



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

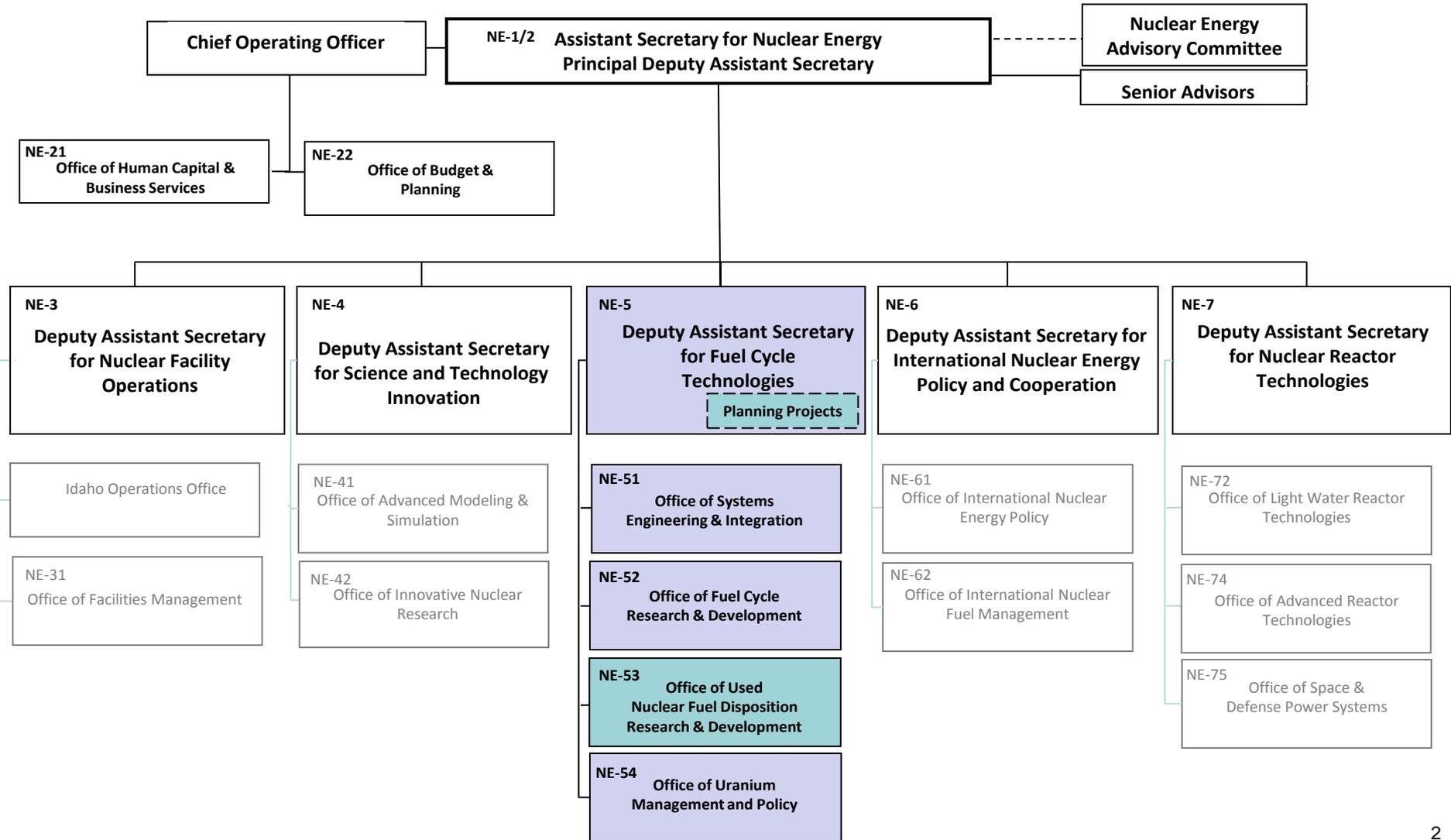
Update on Activities Used Nuclear Fuel Disposition

