



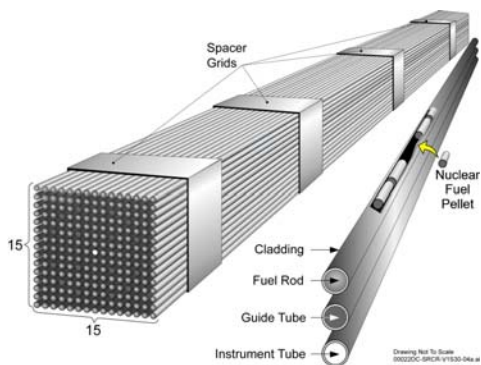
What's Next for Used Nuclear Fuel and Nuclear Waste Management Policy?

January 16, 2013

Mark T. Peters
 Deputy Laboratory Director for Programs
 Argonne National Laboratory

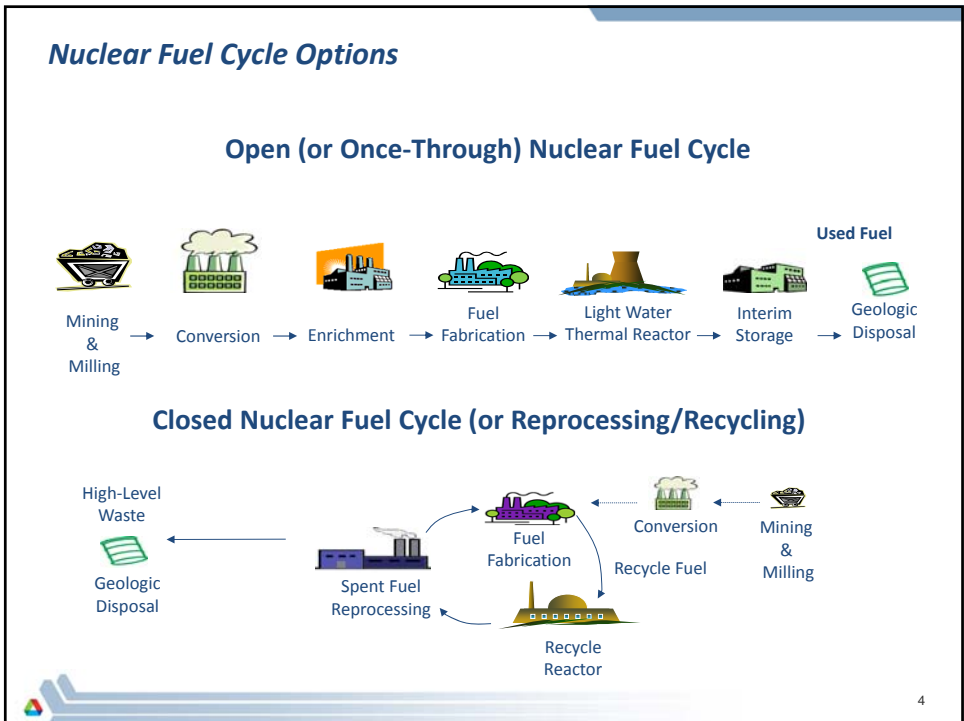
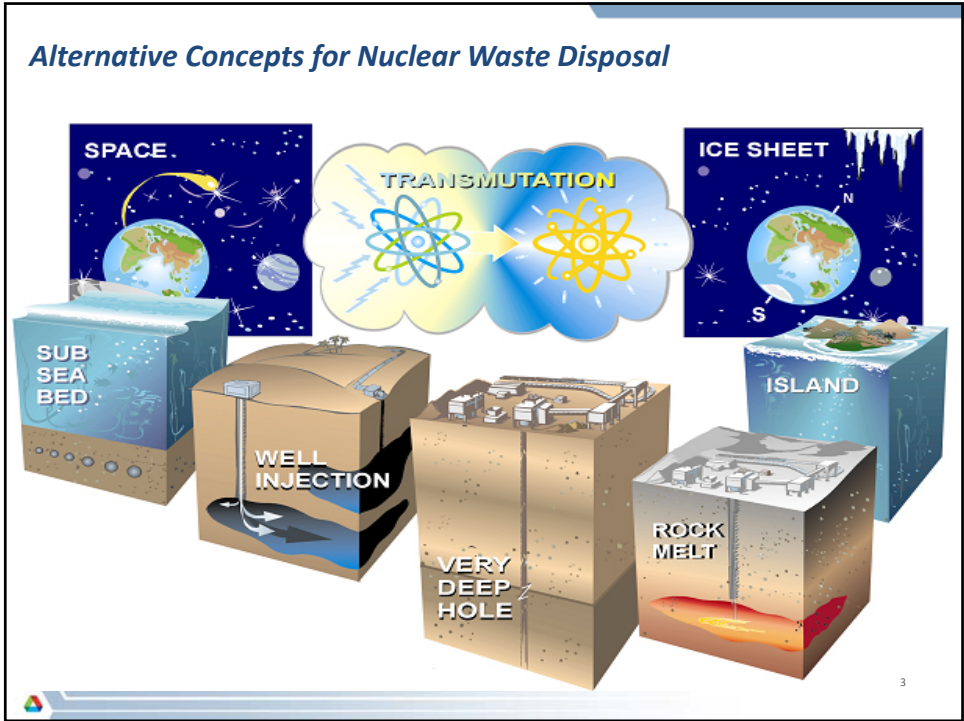
Used Nuclear Fuel Management

