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U.S. Nuclear Regulatory Commission
Washington, D.C. 2055-0001
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Spent Fuel Transportation Risk Assessment: Draft Report for Comment (NUREG-2125), NRC, May 2012.

We appreciate the opportunity to review and comment on NRC's "Spent Fuel Transportation Risk Assessment" (SFTRA), issued as NUREG-2125 in May 2012. We also appreciate the special effort of NRC staff to clarify technical questions that arose in our review. We understand that the SFTRA is the third in a sequence of NRC transportation risk assessments[1], each using somewhat different assumptions regarding cask properties and route environs as well as evolving model assessment tools.

NUREG-2125 is issued at a point when the U.S. Nuclear Waste Program is in reformulation, but at least a decade before procurement of casks in numbers required to support a large-scale spent fuel transport campaign. The January 2012 report of the Blue Ribbon Commission on America's Nuclear Future, recommended consideration of a standardized cask design with multiple purpose canisters. We assume that NRC intends to update this analysis when the casks for

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[1] NUREG-2125: Spent Fuel Transportation Risk Assessment, May 2012

NUREG/CR-6768: Spent Nuclear Fuel Transport.: Package Performance Study Issues Report, June 2002

NUREG-0170: Final EIS on the Transport. of Radioactive Material by Air and Other Modes, Dec. 1977

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a large-scale campaign have been selected, but before large-scale procurement. And, we assume this update will be conducted with full input from stakeholders.

1. **Technical and Perceived Risks.** The SFTRA (pg. F-11) concludes that "the collective dose risks from routine transportation are vanishingly small," and that "if there were an accident during a spent fuel shipment, there is only about a one in a billion chance the accident would result in a release of radioactive material"— rather dramatic language for an NRC assessment of a contested topic. Even if the assessment supports the dramatic summary language (which later comments question) these are findings of a NRC technical risk assessment — conducted by people with primarily technical backgrounds, working in an agency that is part of the U.S. nuclear complex and that is inclined to rely on technical bases for decisions, but which would not be directly involved in SNF transport planning and operation. By contrast, persons in communities affected by SNF transport will generally not have technical backgrounds, will have no association with the U.S. nuclear complex, and can expect no economic benefit from SNF transport through their communities. Their judgments will be based on perceived, not technical, risks—less on risk probability than extreme cases, less on technical risk than on institutional trust.

   People in corridor communities may be persuaded to accept technical risk assessments such as those in NUREG-2125, but they will do so based mainly on their judgment of the institutions and people responsible for the campaign (their competency, transparency and integrity), not on the basis of a technical risk assessment of SNF transportation casks.

   The NRC SFTRA should clearly convey that the NRC appreciates the distinction between technical and perceived risks in SNF transport. While we depend on NRC to provide assurance that the technical risks (as they relate to casks) are as low as reasonably possible, that assurance is only a first step in the design of a successful large-scale transport campaign. NRC should convey, not only that this is the case, but that it does not expect that it should be otherwise, and that it is reasonable and appropriate that affected people should consider factors other than technical risk. The National Academies recognized this as part of their 2006 study, "Going the Distance", as did the Blue Ribbon Commission in January 2012. The NRC should take care to avoid the implication that technical risk should be determinative.

   In addition, given the recent experiences with the Deepwater Horizon oil spill and the nuclear disaster at Fukushima, the public is understandably skeptical of government assurances that severe accidents cannot happen – when there is ample evidence to the contrary. The NRC must recognize that the public will likely not accept their technical findings.

2. **Sabotage-Terrorism Risk**. Page 2 states that the SFTRA "does not include the probabilities or consequences of malevolent acts," and our inquiries on the topic are referred to NRC's Office of Nuclear Security and Incident Response. The 2006 National Academies' study, "Going the Distance" (pgs. 8-9) recommended an examination of the topic by a technically knowledgeable group that is independent of the government and free from institutional and financial conflicts of interest. The NAS recommends that this group should consider: a) the threat environment; b) the response of packages to credible malevolent acts; and c) operational security requirements.

