



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

Transportation of Commercial Spent Nuclear Fuel

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An Adaptive, Consent-Based Path to Nuclear Waste Storage and Disposal

- In January 2013, the Administration issued its **Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste**
- **Strategy:**
 - Embraced the core findings of the Blue Ribbon Commission on America's Nuclear Future
 - Disposition nuclear waste must be based not only on sound science, but also on achieving public acceptance at the local, state and tribal levels.

STRATEGY
FOR THE MANAGEMENT
AND DISPOSAL
OF USED NUCLEAR FUEL AND
HIGH-LEVEL RADIOACTIVE WASTE

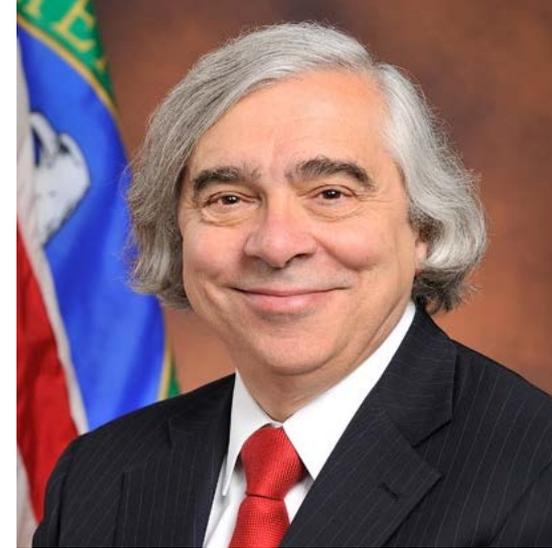


JANUARY 2013



Parallel Path Forward

- **On March 24, 2015 President Obama authorized the Energy Department to move forward with planning for a separate repository for high-level radioactive waste resulting from atomic energy defense activities.**
- **In remarks before the Bipartisan Policy Center, Secretary Moniz discussed this path forward for defense waste as well as a parallel path for storage and disposal of commercial spent fuel, consistent with the Administration's January 2013 Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste, which built upon the work of the bipartisan Blue Ribbon Commission on America's Nuclear Future completed in January 2012.**
- **Secretary Moniz announced three specific actions that the Department will undertake –**
 - Planning for a defense-only repository
 - Moving forward with planning for interim storage of commercial spent fuel
 - Moving forward with a consent-based siting process for both types of facilities



Comprehensive Workable Solutions are Required

(one size does not necessarily fit all)

■ Commercial spent fuel & high level waste:

- 61 operating reactor sites in 30 states
- 13 shutdown reactors
- West Valley

■ DOE-managed spent fuel & high level waste:

- Navy spent fuel in Idaho
- Commercial and defense origin spent fuel (3 primary sites)
- Defense high level waste at Hanford, Savannah River, and Idaho



Implementation of Administration's Strategy

- Full implementation of the Administration's Strategy will require new legislation,
- The FY16 Budget Request includes **\$108.4 million**
 - **\$30.0 million** for Integrated Waste Management System activities (NFST),
 - Conduct preliminary generic process development and other non-R&D activities related to storage, transportation, and consent based siting.
 - **\$75.4 million** for Used Nuclear Fuel Disposition R&D activities
 - Conduct supporting R&D to enable storage, transportation, and disposal of spent nuclear fuel and wastes generated by existing and future nuclear fuel cycles.
 - **\$3.0 for activities**
 - Exploring potential alternative disposal options for some DOE-managed HLW and SNF.

Blue Ribbon Commission Recommendations

Use of Existing Authority

Recommended Focus Areas:

■ Storage

- “Using existing authority in the NWPA, DOE should begin laying the groundwork for implementing consolidated storage and for improving the overall integration of storage as a planned part of the waste management system”

■ Transportation

- “DOE should complete the development of procedures and regulations for providing technical assistance and funds ..., and begin providing funding, for working with states and regional state-government groups and training local and tribal officials ... in preparation for movement of spent fuel from shutdown reactor sites to consolidated storage.”

■ Disposal

- “DOE should keep a repository program moving forward through valuable, non-site specific activities, including R&D on geological media, work to design improved engineered barriers, and work on the disposal requirements for advanced fuel cycles.”
- “DOE should develop an RD&D plan and roadmap for taking the borehole disposal concept to the point of a licensed demonstration.”

