REGULATORS EXPERIENCES IN LICENSING AND INSPECTION OF DRY CASK STORAGE FACILITIES

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ABSTRACT

The United States Nuclear Regulatory Commission (NRC), through the combination of a rigorous licensing and inspection program, ensures the safety and security of dry cask storage. NRC authorizes the storage of spent fuel at an independent spent fuel storage installation (ISFSI) under two licensing options: site-specific licensing and general licensing. In July 1986, the NRC issued the first site specific license to the Surry Nuclear Power Plant in Virginia authorizing the interim storage of spent fuel in a dry storage cask configuration. Presently, there are over 40 ISFSIs currently licensed by the NRC with over 800 loaded dry casks. Current projections identify over 50 ISFSIs by the year 2010. No releases of spent fuel dry storage cask contents or other significant safety problems from the storage systems in use today have been reported. This paper discusses the NRC licensing and inspection experiences.

INTRODUCTION

Background - All operating nuclear power reactors in the United States (US) are storing spent fuel in NRC licensed on-site spent fuel pools (SFPs). Most reactors were not designed to store, in these pools, the full amount of spent fuel generated during the life of plant's operation. Utilities originally planned for spent fuel to remain in the SFPs for a few years after discharge from the reactor core and then to be sent to a reprocessing facility. However, the US Government declared a moratorium on reprocessing in 1977. Although the ban was later lifted, reprocessing has previously not been pursued. Consequently, utilities expanded the storage capacity of SFPs by the use of high-density storage racks. Eventually, utilities needed additional storage capacity. In response to these needs, NRC provided a regulatory alternative for interim spent fuel storage in dry cask storage systems. For spent fuel management, both pool storage and dry storage are safe methods, but there are significant differences. Pool storage requires a greater operational controls on the part of the nuclear power plant to maintain the performance of electrical and mechanical systems using pumps, piping and instrumentation. Dry storage technology uses passive cooling systems with robust cask designs requiring minimal operational controls.

Site Specific License - Initially, NRC only authorized the storage of spent fuel at an independent spent fuel storage installation (ISFSI) under a site specific license under the authority of the Atomic Energy Act of 1954, as amended. Under a site-specific license, an applicant submits a license application to NRC. NRC performs a technical review of all the safety, security, and environmental aspects of the proposed storage facility. An opportunity for public involvement is provided through a formal hearing process administered by the independent NRC Atomic Safety Licensing Board. If the application is approved, the NRC issues an ISFSI license valid for 20 years. NRC regulations also include provisions for renewal for an ISFSI license. A spent fuel storage license contains technical requirements and operating conditions for the ISFSI, and very specific conditions on the spent fuel which the licensee is authorized to store at the site.

The Nuclear Waste Policy Act of 1982, as amended, (NWPA) acknowledged the need for new storage capacity at the site of each civilian nuclear power reactor. The NWPA directed the NRC to take such actions considered necessary to encourage and expedite the effective use of available storage and necessary

additional interim storage. In response, the NRC amended its regulations to provide a second licensing option (referred to as the general license) for the storage of spent fuel.

General License -The NRC regulations convey a general license to nuclear power reactor licensees to store spent fuel in dry storage systems approved by the NRC at a site that is already licensed to operate a nuclear power reactor under 10 CFR Part 50. A wide variety of dry storage systems have already been approved by NRC for general licensees to consider. Fifteen dry storage designs have received Certificates of Compliance (CoC) and are listed in NRC regulations (72.214). General licensees are required to perform evaluations of its site to demonstrate that the site is adequate for storing spent fuel in dry casks. These evaluations must show that the CoC conditions and technical specifications can be met prior to use of the selected dry storage system at the general licensee's site.

The NRC approves spent fuel dry cask storage systems by evaluating each design for a wide range of normal conditions of use and accident conditions such as floods, earthquakes, tornado missiles, and temperature extremes. The NRC issues a CoC for a cask design if the review of the design finds it technically adequate. The cask certificate expires 20 years from the date of issuance with an option for subsequent re-approval. The NRC has prepared standard review plans to guide the NRC staff review of both site specific ISFSI license applications and dry cask storage system applications (NUREG-1567 and NUREG-1536, respectively,) which are available on the NRC Web page.

