DD-13-03

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

Eric J. Leeds, Director

In the Matter of	)	Docket Nos. 50-325, 50-324
	)	
Duke Energy Progress, Inc.	)	License Nos. DPR-71, DPR-62
	)	
Brunswick Steam Electric Plant Units 1 and 2	)	

DIRECTOR'S DECISION UNDER 10 CFR 2.206

I. Introduction

By letter dated July 10, 2012, Mr. David Lochbaum, on behalf of the Union of Concerned Scientists; the North Carolina Waste Awareness & Reduction Network; and the Nuclear Information and Resource Service (the petitioners) filed a petition (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12193A123) under Title 10 of the *Code of Federal Regulations* (10 CFR), Part 2, Section 2.206, "Requests for action under this subpart." The petitioners requested that the U.S. Nuclear Regulatory Commission (NRC, or the Commission) take enforcement action in the form of an order either modifying the Brunswick Steam Electric Plant operating licenses or requiring the licensee to submit amendment requests for these licenses. Specifically, the petitioners requested that the order result in specified revisions of these technical specifications (TSs) for Brunswick Units 1 and 2:

1) Revise TS 2.1, “Safety Limits (SL),” to include a requirement like the one in TS 2.1.1.3 that the water level shall be greater than the top of active irradiated fuel in the spent fuel pool (SFP).

2) Revise footnote (b) for TS Table 3.3.6.2-1, “Secondary Containment Isolation Instrumentation,” to require the Reactor Building Exhaust Radiation—High function to be applicable whenever irradiated fuel is stored in the SFP.

3) Revise footnote (a) for TS Table 3.3.7.1-1, “Control Room Emergency Ventilation (CREV) System Instrumentation,” to require the Control Building Air Intake Radiation—High function to be applicable whenever irradiated fuel is stored in the SFP.

4 - 8) Revise the APPLICABILITY for these TSs to include whenever irradiated fuel is stored in the SFP.

- TS 3.6.4.1, “Secondary Containment”
- TS 3.6.4.2, “Secondary Containment Isolation Dampers”
- TS 3.6.4.3, “Standby Gas Treatment System”
- TS 3.7.3, “Control Room Emergency Ventilation (CREV) System”
- TS 3.7.4, “Control Room Air Conditioning (AC) System”

9 - 12) Revise the APPLICABILITY for the following TSs to be whenever irradiated fuel is stored in the SFP instead of only when irradiated fuel assemblies are being moved in the SFP or secondary containment:

- TS 3.7.7, “Spent Fuel Storage Pool Water Level”
- TS 3.8.2, “AC [alternating current] Sources—Shutdown”
- TS 3.8.5, “DC [direct current] Sources—Shutdown”
- TS 3.8.8, “Distribution Systems—Shutdown.”

13) Revise TS 3.9.7, “Residual Heat Removal (RHR)—High Water Level,” and TS 3.9.8, “Residual Heat Removal (RHR)—Low Water Level,” or add a new limiting condition for

operation (LCO) to require one RHR subsystem to be operable whenever the entire reactor core is offloaded into the SFP.

The petitioners had a recorded conference call with the NRC's Office of Nuclear Reactor Regulation (NRR) Petition Review Board on August 15, 2012, to discuss and supplement the petition. The NRC has made the official transcript of that conference call publicly available online in the NRC's Library at http://www.nrc.gov/reading-rm/adams.html (ADAMS Accession No. ML12234A730). (Persons who do not have access to ADAMS or who encounter problems in accessing the documents located in ADAMS should contact the NRC's Public Document Room reference staff by telephone at 1-800-397-4209, or 301-415-4737, or by e-mail to PDR.Resource@nrc.gov.) During the call, the petitioners reiterated the need for the actions called for in their petition. They also emphasized that, in a way similar to current TS requirements described above, the order to install SFP level instrumentation, issued in response to the accident at Fukushima Dai-ichi in Japan, did not explicitly or implicitly require that the instrumentation be operable or functional when irradiated fuel was present in the SFP. The petitioners stated that the new SFP level instrumentation could be intentionally removed from service, or placed out of service for maintenance, and not required to be available until the next movement of irradiated fuel.

In a letter dated October 31, 2012, the NRC informed the petitioners that their request met the criteria for review under the 10 CFR 2.206 process, and that the agency was referring the issues in the petition to its Office of Nuclear Reactor Regulation for appropriate action.

II. Discussion

The petitioners requested that the NRC take enforcement action in the form of an order that would result in a new TS SL and expand the applicability of numerous TS LCOs related to

SFP storage. The petitioners asserted that the changes sought would provide better management of the risk from irradiated fuel stored in the SFPs.

