



Goals for a Deep Borehole Disposal Workshop

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SNL-MIT Workshop on Deep Borehole Disposal

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,
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Outline

- **Background**
- **Main conclusions from a recent SNL analysis of deep borehole disposal**
- **What we're looking for today**
 - **Is deep borehole disposal a viable concept?**
 - **What are the research needs that will allow it to be fully evaluated?**



Used Nuclear Fuel and High-Level Waste in the United States Today



Commercial Used Nuclear Fuel

**DOE and Defense-Related
Used Nuclear Fuel**

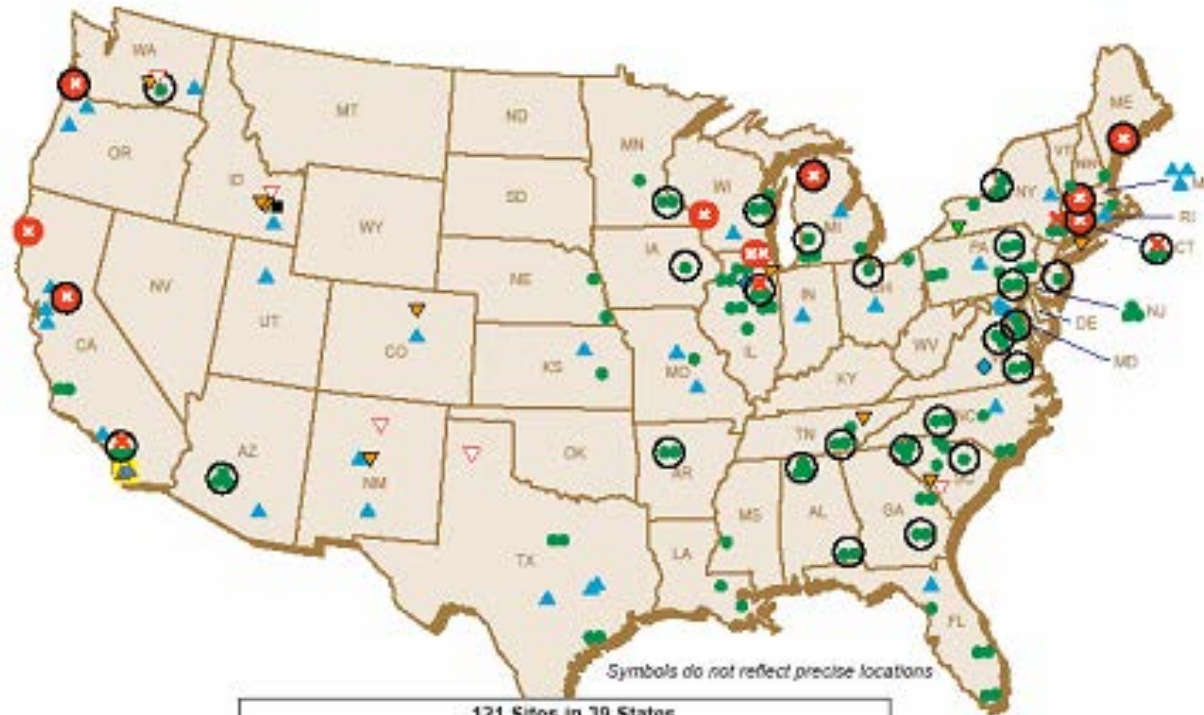


**Defense-Related and Commercial
High-Level Radioactive Waste**



Current Locations of Used Nuclear Fuel and High-Level Radioactive Waste in the United States

