UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
OFFICE OF NEW REACTORS
OFFICE OF FEDERAL AND STATE MATERIALS
AND ENVIRONMENTAL MANAGEMENT PROGRAMS
WASHINGTON, DC 20555-0001

June 20, 2014

NRC INFORMATION NOTICE 2014-09: SPENT FUEL STORAGE OR TRANSPORTATION SYSTEM MISLOADING

ADDRESSEES

All holders of an operating license or construction permit for a nuclear power reactor under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," including those that have permanently ceased operations and have spent fuel stored in spent fuel pools (SFPs).

All holders of or applicants for a combined license issued under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

All holders of or applicants for a certificate of compliance (CoC) for a spent fuel transportation package design under 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

All holders of or applicants for a general or site-specific license for storage of spent fuel, or for a spent fuel storage cask CoC under 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste."

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to notify addressees of SFP and spent fuel dry storage cask misloading events. The NRC expects the recipients to review the information within this IN for applicability to their facilities or cask designs and consider actions, as appropriate, for their facility or cask design. However, suggestions contained in this IN are not NRC requirements; therefore, no specific action or written response is required.

DESCRIPTION OF CIRCUMSTANCES

This section describes SFP and spent fuel dry storage cask misloading events. These events apply to Part 50 and Part 72 licensees. However, because similar operating procedures and personnel may be used to load transportation casks, the possibility of similar misloads should also be considered for Part 71 users.

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Part 50 licensees

Indian Point Unit 2

The Indian Point Unit 2 technical specifications (TS) require fresh fuel in one area of the SFP to be stored with one face of the fuel bundle facing adjacent empty storage cells. On February 17, 2012, the licensee discovered that 11 fresh fuel assemblies that had been moved into that area between January 23 and 24, 2012, were stored in a manner inconsistent with the TS in that those 11 fresh fuel assemblies were stored with at least one face adjacent to a depleted fuel assembly. This error stemmed from incorrect Reactor Engineering move sheets issued that month. The verifier and preparer did not review the TS thoroughly, thus resulting in poor self and peer checking and reviewing. The licensee put corrective actions into place to correct the misload with a new Fuel Assembly Transfer Form (FATF) and other performance actions. The licensee developed training to reinforce TS compliance and independent verification and self checking.

Oconee Units 1 and 2

On June 10, 2009, the licensee found that there had been three prior instances of spent fuel assemblies being incorrectly stored within the SFP, thus violating requirements listed in the TS. These three instances occurred in the shared SFP for Units 1 and 2 during refueling outages. The three misloads existed for approximately 1 week to 1 month before the licensee corrected the issue. According to the TS, once a licensee finds a misload, it must be corrected immediately. Duke Energy, the licensee, concluded that these instances were not corrected in a proper timeframe relative to the required completion time or in a timely manner. As corrective actions, the licensee revised applicable fuel handling procedures to ensure future storage configuration changes are valid before fuel handling.

Sequoyah Units 1 and 2

The licensee improperly stored four spent fuel assemblies in the SFP in violation of Sequoyah TS for criticality control requirements during an October 2009 SFP reconfiguration campaign, which was done to maintain conformance with the SFP decay heat dispersion requirements. The licensee incorrectly placed these four spent fuel assemblies because the FATFs did not properly incorporate the criticality requirements found in the TS. Once this nonconformance was discovered, the licensee took corrective actions to relocate the four misplaced spent fuel assemblies to comply with the TS. The root cause of this misplacement was insufficient procedural guidance involved in designing the SFP configuration and creating the FATFs.

South Texas Unit 2

On October 16, 2008, while planning fuel movements for South Texas Unit 2 SFP, the licensee found a Category 11 fuel assembly in a location where the TS only allowed Category 9 fuel. The licensee removed the Category 11 fuel assembly and placed it in a location of the SFP with no adjacent fuel assemblies. This misplacement was determined to stem from an error mapping the SFP storage configuration. In turn, this mapping was used for creating fuel

transfer forms (FTF). Both the FTF preparer and verifier did not perform proper checking and review. This led to the moving of a Category 11 assembly adjacent to Category 9 assemblies, which violate the TS.

