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From: McCULLUM, Rodney [rxm@nei.org]
Sent: Friday, June 29, 2012 4:18 PM
Subject: Industry Comments on the NRC Draft Report on Identification and Prioritization of the Technical Information Needs Affecting Potential Regulation of Extended Storage and Transportation of Spent Nuclear Fuel
Attachments: 06-29-12_NRC Draft Report on Technical Needs Affecting Extended Storage and Transportation of SNF.pdf; 06-29-12_NRC Draft Report on Technical Needs Affecting Extended Storage and Transportation of SNF_Attachment.pdf

June 29, 2012

Mr. Christian J. Jacobs
Project Manager, Division of Spent Fuel Alternative Strategies
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Mailstop EBB-2B2
Washington, DC 20555-0001

Subject: Industry Comments on the NRC Draft Report on Identification and Prioritization of the Technical Information Needs Affecting Potential Regulation of Extended Storage and Transportation of Spent Nuclear Fuel

References:

1. Letter, Rubenstone to Kokajko, Issuance of Draft Report on Identification and Prioritization of the Technical Information Needs Affecting Potential Regulation of Extended Storage and Transportation of Spent Nuclear Fuel, May 2, 2012 (ML120580123)
2. Used Nuclear Fuel Storage and Transportation Data Gap Prioritization, U.S. Department of Energy (DOE), FCRD-USED-2012-000109, PNL-21360, April 30, 2012
3. Extended Storage Collaboration Program (ESCP) Progress Report and Review of Gap Analyses, Electric Power Research Institute (EPRI) Technical Report 1022914, August 2011
4. Letter, Kessler to Jacobs, EPRI comments on the NRC draft report "Identification and Prioritization of the Technical Information Needs Affecting Potential Regulation of Extended Storage and Transportation of Spent Nuclear Fuel," June 14, 2012

Project Number: 689

Dear Mr. Jacobs:

The Nuclear Energy Institute (NEI) commends the NRC for its efforts to examine the technical needs and potential changes to the regulatory framework that may be necessary to support continued licensing of used nuclear fuel storage over extended time periods. The subject draft report (Reference 1) is an important early step towards addressing the regulatory challenges of extended used nuclear fuel storage, and we welcome the opportunity to comment on this report.

We note that the NRC's efforts to prioritize technical information needs are being conducted in parallel to similar efforts by the U.S. Department of Energy (DOE) as described in Reference 2 and separately by the Electric Power Research Institute (EPRI), under the auspices of EPRI's Extended Storage Collaboration Program (ESCP) as described in Reference 3. While these parallel efforts are identifying many of the same needs, there remains additional work to be done to bring them more fully into agreement. In this respect, we endorse the EPRI comments on this report (Reference 4) that pointed out differences in R&D needs ranking criteria that should be resolved. Similarly, our comments in the attachment to this letter recommend clarifications to the NRC's approach, which, if adopted, would be additionally helpful towards establishing consensus on the prioritization of technical information needs.

We believe that agreement between the various prioritization approaches is vital to establishing a strong regulatory framework for extended storage. It is important that this framework consider the implications of the DOE's used fuel disposition plans, opportunities to benefit from the DOE's research programs, and the experience that already exists with used nuclear fuel storage both in the U.S. and internationally (as reflected in the ESCP program). To this end, we encourage the NRC to continue to engage the DOE and the industry through the ESCP program.

There are several aspects of the draft report that we find to be valuable towards building the consensus needed to further develop the technical basis for extended storage. Three areas are particularly noteworthy:

1. The NRC's "Methodology for Identifying and Prioritizing Potential Technical Information Needs" (section 2 of the draft report), if effectively applied, would appropriately focus the scope of technical basis development efforts based on the six assumptions and five uses for the information identified therein. In the attachment to this letter, we make recommendations for further clarification of these assumptions and uses to ensure effective application.
2. The NRC's approach to identifying "Potential Technical Information Needs" (section 3 of the draft report) appropriately focuses on both level of knowledge and regulatory significance. It also recognizes and describes the distinct roles of the licensee and the regulator in a highly useful fashion. We agree with the manner in which the NRC has addressed these roles and offer specific comments to provide further clarification in the attachment to this letter.
3. The NRC, in sections 4 and 5 of the draft report, appropriately considers the regulatory significance and potential impact on safety as the key considerations in the overall prioritization for further research. However, we believe the identification of the regulatory significance and potential impact to safety could be further improved and have provided specific comments to address such improvements in the attachment to this letter.