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Used Fuel Disposition and Nuclear Fuels Storage & Transportation:

■ Used Nuclear Fuel Disposition R&D Campaign (\$49M in FY15)

- conduct scientific R&D to enable storage, transportation and disposal
- Identify alternative disposal (generic)

■ Nuclear Fuels Storage and Transportation Planning Project (\$22.5M in FY15)

- Lay the groundwork for implementing interim storage, including associated transportation
- Develop a foundation for a new nuclear waste management organization.

Key Elements of the Used Nuclear Fuel Disposition R&D

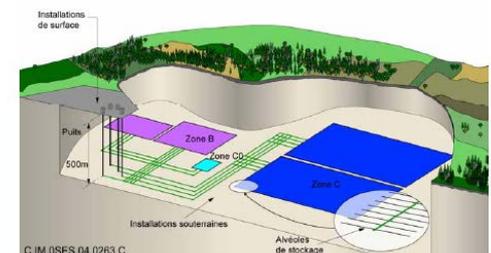
■ Used Nuclear Fuel Disposition R&D Campaign include:

■ Storage and Transportation R&D

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

■ Disposal R&D

- Provide a sound technical basis for multiple viable disposal options
- Evaluate the feasibility of the deep borehole disposal concept
- Evaluate the technical feasibility of the direct disposal of existing storage and transportation canisters



Extended Storage & Subsequent Transportation: R&D Gap Analyses & R&D Priorities

DOE, NRC, NWTRB, EPRI and others have identified and prioritized technical gaps

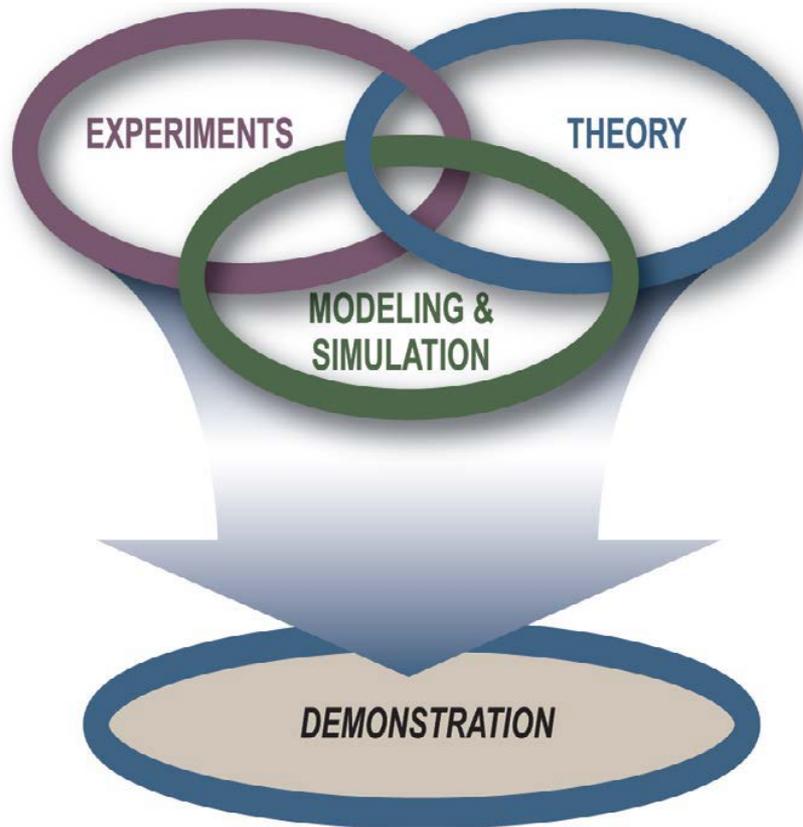
- **NWTRB:**
 - Evaluation of the Technical Basis for Extended Dry Storage and Transportation of Used Nuclear Fuel
- **NRC:**
 - Identification and Prioritization of the Technical Information Needs Affecting Potential Regulation of Extended Storage and Transportation of Spent Nuclear Fuel
- **UFD R&D Campaign Focus:**
 - Conducting Gap Analysis to Support Extended Storage of Used Nuclear Fuel
 - Used Nuclear Fuel Storage and Transportation Data Gap
 - Prioritization



