

REGULATORY OPTIONS FOR CONSIDERING MODERATOR EXCLUSION

The staff proposes three options to address the moderator exclusion issue for Commission consideration:

- Option 1. Consider moderator exclusion for transport of commercial spent fuel under 10 CFR 71.55(e) for hypothetical accident conditions, and on a limited-shipment basis, as a 10 CFR 71.55(c) exception to the subcriticality requirement of 10 CFR 71.55(b)

Description of Option: This option represents maintenance of the status quo. Under this option, applications for design approval would be assessed consistent with Interim Staff Guidance No.19, [i.e., transportation packages for commercial spent fuel may rely on moderator exclusion to meet 10 CFR 71.55(e)]. The staff would review requests for moderator exclusion under 10 CFR 71.55(c) for specific shipments or specific shipping campaigns based on appropriate risk information. Applications for specific shipments or shipping campaigns could be accepted under the provisions of 10 CFR 71.55(c). The applicant would provide information about the special design features of the package, and measures taken before each shipment, to ensure that the containment system does not leak. In addition, the applicant would provide appropriate risk information to demonstrate an adequate margin of safety against accidental criticality. Appropriate risk information would provide justification for approval of the shipments as an exception to the requirements of 10 CFR 71.55(b). Such risk information may include shipment-specific details such as: (1) nuclear reactivity of the cask system, and a quantified assessment of margins against accidental criticality; (2) modal or carrier restrictions; (3) identification of routes, including route characteristics and accident frequency information; (4) special loading and unloading controls; and (5) other operational controls exercised during transport.

Pros:

- Maintains the current defense-in-depth against inadvertent criticality. This defense-in-depth provides margins of safety that are particularly important when considering potential misloading events, loading and unloading operations, and possible future reliance on burnup credit in cask designs.
- Clearly supports NRC's strategic outcome of preventing inadvertent criticality events.
- Does not require new guidance or rulemaking, and does not significantly impact NRC resources.

Cons:

- May limit the number of commercial spent fuel elements that can be shipped in a single cask, and may increase the number of shipments.
- Increases the cost of cask fabrication for commercial spent fuel, because neutron absorbers are typically needed.
- Increases the U.S. Department of Energy's (DOE's) difficulties in demonstrating subcriticality for non-commercial spent fuel in the Idaho National Laboratory (INL) canister.

Option 2. Consider moderator exclusion in spent fuel cask-design approvals under the provisions of 10 CFR 71.55(c), as justified by additional risk information.

Description of option: Under this option, a spent fuel cask design that relies on moderator exclusion for criticality safety could be reviewed and approved under the provisions of 10 CFR 71.55(c). Significant risk information would be needed in reviewing such a request. In addition, before accepting such an application, the staff would: (1) evaluate the existing environmental impact statements (EIS) and risk assessments that support spent fuel transportation activities, to ensure that they would remain valid under the introduction of this type of accident, albeit with a low probability; and (2) develop formal guidance, giving the basis for accepting and approving such a request. This guidance would describe the type of risk information needed to support a design approval, under the provisions of 10 CFR 71.55(c). This risk information would include: (1) consideration of the nuclear reactivity of the cask system, including consideration of credit for fuel burnup; (2) identification of design-basis accidents; (3) probabilistic accident information; (4) evaluation of human factors; and (5) special considerations for loading and unloading operations.

Pros:

- May allow larger-capacity spent fuel cask-design approvals, which could reduce the number of shipments.
- Reduces costs of cask fabrication, because neutron absorbers would likely not be needed for subcriticality.
- Does not require rulemaking, and may be completed in a shorter time than rulemaking.
- May result in guidance development that could: (1) increase the body of knowledge regarding transportation risks associated with moderator exclusion; and (2) address moderator exclusion and burnup credit in a coherent risk-informed context.
- May provide an efficient mechanism to gain experience in evaluating applications for moderator exclusion, before any initiation of rulemaking.

Cons:

- May reduce margins of safety against NRC's strategic outcome of preventing inadvertent criticality events.
- Reduces margins of safety in spent fuel loading and unloading operations.
- May result in routine use of packages approved under a regulatory exception, with important safety significance.
- Results in a less open and transparent process because there is no public participation in the cask-design-approval process.
- Requires significant staff resources for reevaluation of environmental assessments, guidance development, and technical review of applications.

Option 3. Initiate rulemaking to codify the acceptable uses of moderator exclusion for spent fuel transportation packages, while continuing current staff practices, as described under Option 1, in the interim.

