

**FINAL SAFETY EVALUATION**

**BY THE OFFICE OF NUCLEAR REACTOR REGULATION**

**TECHNICAL SPECIFICATIONS TASK FORCE TRAVELER**

**TSTF-557, REVISION 1,**

**“SPENT FUEL STORAGE RACK NEUTRON ABSORBER MONITORING PROGRAM”**

**USING THE CONSOLIDATED LINE ITEM IMPROVEMENT PROCESS**

**(EPID L-2017-PMP-0025)**

**1.0 INTRODUCTION**

By letter dated December 19, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17353A608), the Technical Specifications Task Force (TSTF) submitted Technical Specifications Task Force (TSTF) Traveler TSTF-557, Revision 1, “Spent Fuel Storage Rack Neutron Absorber Monitoring Program.” Traveler TSTF-557 proposes changes to the Standard Technical Specifications (STS) for all plant designs, including Babcock and Wilcox, Combustion Engineering, Westinghouse, General Electric, and Westinghouse AP1000® plants. These changes will be incorporated into future revisions of NUREG-1430, NUREG-1431, NUREG-1432, NUREG-1433, NUREG-1434, and NUREG-2194.<sup>1</sup> This traveler will be made available to licensees for adoption through the consolidated line item improvement process.

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<sup>1</sup> U.S. Nuclear Regulatory Commission, “Standard Technical Specifications, Babcock and Wilcox Plants,” NUREG-1430, Revision 4.0, April 2012, Volume 1, “Specifications” (ADAMS Accession No. ML12100A177), and Volume 2, “Bases” (ADAMS Accession No. ML12100A178).

U.S. Nuclear Regulatory Commission, “Standard Technical Specifications, Westinghouse Plants,” NUREG-1431, Revision 4.0, April 2012, Volume 1, “Specifications” (ADAMS Accession No. ML12100A222), and Volume 2, “Bases” (ADAMS Accession No. ML12100A228).

U.S. Nuclear Regulatory Commission, “Standard Technical Specifications, Combustion Engineering Plants,” NUREG-1432, Revision 4.0, April 2012, Volume 1, “Specifications” (ADAMS Accession No. ML12102A165), and Volume 2, “Bases” (ADAMS Accession No. ML12102A169).

U.S. Nuclear Regulatory Commission, “Standard Technical Specifications, General Electric Plants, BWR/4,” NUREG-1433, Revision 4.0, April 2012, Volume 1, “Specifications” (ADAMS Accession No. ML12104A192), and Volume 2, “Bases” (ADAMS Accession No. ML12104A193).

U.S. Nuclear Regulatory Commission, “Standard Technical Specifications, General Electric Plants, BWR/6,” NUREG-1434, Revision 4.0, April 2012, Volume 1, “Specifications” (ADAMS Accession No. ML12104A195), and Volume 2 (ADAMS Accession No. ML12104A196).

U.S. Nuclear Regulatory Commission, “Standard Technical Specifications, Westinghouse Advanced Passive 1000 (AP1000®) Plants,” NUREG-2194, Revision 0, April 2016, Volume 1, “Specifications” (ADAMS Accession No. ML16110A277), and Volume 2, “Bases” (ADAMS Accession No. ML16110A369).

The proposed changes would add a new program entitled, "Spent Fuel Storage Rack Neutron Absorber Monitoring Program." The purpose of the program is to ensure the boron-10 areal density of the neutron absorber material (NAM) assumed in the spent fuel pool (SFP) storage rack nuclear criticality analyses remains conservative with respect to the actual plant conditions. The program is optional and may be adopted by licensees that have licensing requirements for a SFP NAM monitoring program.

## **2.0 REGULATORY EVALUATION**

### **2.1 DESCRIPTION OF SPENT FUEL POOL STORAGE RACKS**

The credited NAM installed in the SFP storage racks ensures that the effective multiplication factor ( $k$ -effective,  $k_{eff}$ ) does not exceed the values and assumptions used in the criticality analysis of record (AOR) and other licensing basis documents. The AOR is the basis, in part, for demonstrating compliance with plant technical specifications (TS) and with applicable NRC regulations. Degradation or deformation of the credited NAM may reduce safety margin and potentially challenge the subcriticality requirement. The NAM utilized in SFP racks exposed to treated water or treated borated water may be susceptible to reduction of neutron absorbing capacity, changes in dimension that increase  $k_{eff}$ , and loss of material. A monitoring program is implemented to ensure that degradation of the NAM used in SFPs, which could compromise the ability of the NAM to perform its safety function as assumed in the AOR, will be detected.

