U.S. DEPARTMENT OF ENERGY | Nuclear Energy

Nuclear Energy University Programs
Fiscal Year 2020
Annual Planning Webinar

Spent Fuel and Waste Disposition
FC - 4.1 Disposal
FC - 4.2 Storage & Transportation

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NEUP Federal Point of Contact

Spent Fuel and Waste Disposition

Office of Nuclear Energy

U.S. Department of Energy

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Used Fuel Disposition Overview

❖ DOE Office of Nuclear Energy Mission

- Advance nuclear power as a resource capable of meeting the nation's energy, environmental, and national security needs by resolving technical, cost, safety, proliferation resistance, and security barriers through research, development, and demonstration as appropriate

❖ Spent Fuel and Waste Disposition Mission

- Identify alternatives and conduct scientific research and technology development to enable storage, transportation and disposal of spent nuclear fuel and wastes generated by existing and future nuclear fuel cycles

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Used Fuel Disposition Campaign R&D Participants

Pacific Northwest NATIONAL LABORATORY

SRNL SAVANNAH RIVER NATIONAL LABORATORY

Los Alamos NATIONAL LABORATORY

Sandia National Laboratories

Argonne NATIONAL LABORATORY

Science in the National Interest

Lawrence Livermore National Laboratory

Department of Energy University of California

Lawrence Livermore National Laboratory ensures national security and applies science and technology to important problems of our time.

ornl OAK RIDGE NATIONAL LABORATORY

INL Idaho National Laboratory

BERKELEY LAB

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Grand Challenge

- **The *Grand Challenge* for the Spent Fuel and Waste Campaign is to provide a sound technical basis for the safety and security of long-term storage, transportation, and disposal of used nuclear fuel and wastes from the nuclear energy enterprise**
- **Importance: Supports the establishment of SNF management and disposition pathways**

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Used Fuel Disposition Research Needs

❖ Disposal

- Provide a sound technical basis for assurance that the US has multiple viable disposal options available when national policy is ready
- Identify and research generic sources of uncertainty that challenge the viability of disposal concepts
- Increase confidence in robustness of generic disposal concepts to reduce the impact of site-specific complexity
- Develop the science and engineering tools required to address the needs above

❖ Storage/Transportation

Develop the technical bases:

- To demonstrate used fuel integrity for extended storage periods
- For fuel retrievability and transportation after extended storage
- For transportation of high burnup fuel

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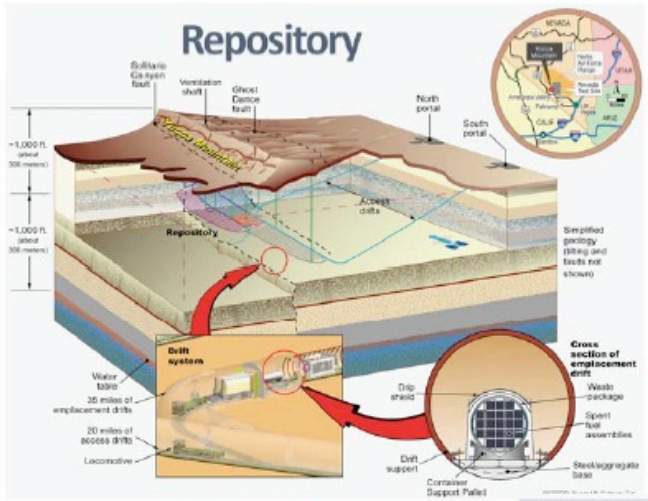
NEUP R&D Work Scope Description: Used Fuel Disposition FC-4.1: Disposal

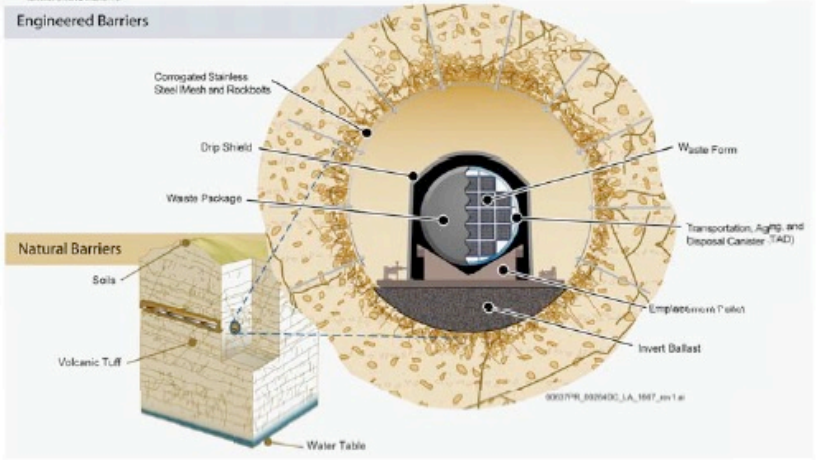


Candidate Geologies

- clay/shale
- salt
- crystalline rock
- tuff

Barriers for Waste Isolation

- Unsaturated Zone
- Waste Form
  - **Glass or hard ceramic**
- Engineered Barrier System



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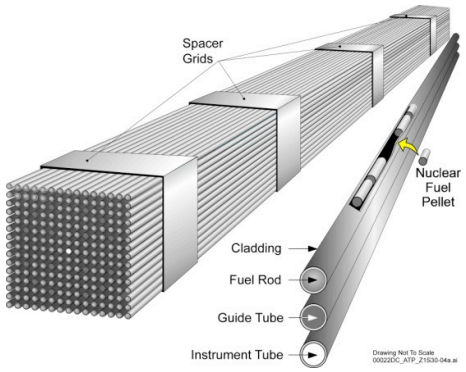
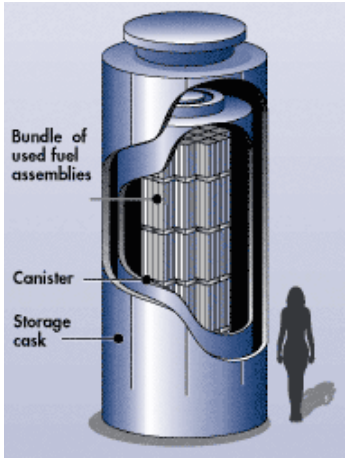
Storage System Components

I. Fuel
I. Fuel/Pellet
II. Cladding
III. Assembly hardware



II. Cask
I. Internals (baskets, neutron poisons)
II. Container (canister, welds, seals, bolts)
III. Overpack/Storage module



III. ISFSI
I. Pad
II. Rebar
III. Physical Protection

IV. Monitoring Systems
I. Remote inspection
II. In-package sensors
III. Security

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Used Fuel Disposition FC-4.1 Focus Areas for University Proposals

- Two Program Supporting R&D proposals are being solicited in the Used Fuel Disposition Area, FC-4.1 Disposal and FC-4.2 Storage & Transportation (University-led up to $800,000 for 3 years)

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Used Fuel Disposition FC-4.1 and FC-4.2 R&D Proposals

❖ FC-4.1 Disposal

Develop new technologies, models, and validation techniques to support the permanent disposal of spent nuclear fuel and high-level radioactive waste for a variety of generic mined repository concepts in various rock media, including:

- waste package failure modes and material degradation processes
- new techniques for in-situ field characterization of hydrologic, mechanical, and chemical properties
- alleviating post-closure criticality concerns
- novel buffer materials, engineered/natural system component properties and failure modes

❖ FC-4.2 Storage and Transportation

- Develop novel technologies for mitigating chlorine induced stress corrosion pitting and cracking to improve the reliability of long term storage and maintenance of SNF Storage Canisters