

September 28, 2011

MEMORANDUM TO: Jack R. Davis, Deputy Director
Division of High-Level Waste Repository Safety
Office of Nuclear Material Safety
and Safeguards

Marissa G. Bailey, Deputy Director
Division of Fuel Cycle Safety and Safeguards
Office of Nuclear Material Safety
and Safeguards

Douglas W. Weaver, Deputy Director
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

FROM: Thomas Matula, Senior Project Manager */RA/*
Division of High-Level Waste Repository Safety
Office of Nuclear Material Safety
and Safeguards

SUBJECT: FINAL REPORT - PLAN FOR INTEGRATING SPENT NUCLEAR
FUEL REGULATORY ACTIVITIES WORKING GROUP

In a June 21, 2010, memorandum to the Commission, the Director of the Office of Nuclear Material Safety and Safeguards issued the Plan for Integrating Spent Nuclear Fuel Regulatory Activities (ISFRA). A Working Group (WG) was formed to perform the integration process described in Appendix A of the ISFRA. The WG used this integration process to integrate regulatory activities relating to the phases in the back end of the fuel cycle (BEFC). Enclosed is the WG's final report describing the results of its integration of the core program areas of the BEFC. The WG completed its assigned tasks and should now be ended. The ISFRA Plan and associated integrating activities should be transferred to the Systems Analysis and Integration Group within High-Level Waste Repository Safety.

Enclosure:
Integrating Spent Nuclear Fuel Regulatory Activities
Working Group Final Report

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In a June 21, 2010, memorandum to the Commission, the Director of the Office of Nuclear Material Safety and Safeguards issued the Plan for Integrating Spent Nuclear Fuel Regulatory Activities (ISFRA). A Working Group (WG) was formed to perform the integration process described in Appendix A of the ISFRA. The WG used this integration process to integrate regulatory activities relating to the phases in the back end of the fuel cycle (BEFC). Enclosed is the WG's final report describing the results of its integration of the core program areas of the BEFC. The WG completed its assigned tasks and should now be ended. The ISFRA Plan and associated integrating activities should be transferred to the Systems Analysis and Integration Group within High-Level Waste Repository Safety.

Enclosure:
Integrating Spent Nuclear Fuel Regulatory Activities
Working Group Final Report

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Plan for Integrating Spent Nuclear Fuel Regulatory Activities Working Group Final Report

Background

In a June 21, 2010, memorandum to the Commission, the Director of the Office of Nuclear Material Safety and Safeguards (NMSS) issued the Plan for Integrating Spent Nuclear Fuel Regulatory Activities (ISFRA) [ML101030098]. The purpose of the ISFRA Plan is to assure that the Nuclear Regulatory Commission (NRC) treats spent nuclear fuel and high-level waste regulation as a system of interrelated activities so that decisions made about one component or area of the back end of the nuclear fuel cycle adequately consider and integrate related components or areas.

A Working Group (WG) was formed to perform the integration process described in Appendix A of the ISFRA Plan. A list of Steering Committee and WG members for the ISFRA Plan is in the Attachment to this report. The WG used this integration process to integrate regulatory activities relating to the phases in the back end of the fuel cycle (BEFC).

WG Observations

1. The existing NRC regulations for the core areas of spent fuel independent storage and transportation Parts 71 and 72 provide an adequate basis for safety and are sufficiently flexible to accommodate operational and licensing activities in those areas because they are performance based. The plans for regulations regarding reprocessing (Part 7X), although not yet completed, and the regulations for disposal (Parts 60 and 63) were considered in this licensing integration review.
2. Guidance documents (e.g., NUREGs and Office Instructions), which implement NRC regulations, are: (1) often narrowly focused on current operational practices and may not be helpful for the licensing of aspects of potential new facility designs; (2) often based on design specific or operational factors; (3) often representing the current way of doing things and may not be appropriate for future operations or designs; and (4) likely to be difficult to coordinate across the BEFC until the total fuel cycle is known (e.g., resolution of fuel cladding integrity and cask design issues).
3. New licensing strategies may be needed to integrate future operations for the BEFC once national fuel policy is established. For instance, plans must be established for disposition of the spent fuel before regulatory integration can occur.
4. Complying with BEFC regulations requires information for technical review and compliance determination. Currently this required information is identified in the applicable regulations and is captured and made available for spent fuel management

