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SCREENING REVIEW

10CFR71, NUREG-1609, NUREG-4775, AND SHIPPING RELATED REGULATORY GUIDES

by NEI Licensing Task Force Subcommittee 2

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INTRODUCTION AND BACKGROUND

The Nuclear Regulatory Commission's (NRC) "Draft Project Plan to Prepare the U. S. Nuclear Regulatory Commission to License and Regulate Accident Tolerant Fuel," issued in early 2018, proposed four preparatory tasks. Task 2: 'Fuel Cycle, Transportation, and Storage Regulatory Framework' was to address out-of-reactor regulatory framework in support of 1) batch loading of Accident Tolerant Fuel (ATF) into NRC-regulated power plants, and 2) crediting the safety enhancements of ATF in the licensing basis of NRC-regulated power plant.

Following the issuance of the NRC's first draft plan, Subcommittee 2 was formed under the NEI ATF Licensing Task Force to screen for potential ATF impacts in 10CFR70, 10CFR71, 10CFR72, various NUREGs, and fabrication/transport/storage-related Regulatory Guides. This document presents the results of the screening completed in 2018 by Subcommittee 2, which focused on a subset of these documents.

In September 2018, after the planned work of Subcommittee 2 for 2018 was essentially complete, the NRC issued Version 1.0 of the project plan. Section 8, Table 8.1 of the NRC project plan presents the regulatory and guidance documents identified by the NRC as potentially requiring changes for ATF. These are NUREG-1609 "Standard Review Plan for Transportation Packages for Radioactive Material," NUREG-1617 "Standard Review Plan for Transportation Packages for Spent Nuclear Fuel," NUREG-1520 "Standard Review Plan for Fuel Cycle Facilities License Applications," and "Standard Review Plan for Spent Fuel Dry Storage Systems and Facilities," and a link to 25 Interim Staff Guidance documents.

2018 REVIEWS

The ATF Licensing Task Force Subcommittee 2 has completed a review of regulatory documents pertaining to non-irradiated fuel transportation for a limited scope of ATF concepts. The concepts included were only near-term and included UO2 based fuel pellets (not including U3Si2 pellets which will occur in the next phase of reviews) under 5 wt% U-235 and zirconium-based claddings. This was done to facilitate the initial shipment of Lead Test Rods/Assemblies to domestic utility reactors. Those regulations reviewed were:

10CFR71	Packaging and Transportation of Radioactive Material
49CFR107	Hazardous Materials Program Procedures
49CFR173	Shippers – General Requirements for Shipments and Packagings
49CFR177	Carriage by Public Highway
49CFR178	Specifications for Packagings
49CFR180	Continuing Qualification and Maintenance of Packagings
NUREG 1609	Standard Review Plan for Transportation Packages for Radioactive Fuel
NUREG/CR 4775	Guide for Preparing Operating Procedures for Shipping Packages
RG 7.6 Rev 1	Design Criteria for the Structural Analysis of Shipping Cask Containment Vessels
RG 7.7 Rev 1	Administrative Guide for Verifying Compliance with Packaging Requirement for Shipping and Receiving Radioactive Material
RG 7.9 Rev 2	Standard Format and Content of Part 71 Applications for Approval of Packages of Radioactive Material
RG 7.10 Rev 3	Establishing Quality Assurance Programs for Packaging Used in Transport of Radioactive Material

The subcommittee's review did not identify any changes needed for transportation of fuel for completion of near-term activities. The regulations were general enough in their wording that they could be used for each of the ATF concepts to ensure all requirements would be met. For shipping, each vendor's shipping container Certificate of Compliance (CoC) is undergoing review to ensure it can be used for the specific ATF concept, or if a revised (or new) CoC will be required. Vendors will address any necessary revisions to shipping container CoCs individually.

Reviews of these and other regulatory documents will be needed to support long-term ATF concepts, post-irradiation shipment and storage, and increased enrichment and burnup. But for now, the subcommittee has not given these high priority. These activities will be included in the ATF Licensing Task Force Sub-Committee 2 Long-Term Plan.

In addition, 10CFR70 Domestic Licensing of Special Nuclear Material and 10CFR72 Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste were reviewed for relevance to the ATF concepts. While the results of the 10CFR72 review were in line with those of 10CFR71 above, additional insights were provided for 10CFR70. The insights from that review are provided on the next page.

10 CFR 70

Note: Guidance in NUREG-1520 is critical in the development of an ATF manufacturing process.

- Key definitions like the Formula Quantity of Special Nuclear Materials (SNM), for low, moderate, and strategic quantities and enrichments – may affect ATF designs, and the manner in which the fuel fabrication facilities are licensed, guarded, inventoried (control and accounting), etc. Regulatory requirements are generally graded depending upon low, moderate, or strategic levels. On a case-by-case basis, designers will have to consider carefully the ultimate enrichment levels, etc., and assess the regulatory requirements imposed by the resulting SNM category.
- 10CFR70.74 Criticality accident requirements – the language is probably workable but not ideal. This section of the regulation governs SNM quantity and form that will need to be evaluated for ATF impacts. Rather than being performance-based like the rest of Part 70, it is very prescriptive.
- 10CFR70.72 Facility changes and change process – introduction of any significant change in the type, form, or quantity of materials involved in the manufacturing of an ATF design must consider this change process. For more significant changes, a license amendment will be required. For less significant changes, there may be latitude for the licensee to proceed without a license amendment but the change process is quite prescriptive and will require thorough assessments of the impacts of the change.

CONCLUSION

- In general, 10CFR70 was written to be a performance-based regulation and, as a result, is less prescriptive than Part 50. It uses generic terms such as “special nuclear material” so that the performance requirements are determined without regard for the physical form of material (e.g., metal, powder, UO2, U3O8). However, the physical form may be important in the assessment of the ability to meet a performance requirement.
- Part 70 attempts to implement a graded approach in its treatment of “special nuclear material” by the quantity or enrichment of the material. Historically, the regulation has been interpreted in various ways.
- For any or all ATF designs, the 70.72 change process must result in a critical review of the process and facility changes necessary to introduce any change in the type or form of material being utilized. Changing from the manufacturing of fuel in a ceramic (UO2) form to metal or other compound will fit within the regulatory framework as it is written and the general performance criteria should work. However, the analysis to demonstrate compliance with those performance criteria must be sound, and significant changes will almost certainly require a license amendment.
- 70.72(c)(1)(ii) effectively prohibits “new and different” processes or technologies so a license amendment is likely to be required for all ATF designs except those most similar to the existing fuel.

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