Pressurized Water Reactor Used Fuel Assembly

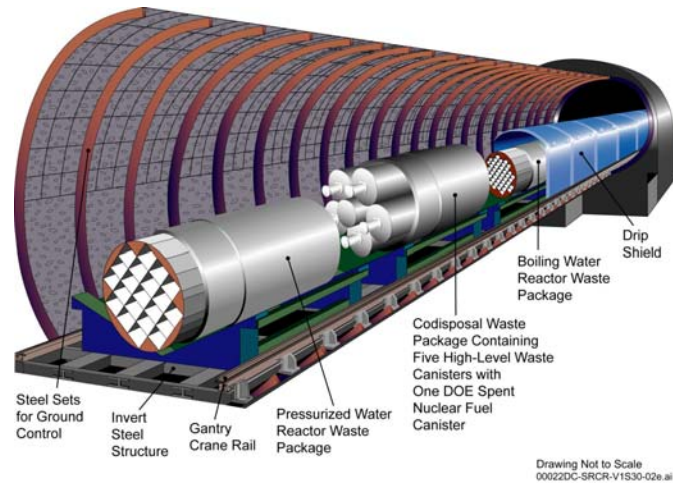


Challenges

2% Transuranics (Pu, Np, Am, Cm)	→	Long-term dose, heat generation, proliferation
5% Fission Products	→	Heat generation, long-term dose
93% Uranium	→	Waste volume



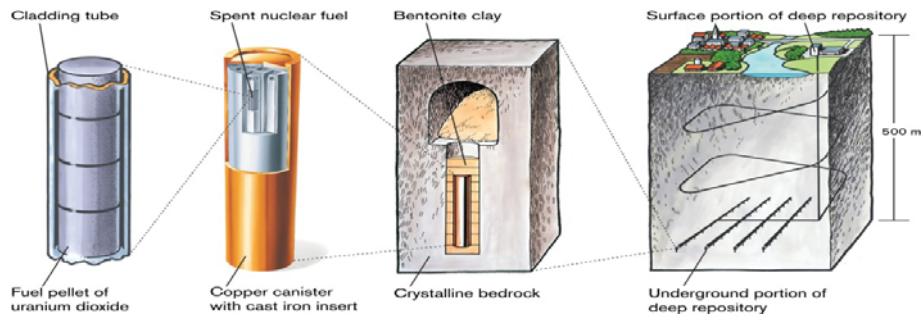
Geologic Disposal -- U.S. Approach



Drawing Not to Scale
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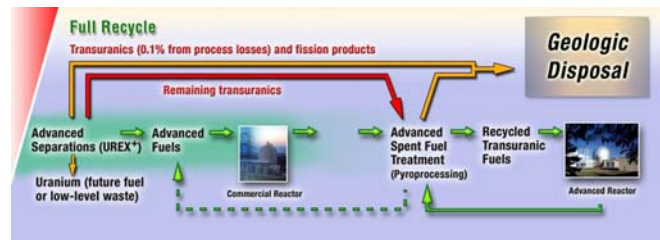
**Swedish Approach for Geological Disposal
(after Lundqvist, 2006)**



