



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

June 14, 2023

Mr. R. Keith Brown  
Regulatory Affairs Director  
Southern Nuclear Operating Co., Inc.  
3535 Colonnade Parkway  
Birmingham, AL 35243

SUBJECT: JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2 - DRAFT SAFETY EVALUATION FOR LICENSE AMENDMENT REQUEST TO REVISE TECHNICAL SPECIFICATION 4.3, "FUEL STORAGE," TO CORRECT TABULATED VALUES FROM THE ASSOCIATED SPENT FUEL POOL CRITICALITY ANALYSIS (EPID L-2022-LLA-0138)

Dear Mr. Brown:

By letter dated September 21, 2022 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML22264A300), Southern Nuclear Operating Company, Inc. (SNC, the licensee) submitted a license amendment request (LAR), regarding changes to the Technical Specifications (TSs) for Renewed Facility Operating License Nos. NPF-2 and NPF-8 for Joseph M. Farley Nuclear Plant (Farley), Units 1 and 2, respectively, to the U.S. Nuclear Regulatory Commission (NRC) staff for review.

The proposed LAR would revise the TS 4.3, "Fuel Storage" to correct tabulated values from the associated spent fuel pool (SFP) criticality analysis. The proposed changes to TS 4.3 and updates the SFP criticality safety analysis to correct errors in the Analysis of Record (AoR). The AoR was approved by Amendment Nos. 229 and 226, dated October 6, 2020 (ML20196L929) for Farley, Units 1 and 2, respectively.

Enclosed for SNC review is a copy of the NRC staff's draft safety evaluation (SE) for the LAR.

Pursuant to Section 2.390 of Title 10 of the *Code of Federal Regulations* (10 CFR), the NRC staff has determined that the enclosed draft SE does not contain proprietary information. However, the NRC staff will delay placing the draft SE in the public document room for a period of 10 working days from the date of this letter to provide SNC with the opportunity to comment on any proprietary aspects.

If SNC believes that any information in the enclosure is proprietary, please identify such information line-by-line and define the basis pursuant to the criteria of 10 CFR 2.390. After 10 working days, the draft SE will be made publicly available. The final SE will be issued after 10 working days and will be made publicly available.

R. Brown

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If you have any questions, please contact John G. Lamb at 301-415-3100 or [John.Lamb@nrc.gov](mailto:John.Lamb@nrc.gov).

Sincerely,

Michael T. Markley, Chief  
Plant Licensing Branch II-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos.: 50-348 and 50-364

Enclosure:  
As stated

cc without enclosure: Listserv



UNITED STATES  
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO

AMENDMENT NO. 246 TO RENEWED FACILITY OPERATING LICENSE NO. NPF-2

AND

AMENDMENT NO. 243 TO RENEWED FACILITY OPERATING LICENSE NO. NPF-8

SOUTHERN NUCLEAR OPERATING COMPANY, INC.

JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-348 AND 50-364

1.0 INTRODUCTION

By letter dated September 21, 2022 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML22264A300), Southern Nuclear Operating Company, Inc. (SNC, the licensee) requested changes to the Technical Specifications (TSs) for Renewed Facility Operating License Nos. NPF-2 and NPF-8 for Joseph M. Farley Nuclear Plant (Farley), Units 1 and 2, respectively.

The NRC issued Amendment Nos. 229 and 226, dated October 6, 2020 (ML20196L929) for Farley, Units 1 and 2, respectively. Those amendments set the values in the Farley, Units 1 and 2, TSs Tables 4.3-1 through 4.3-5. Those values were determined in WCAP-18414-P, Revision 0, "J. M. Farley Units 1 and 2 Spent Fuel Pool Criticality Safety Analysis." Amendments Nos. 229 and 226 set WCAP-18414-P, Revision 0, as the Analysis of Record (AoR) for both Farley, Units 1 and 2, spent fuel pool (SFP) criticality. Subsequently the licensee found errors in WCAP-18414-P that necessitate changes to Farley, Units 1 and 2, TSs Table 4.3-3 and Table 4.3-4. This proposed LAR is to make those changes and if approved will make WCAP-18414-P, Revision 3, the AoR for both Farley, Units 1 and 2, SFP criticality.

2.0 REGULATORY EVALUATION

2.1 System Design and Operation

From the letter dated September 21, 2022, SNC stated the following.

Enclosure

The SFP [spent fuel pool] is made up of one fuel storage rack design (region) that maintains 10.75-inch center-to-center spacing between spent fuel assemblies. The Farley Units 1 & 2 SFPs each consist of two 6 x 7, nineteen 7 x 7, and seven 7 x 8 storage racks. The spent fuel racks are freestanding and are free to move on the pool liner floor during a seismic event.