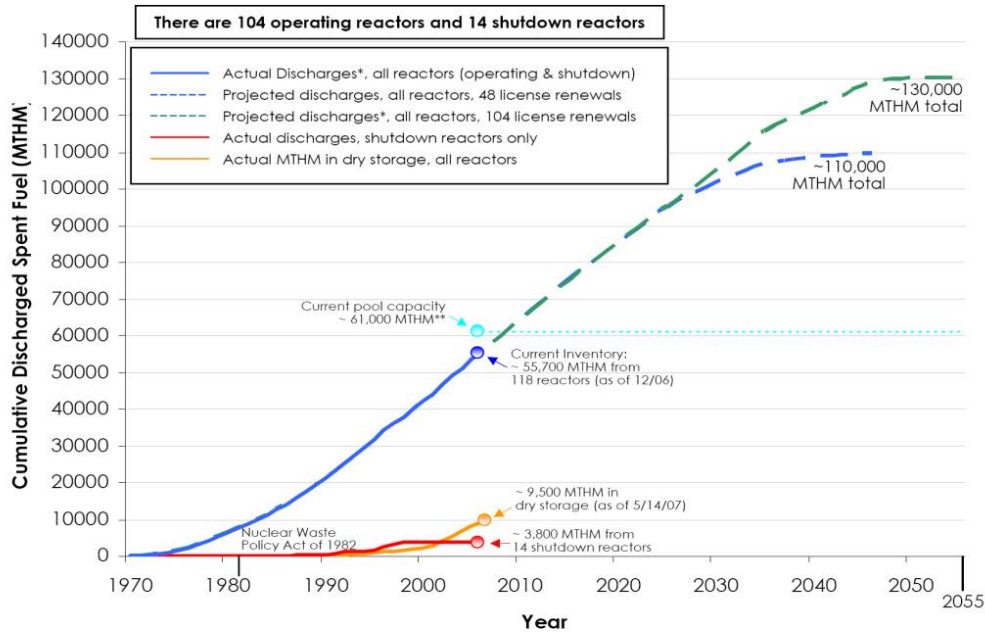
121 sites in 39 states



As of February 2008



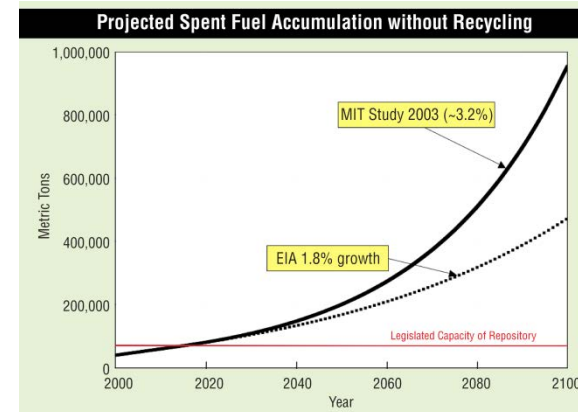
Commercial Used Nuclear Fuel



Existing power plants (above)

With new power plants (right)

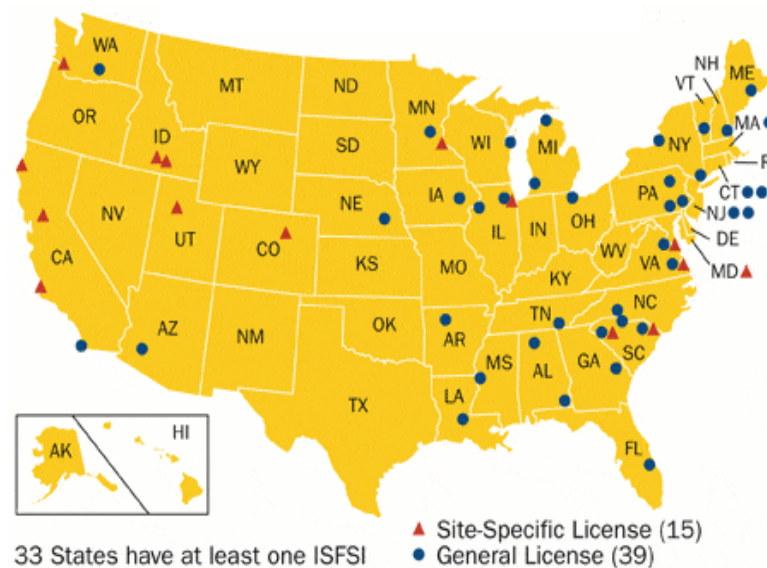
The US inventory of used fuel will increase in all scenarios





Locations of NRC-Licensed Dry Storage Facilities for Used Fuel

- **Currently 54 dry cask storage NRC-licensed Independent Spent Fuel Storage Installations (ISFSIs) in 33 states**
- **Orphaned fuel: There are 14 shutdown reactors at 13 sites in 9 states with used fuel in wet or dry storage**





US Support for Research on Deep Borehole Disposal

- **Historically, US evaluation of deep boreholes began in 1950s, extensive work in 1970s, again in 1990s**
 - **Early work established the basics of the concept: context has changed, but science remains sound**
- **Current US activity**
 - **MIT: ongoing work led by Mike Driscoll**
 - **Sandia: Lab-directed R&D beginning in 2009**
 - **DOE Office of Nuclear Energy reopens Federal consideration of the concept of deep borehole disposal in 2009**



New Observations from the Preliminary SNL Analysis

- **All used fuel from the existing US LWR reactors could be emplaced in approximately 1000 deep boreholes**
 - **SAND2009-4401 estimates that 109,300 MTHM of UNF and HLW could be disposed of in ~950 boreholes**
- **Total costs are competitive with mined repositories**
 - **SAND2009-4401 estimates a very rough total program cost for the US of \$71B**
- **Long-term performance is likely to be excellent**
 - **SAND2009-4401 estimates peak dose from a single disposal borehole containing 400 PWR assemblies to be 10^{-10} mrem/yr (10^{-12} mSv/yr), well below US and international standards**



Additional Observations from the Preliminary Sandia Analysis

- **Further work is needed to test preliminary observations about long-term performance**
 - **Scenarios with other release pathways**
 - **Thermal-hydrologic-chemical-mechanical behavior of the borehole and surrounding rock should be modeled more accurately**
 - **Seal design needs further basis**
 - **Engineered materials that sequester iodine could increase confidence in near-zero releases**
 - **Performance assessment analyses should address arrays of multiple emplacement holes**



Additional Observations from the Preliminary Sandia Analysis (cont.)

- **Detailed cost analysis would be beneficial**
- **Consideration of changes in legal and regulatory requirements will be needed**
- **Detailed analyses of engineering systems and operational practices for emplacement are needed**

- **A full-scale pilot project should be undertaken**



Goals for the Workshop

- **From the workshop agenda**
 - **To develop and document a consensus on needed research for borehole disposal of nuclear waste**
 - **To introduce the concept of borehole disposal to a broader range of interested observers, practitioners, and policy-makers in the nuclear waste field**
 - **To engage knowledgeable people from outside the nuclear waste community with relevant technical expertise in developing insights into research needs for borehole disposal**