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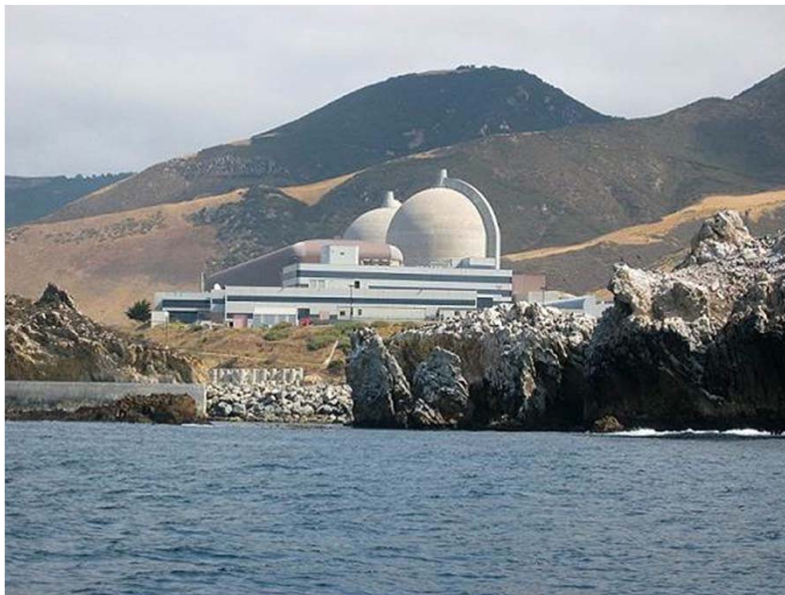
Closing the Nuclear Fuel Cycle: Technical Challenges

- **Separations and Processing**
 - Process losses, waste forms, safeguards, and cost reduction
- **Advanced Reactors**
 - Cost Reduction
- **Scale-up is needed to discover and solve industrial issues**



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Nuclear Energy, Nuclear Waste Today



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Federal Government Faces Multiple Obligations Regarding Nuclear Waste Management

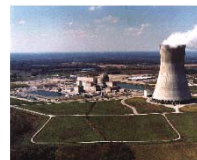


Support Nuclear Navy Mission



Support Surplus Weapons Material Disposition

- **National Security**
 - Support continued operations of the Navy's principal combat vessels
- **Nuclear Non-Proliferation**
 - Ensure security of nuclear fuel and nuclear waste
- **Energy and Economic Security**
 - Maintain nuclear energy option that supplies 20% of our electricity needs to sustain present and future economic security
- **Homeland Security**
 - Accept nuclear materials now stored at sites within 75 miles of 162 million Americans
- **Environmental Protection**
 - Ensure environmentally sound disposition of our government defense and commercial wastes



Support Commercial Nuclear Energy Option



Support Defense Complex Clean-Up

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Current Locations of Used Nuclear Fuel (UNF) and High-level Radioactive Waste (HLW)



121 Sites in 39 States

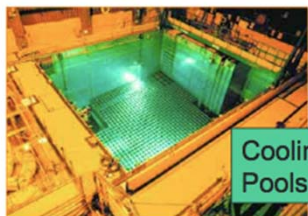
Commercial Reactors	Research Reactors
<ul style="list-style-type: none"> ● operating reactors ▲ shutdown reactors at operating reactor sites ✖ shutdown reactors at shutdown reactor sites where SNF stored for removal after repository opening 	<ul style="list-style-type: none"> ▲ operating reactors ▲ shutdown reactors with SNF on site
<ul style="list-style-type: none"> ◆ Commercial SNF Pool Storage (except Pressurized) ○ Commercial Dry Storage Sites ■ Highly Enriched Uranium at Shutdown Site 	<ul style="list-style-type: none"> ▼ DOE-Owned SNF and HLW ■ Commercial HLW ▼ Surplus Plutonium ■ Naval Reactor Fuel

As of February 2008

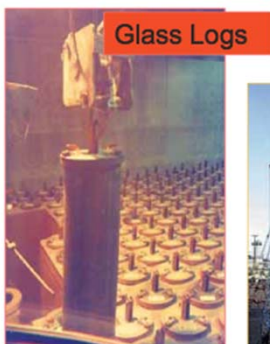
121 sites in 39 states

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How is Used Nuclear Fuel and High-level Waste Currently Stored?