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U.S. Nuclear Waste Technical Review Board
Fall Board Meeting
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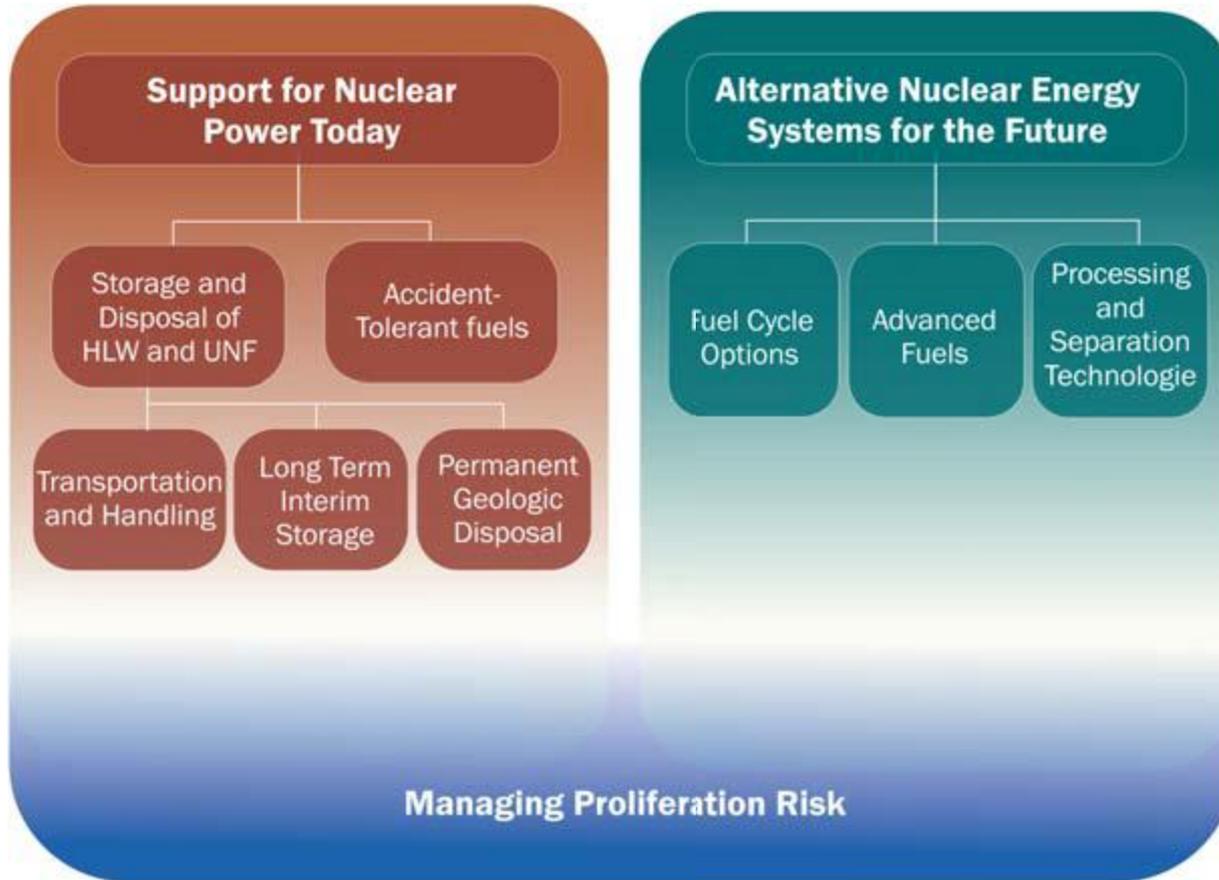