### **2.2 PROPOSED CHANGES TO THE STANDARD TECHNICAL SPECIFICATIONS**

A new program would be added to Section 5.5, "Program and Manuals." The new program would appear in each STS NUREG as:

#### **5.5.XX [Spent Fuel Storage Rack Neutron Absorber Monitoring Program**

This Program provides controls for monitoring the condition of the neutron absorber used in the spent fuel pool storage racks to verify the Boron-10 areal density is consistent with the assumptions in the spent fuel pool criticality analysis. The program shall be in accordance with NEI 16-03-A, "Guidance for Monitoring of Fixed Neutron Absorbers in Spent Fuel Pools," Revision 0, May 2017[, with the following exceptions:

1. .]

### **2.3 APPLICABLE REGULATORY REQUIREMENTS AND GUIDANCE**

Section IV, "The Commission Policy," of the "Final Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors," published in the *Federal Register* on July 22, 1993 (58 FR 39132), states, in part:

The purpose of Technical Specifications is to impose those conditions or limitations upon reactor operation necessary to obviate the possibility of an abnormal situation or event giving rise to an immediate threat to the public health and safety by identifying those features that are of controlling importance to

safety and establishing on them certain conditions of operation which cannot be changed without prior Commission approval.

...[T]he Commission will also entertain requests to adopt portions of the improved STS [(e.g., TSTF-557)], even if the licensee does not adopt all STS improvements. ...The Commission encourages all licensees who submit Technical Specification related submittals based on this Policy Statement to emphasize human factors principles.

...In accordance with this Policy Statement, improved STS have been developed and will be maintained for each NSSS [nuclear steam supply system] owners group. The Commission encourages licensees to use the improved STS as the basis for plant-specific Technical Specifications. ...[I]t is the Commission intent that the wording and Bases of the improved STS be used ... to the extent practicable.

As described in the Commission's "Final Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors," the NRC and industry task groups for new STS recommended that improvements include greater emphasis on human factors principles in order to add clarity and understanding to the text of the STS, and provide improvements to the Bases of STS, which provides the purpose for each requirement in the specification. The improved vendor-specific STS were developed and issued by the NRC in September 1992.

The regulation at Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.36(b) requires:

Each license authorizing operation of a ... utilization facility ... will include technical specifications. The technical specifications will be derived from the analyses and evaluation included in the safety analysis report, and amendments thereto, submitted pursuant to [10 CFR] 50.34 ["Contents of applications; technical information"]. The Commission may include such additional technical specifications as the Commission finds appropriate.

The regulation at 10 CFR 50.36(c)(5) requires TS to include administrative controls, which "are the provisions relating to organization and management, procedures, recordkeeping, review and audit, and reporting necessary to assure operation of the facility in a safe manner."

The regulation in paragraph (b)(4) of 10 CFR 50.68, "Criticality accident requirements," states that if the licensee does not credit soluble boron in the SFP criticality AOR, the  $k_{\text{eff}}$  of the SFP storage racks must not exceed 0.95 at a 95 percent probability, 95 percent confidence level if flooded with unborated water. If the licensee does take credit for soluble boron, the  $k_{\text{eff}}$  of the SFP storage racks must not exceed 0.95 at a 95 percent probability, 95 percent confidence level, if the racks are flooded with borated water, and if flooded with unborated water, the  $k_{\text{eff}}$  must remain below 1.0 at a 95 percent probability, 95 percent confidence level.

The STS Section 5.5 program imposes a requirement to have a licensee-controlled program that is in accordance with Nuclear Energy Institute (NEI) topical report NEI 16-03-A, "Guidance for Monitoring of Fixed Neutron Absorbers in Spent Fuel Pools," Revision 0, dated May 2017

(ADAMS Accession No. ML17263A133). The NRC staff approved NEI 16-03 in a safety evaluation (SE) dated March 3, 2017 (ADAMS Accession No. ML16354A486). The NEI 16-03-A topical report and the NRC's SE for NEI 16-03 provide the technical justification for the proposed program.