Zion Units 1 and 2

On July 13, 2011, the licensee improperly stored the fuel assembly in the spent fuel pool for Zion Units 1 and 2, where a two-region configuration had been installed. While reviewing records during a site training class, the licensee determined that a fuel rod storage canister (FRSC) was incorrectly stored in Region 2 of the SFP. The licensee determined that 9 of the 13 fuel rods contained in the FRSC did not satisfy the requirements to allow Region 2 rack storage. This FRSC storage was considered a violation of permanently defueled TS, and the licensee initiated immediate relocation to SFP Region 1.

Part 72 licensees

Palisades

The licensee determined in November 2000 that 11 spent fuel assemblies had been incorrectly placed into five Ventilated Storage Casks (VSC-24) at the Palisades Plant during the June 1999 to August 1999 spent fuel loading campaign. The CoC required the assemblies to undergo 5 years of cooling following their discharge from the reactor core before being loaded in the cask. However, the assemblies in question had cooled for just over 4 years. The licensee determined that the event was caused by an error in recording the core discharge dates for these assemblies. As part of the corrective actions, the licensee modified the fuel selection process to include a specific procedure for fuel selection. In addition, the licensee upgraded the reactor engineering fuel management file to include fuel cycle date information.

Grand Gulf

On June 18, 2008, during a data update of the Cask Loading Database, the licensee discovered that four HI-STORM 100 model casks had been incorrectly loaded with fuel bundles that exceeded limits specified in the CoC. The licensee found that, due to errors in the Cask Loading Database, 8 assemblies exceeded the individual assembly decay heat or exposure limits allowed in the CoC. The database contained incorrect bundle exposures for the affected assemblies. During the time in which the licensee was identifying these errors, the decay heat loads for all of the assemblies in question had been verified to be within the CoC limits. As a result of this event, the licensee developed a standard procedure for developing the necessary databases and calculations for selecting and analyzing spent fuel cask loads and for addressing the scope and method for performing the independent verification.

North Anna and Surry

In March 2011, during a review of historical NUHOMS® dry storage canister (DSC) loading certification documents for North Anna and Surry, the licensee discovered that a number of DSCs were incorrectly loaded. The cask design included asymmetrical decay heat limits that were not adequately described in the written cask loading procedures, leading to repeated errors in the loading process. These errors resulted in 17 assemblies exceeding the maximum decay heat limits for their respective canister locations. The licensee's corrective actions involved revising procedures to include an explanation of the asymmetrical decay heat limits.

BACKGROUND

Appendix A to 10 CFR Part 50, "General Design Criteria for Nuclear Power Plants," Criterion 62, "Prevention of Criticality in Fuel Storage and Handling," requires "Criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations." Additionally, regulations in 10 CFR 50.68, "Criticality Accident Requirements," contain criteria that a licensee must meet to ensure that the pool is maintained subcritical at all times.

For dry cask storage, 10 CFR 72.124(a) requires that:

> Spent fuel handling, packaging, transfer, and storage systems must be designed to be maintained subcritical and to ensure that, before a nuclear criticality accident is possible, at least two unlikely, independent, and concurrent or sequential changes have occurred in the conditions essential to nuclear criticality safety. The design of handling, packaging, transfer, and storage systems must include margins of safety for the nuclear criticality parameters that are commensurate with the uncertainties in the data and methods used in calculations and demonstrate safety for the handling, packaging, transfer and storage conditions and in the nature of the immediate environment under accident conditions.

DISCUSSION

Both the SFP licenses and the spent fuel dry storage cask CoCs contain storage requirements for spent and fresh nuclear fuel. Those requirements are based on NRC reviewed and approved analyses that, if adhered to, will provide reasonable assurance of compliance with the applicable storage regulations. Failure to adhere to those requirements places the fuel storage system in an unanalyzed condition and could lead to a potential safety concern.

The above events show that misloading of fuel assemblies into SFPs and spent fuel dry storage casks can occur as a result of inadequate procedures or training. SFP and spent fuel dry storage cask loading requirements can be quite complex, often with several different sets of criteria that must be met simultaneously.

CONTACT

This IN requires no specific action or written response. Please direct any questions about this matter to the technical contacts listed below or the appropriate NRC project manager.

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Note: NRC generic communications may be found on the NRC public Web site, http://www.nrc.gov, under Electronic Reading Room/Document Collections.

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