UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

February 14, 2013

Mr. R. W. Borchardt
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: DRAFT NUREG-2125, "SPENT FUEL TRANSPORTATION RISK ASSESSMENT"

Dear Mr. Borchardt:

During the 601st meeting of the Advisory Committee on Reactor Safeguards, February 7-8, 2013, we completed our review of Draft NUREG-2125, "Spent Fuel Transportation Risk Assessment." This matter was also reviewed during our 600th meeting, December 6-8, 2012, and by our Radiation Protection & Nuclear Materials Subcommittee during a meeting on September 18, 2012. During these meetings, we had the benefit of discussions with representatives of the NRC staff. We also had the benefit of the documents referenced.

CONCLUSIONS AND RECOMMENDATION

1. NUREG-2125 should be published after the responses to our comments are incorporated.

2. NUREG-2125 provides a more complete and realistic assessment than earlier risk studies. However, it does not include a systematic assessment of the potential for phenomena that may not occur in design basis accidents, but could become important under the more extreme conditions associated with beyond design basis accidents.

3. Despite the lack of a systematic assessment of the range of phenomena that could result in failure and releases, the results in NUREG-2125 continue to support the conclusion that risks from accidents involving spent fuel casks certified under the current regulatory framework are very low.

BACKGROUND

The staff has conducted and published a series of studies evaluating the risks associated with the transportation of spent nuclear fuel (SNF) in casks. Past risk assessments of SNF transportation have used simplified event trees to determine accident conditions and their associated probabilities along with simplified, conservative, structural and thermal analyses of generic cask designs. In the current study, NUREG-2125, the risk assessment was performed using actual cask designs, state-of-the-art structural and thermal analysis tools, and more realistic accident scenarios.

NUREG-2125 documents the evaluations of risks associated with SNF shipments by rail or highway. It is not intended to be a risk assessment for any specific transportation campaign and does not address the probabilities or consequences of malevolent acts.

SNF transportation casks are designed to maintain their integrity in accidents. These casks are designed to pass the sequential series of tests described in 10 CFR 71.73, and include:

- A free drop through a distance of 9-meter (30-foot) onto a flat, essentially unyielding, horizontal surface, striking the surface in a position for which maximum damage is expected.

- A 1-meter (40-inch) drop onto a fixed 15-cm (6-inch) diameter steel cylindrical bar (vertical post), to test the cask's resistance to punctures.

- A 800°C (1475°F) fire that fully engulfs the cask for 30 minutes.

- An external pressure of 2 MPa (290 psi) for a period of not less than one hour without collapse, buckling, or in leakage of water. This pressure is equivalent to an immersion in 200 meters (660 feet) of water.

The casks must maintain containment, shielding, and criticality control functions following these tests.

DISCUSSION

The ability of a transportation cask to maintain its structural integrity under mechanical forces and thermal loading conditions is a critical issue for transportation safety and important in understanding and quantifying transportation risks.

NUREG-2125 presents results from studies of radiological impacts of SNF shipments under normal and accident conditions for a range of road and rail routes through rural and urban areas across the country. The casks selected for this study were constructed of steel with lead, depleted uranium, or steel shielding. The casks considered in this analysis are the NAC-STC and Holtec HI-STAR 100 rail casks and the GA-4 legal weight truck cask.

Improved event trees were used to estimate the probabilities of accident conditions. Fire scenarios were extended to consider very low frequency events such as the failure of a large rail tank car loaded with hydrocarbon fluids in which all of the fuel in the tank car is released and assumed to form a pool. The pool area is conservatively assumed to be no larger than needed to support a fire that would engulf the cask and prolong the duration of the fire. Finite element analyses were performed to analyze how the casks responded to impact and thermal accident conditions. NUREG-2125 also includes an assessment of consequences involving criticality and concludes that criticality is not a credible scenario.

RADTRAN, a transportation risk assessment computer code, was used to calculate routine doses and accident dose risks for representative truck and rail shipments. RADTRAN is the national and international standard for transportation risk assessment for radioactive materials. It combines user-determined demographic, routing, transportation, packaging, and materials data with meteorological data (partly user-determined) and health physics data to calculate expected radiological consequences of incident-free radioactive materials transportation and of associated accident risks.

These studies found: 1) the collective doses from normal SNF shipments were 10,000 to 100,000 times less than collective background radiation doses, 2) there was little variation in the risks per kilometer of transport distance over the routes analyzed, 3) there was no release of radioactive material in any of the accident scenarios provided that the SNF was loaded in an inner welded stainless steel canister, and 4) only rail casks without inner welded stainless steel canisters would release radioactive material, and only then in very small amounts, after exceptionally severe and improbable accidents.

The analyses in NUREG-2125 continue to support the conclusion that radiological risks from SNF transportation using NRC-certified casks are very low and that the current regulations for transportation of radioactive material are adequate to protect public health and safety.

Although NUREG-2125 is a more complete and realistic assessment than earlier risk studies, it does not include a systematic assessment of the potential for phenomena that may not occur in design basis accidents, but could become important under the more extreme conditions associated with beyond design basis accidents.

During our meetings with the staff, we made a number of comments about the potential impact of phenomena that were not addressed in the analyses presented in NUREG-2125. We also emphasized that it is important to ensure that input data are appropriate for the predicted range of conditions. The staff has proposed changes to the NUREG that address these issues. With the exception of the treatment of the stainless steel thermal diffusivity, the proposed changes should be incorporated. However, last minute ad hoc considerations of selected phenomena are not a suitable substitute for a systematic, multi-disciplinary assessment of potentially important phenomena.

All the “collective dose” results in NUREG-2125 are probability weighted. This is not made clear in any of the tables and figures. A clear definition of collective dose and how it is used in this report should be provided.

NUREG-2125 describes the results and the analyses in a variety of forms that are intended for a range of audiences from the general public to technical experts. The public summary in Appendix F should be given more prominence in the report.

We commend the staff for their efforts to improve our understanding of the risks of SNF transportation accidents.

Dr. Dana Powers did not participate in the Committee's deliberations regarding this matter.

Sincerely,

/RA/

J. Sam Armijo
Chairman

REFERENCES

1. Memorandum to Edwin M. Hackett, Draft NUREG-2125, "Spent Fuel Transportation Risk Assessment," August 24, 2012, (ML12240A017)

2. Draft Report for Comment, "Spent Fuel Transportation Risk Assessment," NUREG-2125 (ML12125A218)

3. Memorandum to Edwin M. Hackett, Response to Request For Additional Information Regarding Draft NUREG-2125, "Spent Fuel Transportation Risk Assessment," January 31, 2013, (ML13031A236)

4. Letter to Dale E. Klein, "Spent Fuel Transportation Package Response to the Baltimore Tunnel Fire Scenario," November 28, 2006, (ML063380255)

5. 10 CFR Part 71, "Packaging and Transportation of Radioactive Material," 01/01/2012 (http://www.nrc.gov/reading-rm/doc-collections/cfr/part071/)

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