Inspection - The NRC conducts periodic inspections of both site-specific licensees and general licensees. Inspections occur during cask design, cask construction, site preparation and ISFSI pad construction, pre-operational or trial run, cask loading, and ISFSI operations. The inspections are conducted at cask design facilities, cask manufacturing plants, and the ISFSI site. The inspection program has the same underlying safety and security focus for facilities licensed under either a site specific or general licensing options. The NRC has prepared procedures to guide the NRC staff on inspection of both site specific ISFSI license applications and dry cask storage system applications (MC 2690, MC 2690A & MC 2690B) which are available on the NRC Web page.

DISCUSSION

NRC=s strategic plan presents its mission, vision, goals, and outcomes that will guide NRC=s strategic direction for the next 5 years. The strategic plan is centered around five goals; safety, security, openness, effectiveness and management. The first and most important goal is safety. The strategic plan goes into detail on how NRC=s storage activities feature prominently in strategies for accomplishing these goals. For example, the completion of technical reviews of spent fuel dry storage systems to ensure that they will be safe and secure for use at any licensed spent fuel storage facility is specifically tracked. Achieving these strategic goals requires a collective effort of the NRC and its licensees and certificate holders.

Currently, there are over 40 ISFSIs currently licensed by NRC with over 800 loaded dry casks in 26 states. There has been a marked increase in the rate of new licensees over the last few years. For example the number of ISFSIs have more than tripled from 12 in 1999 to present. Additional site-specific ISFSIs and generally licensed ISFSIs are expected to be operating within the next few years with current projections of over 50 ISFSIs by the year 2010. A significant work load for cask certifications will continue to grow as

nuclear power plants require increased spent fuel storage capacity and designs are proposed that accommodate higher-burnup fuel and higher heat loads for recently discharged spent fuel.
Openness involving communication and involvement between the NRC and its stakeholders is the cornerstone of strong, fair regulations and is key to maintaining and improving safety performance. The NRC held a first of a kind engagement with industry stakeholders in a licensing process review conference in February 2005 to solicit feedback on NRC performance and recommendations for improvements to its licensing process. Over 140 representatives of the regulated industry, other Federal agencies, cask designers, media and press, and members of the public actively participated in a full day discussion of experiences and suggestions for process improvements. The NRC has adopted many of the suggestions identified during the conference, including establishment of an industry-NRC task force to focus on process improvement. Two examples of initiatives being addressed are improving the process for requests for additional information and the interim staff guidance documents (ISG). Standard review plans have been augmented with ISGs to support timely decisions about technical and regulatory issues. Currently, 22 ISGs have been issued and the process has changed to include stakeholder input and review of draft ISGs to ensure that the final ISG is reflective of stakeholder experience. To address emerging technical needs, the NRC is considering future ISGs for increasing high-burnup fuel, defining thermal analysis parameters, clarifying the definition of damaged fuel and fuel retrievability, and allowance for additional burnup credit. Resolution of these issues is needed to ensure that future designs have an adequate technical basis to support regulatory decisions and to meet industry spent fuel storage needs.

An example of how the NRC is increasing efficiency of its regulations is its initiative to provide increased license renewal terms for ISFSI licensees. NRC recently issued a license renewal for the Surry Nuclear Power Plant ISFSI for a 40-year ISFSI license renewal term. The regulations permit a 20-year license renewal term, but the licensee requested an exemption to allow a 40-year term and provided a technical basis that staff review found acceptable. The Surry ISFSI was the first dry cask storage site licensed in the US, in 1986, and the first license renewal granted for an ISFSI. Following the decision, the Commission directed the NRC staff to explore a potential rulemaking to permanently change the license duration set in 10 CFR Part 72. Since then, the H.B Robinson Nuclear Power Plant ISFSI has also been granted an exemption, and issued a 40-year renewal period for their ISFSI license.