We believe that the exchange of information between the industry, the DOE and the NRC concerning the technical and regulatory aspects of extended storage of used nuclear fuel has been useful. We encourage the NRC to continue to engage the DOE and participate in the EPRI ESCP program to forge consensus approaches to addressing the technical and regulatory challenges of extended storage. We look forward to continued interaction with the NRC in this regard. If you have any questions, please do not hesitate to address them to me.

Sincerely,

Rod McCullum
Director, Used Fuel Programs

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June 29, 2012

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Dear Mr. Jacobs:

The Nuclear Energy Institute (NEI)¹ commends the NRC for its efforts to examine the technical needs and potential changes to the regulatory framework that may be necessary to support

¹ NEI is the organization responsible for establishing unified industry policy on matters affecting the nuclear energy industry. NEI's members include all entities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect/engineering firms, fuel fabrication facilities, nuclear material licensees, and other organizations and entities involved in the nuclear energy industry.

continued licensing of used nuclear fuel storage over extended time periods. The subject draft report (Reference 1) is an important early step towards addressing the regulatory challenges of extended used nuclear fuel storage, and we welcome the opportunity to comment on this report.

We note that the NRC's efforts to prioritize technical information needs are being conducted in parallel to similar efforts by the U.S. Department of Energy (DOE) as described in Reference 2 and separately by the Electric Power Research Institute (EPRI), under the auspices of EPRI's Extended Storage Collaboration Program (ESCP) as described in Reference 3. While these parallel efforts are identifying many of the same needs, there remains additional work to be done to bring them more fully into agreement. In this respect, we endorse the EPRI comments on this report (Reference 4) that pointed out differences in R&D needs ranking criteria that should be resolved. Similarly, our comments in the attachment to this letter recommend clarifications to the NRC's approach, which, if adopted, would be additionally helpful towards establishing consensus on the prioritization of technical information needs.

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There are several aspects of the draft report that we find to be valuable towards building the consensus needed to further develop the technical basis for extended storage. Three areas are particularly noteworthy:

1. The NRC's "Methodology for Identifying and Prioritizing Potential Technical Information Needs" (section 2 of the draft report), if effectively applied, would appropriately focus the scope of technical basis development efforts based on the six assumptions and five uses for the information identified therein. In the attachment to this letter, we make recommendations for further clarification of these assumptions and uses to ensure effective application.
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3. The NRC, in sections 4 and 5 of the draft report, appropriately considers the regulatory significance and potential impact on safety as the key considerations in the overall prioritization for further research. However, we believe the identification of the regulatory

Mr. Christian J. Jacobs

June 29, 2012

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significance and potential impact to safety could be further improved and have provided specific comments to address such improvements in the attachment to this letter.

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Sincerely,

A handwritten signature in black ink, appearing to read 'Rod McCullum', with a stylized, cursive script.

