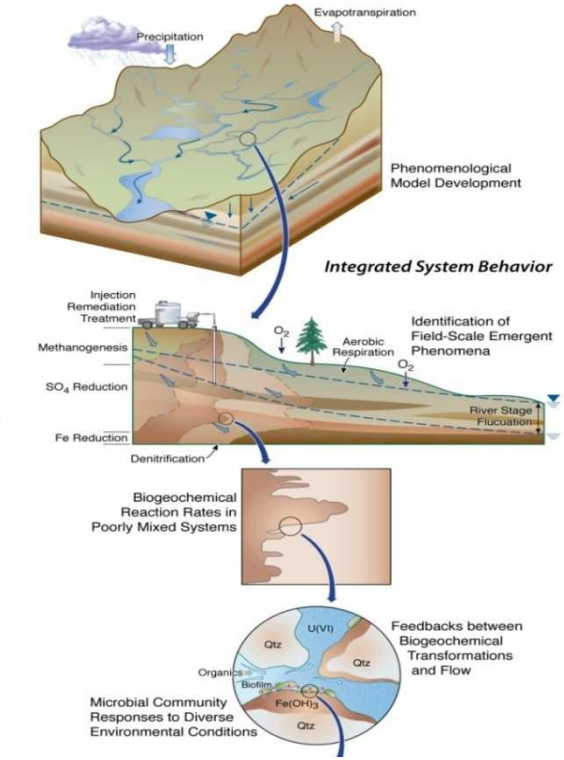
Science/Technology Innovation and Development results in:

- Improved worker safety
- Reduced technical risk
- Accelerated cleanup
- Resolution of complex technical challenges
- Significant lifecycle savings

Challenge for Technical advancement

Advanced Simulation Capability for Environmental Management (ASCEM)

- **ASCEM** is a **State-of-the-art approach** for predicting contaminant fate and transport
- Based on a **modular, extensible and open source** design that:
  - Leverages existing DOE computational capabilities
  - Provides a dynamic and evolving **community platform** for testing and integrating new process-based understanding
- **Integrates key tools into single framework**, including simulation, data management, visualization, parameter estimation and uncertainty quantification
- http://ascemdoe.org

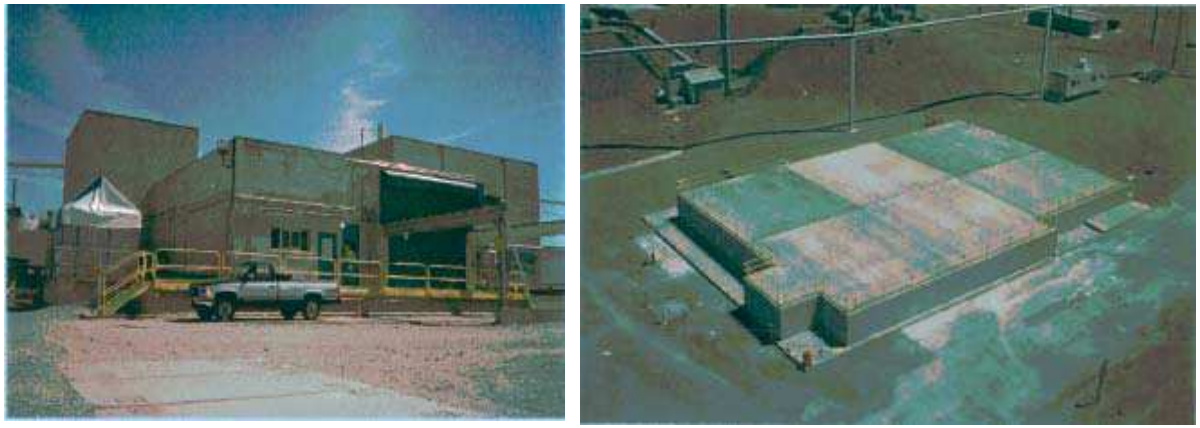


Wide Range of Platforms

Challenge for Technological Advancement

In-Situ Decommissioning:

- Entails limited or no deactivation/ decontamination of a selected number/type of excess contaminated nuclear facilities and filling void spaces with grout or other similar materials.
- Resultant end state is a “concrete monolith” either totally in the subsurface or partially above the surface.
- Aim is to provide long-term (1,000 years) containment of all contamination.
- Requires monitoring of contamination movement



Idaho’s old calcining facility before and after decommissioning (conceptual)

Specially engineered grout fill being pumped into a Savannah River P Reactor building

Lessons Learned

- **Based on successes at Rocky Flats, Fernald, Mound, and other DOE sites, EM has developed Lessons Learned. These lessons are continuing to be applied to ongoing EM cleanup effort.**

- **Over the years, EM program has solved many cleanup problems that one time seemed unsolvable. Lessons Learned from these and other EM efforts can be used to address decommissioning and remediation issues all over the world.**

- **EM lessons learned can be accessed at**
  http://www.hss.doe.gov/sesa/analysis/ll/links.html
  http://rockyflats.apps.em.doe.gov/

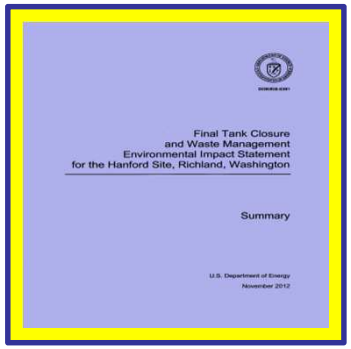
TMI Fuel Storage Facility at Idaho

Chernobyl Nuclear Reactor after the disaster

Fukushima Reactors damage due to 2011 tsunamimage

Examples of Lessons Learned

- **Never lose focus on safety of workers and the public.**
- **Keep focused on technologies, which often change over time and encourage innovation – one size does not fit all!**
- **Define future use and end states as early as possible.**
- **Having plans and environmental acceptance in place allows rapid project startup.**
- **On-site disposal cells and in-situ decommissioning (ISD) or entombment can provide huge waste disposal costs savings.**
- **Improving Contract and Project Management can Deliver Results On-Time, Within Cost, and with World Class Technical Competencies.**
- **Specifying deactivation of contaminated facilities must be systematic and thorough.**



Hanford Tank closure and Waste Management EIS

U-Canyon at Hanford (ISD Project)

235-F Building at Savannah River Site (Deactivation Project)

In Conclusion

- Time is not on our side – costs and risks increase over time.
- We have a responsibility to relieve future generations of this environmental and financial liability.
- We have delivered significant cleanup results in the past several years, while completing projects on time and within cost