Cooling Pools



Glass Logs

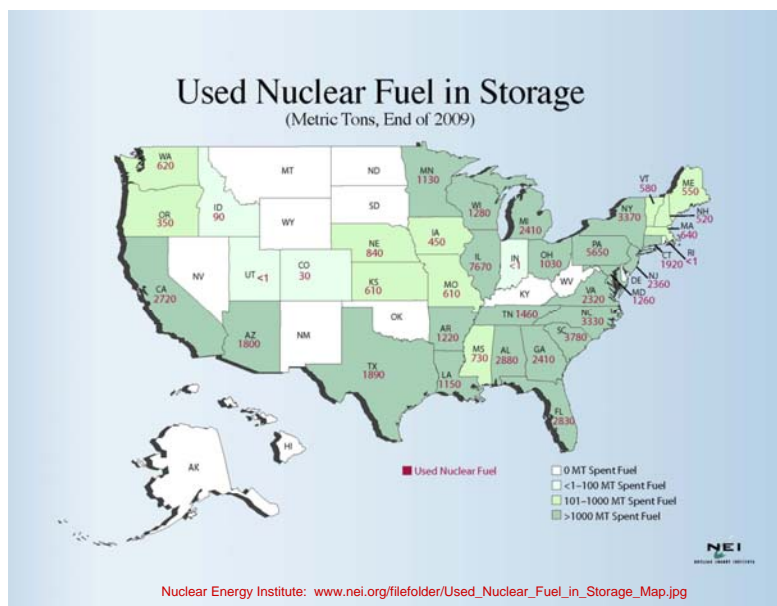


Dry Cask Storage

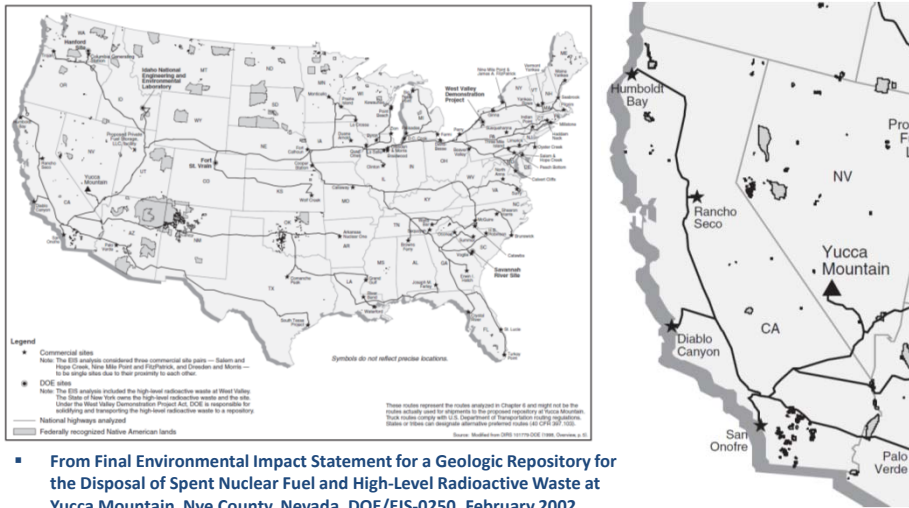


Liquid Storage

Used Fuel Storage

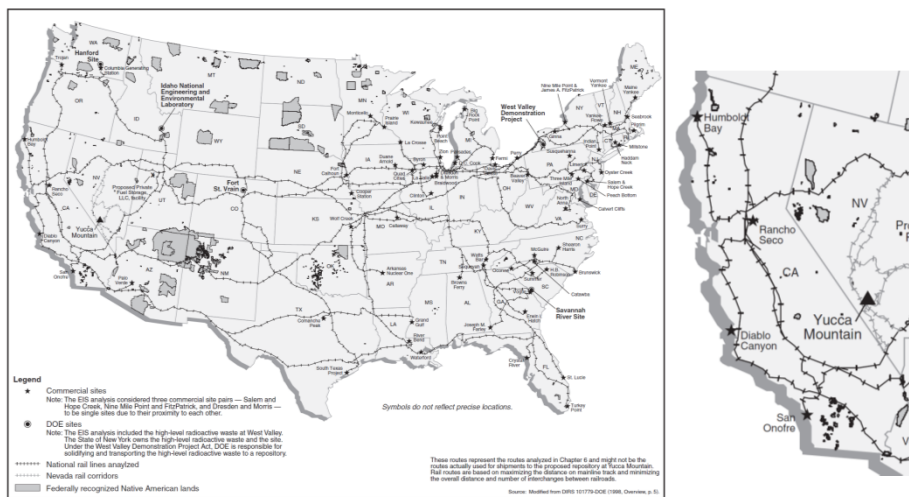


Used Fuel Transportation – Representative Truck Routes



From Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, DOE/EIS-0250, February 2002. Appendix J, Figure J-5