Rod McCullum

c: Mr. Douglas W. Weaver, NMSS/DSFST, NRC
Mr. Lawrence E. Kokajko, NMSS/SFAS, NRC
Mr. Jim L. Rubenstone, NMSS/SFAS/STB, NRC

Specific Comments on the NRC Draft Report on Identification and Prioritization of the Technical Information Needs Affecting Potential Regulation of Extended Storage and Transportation of Spent Nuclear Fuel

1. Role of Technical Information Needs (Sections 1&2)

The NRC's "Methodology for Identifying and Prioritizing Potential Technical Information Needs," if effectively applied, would focus the scope of the agency's technical basis development efforts based on the 6 assumptions and 5 uses for the information identified therein. We believe the intended uses and the assumptions could be further clarified in the following specific areas:

- a) Reconciliation of the proposed methodology with the NRC's established policy on the regulatory approach for establishing technical bases and any necessary aging management of dry storage. This policy is explained in the Commission's Statements of Consideration for the 2011 rulemaking for 10 CFR Part 72 (76FR8876) wherein the Commission states "1) NRC staff expects very little to no fuel degradation at the end of an extended licensing period, 2) The NRC staff also expects limited degradation of other internal components because there are no significant corrosive influences in the inert environment, either for the fuel or for other components... 3) The other external components of the storage systems (which are exposed to weathering effects) would already be covered by an inspection and corrective action program, or routine maintenance." In keeping with NRC's statement on page 1-2 "...this report specifically assumes that the future licensing of spent fuel storage will follow current licensing practices," we recommend that the following areas of the report be revised to align with the established policy:
 - i. When discussing the need for monitoring of components (identified as a cross-cutting issue in the report), the NRC should clarify which components or degradation mechanisms require additional monitoring or inspection. Consistent with the current licensing practices, the NRC should clarify that the fuel and cask internals would not be monitored or inspected during extended storage or transportation. The regulatory approach would be to establish guidance for EST to preclude degradation mechanisms based upon design features or operating limits. For degradation mechanisms that could not be precluded, the storage term limit would be identified based upon the timing of the degradation mechanisms of concern. This would establish the basis of EST to periods up to 300 years, or up to some shorter time period depending on whether there are age-limiting fuel or internal degradation mechanisms that could not be reasonably precluded.
 - ii. It is noted that on page 3-6 the NRC states "For many of the degradation phenomena listed in Table 3-1, there are no existing capabilities for in-service inspection and monitoring of operating storage systems..." and on page 3-7 "Such methods would be valuable tools for confirming model predictions and for aging management." Similar statements are made on page 5-4. These statements should

be clarified to communicate that they only advocate for developing monitoring and inspection for external degradation mechanisms and are not advocating for monitoring or inspection of cask internal or fuel degradation mechanisms.

- iii. On page B1-1, the NRC makes the assumption that monitoring techniques have been developed to determine the conditions inside the system. This is not consistent with the current regulatory approach, and should be revised to incorporate the first two principles from the NRC's statements of consideration on the 2011 rulemaking for 10 CFR Part 72.
 - iv. In Table 3-1, the "Monitoring or Inspection Capability" is defined as "No" for the fuel and cask internal degradation mechanisms. This should be clarified as "N/A."
- b) Application of the existing regulatory approach should be proposed to determine whether regulations are adequate or if regulatory changes or alternatives are necessary. This includes the role of clad integrity, which was appropriately identified in the report as an NRC policy issue. Therefore, implementation of comment #1a is important to determine whether changes to NRC regulations or policy are warranted for extended storage periods.
- c) Clarification as to whether the NRC intends to retrofit guidance for systems within the first 80 years based upon potential degradation mechanisms that only become relevant beyond 80 years. We agree with the statement in the draft report that "The current regulatory framework supports at least the first 80 years of dry cask storage..." and that the current guidance is sufficient to ensure regulatory compliance for the first 80 years. However, on page 2-2, the NRC states that one purpose is to "Enhance regulatory guidance..." which on page 1-2 is characterized as "These data will also help determine whether current NRC staff guidance...should be revised for use in longer term storage." This is further emphasized on page 5-4, which states: "...some of the phenomena may have more direct implications for changes in system fabrication or design." We believe that any enhancements to guidance necessary for storage beyond 80 years should not be compulsory for storage up to 80 years. This recognizes the low likelihood of storage beyond 80 years for any system, and even if it is needed, it would only be for a small population of casks. Therefore, imposition of more strict guidance within the first 80 years that is only necessary to address degradation mechanisms beyond 80 years would impose unnecessary burdens on a large number of casks. We believe that these decisions should be made by the Commission as a matter of policy when it evaluates whether there is a potential need for changes to the regulations for EST.

