

POLICY ISSUE INFORMATION

May 31, 2013

SECY-13-0057

FOR: The Commissioners

FROM: Catherine Haney, Director
Office of Nuclear Material Safety
and Safeguards

SUBJECT: ANNUAL STATUS REPORT: ACTIVITIES RELATED TO
EXTENDED STORAGE AND TRANSPORTATION

PURPOSE:

This paper provides the Commission with a status report on the staff's activities related to the extended storage and transportation (EST) of spent nuclear fuel (SNF). The staff last updated the Commission on this matter in May 2012 (Ref. 1). This paper responds to the Commission's direction to provide an annual status report (Ref. 2) and does not address any new commitments.

BACKGROUND:

The staff of the U.S. Nuclear Regulatory Commission (NRC) is working to identify and address areas that might affect regulation of safe and secure storage of SNF over extended periods and for its subsequent transportation. The goal of these efforts is to identify any technical or regulatory conditions that might indicate a need for changes to NRC regulations or guidance for storage and transportation of SNF to ensure the regulatory framework for these activities is appropriate. The Office of Nuclear Material Safety and Safeguards (NMSS), as the agency lead for these efforts, is coordinating with the Office of Nuclear Regulatory Research (RES), the Office of Nuclear Reactor Regulation (NRR), and other NRC initiatives in addressing the identified technical information needs.

In 2010, the staff was directed by the Commission to examine potential EST issues in conjunction with considerations for a possible update to its Waste Confidence Decision and Rule covering a longer time period (Ref. 2). Both EST and Waste Confidence were discussed

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in the annual status paper provided to the Commission last year, in May 2012 (Ref. 1). Subsequently, on June 8, 2012, the Circuit Court for the District of Columbia found that some aspects of the Waste Confidence Decision, as amended in 2010, did not satisfy the NRC's National Environmental Policy Act (NEPA) obligations, and vacated the Commission Decision and Rule (*New York v. NRC*, 681 F.3d 471 (D.C. Cir. 2012)). The Commission then directed the staff to proceed directly with development of a generic environmental impact statement (GEIS) and Rule (Ref. 3). The efforts on Waste Confidence rulemaking have been separated from the EST work, and the present paper concerns only the EST activities. The staff is currently working to develop the Waste Confidence draft GEIS and proposed Rule. In the draft GEIS, staff is using existing information to analyze potential impacts of continued SNF storage into the future.

The EST effort focuses on identifying and resolving potential issues associated with storage and transportation of SNF over extended periods. While staff anticipates that the current regulatory framework for storage and transportation can be extended to accommodate future needs, it acknowledges that licensing practices may evolve over time in response to improved understanding, operational experience, and Commission policy direction. The staff continues to coordinate closely between the EST project and the current Waste Confidence work. The current Waste Confidence rulemaking effort is not dependent on results from the EST work.

DISCUSSION:

As discussed in the 2012 Status Paper (Ref. 1), the goal of the EST project is to identify what changes in regulatory framework might be needed. This goal requires assessment of both technical and potential regulatory issues. Given anticipated resources, the staff projects that this assessment will be completed by 2021. The enclosure provides resource estimates for this projection. Any urgent matters or policy issues will be brought to the Commission as they are identified. At this point, the staff anticipates that EST is more likely to lead to changes in staff guidance and inspection procedures, rather than changes in regulations. Although the EST project encompasses both technical and potential regulatory issues, most of the staff's focus this past year has been on technical areas associated with EST.

Technical Areas

To assess potential changes to NRC regulations or guidance for storage and transportation, the staff has systematically evaluated the potential effects of material-degradation processes on the performance of the systems, structures, and components (SSC) used for dry storage and transportation of SNF (Ref. 4). This evaluation has considered both the current level of knowledge on the initiation time, progression rate, and end state of the various degradation processes, and the potential impact on the safety or regulatory function of the particular SSC. Those processes that might have impacts on the safety function, and for which the level of knowledge is relatively low (i.e., for which operating experience is limited and other supporting technical information is still in development), are identified as high priority for further investigation. The staff has identified five areas of technical information as the first tier:

- stress corrosion cracking of austenitic stainless-steel canisters and welds
- swelling of fuel pellets over time, including fuel fragmentation and potential gas release
- more realistic models for thermal evolution of storage components and SNF over time
- effects of residual moisture after drying
- inservice monitoring methods for storage systems, structures, and components