Proposed Organization Office of Nuclear Energy





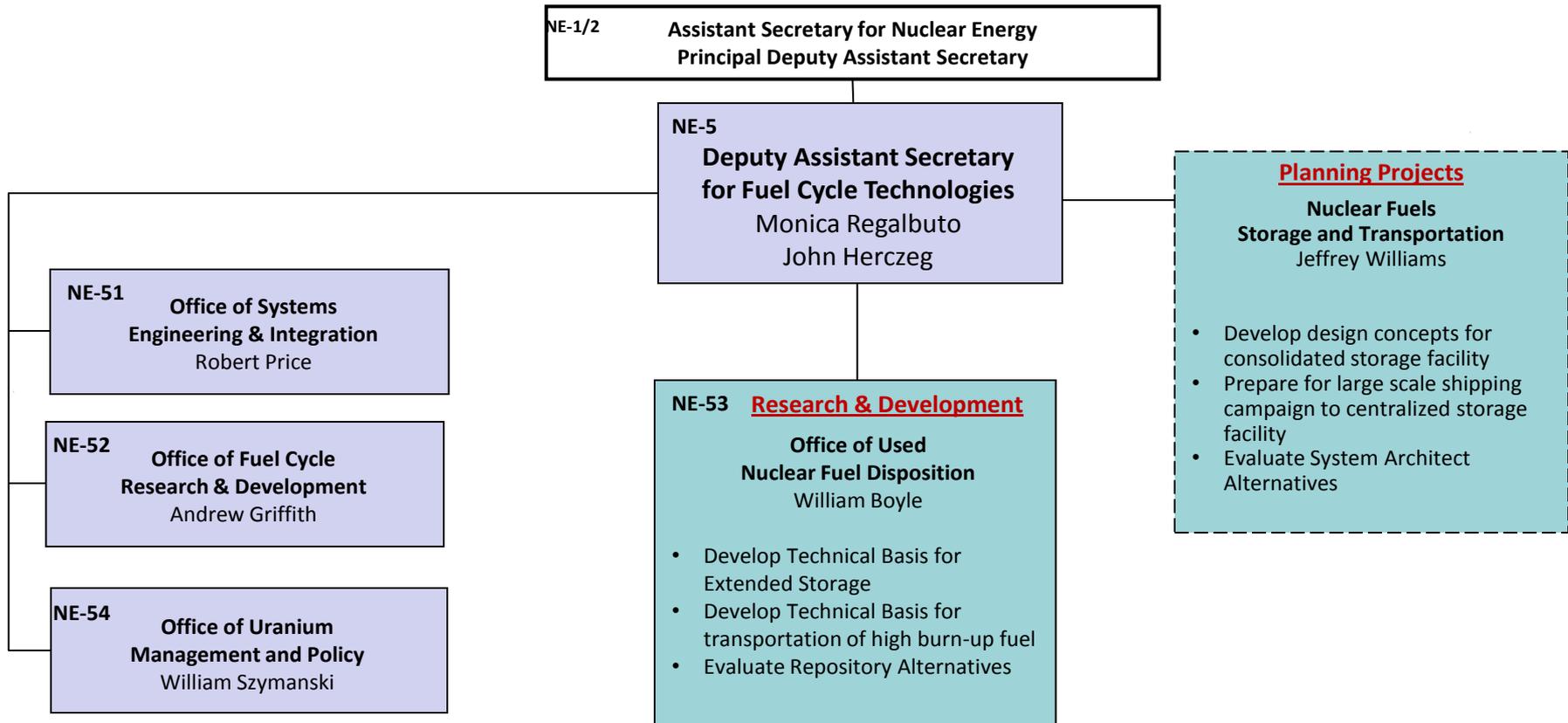
Fuel Cycle Technologies (FCT) Balances Near-Term and Long-Term Objectives



- **Satisfy increasing demand for near-term action on (1) used nuclear fuel storage (transportation) and disposal and (2) accident tolerant fuels.**
- **Maintain the momentum for long-term R&D activities with the potential for game-changing improvements.**



NE-5 Organizations Supporting Used Fuel Disposition (UFD)





Nuclear Energy Role in US Energy Supply

■ Nuclear power is clean, reliable base load energy source

- Provides 19% of U.S. electricity generation mix
- Provides over 61% of U.S. emission-free electricity
 - Avoids about 700 MMTCO₂ each year
 - Helps reduce overall NOx and SOx levels

