

BACK END STRATEGY IN USA: INTERFACES RELATED ISSUES AND POTENTIAL SOLUTIONS

UNITED STATES OF AMERICA, SIXTH NATIONAL REPORT FOR THE
JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT
AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

TECHNICAL MEETING ON INTEGRATED APPROACHES TO
THE BACK END OF THE FUEL CYCLE

Vienna, Austria
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ORGANIZATION: GOVERNMENT AND COMMERCIAL ENTITIES

- Commercial Sector: Owners and operators of nuclear power plants (NPPs) and other types of facilities that generate radioactive waste manage their spent fuel and radioactive waste prior to disposal generally under their NRC operating license.
 - The U.S. Federal Government or state governments (as Agreement States) regulate waste disposal sites.
 - Government custody of radioactive waste and disposal facilities can occur at different stages of the waste management scheme depending on the type of radioactive waste and generating activity.
- Government Sector: The U.S. Department of Energy (DOE) is responsible for and performs most of the spent fuel and radioactive waste management activities for government-owned and generated radioactive waste and materials, which are mostly located on government-owned sites.

ORGANIZATION: GOVERNMENT AND COMMERCIAL ENTITIES

- Regulatory System: The regulatory system for spent fuel and radioactive waste management in the U.S. involves several agencies:
 - Nuclear Regulatory Commission (NRC), regulating the commercial nuclear sector;
 - Environmental Protection Agency (EPA), establishing environmental standards; and
 - Department of Energy (DOE), regulating its own government programs.
- Section 274 of the Atomic Energy Act of 1954, as amended (AEA), permits NRC to discontinue its authority and the states to assume regulatory authority over byproduct, source, and special nuclear materials to the states, U.S. territories; and the District of Columbia, through the NRC's Agreement State Program.
 - This authority includes regulating commercial low-level waste (LLW) disposal sites, uranium mill tailings sites, and disposal of uranium mill tailings.

INTERFACES

- The U.S. recognizes the importance of this integration and manages the interfaces between various steps, e.g., storage, transportation, and disposal.
- Integration is achieved through interface management, such as specified waste acceptance criteria, so generators and operators of disposal facilities have a common understanding of the waste characteristics, packaging requirements, transportation specifications, etc.
- Acceptance requirements constrain the management of interfaces between the various steps in spent fuel and waste management.
- The U.S. has regulations governing cradle-to-grave management of radioactive waste, and waste managers are responsible for the safety of their inventories under the terms of their licenses or safety bases.

COMMERCIAL SNF MANAGEMENT - OVERVIEW

- The U.S. produces spent fuel in commercial nuclear power plants (NPPs) and research reactors. Currently, 99 licensed NPPs provide about 20 percent of U.S. electricity.
- All operating NPPs are storing spent fuel in NRC-licensed onsite spent fuel pools and over half are storing spent fuel in NRC-licensed independent spent fuel storage installations (ISFSIs) located onsite.
- Most NPPs that have been decommissioned or are undergoing decommissioning also have spent fuel stored onsite pending disposal. Most permanently-shutdown commercial NPPs currently have, or are planning to have, their spent fuel stored at onsite ISFSIs.

CONTINUED STORAGE OF COMMERCIAL SNF

- In September 2014, the U.S. Nuclear Regulatory Commission (NRC) issued a revised rule at 10 CFR 51.23 and its associated NUREG-2157, Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel, Vols. 1 and 2.
- “Continued Storage of Spent Nuclear Fuel” rule codifies NRC’s generic determinations regarding the environmental impacts of continued storage of spent fuel beyond a reactor’s operating license.
- Analysis considered the storage of spent fuel under three separate scenarios:
 - (1) the short-term timeframe considers 60 years beyond the reactor’s license term (including two renewal terms);
 - (2) the long-term timeframe considers an additional 100 years; and
 - (3) the indefinite timeframe assumes that no repository becomes available.