The NRC staff reviewed the petitioners' requested actions against the regulatory framework that is in place to determine when TS SLs, LCOs, or design features are required, including the Commission's policy statement on TSs.

For completeness, the staff also includes a discussion of other mechanisms that are in place to control the safe operation of the reactor and the storage of the irradiated fuel in the SFP, and describes the actions the Commission has taken and plans to take with regard to SFP level indication in the event of a beyond-design-basis external event.

A. Regulatory Framework for Technical Specifications

Section 182a of the Atomic Energy Act requires applicants for nuclear power plant operating licenses to include TSs as part of the license. The NRC's regulatory requirements related to the content of the TSs are contained in 10 CFR 50.36, "Technical Specifications."

The regulations of 10 CFR 50.36 require that each license authorizing operation of a production or utilization facility include TSs derived from the analyses and evaluations included in the safety analysis report. The regulations require that the TSs include items in the following categories: (1) SLs, limiting safety systems settings and control settings, (2) LCOs, (3) surveillance requirements, (4) design features, and (5) administrative controls. SLs for nuclear reactors, as described in 10 CFR 50.36(c)(1)(i)(A), are limits on important process variables that are found to be necessary to reasonably protect the integrity of the physical barriers that guard against the uncontrolled release of radioactivity. LCOs, as described in 10 CFR 50.36(c)(2), are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When an LCO of a nuclear reactor is not met, the licensee must shut down the reactor or follow any remedial action permitted by the TSs until the

condition can be met. Design features to be included, as described in 10 CFR 50.36(c)(4), 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 by other TSs.

The regulations in 10 CFR 50.36(c)(2)(ii) require that a TS LCO of a nuclear reactor must be established for each item meeting one or more of the four criteria specified in the regulation. Specifically, 10 CFR 50.36(c)(2)(ii), states:

> A technical specification limiting condition for operation of a nuclear reactor must be established for each item meeting one or more of the following criteria:
>
> (A) *Criterion 1*. Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.
>
> (B) *Criterion 2*. A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
>
> (C) *Criterion 3*. A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
>
> (D) *Criterion 4*. A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.

B. Commission Policy Statement Regarding Technical Specifications

The Commission issued a policy statement regarding TSs on July 22, 1993 (58 FR 39132). The policy included the following discussion regarding the purpose of the TSs:

> 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.

The policy statement goes on to discuss the above criteria for LCOs that were later codified in 10 CFR 50.36. These criteria were described as addressing those aspects of reactor operation that contribute to the prevention of accidents and provide the capability to provide immediate mitigation of accidents.

The SLs, LCOs, and design features included in each facility's TSs are derived from the analyses and evaluations included in the safety analysis report. Evaluations demonstrating the prevention of accidents related to the SFP have been included in Chapter 9 of the Updated Final Safety Analysis Report (UFSAR) for Brunswick, Units 1 and 2. These evaluations include prevention of a significant loss of coolant inventory under accident conditions and prevention of criticality, in ways consistent with General Design Criteria 61 and 62 of Appendix A to 10 CFR Part 50. The evaluations of these events indicate that prevention has been principally achieved through the geometric arrangement of, and materials of construction used in, the SFP. Therefore, the necessary restrictions on the geometric configuration and material selection are provided in TS 4.3, "Fuel Storage," in the design features section of the Brunswick TSs. Similarly, analyses of accidents giving rise to an immediate threat to public health and safety requiring immediate mitigation have been included in Chapters 6 and 15 of the UFSAR for Brunswick, Units 1 and 2. Of these accident analyses, only the fuel-handling accident could potentially involve the SFP. Establishment of appropriate initial conditions and availability of equipment necessary for immediate mitigation of the fuel-handling accident is controlled by TS LCOs. These LCOs are designated as applicable only during movement of irradiated fuel

because the fuel-handling accident is not credible when all fuel is properly seated in its storage locations.

C. Other Regulatory Control Mechanisms

Requirements for ensuring the safety of reactor operation and spent fuel storage are described for each NRC-licensed facility in its safety analysis report. Under the provisions of 10 CFR 50.34, "Contents of Applications; Technical Information," an applicant for a construction permit must include the principal design criteria for a proposed facility, a description of the design bases, and the relationship of the design bases to the principal design criteria in the preliminary safety analysis report. As part of the application for an operating license, these principal design criteria and the facility design bases were transferred to the final safety analysis report supporting plant operation.