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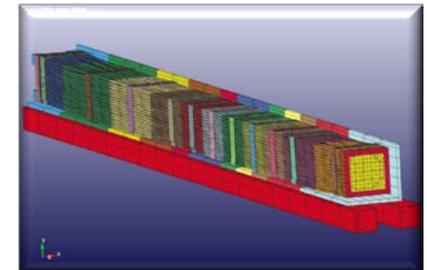
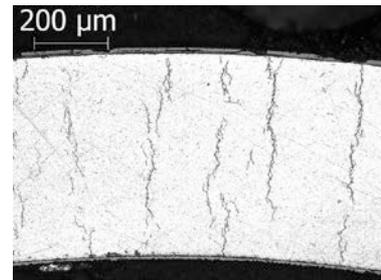
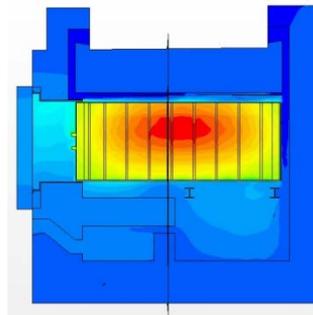
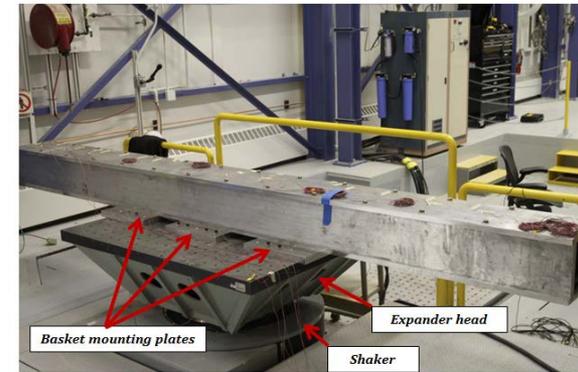
Extended Storage & Transportation Integrated R&D





Evaluation of degradation mechanisms relevant to long-term storage and subsequent transportation:

- Effects of hydride formation and reorientation on the material properties of high-burnup cladding
- Corrosion of stainless steel canisters
- Thermal history of used fuel in storage
- Thermal profiles of dry storage systems
- Mechanical loads on fuel assemblies during normal conditions of transport



Joint DOE & Industry Demonstration Project on High Burnup Spent Fuel

Purpose: to understand the of degradation mechanisms over extended periods of time

- Loading a demonstration TN-32B cask with high burn-up fuel
- Drying of the cask contents using typical process
- Dry storage and monitoring at the North Anna site
- Extracting, shipping, and examination of “sister” rods
- Future: cask opening and examination of rods
- Coordinated with NRC



Dominion



Sandia
National
Laboratories



**Pacific
Northwest**
NATIONAL
LABORATORY



that will be used for the project

On-Going R&D Relevant to: Transportation → Storage → Transportation

- Conducting R&D to close technical gaps germane to both the initial transportation of SNF and any subsequent transportation that would be required after interim storage
- Understanding “aging management” during interim storage and would provide part of the bases for subsequent transported to a repository
- Aging management under development
 - Evaluating of degradation during storage
 - Generic pilot interim storage facility design and Topical Safety Analysis Report for submittal to the NRC to address aging management and other regulatory issues in advance of site-specific licensing

Nuclear Fuels Storage and Transportation (NFST) Planning Project

■ Laying the ground work for interim consolidated storage:

- Development of pre-conceptual designs of a generic interim storage facilities
- Perform systems analysis
 - reduce cost and accelerate construction time
 - Promote integration of storage into waste management system
- Compile lessons-learned relative to siting process
- Evaluate system benefits of standardization

■ Prepare for the large-scale transportation:

- Collaborate with stakeholders on revised NWSA Section 180(c) Policy and National Transportation Plan
- Evaluate the inventory, transportation interface, and shipping status of used nuclear fuel, with initial focus on shut-down reactor sites
- Assess and address transportation needs