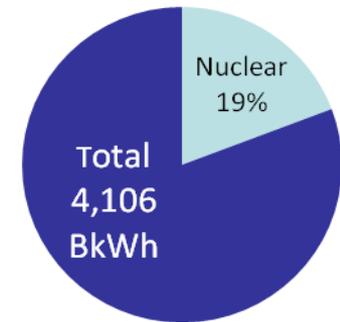
■ 100 GWe nuclear capacity - 104 operating plants

- Fleet maintaining approximate 90% average capacity factors
- Most expected to apply for license renewal for 60 years of operation.

U.S. electricity demand projected to increase ~24% by 2030

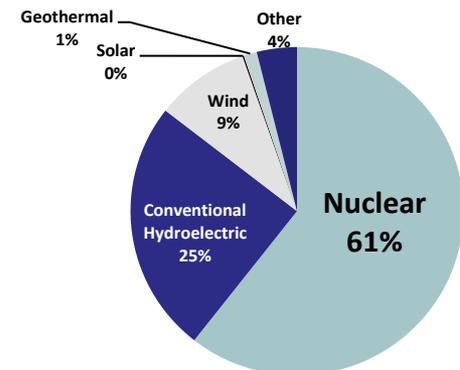
U.S. Electricity Net Generation (2011)

Source: Energy Information Administration



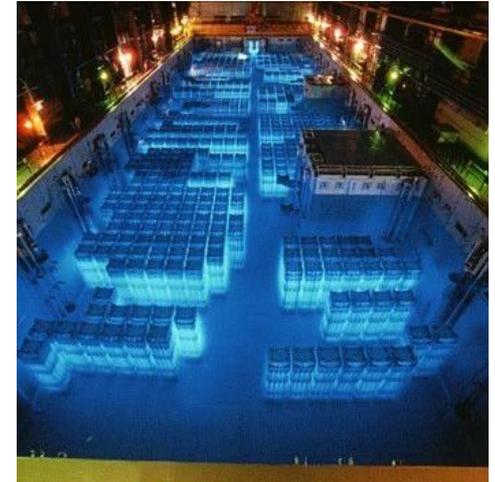
Net Non-emitting Sources of Electricity

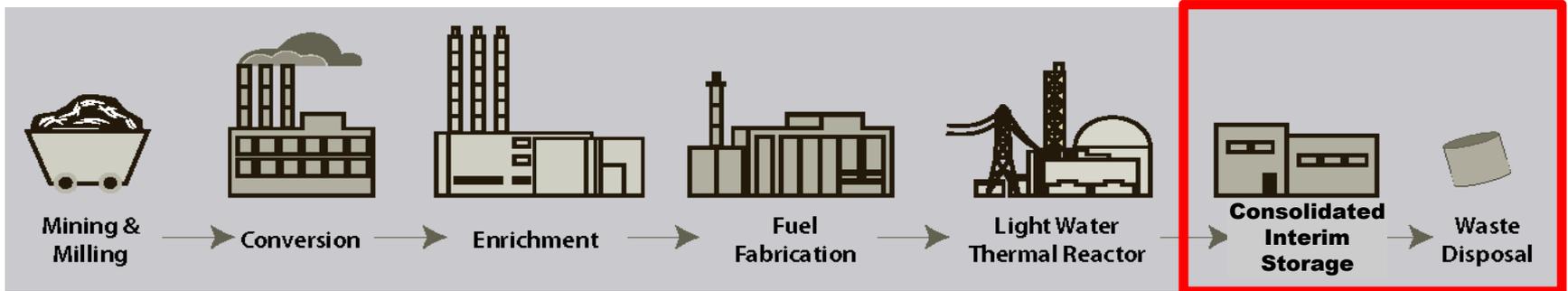
Source: Energy Information Administration