   We and other State Regional Groups have recommended that the findings from such an examination should be shared with a selection of state government officials with appropriate technical background and clearances. We have also inquired whether the PRESTO and P-Thermal tools used in the SFTRA could be applied to assess the second of the three topics identified by the National Academies—the response of packages to credible malevolent acts.

   The purpose of this comment is not to suggest that security risk should be included in the SFTRA, but to make the obvious point that security cannot be divorced from other transportation risks in consultations with corridor communities, and to inquire about the status of the recommendations made by NAS in 2006, and subsequently by us and others. Were federal and state officials to consult with corridor communities regarding a SNF transport campaign, what would we be able to say about the risk of malevolent acts?

3. **Cask Design vs. Construction-Maintenance**. A difference between the SFTRA and previous NRC transportation risk assessments is that the SFTRA descriptions for the selected casks include all the design margins (vis-à-vis NRC requirements) reflected in the manufacturer's certificate of compliance (pg. 9), and that these margins are not degraded in use over a 50-year transportation campaign. NRC's assurance that the design margins assumed are present in practice is based on: a) the NRC Quality Assurance Plan; b) NRC inspections (but not of every cask at each stage of manufacture); and c) an external radiation measure prior to each shipment.

   We would appreciate NRC consideration of how this quality assurance plan would function in a large-scale shipment campaign involving manufacture of many casks, each used many times in cross-country transport and handling.

   - How does the NRC Quality Assurance Plan ensure that the design margins assumed in the SFTRA are retained over a large-scale, long-term transportation campaign?
   - Which of the design margins included in the certificate of compliance are most likely to be degraded in use, and how would NRC processes identify and address these early rather than late?

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4. **Finite Element Models**. We appreciate the necessary role of finite element models (such as PRESTO and P-Thermal) in assessing the response of specific cask designs to specified events. We would appreciate a better understanding of how these models are calibrated or benchmarked to represent different cask designs, and how they reliably predict the interactions of the several cask components (impact limiter, cask body and wall, cask and canister seals, SNF contents) in extreme events or event sequences:

   - What physical tests of casks and cask components have been conducted? How are these results (which reflect a specific event) incorporated into finite element models and applied to predict cask response in very different events?
   - What physical tests of cask scale models have been conducted, and how can we be confident that these results apply to full-scale casks of other designs under different event scenarios?
   - Has NRC identified other physical tests needed to improve the calibration of its finite element models and their representation of extreme events or event sequences?

   We appreciate that this may not be easily explained to the uninitiated, but it is a necessary step to develop confidence in the results produced by complex models. Implicitly, the SFTRA asks stakeholders to not only accept but to rely on the results of finite element models. Appendix C ("Details of Cask Response to Impact Accidents") discusses how the models were applied in the SFTRA analysis, but is less clear about how the models reflect physical tests of cask components, scale models and/or full-scale tests, and how these reflect the Section 71.73 cask sequence:

   - Sections C.4.3-4.5 reference tests used to derive the forces imparted by impacts on various targets, but these were generally conducted in the 1970s or 1980s.
   - Section C.5.1 (pg. C-62) states the following: "The response of spent power reactor fuel assemblies to impact accidents is not well understood. While this area has been investigated in the past (Sanders et. al., 1992), those models tended to be relatively crude and imprecise. In addition, utility companies have renewed their interest in shipping higher burnup spent fuel. Therefore, it is essential to determine a more accurate response of spent fuel assembly to impact loads that may be affected by transportation or handling accidents or malevolent acts."

   The SFTRA needs a side-by-side assessments of cask components, physical tests (reflecting the Section 71.73 sequence and other accident conditions), model calibrations, and NRC's assessment of the gaps in model representation of potential accident conditions.

5. **Sample Routes**. We understand that the routes in the SFTRA (pgs. 23-27) are intended as examples. However, shipment to Hanford is illegal under the state-federal agreement, and Skull Valley is a SNF storage destination that does not have host state consent. Three of the four origin sites for removal to consolidated storage are east of the 100th meridian, while three of the four destination sites are west of the 100th meridian. The implications of these storage destinations for disposal site identification are not considered.