2. Approach to Determining "Potential Technical Information Needs" (Section 3)

The NRC's approach to identifying "Potential Technical Information Needs" appropriately focuses on both level of knowledge and importance to safety. It also recognizes and describes the distinct roles of the licensee and the regulator in a highly useful fashion. In this context, the report, on page 2-2, clearly identifies that the NRC's need for technical information is to develop guidance for cask systems, provide a technical basis for reviewers, and develop inspection guidance. On page 6-5, the

NRC further notes that "A low priority ranking only indicates that enough information is available for regulatory considerations." We agree with these statements, and we further observe that the NRC frequently provides guidance on one or more acceptable approaches, and/or acceptable design or operating limits, that would address technical concerns. This includes age-dependent degradation mechanism. It is important that this approach, in practice, be implemented in the efficient manner implied by these statements. In this regard, we recommend the following:

- a) The NRC should address the role that regulatory guidance and generic issue resolution will play in regulating extended storage. In the ACRS Sub-committee meeting on June 5th, 2012, the NRC staff made comments suggesting considerable uncertainty in this area. These statements indicated that the staff was only concerned with identifying whether a phenomenon was a concern or not and that the NRC expected the industry to determine how to address the phenomenon. We recognize industry's role in identifying and resolving technical issues. However, if the NRC intends only to go so far as to determine that a phenomenon is or could be an issue, it is not fulfilling its role in ensuring regulatory efficiency by addressing the resolution of issues generically, nor through establishing clear guidance that articulates the agency position. Indeed, the NRC typically goes beyond just identifying whether a technical issue is a concern and pursues resolution of the technical issues with the goal of establishing guidance for generic resolution of the issue. A case in point is the NRC's program from 1998 to the early 2000s that comprehensively investigated high burnup issues related to reactor, storage and transportation issues, ultimately resulting in clear guidance and generic resolutions. In this respect, the level of knowledge rankings in Table 3-1, as determined in Appendix A, should be clarified. For example, we note that on page A1-10, the NRC identifies the need for additional data related to phenomenon of hydride reorientation for reasonable assurance of transportation, yet it rates the level of knowledge as high. We further note that current NRC guidance in this area lacks generic criteria for providing reasonable assurance for transportation and establishes that it will be addressed on a case-by-case basis. We encourage the NRC to ensure that the ranking for level of knowledge also identify, where appropriate, actions to develop generic guidance that communicates an acceptable approach.
- b) The NRC should clarify the ranking of level of knowledge, which, in the draft report, is focused mainly on three questions: 1) when degradation initiates, 2) how fast it proceeds, and 3) when it concludes. While we agree with these, we also believe that the following is a key consideration on ranking the level of knowledge "Does the NRC have enough information to either 1) determine it is not an issue out to 300 years, or 2) establish guidance to either a) preclude the phenomenon from occurring out to 300 years, or b) identify the maximum timeframe for which it could be precluded and whether there are appropriate aging management techniques beyond this timeframe up to 300 years." This key consideration will ensure that the results can be readily applied in 1) determining the maximum timeframe for which the NRC has reasonable assurance for extended storage and transportation, and 2) identify the time limiting degradation mechanism for the purposes of identifying whether there may be potential rule changes that could extend the maximum timeframe for which the NRC has reasonable assurance.

- c) The NRC should refine its prioritization of degradation mechanisms. We commend the NRC for compiling an exhaustive list of degradation mechanisms that could potentially be applicable to dry storage systems beyond 80 years and up to 300 years. We recognize that identifying this exhaustive list is the appropriate first step in identifying and prioritizing gaps and technical needs. However, we note that the degradation mechanisms vary from those that have a high likelihood of occurrence all the way to those that are theoretical and somewhat speculative as to whether they would occur. In this respect, placing a higher ranking on the phenomenon for which there is greater likelihood of occurrence would appropriately focus future R&D plans. This may also be partially accounted for in the NRC's cross-cutting issues, which could serve the purpose of providing early information that could later screen-out phenomena that are not potentially applicable to EST. For example, the NRC's approach to focus on the thermal profiles will provide clarity on whether temperature-based phenomena are applicable.