The staff also identified an additional eight second tier items for further work:

- propagation of existing flaws in cladding
- impacts to fuel-assembly hardware from wet corrosion, stress corrosion cracking, and metal fatigue
- metal fatigue of cladding caused by temperature fluctuations, stress corrosion cracking, and delayed hydride cracking
- low-temperature creep and galvanic corrosion of cladding
- microbiologically influenced corrosion of stainless-steel, carbon-steel, and cast-iron body, welds, lids, and seals
- embrittlement of fuel-basket welds at low temperature, and metal fatigue caused by temperature fluctuations
- thermal aging and creep of neutron absorbers
- concrete degradation, particularly for less-accessible components

The staff's evaluation of technical information needs considered previous assessments from industry, DOE, and other technical groups. The staff's final report on technical information needs for EST incorporates input from the Advisory Committee on Reactor Safeguards (Ref. 5) and from public comments received on the draft report. Over the past year, the staff has made progress in all of the first tier technical areas, as well as several areas on the second tier, through an established User Need with RES. This work includes development of specific research plans, enhancements of modeling capabilities, surveys of potentially applicable methods for nondestructive examination, focused laboratory experiments on conditions for stress corrosion cracking, and a survey of risk information for EST. Documentation of this work includes a NUREG/CR on the stress corrosion cracking experiments, two technical reports on possible effects of residual moisture after cask drying, and two reports on potentially applicable methods for remote monitoring and inspection. These reports have been issued or are currently being finalized.

The staff also has developed additional capability for modeling of storage cask thermal evolution over time, using methods from computational fluid dynamics. These models allow more complete consideration of those phenomena that might become more significant at lower temperatures, such as susceptibility of canisters to stress corrosion cracking or potential loss of fuel cladding ductility. Over the coming year, the staff will continue work in these areas and on each of the identified technical information needs.

The NRC staff's identification and prioritization of technical information needs has been made available to industry and other technical groups working on EST topics. The staff continues to interact with the Electric Power Research Institute (EPRI), through its Extended Storage Collaboration Program (ESCP), and with DOE, international counterparts, and university researchers. These interactions help to avoid duplication of effort and maintain focus on those areas that the staff considers to be most important for safe storage and transportation. In addition to the EPRI-led ESCP, the staff continues to share technical information and research plans through initiatives organized by the Nuclear Energy Agency and International Atomic Energy Agency, as well as through staff-level interactions with other technical researchers both in the United States and abroad. These interactions also allow staff to share technical and regulatory insights with foreign regulators and to promote good regulatory practices in spent fuel storage and transportation, particularly to countries without well-developed spent fuel management programs.

The efforts to coordinate research among different technical groups have already shown value. Through discussions that began within ESCP, industry and DOE identified their interest in a full-scale demonstration project on dry storage of high-burnup spent fuel to gather confirmatory data on behavior of stored fuel over time. This information builds on data acquired from an earlier cask demonstration with low-burnup fuel. Through its technical information needs report, other industry communications, and ESCP, NRC staff has encouraged development of such confirmatory data through a demonstration project. DOE has recently awarded a contract to an industry consortium to plan, design, and execute the demonstration using an instrumented cask at a utility site. Detailed monitoring of the cask will provide temperature, humidity, gas composition, and other data on the fuel and interior of the cask beginning at time of deployment. At some future date, the cask will be opened to remove stored fuel rods for characterization and comparison to results on comparable rods separated before loading and stored in a spent fuel pool. NRC staff expects the demonstration to provide important information for extended storage, as well as to inform near-term licensing activities for storage of high-burnup fuel. In particular, the monitoring data will help to validate thermal models and will allow evaluation of assumptions regarding residual moisture following cask drying. Data from characterization of high-burnup fuel that has been stored in the demonstration cask for a decade (or longer) will contribute to the technical basis for storage over much longer periods, especially for early indicators of changes in cladding, other assembly components, and the fuel itself. Identification of any early changes in material behavior can also support projections of effects over the expected longer time periods of dry storage.