The NRC staff's guidance for the review of TS is in Chapter 16.0, "Technical Specifications," of NUREG-0800, Revision 3, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR [Light-Water Reactor] Edition" (SRP), March 2010 (ADAMS Accession No. ML100351425). As described therein, as part of the regulatory standardization effort, the NRC staff has prepared STS for each of the LWR designs. Accordingly, the NRC staff's review includes consideration of whether the proposed changes are consistent with the applicable reference STS (i.e., the current STS), as modified by NRC-approved travelers. In addition, the guidance states that comparing the change to previous STS can help clarify the TS intent

Section 9.1.1, Revision 3, of the SRP, "Criticality Safety of Fresh and Spent Fuel Storage and Handling," March 2007 (ADAMS Accession No. ML070570006), provides guidance regarding the acceptance criteria and review procedures to ensure that the proposed changes satisfy the requirements in 10 CFR 50.68.

Section 9.1.2, Revision 4, of the SRP, "New and Spent Fuel Storage" (ADAMS Accession No. ML070550057), provides guidance regarding the acceptance criteria and review procedures to ensure that the proposed changes satisfy the requirements in 10 CFR 50.68.

NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," December 2010 (ADAMS Accession No. ML103490041), provides guidance on what constitutes an acceptable monitoring program for NAM credited for criticality control in the SFP.

### **3.0 TECHNICAL EVALUATION**

The NRC staff reviewed the proposed changes to STS and the technical justification for the changes provided in Traveler TSTF-557. The NRC staff reviewed the technical justification for the proposed changes to ensure the reasoning was logical, complete and clearly written as described in Chapter 16 of NUREG-0800. The NRC staff reviewed the proposed changes for consistency with conventional terminology and with the format and usage rules embodied in the STS. The NRC staff also reviewed the STS changes to ensure adoption of the traveler by future applicants would provide assurance that an applicant's TS would continue to comply with the requirements of 10 CFR 50.36. Finally, NRC staff also reviewed the changes to ensure any limitations or conditions placed on adoption of the traveler by future applicants were clearly described.

#### **3.1 NEW PROGRAM FOR MONITORING NEUTRON ABSORBER**

The purpose of the program is to ensure the boron-10 areal density of the NAM assumed in the SFP storage rack nuclear criticality analyses remains conservative with respect to the actual plant conditions.

The TS Section [5.5] program imposes a requirement to have a licensee-controlled program that is in accordance with NEI 16-03-A, "Guidance for Monitoring of Fixed Neutron Absorbers in Spent Fuel Pools," Revision 0, May 2017. In the SE for NEI 16-03, dated March 3, 2017, the NRC approved and accepted the document for referencing in licensing applications for nuclear

power plants. The NEI 16-03-A topical report and the NRC's SE for NEI 16-03 provide the technical justification for the proposed program.

The purpose of a NAM monitoring program is to verify that the NAM installed in SFPs continues to perform its safety function (i.e., criticality control) as assumed in the AOR. The guidance provided in NEI 16-03-A for a NAM monitoring program relies on periodic inspection, testing, monitoring, and analysis of the NAM to ensure that the required subcriticality margin is maintained in accordance with 10 CFR 50.68 requirements. To accomplish this purpose, the guidance document states that a monitoring program must be capable of identifying unanticipated changes in the absorber material and determining whether anticipated changes can be verified. The guidance recommends a combination of coupon testing, in situ measurement, and SFP water chemistry monitoring as a means to monitor potential changes in characteristics of the NAM. The NRC staff reviewed the proposed guidance for what constitutes an acceptable monitoring program and its ability to ensure that potential degradation of SFP NAM will be detected, monitored, and mitigated.