The revised SFP criticality safety analysis, "J. M. Farley Units 1 and 2 Spent Fuel Pool Criticality Safety Analysis" (WCAP-18414-P, R3 (Proprietary Version) and WCAP-18414-NP, R3 (Non-Proprietary Version) evaluates the SFP storage racks for the placement of fuel within the storage arrays defined in the technical specifications. Credit is taken for the negative reactivity associated with burnup and post-irradiation cooling time (decay time) for assemblies which have been operated in the reactor.

## 2.2 Proposed Changes

The licensee proposed to revise the TS Table 4.3-3 and TS Table 4.3-4 as shown in Attachment 1 of the letter dated September 21, 2022.

## 2.3 Applicable Regulatory Requirements

The applicable regulatory requirements are provided below.

The U.S. Nuclear Regulatory Commission (NRC) regulatory requirements related to the content of the TS are contained Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.36, "Technical specifications." The regulation at 10 CFR 50.36(c)(4) states:

Design features. Design features to be included are those features of the facility such as materials of construction and geometric arrangements, which, if altered or modified, would have a significant effect on safety and are not covered in categories described in paragraphs (c) (1), (2), and (3) of this section.

The regulation at 10 CFR 70.24, "Criticality accident requirements," paragraph (a)(1) states:

The monitoring system shall be capable of detecting a criticality that produces an absorbed dose in soft tissue of 20 rads of combined neutron and gamma radiation at an unshielded distance of 2 meters from the reacting material within one minute. Coverage of all areas shall be provided by two detectors.

On July 31, 1996 (ML20116D649), Farley, Units 1 and 2, were granted an exemption from 10 CFR 70.24(a)(1) regarding the requirement that a licensee have a criticality accident monitoring system with two detectors. The NRC staff granted the exemption from 10 CFR 70.24(a)(1) because the staff found that inadvertent or accidental criticality will be precluded through compliance with the Farley TSs, the geometric spacing of fuel assemblies in the new fuel storage facility and spent fuel storage pool, and administrative controls imposed on fuel handling procedures. The exemption from 10 CFR 70.24(a)(1) remains the licensing bases for new and spent fuel storage at Farley, Units 1 and 2.

Appendix A to 10 CFR Part 50, "General Design Criteria for Nuclear Power Plants" (hereinafter referred to as GDC), establishes the minimum requirements for the principal design criteria for water-cooled nuclear power plants. The principal design criteria establish the necessary design,

fabrication, construction, testing, and performance requirements for structures, systems, and components (SSCs) important to safety. The applicable GDCs to this amendment request are as follows:

- *Criterion 61* (GDC 61), "*Fuel storage and handling and radioactivity control*," specifies that "the fuel storage and handling, radioactive waste, and other systems which may contain radioactivity shall be designed to assure adequate safety under normal and postulated accident conditions. These systems shall be designed (1) with a capability to permit appropriate periodic inspection and testing of components important to safety, (2) with suitable shielding for radiation protection, (3) with appropriate containment, confinement, and filtering systems, (4) with a residual heat removal capability having reliability and testability that reflects the importance to safety of decay heat and other residual heat removal, and (5) to prevent significant reduction in fuel storage coolant inventory under accident conditions.
- *Criterion 62* (GDC 62), "*Prevention of criticality in fuel storage and handling*," specifies that "criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations."

The NRC staff considered the following guidance in reviewing the LAR.

The NRC staff's review was performed consistent with Section 9.1.1, "Criticality Safety of Fresh and Spent Fuel Storage and Handling" (ML070570006), and Section 9.1.2, "New and Spent Fuel Storage," subsection I.11 area of review related to chemical engineering issues (ML070550057) of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR [Light-Water Reactor] Edition" (SRP).

Regulatory Guide 1.240, "Fresh and Spent Fuel Pool Criticality Analyses," (ML20356A127) describes an approach that the NRC staff considers acceptable to demonstrate that NRC regulatory requirements are met for subcriticality of fuel assemblies stored in fresh fuel vaults and spent fuel pools at light-water reactor (LWR) power plants. It endorses, with clarifications and exceptions, the Nuclear Energy Institute (NEI) guidance document NEI 12-16, "Guidance for Performing Criticality Analyses of Fuel Storage at Light-Water Reactor Power Plants," Revision 4, (ML19269E069).

On September 29, 2011, the NRC staff issued Interim Staff Guidance (ISG) DSS-ISG-2010-01 (ML110620086). The purpose of the ISG is to provide updated review guidance to the NRC staff to address the increased complexity of recent SFP nuclear criticality safety (NCS) analyses and operations. The NRC staff also used ISG DSS-ISG-2010-01 for the review of the current application.