Description of Option: This option is recommended, and involves the development of a technical basis for rulemaking, to include a moderator-exclusion provision for spent fuel transportation casks. The approach would consist of developing a regulation specifically

addressing requirements for approving such package designs, and clarifying 10 CFR 71.55 with respect to moderator exclusion. Risk information would be developed to provide a technical basis for the rulemaking. The risk information would be derived from collating and supplementing existing risk assessments for spent fuel transportation, to consider accidental criticality risks. Activities identified above for Option 2 (e.g., guidance development) would also be needed for this option. The rulemaking process would provide an opportunity for stakeholder comment and engagement with the staff in discussing views on moderator exclusion. A place-holder for this rulemaking is included in the Common Prioritization of Rulemakings as an unfunded, low-priority rule.

Pros:

- Allows risk-informed approach to address moderator exclusion within the regulatory framework (i.e., may result in a rule that codifies alternative methods for retaining defense-in-depth while allowing large-capacity casks).
- Enhances openness to stakeholders because it allows involvement in the rulemaking process. This is particularly important in transportation package approval, because moderator exclusion has important safety implications and because there is no public participation in the cask-design-approval process under Part 71.
- Does not rely on use of a regulatory exception, with important safety implications for routine spent fuel shipments.

Cons:

- Involves longer lead time and significant staff resources to develop a technical basis and a final rule.

RESOURCES:

Because resources for Fiscal Year (FY) 2008 are already budgeted, any needed resources for moderator exclusion would have to be reprogrammed from existing budgeted efforts. For FY 2008 activities, if resources are reprogrammed to support moderator exclusion tasks, Office of Nuclear Material Safety and Safeguards (NMSS) work that may be deferred, delayed, or cancelled includes the Division of Spent Fuel Storage and Transportation's (SFST's) efforts on risk-informing guidance, multi-lateral cooperation and assistance, inspection, and lower-priority licensing casework. The budgeting process for FY 2009 would be handled in a similar manner, although staff may have somewhat more latitude in reallocating workload resources in FY 2009, given the additional time for planning.

- Option 1. No significant budget impact. In FY 2008, no resources are budgeted, and no resources are needed.
- Option 2. FY 2008 costs are estimated as 4.5 to 6.0 full-time equivalents (FTEs) in SFST/NMSS. FY2008 activities include: (1) evaluate the EIS and other documents supporting current spent fuel transportation activities; (2) initiate development of formal guidance; (3) review one to two applications for casks for commercial spent fuel transport; and (4) review DOE application for the INL canister design for non-commercial spent fuel transport. The estimate of costs assumes approximately 1.5 FTEs per design review, and 1.0 FTEs for

development of guidance. The average value for design review (1.5 FTEs) accounts for resources needed to review designs that would not otherwise be submitted, or the additional resources needed for the review of moderator exclusion for designs that would have been submitted anyway. This estimate assumes that no new environmental assessments are needed.

FY 2009 costs are estimated as 2.0 to 3.5 FTEs in SFST/NMSS. FY 2009 activities include: (1) complete guidance development; and (2) review one to two applications for casks for commercial spent fuel transport.

Option 3. FY 2008 costs are estimated as 2.0 FTEs in NMSS/SFST and an additional \$300,000 contract cost for technical assistance. The primary FY 2008 activities include: (1) evaluate the EIS and other documents supporting current spent fuel transportation activities; and (2) initiate development of technical basis, including any risk studies, to support rulemaking and development of associated guidance.

FY 2009 costs are estimated as 2.7 FTEs -- 0.5 FTE in the Division of Intergovernmental Liaison and Rulemaking, of the Office of Federal and State Materials and Environmental Management Programs (DILR/FSME), and 2.2 FTEs in SFST/NMSS. FY 2009 activities include: (1) complete development of technical basis; (2) develop a regulatory analysis and a proposed rule, including any needed revisions to 10 CFR 71.55(b); and (3) develop draft guidance.

FY 2010 costs are estimated as 1.0 FTE -- 0.5 FTE in DILR/FSME, and 0.5 FTE in SFST/NMSS. FY 2010 activities include: (1) resolve public comments on the proposed rule; (2) prepare final rule; and (3) develop final guidance.

The information on resources and schedule reflect the current environment. If a significant amount of time (greater than 30 days) passes, or the Commission provides the staff direction that differs from, or adds to, the staff's recommended action, this section of the paper would need to be revisited after issuance of the draft Staff Requirements Memorandum.