SNF DISPOSAL

- In August 2013, the U.S. Court of Appeals for the District of Columbia Circuit ordered NRC to continue with the licensing process for DOE's Yucca Mountain construction authorization application, until Congress directs otherwise or there are no appropriated funds remaining. After the court's decision, NRC completed the Safety Evaluation Report (SER). In addition, NRC staff developed a supplement to DOE's EIS to address groundwater impacts previously identified by NRC staff as requiring additional analysis.
- In January 2015, in its SER, NRC staff found that DOE's license application met the regulatory requirements for the proposed repository, with two exceptions:
 - DOE had not obtained certain land withdrawal and water rights necessary for construction and operation of the repository.

SNF DISPOSAL

- The fiscal year 2018 Budget Request for DOE includes \$120 million to accelerate progress on fulfilling the Federal Government's obligations to address nuclear waste by requesting funding of licensing activities for the Yucca Mountain nuclear waste repository and to establish a robust interim storage program to develop a capability for earlier acceptance of spent fuel. The Budget Request for NRC includes \$30 million for Yucca Mountain licensing activities.
 - And fiscal year 2019

DOE RESEARCH AND DEVELOPMENT ACTIVITIES FOR SNF AND HLW

- The objectives of the U.S. R&D program are to develop and initiate activities to improve the overall integration of storage as a planned part of the waste management system, and develop information, resources, and capabilities to assist future disposal implementation decisions and actions.
- DOE is performing R&D regarding the long-term management of spent fuel to ensure any potential concerns are identified and addressed before safety is compromised.
- The principal focus of DOE's R&D activities is to develop a suite of options that will enable future decision makers to make informed choices about how to safely manage the spent fuel from nuclear reactors.
- An additional objective is to demonstrate technologies to allow commercial deployment of solutions for spent fuel management that are safe, economic, and secure.

DOE RESEARCH AND DEVELOPMENT ACTIVITIES FOR SNF AND HLW

- A sound technical basis for evaluating multiple viable disposal options will increase confidence in the robustness of generic disposal concepts and support development of the science and engineering tools needed to support disposal concept implementation.
- Significant testing, modeling, and demonstration activities will be conducted to enhance and confirm the technical basis for safe storage and disposal of spent fuel, particularly as spent fuel discharge burn-up is increased and as storage times extend beyond what was originally intended.
- R&D also focuses on identifying multiple viable geologic disposal options and concepts in various host media (e.g., mined repositories in salt, clay/shale, and granitic rocks).
 - R&D will transition to site-specific challenges as national policy advances.
 - R&D goals at this stage are to identify generic issues that may need to be addressed in site-specific investigations to increase confidence in the robustness of a site-specific disposal concept.

DOE RESEARCH AND DEVELOPMENT ACTIVITIES FOR SNF AND HLW

- DOE is actively involved in international and bilateral R&D activities
- The U.S. is also collaborating with other countries to conduct joint experiments or data exchanges associated with underground research laboratories.
- Extended Storage Collaboration Program (ESCP) is a consortium of organizations coordinated by the Electric Power Research Institute (EPRI) to investigate aging effects and mitigation options for the extended storage of spent fuel, followed by transportation.
 - DOE is active in this program, and uses it as an effective way to collaborate with industry, regulators, and international organizations dealing with similar topics to enhance the technical basis for extended storage and subsequent transportation of spent fuel.
 - Identification of potential concerns associated with extended dry storage of spent fuel, i.e., storage for periods that involve multiple renewals for term periods in current NRC regulations.

SNF REPROCESSING

- The U.S. declared a moratorium on domestic spent fuel reprocessing in 1977. The moratorium was rescinded in 1981, but commercial reprocessing never resumed in the U.S.
- The DOE recognizes that research and development (R&D) of sustainable fuel cycles and waste management activities are important to support the expansion of nuclear energy.
- DOE is conducting R&D in nuclear fuel and waste management technologies that will enable a safe, secure, and economic fuel cycle.
- The long-term R&D strategy is to investigate the technical challenges in developing sustainable systems and develop solutions that reduce waste while improving resource utilization and safety.