On August 19, 1998, the NRC staff issued an internal memorandum containing guidance for reviewing criticality analyses of fuel storage at light-water-reactor (LWR) power plants. This memorandum is known colloquially as the "Kopp Letter" (ML003728001), after the author, Laurence Kopp. While the Kopp Letter does not specify a methodology, it does provide some guidance on the more salient aspects of an NCS analysis, including computer code validation. The guidance is germane to boiling-water reactors and pressurized-water reactors (PWRs), and to borated and unborated conditions. The NRC staff also used the Kopp Letter for the review of the current application.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Background

As previously stated, SNC found several errors in its current AoR (WCAP-18414-P, Revision 0). Those errors are described in Section 2.3 of the Enclosure to SNC's letter dated September 21, 2022. Since the errors were corrected in the licensee's current AoR, several values in the Farley, Units 1 and 2, TSs Tables 4.3-3 and 4.3-4 require updates. The values in Farley, Units 1 and 2, TSs Tables 4.3-3 and 4.3-4 are coefficients used in third order polynomial equations to determine the burnup requirements for a given Uranium-235 ( $U^{235}$ ) enrichment. Accuracy in those coefficients could result in SNC incorrectly determining non-compliant burnup requirements. This proposed LAR updates Farley, Units 1 and 2, TSs Tables 4.3-3 and 4.3-4 to the corrected coefficients.

#### 3.2 Proposed Change

##### TS 4.3, "Fuel Storage"

The proposed changes to TS 4.3 include:

- The corrected Table 4.3-3 provides the fitting coefficients to calculate the minimum required fuel assembly burnup for fuel categories 3 and 4 for Standard Fuel Assembly (STD)/Robust Fuel Assembly (RFA) fuel.
- The corrected Table 4.3-4 provides the fitting coefficients to calculate the minimum required fuel assembly burnup for fuel categories 3 and 4 for Optimized Fuel Assembly (OFA) fuel.

#### 3.3 Technical Review

SNC's current AoR, WCAP-18414-P, Revision 0, was approved in an NRC letter dated October 6, 2020. To support this proposed LAR, SNC submitted WCAP-18414-P, Revision 3. The majority of WCAP-18414-P is unchanged. Since the NRC had previously approved WCAP-18414-P, Revision 0, the NRC staff focused on the differences between Revision 0 and Revision 3.

As discussed in WCAP-18414-P, Revision 3 section 5.2.2, target keff are established based on the biases and uncertainties at several  $U^{235}$  enrichment amounts. The burnup necessary to meet the target keff at the enrichments are calculated, and the results fitted with a third order polynomial to allow interpolation between the specific enrichment amounts, which were calculated. The coefficients to those polynomials are the contents of Farley TS Tables 4.3-3 and Table 4.3-4. Correcting the errors from WCAP-18414-P, Revision 0, changed some of the target keffs, this in turn, changed the burnup necessary to meet the target keff, and ultimately changed the coefficients of the polynomials used to represent the burnup/enrichment SFP loading requirements.

The NRC staff reviewed the changes that affected the target keffs. Those changes restored the margin that the NRC initially approved in Amendment Nos. 229 and 226, dated October 6, 2020, for Farley, Units 1 and 2, respectively. The NRC staff previously found that margin sufficient to provide reasonable assurance of safe storage of spent nuclear fuel in the Farley, Units 1 and 2, SFPs.

Therefore, the NRC staff finds that the requested changes to the Farley, Units 1 and 2, SFP storage requirements are consistent with the basis for the exemption to 10 CFR 70.24 granted to the licensee.

### 3.4 Evaluation of the TS 4.3 Change

SNC proposed changes to TS 4.3 in order to correct tabulated values to be consistent with Farley, Units 1 and 2, spent fuel pool criticality safety analysis. The corrections restore the SFP storage margins to what the NRC staff approved in the letter dated October 6, 2020.

Based on the NRC staff's analysis provided in Sections 3.1 through 3.3 of this SE, the proposed changes to TS 4.3 values allow for continued safe storage of spent fuel at Farley, Units 1 and 2, because inadvertent or accidental criticality will be precluded through compliance with the Farley TSs, the geometric spacing of fuel assemblies in the new fuel storage facility and spent fuel storage pool, and administrative controls imposed on fuel handling procedures. Therefore, the NRC staff finds that 10 CFR 50.36(c)(4) will continue to be met, because the proposed changes to TS 4.3 values allow for continued safe storage of spent fuel.

### 4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the State of Alabama official was notified of the proposed issuance of the amendments on May 16, 2023. On May 16, 2023, the Alabama State official confirmed that the State of Alabama had no comments.

### 5.0 ENVIRONMENTAL CONSIDERATION

The amendments change the requirements with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration published in the *Federal Register* on December 6, 2022 (87 FR 74669), and there has been no public comment on such finding. Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

### 6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: Kent Wood  
Clinton Ashley

Date: June 14, 2023

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**ADAMS Accession Nos.**

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