While dry cask storage is a primary focus of the EST work, staff is also considering the possibility of continued storage of SNF in spent fuel pools. For operating and decommissioned reactors, 10 CFR Part 50 includes requirements for continued safe operation and maintenance of wet storage practices in spent fuel pools. Regulated practices include maintenance of the structure, operation of security systems, continuance of radiation protection and environmental monitoring programs, and processing of radioactive waste that may be generated. Several of the technical areas identified by staff for dry casks also apply to wet storage. NMSS staff will continue to coordinate with NRR and RES to consider any emerging issues.

Regulatory Areas

In addition to the specific technical-information needs, the staff is examining potential regulatory areas that might need attention for EST of SNF. At this stage, the staff has identified only a small number of potential issues, many of which are being considered under a separate staff initiative on process improvements for current SNF storage and transportation licensing (Ref. 2). Two examples under this current initiative that have implications for EST are greater alignment between regulations for SNF storage and for transportation, and potential changes in current requirements for maintaining cladding integrity to support retrievability of spent fuel assemblies from storage (Ref. 6). Consideration of potential effects of extended storage on physical security requirements for independent spent fuel storage installations, identified in the 2012 EST status paper, is deferred pending completion of rulemaking for security requirements for SNF storage in 10 CFR Part 73, "Physical Protection of Plants and Materials."

During the coming year, an inter-office working group will begin systematic consideration of other potential regulatory issues for EST. This group will work in close coordination with the licensing process improvement initiative. No new policy issues have been identified thus far. Any areas that involve policy questions will be brought to the Commission for resolution.

CONCLUSIONS:

The staff has identified and prioritized technical-information needs that might affect regulations and guidance for extended storage and transportation of SNF. The staff is making progress in addressing those needs, and is coordinating with industry, DOE, international counterparts, and other researchers on work planned and underway. The staff expects that much useful confirmatory information will be gained in coming years from the DOE and industry monitored cask demonstration project with high-burnup spent fuel, discussed previously. The staff is working to identify and address any potential regulatory issues for EST, in conjunction with related initiatives within the NRC, such as the storage and transportation licensing process improvement activities.

RESOURCES:

Resources proposed to continue and complete the EST project are discussed in the nonpublic enclosure. All resources for the EST work is, or will be, identified in the Spent Fuel Storage and Transportation Business Line. Funding considerations for future years will be addressed during the planning, budgeting, and performance-management process at the agency level.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objection.

References

- (1) SECY-12-0078, "Annual Status Report: Activities Related to Extended Storage and Transportation and the Long-Term Waste Confidence Update," May 31, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12059A231).
- (2) SRM-COMSECY-10-0007, "Project Plan for Regulatory Program Review to Support Extended Storage and Transportation of Spent Nuclear Fuel," December 6, 2010 (ADAMS Accession No. ML103400287).
- (3) SRM-COMSECY-12-0016, "Approach for Addressing Policy Issues Resulting from Court Decision to Vacate Waste Confidence Decision and Rule," September 6, 2012 (ADAMS Accession No. ML12250A032).
- (4) Report by the U.S. Nuclear Regulatory Commission, "Identification and Prioritization of the Technical Information Needs Affecting Potential Regulation of Extended Storage and Transportation of Spent Nuclear Fuel," May 2012 (ADAMS Accession No. ML120580143).
- (5) Armijo, J. Sam, Chairman, Advisory Committee on Reactor Safeguards, letter to Allison M. Macfarlane, Chairman, U.S. Nuclear Regulatory Commission, "Technical Information Needs Affecting Potential Regulation of Extended Storage and Transportation of Spent Nuclear Fuel," September 11, 2012 (ADAMS Accession No. ML12255A067).

- (6) Volume 78 of the *Federal Register*, Page 3853 (78 FR 3853), "Retrievability, Cladding Integrity, and Safe Handling of Spent Fuel at an Independent Spent Fuel Storage Installation and during Transportation," January 17, 2013.

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Enclosure:
Projected Resource Needs
Extended Storage and
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- (6) Volume 78 of the *Federal Register*, Page 3853 (78 FR 3853), "Retrievability, Cladding Integrity, and Safe Handling of Spent Fuel at an Independent Spent Fuel Storage Installation and during Transportation," January 17, 2013.

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Enclosure:
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NMSS201300116/WITS 201000286

ADAMS Accession No.; Package – ML13144A717 Memo – ML13130A148;
Enclosure – ML13130A145

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