operations. If there are significant delays in establishing government policies and infrastructure that allows industry to develop and implement integrated spent fuel management plans, there may be a reduction in the quality of the currently generated information available for the future licensing operations for spent fuel. This could be particularly true as plants are decommissioned, access to key personnel is lost, and physical assets are transferred to new organizations. Such information, as discussed below, must be captured, documented, and maintained as quality assurance records, and made available at subsequent cycle operation.

WG Recommendations

The WG made the following recommendations:

1. The focus of future ISFRA efforts should be placed on current initiatives (Integration across the entire BEFC is not possible until industry makes decisions on spent fuel disposition):
 - a. Waste confidence and rulemaking
 - b. Extended storage and transportation
 - c. Storage and transportation regulatory process improvements
 - d. Reprocessing
 - e. Geologic disposal
2. Do not revise the ISFRA Plan at this time
 - a. The ISFRA Plan is sufficiently flexible
 - b. The ISFRA Plan includes current development initiatives
 - c. More information on the national waste management policy changes is needed before the ISFRA Plan is revised
3. Due to the nature of the current regulatory activities to be considered under the refocused ISFRA Plan, the current WG should be ended. The ISFRA Plan and associated integrating activities should be transferred to the Systems Analysis Group within HLWRS.

Objectives and Scope

The ISFRA Plan provides a systematic approach to integrating regulatory activities for the BEFC. NMSS activities are focused on the core program areas. The primary objective of the ISFRA Plan is to facilitate integration of regulatory requirements across the core program areas by:

- identifying critical interfaces and interdependencies across core program areas;
- identifying and filling regulatory gaps created by evolving national policies and industry practices
- increasing the efficiency and effectiveness of current and future regulations and regulatory practices by identifying and adopting common definitions, assumptions, and methodologies (to the greatest extent possible) across core program areas

- eliminating duplication of effort
- identifying impacts and consequences resulting from changes in regulatory programs
- enabling NRC's evolving regulatory framework for the back end of the fuel cycle to leverage the knowledge and operational experience of internal and external stakeholders

Discussion

The WG followed the guidance in the ISFRA Plan for performing its review of the BEFC. The WG used the integration assessment tool (matrix) based on the example matrix in Appendix A of the ISFRA Plan. This matrix was designed to clarify the information needed to regulate each functional element of the fuel cycle (i.e., Fuel Design, Fuel Fabrication, Reactor Operations, Storage, Transportation, Reprocessing, and Disposal). While the matrix conceptually covered the whole fuel cycle, WG activities addressed primarily the BEFC. For this initial look at integration, detailed WG analysis focused only on Storage, Transportation, and Disposal since a large number of significant gaps exist in the regulatory framework for reprocessing.

The WG centered its activities on discussions of each cell in the matrix to determine whether a BEFC phase issue or interface issue exists. For example, through many iterations of the assessment tool matrix, the WG (1) developed "Input" requirements for each "focus" fuel cycle phase; and (2) developed "output" requirements for each "focus" fuel cycle phase. The WG then aligned "input" and "output" requirements with applicable BEFC regulations¹, and examined whether there were inconsistencies between the regulations governing the different BEFC phases. Finally, the WG developed preliminary observations and recommendations.

In general, the WG determined that the regulations provide adequate safety for the phases of the BEFC. The reasoning for this is that all major areas of BEFC regulation are focused on maintaining the same fundamental safety functions. These fundamental safety functions include:

- Limiting worker and public external doses
- Prevention or control of the release of radionuclides from containment or confinement, and
- Prevention of an inadvertent criticality.