Used Fuel Transportation – Representative Rail Routes



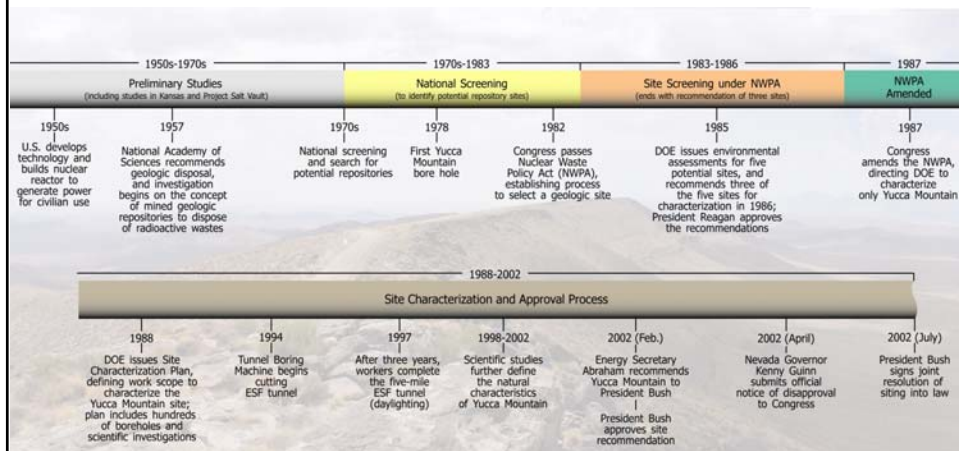
From Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, DOE/EIS-0250, February 2002. Appendix J, Figure J-6

Nuclear Waste Policy



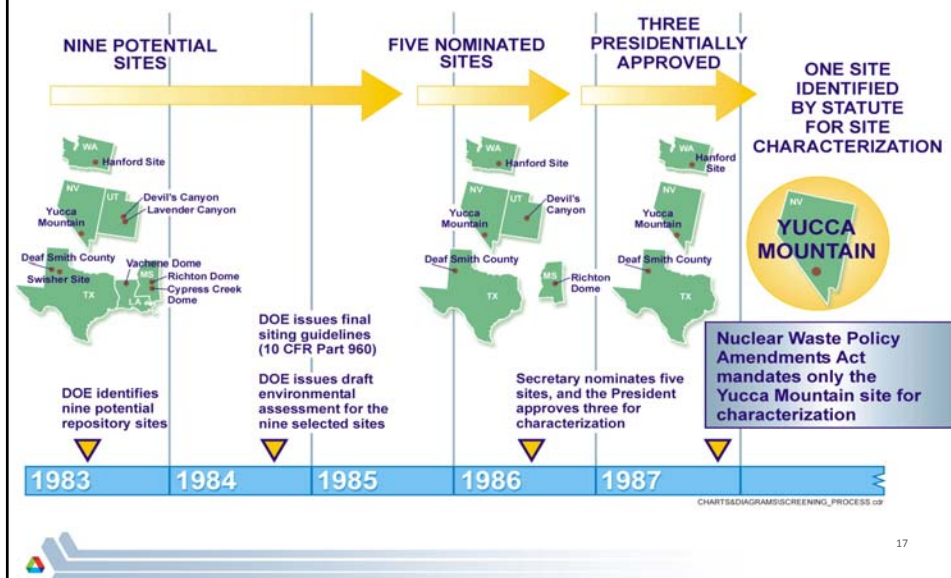
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U.S. Nuclear Waste Policy since 1950