The NRC has many security challenges to face as a result of a changing terrorist environment that poses potential threats to the security of nuclear installations. The agency is actively evaluating potential security challenges to spent fuel storage facilities and operations, as well as transportation of spent fuel, to ensure that the enhanced security programs address these new challenges. Additionally, the NRC has issued several license orders to supplement the agency's security requirements in 10 CFR Part 73 for spent fuel storage and transportation. This is a dynamic area and the NRC continues to evaluate the threat environment and licensee performance to determine if additional security measures are needed.

Regarding security assessments, the NRC has evaluated the response of spent fuel storage casks and transportation packages to various hypothetical terrorist events including large plane crashes into interim storage facilities, an attack on a spent fuel transportation package, and other acts of terrorism. These studies evaluated both un-reinforced and reinforced concrete steel spent fuel storage cask with bolted and welded lid closure and horizontal storage in reinforced concrete. The studies also evaluated rail and legal-weight truck spent fuel transportation packages and consignments of various radioactive material packages. These studies have been completed in 2005 and the Commission is considering the staff recommendations based on the outcome of these evaluations.

The NRC conducts approximately 20 inspections of licensees/vendors/fabricators each year. The NRC uses a systematic approach to identify facilities and sites for inspection, considering, for example, the organization's

inspection history, reported events, and level of design and fabrication activity. The NRC inspects both domestic and foreign vendors and fabricators. The NRC inspection activities have increased to reflect the growth in ISFSIs and the increased fabrication demands to supply casks for ISFSIs. The NRC inspections have resulted in valuable experience that has been and continues to be incorporated into the inspection program, as well as lessons learned that the NRC has passed along to the industry. Pre-operational trial run inspections are very useful to both the licensee and the NRC to demonstrate that the licensee is ready to load fuel into the cask and has done an adequate site evaluation and preparation. The NRC inspections have also focused licensee attention on the need to maintain a questioning attitude, examining changes for new problems, and the importance of an active quality assurance oversight program for all processes of the cask vendor and cask fabricator operations to ensure the quality of the final products. Another valuable lesson learned from the NRC inspections includes the need for licensees to perform early characterization of the fuel to be moved to the cask to ensure the spent fuel meets the conditions of the dry cask storage system CoC.

Recently, integrating NRC technical review staff with NRC inspection staff as an element of our knowledge management program has found that this cross training improves our inspections, our technical evaluations and the inspectablity of our licensing documents.

As the storage technology developed, both the NRC and industry learned how to apply NRC regulations, and conduct inspections. For example lessons learned during this development included the need to properly test multiple pass root weld, the need to consider the heavy loads on the floor loading, that some coatings generate hydrogen gas faster than others, and that quality assurance during fabrication of a cask storage and cask structures must be augmented by close oversight by the utility and cask vendor. We continue to conduct our licensing and inspection program with the flexibility to adjust based on operational experience.

Public interest in the safety and security of nuclear facilities and storage of nuclear waste has grown and is expected to continue to increase as a result of the increasing demand for nuclear power plant license renewal and the prospect for new plant construction. These activities have increased public scrutiny of the nation's nuclear waste policy, namely, how to safely store the nation's growing inventory of spent nuclear fuel and ultimately, how to dispose of it.

CONCLUSIONS

The NRC is committed to furthering its strategic goals to ensure effectiveness and efficiencies through continuous improvement of our processes and management actions, and to actively engage and inform our stakeholder's of our activities. The NRC regulates the US's civilian use of byproduct, source and special nuclear materials to ensure adequate protection of public health and safety, promote the common defense and security, and protect the environment. To support this mission the Spent Fuel Project Office of the NRC enables the safe interim storage of spent fuel in a manner that furthers the national interests. This is accomplished through its regulatory oversight, licensing, inspection and technical review of ISFSIs as well as issuance of CoCs.

REFERENCES

[1] The Nuclear Waste Policy Act of 1982, as amended

[2] NUREG-1536 "Standard Review Plan for Dry Cask Storage Systems"

[3] NUREG-1567 "Standard Review Plan for Spent Fuel Dry Storage Facilities"

[4] Title 10 Code of Federal Regulations Part 72

[5] NRC Inspection Manual Chapter 2690

[6] http://www.nrc.gov/waste/spent-fuel-storage.html