- Each year, U.S. nuclear power plants generate ~2,000 MT of used fuel
- The estimated inventory by the end of CY12 is 70,000 MT of used fuel
 - 27% is stored in dry storage (1650 casks)
 - Projected used fuel quantity in storage by 2020 will be about 88,000 MT
- The current policy for UNF is direct geologic disposal
 - At least one repository will be needed for any option





U.S. path forward

- *BRC provided recommendations that help guide management of used nuclear fuel and fuel cycle R&D*
- *BRC affirms the need for R&D on advanced fuel cycles that represent advantages over today's technologies*



Blue Ribbon Commission Recommendations



- 1. A new, consent-based approach to siting future nuclear waste management facilities.***
- 2. A new organization dedicated solely to implementing the waste management program and empowered with the authority and resources to succeed.***
- 3. Access to the funds nuclear utility ratepayers are providing for the purpose of nuclear waste management.***
- 4. Prompt efforts to develop one or more geologic disposal facilities.***
- 5. Prompt efforts to develop one or more consolidated storage facilities.***
- 6. 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.***
- 7. Support for continued U.S. innovation in nuclear energy technology and for workforce development.***
- 8. Active U.S. leadership in international efforts to address safety, waste management, non-proliferation, and security concerns.***



BRC Assessment of DOE-NE Program (Chapter 13 Near-Term Actions)



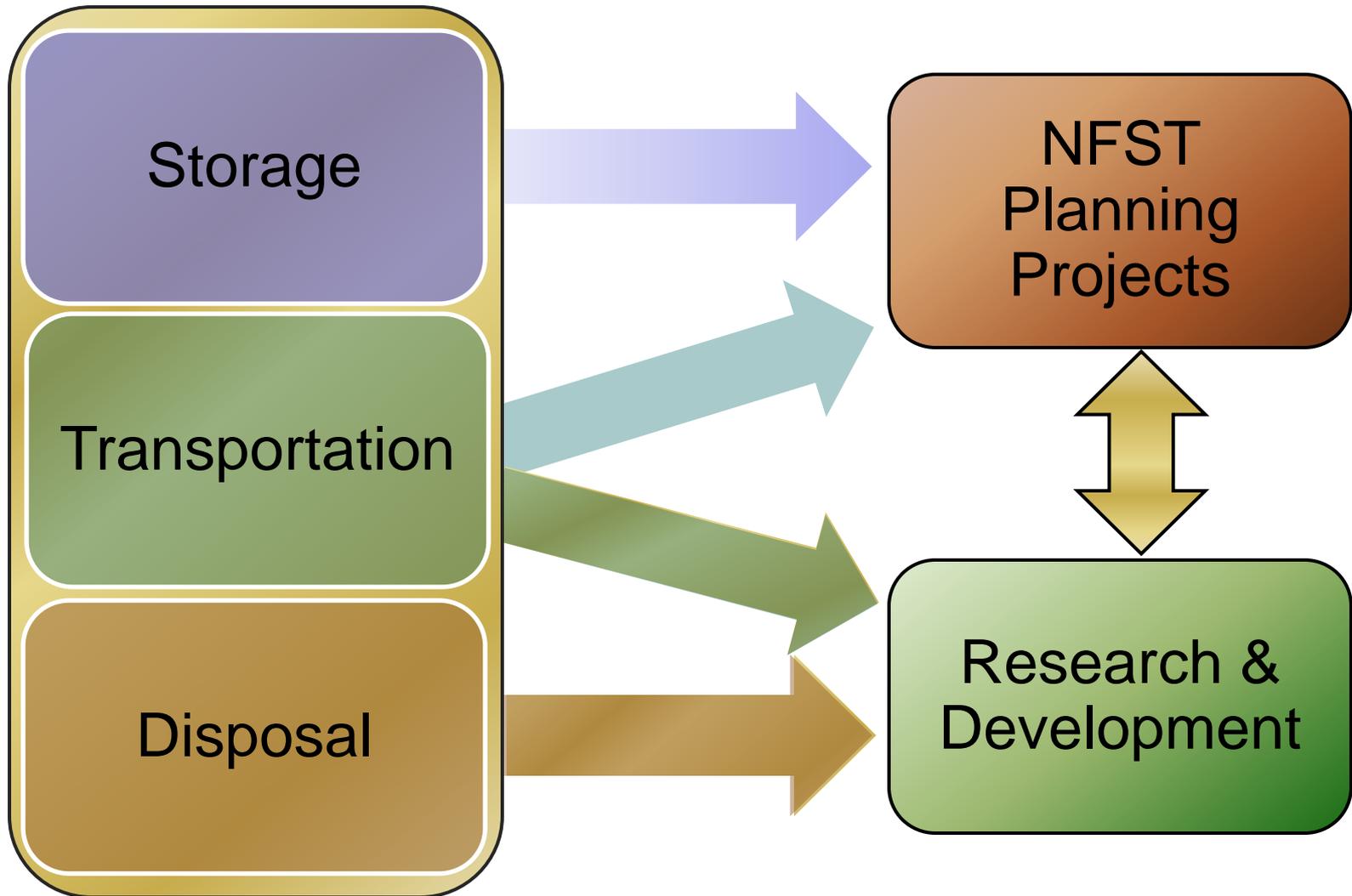
“DOE remains responsible for nuclear waste management activities of the Federal Government, it is important that those steps that do not require the new organization to be in place be initiated as soon as possible”