NFST Activities & Accomplishments

Supporting Consolidated Interim Storage

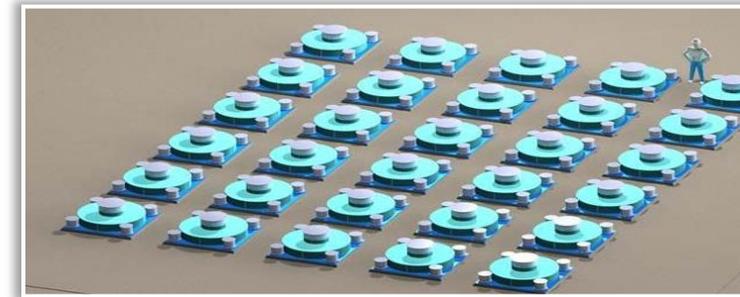
Recently Completed:

“Generic Design Alternatives for Dry Storage of Used Nuclear Fuel”

Work in Progress:

- Developing facility functions and requirements for ISF
- Evaluated costs and impacts of opening non-disposable storage canisters
- Developing data on alternative generic design concepts for:
 1. Receiving
 2. Storing,
 3. Handling and Repackaging UNF canisters to support systems analyses

Implementation of near-term tasks recommended by the Blue Ribbon Commission related to systems analysis and design studies for an interim storage facility.





NFST: Preparing for the Large-Scale Transportation of UNF and HLW

- Collaborating with stakeholders through State and tribal representatives
 - Revised NWSA 180(c) policy
 - Transportation Planning Framework
 - Routing options
- Planning for design, testing, and acquisition of rail cars and transportation casks
- Assessing needs and developing draft planning framework for removing UNF from shutdown reactor sites
- Developing new routing capabilities and investigating routing options from shutdown reactor sites

Implementation of near-term tasks recommended by the Blue Ribbon Commission related to working with stakeholders and developing plans and capabilities for the ultimate shipment of spent nuclear fuel and high level waste.



Private Initiatives to Deploy Interim Storage Facilities

The DOE is aware that two private companies have expressed their intent to apply for licenses to construct away-from-reactor interim storage facilities

- Both envision that DOE would take title for the SNF at the reactor site boundary and be responsible for transportation to the interim storage facility

Comprehensive Workable Transportation Solutions

■ Coordinating Transportation Activities include:

- Office of Nuclear Energy (DOE-NE),
- Office of Environmental Management (DOE-EM), and
- National Nuclear Security Administration (NNSA)

■ Preparations include:

- Transportation Planning Framework
- 180(c) policy implementation exercise
- Routing tool and routing methodology development

■ DOE-EM and NNSA experience supports commercial SNF transportation

- Development of American Association of Railroads standard S-2043 compliant railcar for transporting Naval SNF
- Shipments from West Valley to Idaho National Laboratory

■ To the extent possible and practical, common equipment would be used

- Given the difference between commercial SNF and DOE-owned SNF and HLW, the use of common equipment may be limited
- Planning has not advanced to the stage where the ability to use common equipment is understood.

Conclusions

The Department of Energy:

is committed to moving forward with development of management strategies and technologies for the transportation, storage and disposal of used nuclear fuel and high-level radioactive waste.

■ The Used Nuclear Fuel Disposition & NFST programs are:

- Laying the foundation for the development of storage, transportation and disposal options
- Providing technical analysis in support of extended storage, building on the existing foundations
- Planning for a defense-only repository
- Moving forward with planning for interim storage of commercial spent fuel
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Back-Up Information



Fuel Cycle Research & Development FY 2016 Budget Request

Subprogram	(dollars in thousands)			
	FY 2015 Enacted	FY 2016		
		Request	House Mark	Senate Mark
Material Recovery & Waste Form Development	35,300	35,300	35,300	34,800
Advanced Fuels	60,100	48,700	60,100	60,100
Systems Analysis and Integration	16,900	11,200	11,200	11,100
MPACT	7,600	8,600	8,600	8,500
Fuel Resources	5,600	5,600	5,600	5,500
Used Nuclear Fuel Disposition				
Research & Development	49,000	75,360	55,000	64,000
Integrated Waste Mgmt. System	22,500	30,000	0	30,000
DOE-Managed HLW & SNF	--	3,000	0	3,000
Total	197,000	217,760	175,800	217,000