3. Approach to Determining "Regulatory Significance" and "Overall Prioritization" (Sections 4 & 5)

The NRC appropriately considers the regulatory significance and potential impact on safety as the key considerations in the overall prioritization for further research. However, we believe the identification of the regulatory significance and potential impact to safety could be further improved. Specifically, we recommend:

- a) The rankings in table 4-1 and Appendix B should be expanded to go beyond just identifying which of the six areas for regulatory review they impact. This should appropriately consider the safety significance of the function and the safety significance of the degradation itself. In addition to the safety functions of confinement, sub-criticality and shielding affected, there should be a new column that ranks the safety significance as "high," "medium" or "low." Ideally, the safety significance could be quantified and evaluated against the NRC-established criteria for "no significant risk" such that those which are not risk significant could be screened-out.
- b) In Appendix B, the report does evaluate the relative impact of a degradation mechanism on the functions evaluated. However, the form in which they are reported requires extensive analysis to determine whether the mechanism has a relative high, medium or low safety significant. It is recommended that the table be augmented with the H, M or L designations in each box for which there is an indicated effect, and that an overall column be included that considers the safety significance of all of the effects.

4. Differences Between the NRC's Ranking Approach and That of the EPRI Extended Storage Collaboration Program (ESCP)

Both the NRC draft report and the ESCP gap analysis appropriately base their priority firstly on the importance of a feature or function to maintaining safety. The NRC prioritization then primarily focuses on the level of knowledge known at the time about the process or issue while EPRI expands its consideration beyond the amount of knowledge known about the issue at that time to also take

into account whether significant research is currently being conducted on the issue and how “easy” it would be to initially detect and consequently mitigate the degradation of a safety function that has been affected. Based on the resulting criteria for specific phenomena which could occur, the NRC and EPRI both ranked certain phenomena differently. The table below highlights some of the key differences:

Component	Phenomena	NRC’s ranking	EPRI’s ranking
Cladding	Stress Corrosion Cracking (SCC)	High	Low
	Delayed hydride cracking	High	Medium
	Hydride reorientation	Low	Medium
	Low temperature creep	High	Low
	Low temperature annealing of radiation damage	Not ranked	Medium
	Propagation of existing flaws	High	Not ranked
Fuel assembly hardware	Stress corrosion cracking (SCC)	High	Low
	Metal fatigue caused by temperature fluctuation	High	Low
Bolts	All	High	Medium
Welded canister	Micro-biologically influenced corrosion (MIC)	High	Low/Medium
Concrete Overpack	All	High	Low

We believe that agreement between the various prioritization approaches is vital to establishing a strong regulatory framework for extended storage. It is important that this framework consider the implications of the DOE’s used fuel disposition plans, opportunities to benefit from the DOE’s research programs, and the experience that already exists with used nuclear fuel storage both in the U.S. and internationally (as reflected in the ESCP program). To this end, we encourage the NRC to continue to engage the DOE and the industry through the ESCP program.

5. The NRC’s Conclusions About Areas That Should Receive the Highest Priority (Section 6 of the Report)

We do not agree that the issue of “effects of residual moisture after normal drying” should be given “first priority” as indicated on page 6-5 of the draft report. There are no existing or expected licensing issues surrounding the presence of water in dry storage systems. Also, research programs to quantify the amounts of water that might remain in casks would be of little value as existing information derived from industry experience drying casks in compliance with NRC regulations should provide a sufficient basis for any moisture-related degradation analysis that might be needed. We continue to believe that there is a strong basis to conclude that, given current drying practices, there is very low likelihood there is any moisture of any kind in the canister.