DOE should :

- **Begin laying the groundwork for implementing consolidated storage (perform system analyses, design studies)**
- **Begin proving funding, for working with state and regional state-government groups and training local and tribal officials in preparation for movement of spent fuel from shutdown reactor site to consolidated storage**
- **Keep a repository program moving forward through valuable, non-site specific activities, including R&D on geological media and work to design improved engineered barriers.**



Used Fuel Disposition Program Areas



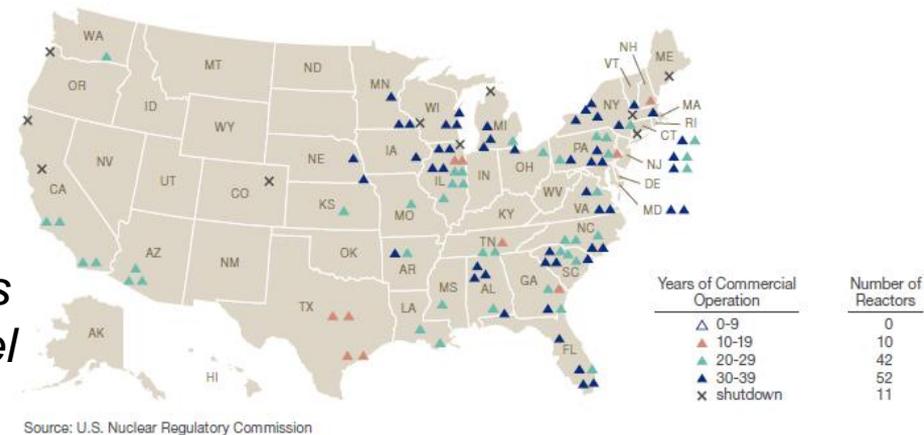


NFST Project Transportation Activities

Objective:

Ensure the implementation of a staged, adaptive, consent-based transportation for SNF and HLW

- *Re-engage with regional groups to better understand stakeholder issues related to the movement of spent fuel*
- *Employ successful approaches from past experiences*



BRC recommends that the development of routes from shut down reactors in the region be developed in a collaborative manner and in a similar process found in successful DOE shipping campaigns, such as WIPP



NFST Project Transportation Activities (cont'd)

- **Planning report for shipping stranded fuel from shutdown sites to a consolidated interim storage facility**
- **Finalize NWPA 180 (c) policy regarding financial and technical assistance to states along transportation routes for UNF**
- **Develop communication products**
- **Complete assessment of transportation hardware needs (e.g., cask, rail cars, support and security)**





NFST Project Storage Activities

Objective:

Begin laying the ground work implementing consolidated storage

- **Build on previous DOE work and industry storage licensing efforts**
 - *Evaluation of design concepts for consolidated storage*
 - *Develop communication packages for use in interaction with potential host communities which describe various attributes of a consolidated storage facility*
- **Siting - initiate development of consent based process**
- **PEIS - evaluate the benefits of a Programmatic EIS**
- **Evaluate system benefits of standardizing packaging**





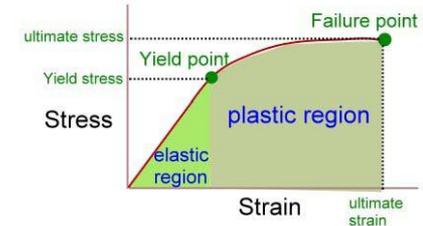
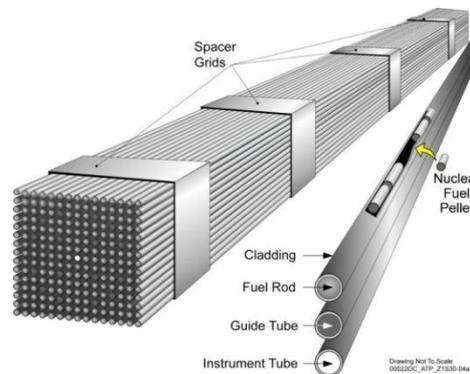
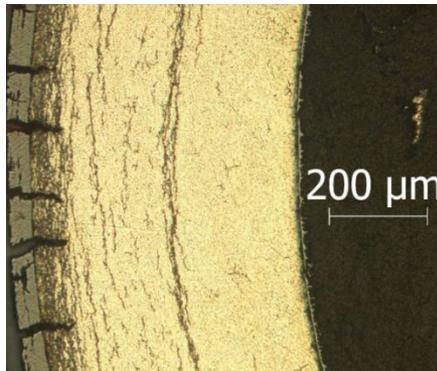
Research & Development: Storage and Transportation

Objective

Prepare for the eventual large-scale transport of spent nuclear fuel and high level waste

Develop the technical basis for:

- Extended storage of used nuclear fuel
- Fuel retrievability and transportation after extended storage
- Transportation of high burn-up used nuclear fuel





Research & Development: Storage and Transportation (cont'd)

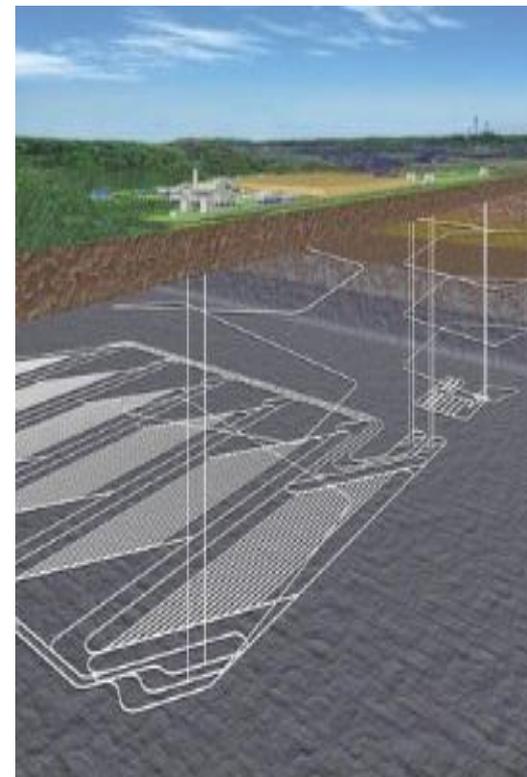
- **Better understand potential degradation mechanisms in long term dry cask storage including:**
 - *Complete the identification of data gaps to support license amendments beyond 40 years for dry storage*
 - *Continue material testing to support modeling and simulation of used fuel aging*
 - *Participate with industry and others on full-scale storage demonstration of high burn-up used fuel*



Research & Development Disposal

Objectives:

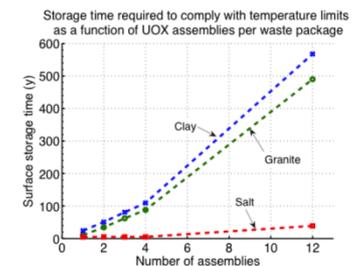
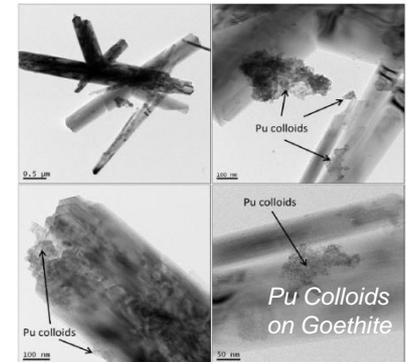
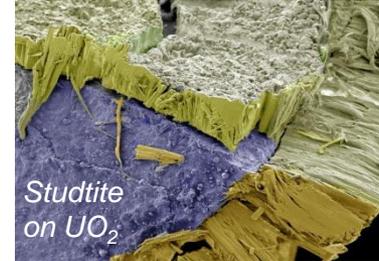
1. Provide a sound technical basis for the assertion that the U.S. has multiple viable disposal options
2. Increase confidence in the robustness of generic disposal concepts
3. Evaluate the BRC recommendation for developing a near term plan for taking the borehole disposal concept to the point of a demonstration





Research & Development Disposal

- **Focus on increasing confidence in generic disposal concepts**
 - *Evaluating engineered barrier systems for mined repositories in salt, crystalline rock, and clay/shale*
 - *Enhanced understanding of natural system performance: groundwater flow and radionuclide transport in geologic media*
 - *Integrating repository design concepts and host rock geology through thermal load management*

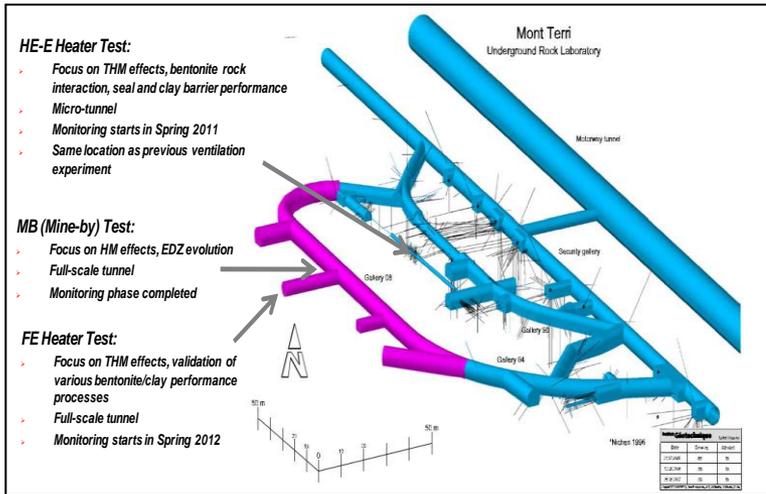




Activities in Disposal – International Collaboration

Formal collaborative R&D arrangements with ongoing programs in Europe and Asia

Major current or soon-to-be started experiments



- Mont Terri:** International underground research laboratory (URL) in clay in Switzerland
 - *Joining the URL gives DOE access to data from all Mont Terri R&D, also the opportunity to conduct new experiments*
- Colloid Formation and Migration Project**
 - *Colloid research at Grimsel granite URL in Switzerland*
- DECOVALEX: (Development of Coupled Models and their Validation against Experiments)**
 - *DOE has participated in the past. New phase of project began Spring 2012*
- KAERI Underground Research Tunnel (KURT)**
 - *Collaborative US/ROK experiments begin in 2013*

Concluding Remarks

- **The Office of Fuel Cycle Technologies is developing used fuel waste management strategies**
- **The Used Fuel Disposition program is laying the foundation for the development of storage, transportation and disposal options**
 - **Program plans are closely tied to BRC near term technical recommendations and continue to adjust to meet changing priorities**

Projects and R&D underway to address key issues