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NWPA-Directed Site Selection Process Through 1987



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The National Repository Program



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All Nuclear Utilities Operate Under Standard Contract Requiring DOE to Accept Used Nuclear Fuel

- Under Nuclear Waste Policy Act, all nuclear utilities must sign a contract with DOE to accept used fuel
- In 1983, all nuclear utilities signed Standard Contract
- In 1998, Nation's utilities sued federal government over the delay in acceptance of used nuclear fuel
- Courts ruled, delay makes DOE liable for partial breach of contract
- Federal government offered utilities settlement to avoid multiple trials for damages
- DOE has developed an amendment to the Standard Contract for Disposal of UNF and/or HLW to support the development of the next generation of nuclear reactors

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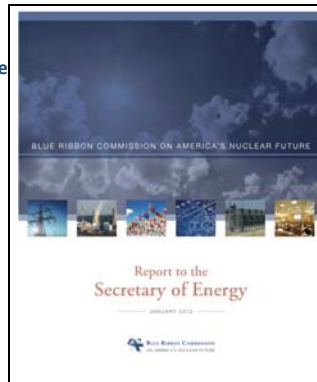
Current Status of the Nuclear Waste Fund

- Congress established the Nuclear Waste Fund to provide funding for repository development and operations
- Utilities pay 1 mill per kilowatt-hour fee on electricity generated and sold from nuclear reactors
 - Revenues average \$750 million per year
 - Approximately \$18 billion in fees paid to date
- Excess funds invested in Treasury securities
 - Approximately \$15 billion in interest earned to date
 - Current interest revenues now average \$1 billion per year
- Current value of the fund is approximately \$25 billion

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Blue Ribbon Commission (BRC) on America's Nuclear Energy Future

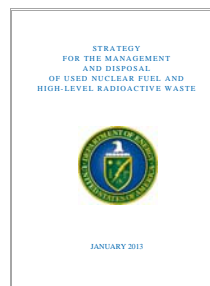
- Recommendations from the BRC's Report to the Secretary of Energy, January 2012 (<http://brc.gov/>)
 - A new, consent-based approach to siting future nuclear waste management facilities;
 - A new organization dedicated solely to implementing the waste management program and empowered with the authority and resources to succeed;
 - Access to the funds nuclear utility ratepayers are providing for the purpose of nuclear waste management;
 - Prompt efforts to develop one or more geologic disposal facilities;
 - Prompt efforts to develop one or more consolidated storage facilities;
 - Prompt efforts to prepare for the eventual large-scale transport of spent nuclear fuel and high-level waste to consolidated storage and disposal facilities when such facilities become available;
 - Support for continued U.S. innovation in nuclear energy technology and for workforce development; and
 - Active U.S. leadership in international efforts to address safety, waste management, non-proliferation, and security concerns.



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Response to Blue Ribbon Commission

- DOE's Response
 - DOE established 4 working groups
 1. Governance Framework and Funding
 2. System Design & Architecture
 3. Consent Based Siting
 4. Transportation Routing, Safety and Security
 - Released January 11, 2013
 - <http://energy.gov/sites/prod/files/Strategy%20for%20the%20Management%20and%20Disposal%20of%20Used%20Nuclear%20Fuel%20and%20High%20Level%20Radioactive%20Waste.pdf>
 - Agreed broadly with BRC
 - Pilot Storage Facility by 2021; Commercial Storage Facility by 2025; Geologic Repository by 2048
- Congressional Response
 - Senator Bingaman's Bill: "Nuclear Waste Administration Act of 2012"



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What's Next?

- **Role of nuclear energy in addressing energy security and climate change challenges**
- **Ever-growing UNF and Waste Inventory**
- **Waste Confidence Rulemaking**
- **Yucca Mountain Litigation**
- **Response to Blue Ribbon Commission (Administration/Congress)**
- **Amendment to Nuclear Waste Policy Act**
 - **Management of existing and future waste and used fuel inventory**
 - **Social, policy, management, and financial framework**
- **Fuel Cycle and Waste Management Options informed by Science and Engineering**