Also, while WG's "inputs" and "outputs" related to Storage, Transportation, and Disposal first appeared to be very specific to each BEFC phase, the numerous WG discussions of each cell made it clear that determinations for complying with the regulations depends on the availability

¹ Based on analyses of the regulations for transportation and the storage of spent fuel delineated in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71 and 10 CFR Part 72; and for waste disposal, a composite of 10 CFR Part 63 (which is "risk informed" and applies only to the "Yucca Mountain site") and 10 CFR Part 60 (which is not "risk informed" and applies to sites other than Yucca Mountain), and recognizes the intention to revise Part 60 (using Part 63 as a model) to conform with the need for risk informed regulations.

of information on which to base a technical review. The primary non-site information or facility-specific information needed to regulate BEFC activities, while not specifically required by regulation, is inferred by regulation and includes one or more of the following:

- ✓ Radiological inventory
- ✓ Chemical inventory
- ✓ Thermal Inventory
- ✓ Canister size
- ✓ Canister weight
- ✓ Chemical form
- ✓ Physical form
- ✓ Canister structure
- ✓ Shielding design
- ✓ Criticality control
- ✓ Generic waste form degradation characteristics
- ✓ Burn up calculations
- ✓ Canister materials
- ✓ Canister internals
- ✓ Generic spent fuel package/canister degradation characteristics
- ✓ Physical condition of the waste

To date, the WG has not revised its integration assessment tool (matrix) using the above list, and based on the regulations for each BEFC phase (i.e., storage transportation, and disposal) the WG has not determined the specific “input”/“output” needs for each BEFC phase. It is recommended that continuation of integration activities include revising the matrix in order to determine which BEFC phase needs what information from the list, and specifically which BEFC phase has the primary responsibility for maintaining the “input” record, and the primary responsibility for supplying that record as “output” to other BEFC users. Finally, the WG believes that the revised matrix would apply to the whole fuel cycle. Therefore, it recommends that the integration assessment tool (matrix) be further expanded to include the whole fuel cycle (front end, as well as back end).

The existing regulations in 10 CFR Parts 71 and 72 provide adequate safety for the core program areas of storage and transportation. The regulations are focused on maintaining basic safety functions by limiting dose, controlling the release of radio-nuclides, and preventing an inadvertent criticality. This is expected to remain true no matter what future changes in fuel cycle operations occur as a result of possible policy changes. In addition, the regulations are flexible enough to support anticipated changes in technology and policy because they are based on performance requirements rather than specific technologies. The same is generally anticipated for reprocessing as most revisions the staff makes to the regulations (new Part 7X) are anticipated to be risk-informed, performance-based, and technology neutral.

However, current storage and transportation regulations are not fully integrated in the sense that they currently allow applicants to optimize spent fuel cask designs based on either storage or transportation considerations. For example, there are no explicit limits in Part 72 on the size of storage casks. Optimizing cask size based on storage considerations alone could result in a cask which is too large to be shipped by conventional rail. Similarly, Part 72 would permit a cask designed for storage only without requiring a facility to maintain the means for repackaging the spent fuel into a transportation cask. The result of optimizing a cask around a particular fuel cycle operation, such as storage or transportation, is that it has the potential to create additional steps between fuel cycle operations. An example is the need to remove spent fuel from storage casks and repackage it into transportation casks. Applicants are currently allowed to optimize storage and transportation cask designs independently, because there is no real forcing function within Part 71 and 72 regulations that require that transportation and storage cask designs be fully integrated.

Until the final design and operational requirements of all core program areas of the BEFC are defined, major challenges in developing new licensing strategies will continue such as:

1. The role of fuel cladding integrity.
2. The size and payloads of storage, transportation, and disposal canisters/casks.
3. The definition of "retrievability" for disposal.
4. Integration of storage/transportation interface to avoid "orphaned" sites.
5. A spent fuel burn-up limit or minimum cooling time for reprocessing.
6. The maximum allowable storage time for high-level liquid waste at a reprocessing facility.

ATTACHMENT

Plan for Integrating Spent Nuclear Fuel Regulatory Activities (ISFRA)

ISFRA Steering Committee

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and Safeguards

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