In the NRC staff's SE of NEI 16-03, the staff determined that an appropriate combination of the three methods listed above (coupon testing, in situ measurement, and SFP water chemistry monitoring) as described in NEI 16-03-A, can comprise an effective NAM monitoring program. Section 3.4 of the NRC's SE of NEI 16-03 states that in order for a NAM program to be acceptable, a licensee must perform neutron attenuation testing to verify the boron-10 areal density. Further, in Section 4.0 of the NRC staff's SE of NEI 16-03, the staff concluded that a NAM monitoring program implementing the guidance in NEI 16-03-A provides reasonable assurance that such program will be able to detect degradation of neutron absorbing material, and provides assurance that the ability of the NAM to provide the criticality control relied upon in the AOR, is maintained. As noted above, the topical report NEI 16-03-A and the NRC staff's SE approving NEI 16-03 provide the technical justification for the proposed program in TSTF-557.

The NRC staff reviewed the technical justification in TSTF-557 and determined it was logical, complete, and clearly written as described in Chapter 16 of NUREG-0800. The NRC staff further notes that the NRC's approval of TSTF-557 will allow licensees to more readily incorporate an acceptable NAM monitoring program into their TS.

### 3.2 FORMATTING OF PROPOSED PROGRAM

The specification is in brackets, indicating that its applicability is plant-specific. A monitoring program is only applicable to plants that credit NAM in their SFP criticality analysis. In addition, plants may have been approved for use of NAM without a TS monitoring program, or may have adopted alternate TS or license condition monitoring requirements. Likewise, brackets are used to denote optional provisions for a licensee to request exceptions to NEI 16-03-A.

The NRC staff reviewed the format and content of the proposed change to STS in TSTF-557 and determined that the change is consistent with conventional terminology and with the format and usage rules embodied in the STS.

### 3.3 CONTINUED COMPLIANCE WITH THE REQUIREMENTS OF 10 CFR 50.36

Adoption of the STS changes proposed in TSTF-557 by future applicants should provide assurance that an applicant's TS would continue to comply with the requirements of 10 CFR 50.36. Based on its review, the NRC staff determined that implementation of a monitoring program into the TS, as described in TSTF-557, meets the regulatory requirements

and provides reasonable assurance that plants adopting these TS will have the requisite requirements to continue to meet 10 CFR 50.36.

### 3.4 MODEL LICENSE AMENDMENT

A model license amendment application was included in Traveler TSTF-557. It is anticipated that licensees may request adoption of the proposed change as part of a larger license amendment request related to SFP storage and a revised SFP critical analysis. However, the model may be used by licensees desiring to voluntarily adopt the traveler. The model includes appropriate bracketed sections to accommodate plant-specific information as well as requests for plant-specific exceptions and required justifications. The model also includes a reviewer's note to prompt licensees to include appropriate required information to fully describe and justify any variations from the model.

The NRC staff reviewed the model license amendment application and determined that limitations or conditions placed on adoption of the traveler by future applicants are clearly described.

### 4.0 CONCLUSION

The NRC staff reviewed Traveler TSTF-557, which proposed changes to NUREG-1430, NUREG-1431, NUREG-1432, NUREG-1433, NUREG-1434, and NUREG-2194. The NRC staff determined that the proposed changes to the STS meet the standards for TS in 10 CFR 50.36(b). The regulations at 10 CFR 50.36 require that TS include items in specified categories, including administrative controls.

Based on its review of TSTF-557 and previous approval of NEI 16-03, the NRC staff has determined that a NAM monitoring program meeting the provisions in NEI 16-03-A will allow a licensee to reasonably ensure that the ability of the NAM to perform its safety function, as assumed in the AOR, is maintained, thus demonstrating compliance with the subcriticality requirements of 10 CFR 50.68. The NRC staff finds that the proposed new monitoring program, as adopted by licensees, will allow a licensee's TS to continue to meet the requirements of 10 CFR 50.36(c)(5). The STS, as modified by TSTF-557, will continue to specify the requirements for administrative controls. The NRC staff also concluded that the traveler and model application contain appropriate limitations or conditions for adoption of the traveler by future applicants.

Additionally, the changes to the STS were reviewed and found to be technically clear and consistent with customary terminology and format in accordance with SRP Chapter 16.0. The NRC staff reviewed the proposed changes against the regulations and concludes that the changes continue to meet the requirements of 10 CFR 50.36(b), 50.36(c)(5), and 50.68, for the reasons discussed above, and thus provide reasonable assurance that adoption of these changes will have the requisite requirements and controls to operate safely. Therefore, the NRC staff concludes that the proposed changes are acceptable.

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