   We suggest that NRC consider ways to conduct the analysis while avoiding implications regarding the siting of off-site storage or disposal facilities.

6. **Route Assessment**. The route assessment tools used in the SFTRA analysis have limitations that reflect limited maintenance-development funding in recent years:

   - Even with an adjustment from 2000 to 2006, resident population estimates are six years out-of-date.
   - The TRAGIS process for identifying rural, suburban and urban route segments (Fig. 2.4) is rather crude and not confidence inspiring.
   - Estimates of non-residential populations (employment, shopping, education and entertainment centers) use a RADTRAN "back-of-the-envelope" method.

   The problem with these calibration issues is not necessarily that they dramatically affect assessment results, but that they affect the credibility of the process by not reflecting what stakeholders know to be the case in their own communities. WIEB and others have suggested remedies, which should be considered and incorporated before these tools are applied in actual transportation system design.

7. **Radiation Risk**. As we understand, the GA-4 cask selected for the SFTRA (pg. 10) would be shipped under heavy-haul rules, which involve logistical complications and potential delay. Are these complications and delays reflected in the RADTRAN assessment of radiation exposure? The NAC-STC and Hi-Star 100 rail casks selected for the SFTRA would be used to remove fuel from site that lack Class A rail access, and thus require intermodal shipment and transfer before cross-country shipment. Are these logistical complications reflected in the RADTRAN assessment of radiation exposure?

8. **Fire Risk Assessment**. We have several, related questions regarding the SFTRA fire risk assessment:

   - **Actual and Modeled Fire Plumes**. The introduction (pg. 71) states that, since "(a)ctual fire plumes have location- and time-varying temperature distributions that vary from about 600 degrees C to more than 1200 degrees C ... an evenly-applied 800 degrees C ... used in a certification analysis could be more severe for cask seals and fuel rod exposure than exposure to an actual fire." Please explain why 800 degrees C evenly-applied would be "more severe" than a location and time-varying temperature of 1200 degrees C. Would this not depend on how much the location and time varies in the actual fire? Would an evenly-applied 800 degrees C be more likely to cause fuel rod burst than a actual fire which reaches 1200 degrees C for 5-10 minutes?

- **Fire Scenarios Assessed**. As we read their descriptions in Section 4.2 (pgs. 72-75), the SFTRA fire scenarios involve none in which: a) an accident precedes the fire, and/or b) the fire occurs in an enclosed space (e.g. the MacArthur Maze, the Baltimore Tunnel), and/or, c) the fuel cladding is deteriorated or damaged. If this observation is correct, we suggest that the SFTRA discuss the circumstances that its analysis does not address and why.
- **The 10 CFR 71.73 "Sequential Application."** The chapter summary (pg. 107) states that "This chapter presents the realistic analyses of four fire accident scenarios ... described in 10 CFR 71.73." However, Section 71.73 states that "(e)valuation for hypothetical conditions is to be based on *sequential application* of the tests specified ... in the order indicated,[2] to determine their cumulative effect on a package ... ." (emphasis added). If the SFTRA does not analyze the test sequence, can it say that "it presents the realistic analyses of ... the hypothetical accident conditions described in 10 CFR 71.73"?

9. **Public Involvement and Participation**. We understand that the SFTRA has been under development for several years. Yet, we did not learn of it until two months ago—May 16, when the 500-page draft report was introduced but not discussed in detail at the National Transportation Stakeholders Forum. We would appreciate a greater opportunity for review and input as the SFTRA is revised and finalized. In this process, we would appreciate NRC's consideration and responses to the questions and issues raised above.

Thank you for your consideration. Please call Jim Williams (WIEB, 303-573-8910 x6) if you have questions.

Sincerely,

Ken Niles
Committee Chair
High-Level Radioactive Waste

[2] 1. Free drop; 2. Crush; 3. Puncture; 4. Thermal (average flame temperature of at least 800 degrees C for a period of 30 minutes); and 5. Immersion-fissile material.