The safety analysis report includes a number of additional conditions and limitations that are also important to safe reactor operation and spent fuel storage. These additional conditions and limitations are subject to regulations that restrict the changes that can be implemented without prior Commission approval. Among these regulations are requirements to implement managerial and administrative controls to assure safe operation through implementation of the facility's quality assurance program (10 CFR 50.54(a)) and requirements for licensees to obtain NRC approval before implementing changes to the facility or facility procedures that do not meet certain criteria (10 CFR 50.59, "Changes, Tests and Experiments").

In addition to these regulations, the administrative TSs for nuclear power plants typically include a requirement to establish, implement, and maintain a broad range of procedures for safe operation of the facility. Specifically, Brunswick administrative TS 5.4.1 requires, in part, that written procedures be established, implemented, and maintained for the applicable procedures recommended in Appendix A to Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operation)," dated November 1972. These recommended procedures

include general plant operations (e.g., refueling and operation of refueling equipment), operation of plant systems (e.g., the electrical distribution system, the reactor building ventilation systems, the shutdown cooling system, and the standby gas treatment system), procedures for response to alarm conditions (e.g., low SFP level alarm response), and procedures for combating emergencies (e.g., damage to irradiated fuel during refueling and acts of nature).

The design basis of the various facility structures, systems, and components (SSCs); the quality assurance program; the change control processes; and the required plant procedures work in concert to ensure that the facility's SSCs would be kept within the design limits described in the UFSAR to accomplish their functions during normal operating conditions and design-basis accident conditions. The Brunswick design-basis information included in Chapter 9 of the UFSAR addresses many of the capabilities the petitioners identified as important for safe irradiated fuel storage. These capabilities include the following:

- a system design that prevents unintentional removal of the water inventory and provides SFP cooling,
- an SFP cooling and cleanup system and supplemental SFP cooling system that keep SFP water temperature below 125 degrees Fahrenheit (°F)
- an SFP design that ensures sufficient thermal inertia to place an alternate means of SFP cooling in service following a loss of forced cooling before SFP coolant temperature exceeds 150°F
- an RHR system that provides an alternate or supplemental means of cooling the SFP when the full core has been transferred to the pool or when the normal SFP cooling system is unavailable

- an RHR System that provides a seismically-qualified makeup flow path from the suppression pool to maintain adequate fuel pool coolant inventory in the event of a loss of SFP coolant

D. Control of Equipment Availability during Maintenance

The regulations at 10 CFR 50.65 govern the control of equipment availability during maintenance. Because irradiated fuel is continually present in the SFP once the reactor discharges the first batch of spent fuel, and the conditions are most challenging during the period the reactor is shut down for refueling, maintenance of equipment related to the safe storage of spent fuel is typically addressed as part of shutdown risk management. Guidance for shutdown risk management under 10 CFR 50.65 is contained in NUMARC 93-01, Revision 4A, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," April 2011 (ADAMS Accession No. ML11116A198), which the NRC staff endorsed with comments in Regulatory Guide 1.160, Revision 3, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," May 2012 (ADAMS Accession No. ML113610098). Guidance for implementation of the risk management requirements of 10 CFR 50.65(a)(4) during shutdown operations is included in Section 11.3 of NUMARC 93-01. This guidance specifies that the scope of the required risk management includes these key safety functions:

- decay heat removal capability
- inventory control
- power availability
- reactivity control
- containment (primary/secondary)

Although these risk management guidelines are qualitative in nature, the NRC staff concluded the guidelines were adequate for managing the availability of key safety functions in the SFP based on the slow evolution of events during shutdown.

E. Reliable Spent Fuel Pool Level Instrumentation

Following the earthquake and tsunami at the Fukushima Dai-ichi nuclear power plant in March 2011, the NRC identified that reliable SFP instrumentation was needed to avoid the confusion and misapplication of resources that can result from beyond-design-basis external events when adequate instrumentation is not available. On March 12, 2012, the Commission established new SFP level instrumentation requirements with the issuance of Order EA-12-051 (hereinafter, order), "ORDER MODIFYING LICENSES WITH REGARD TO RELIABLE SPENT FUEL POOL INSTRUMENTATION." The order required licensees to have reliable indication of the water level in their SFPs. The staff also issued Interim Staff Guidance JLD-ISG-2012-03, which endorsed the Nuclear Energy Institute's (NEI's) industry guidance document NEI 12-02, "Industry Guidance for Compliance with NRC Order EA-12-051, 'To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation.'" This document describes methods that are acceptable to the staff for complying with EA-12-051.

Specifically, the order required holders of operating licenses to have a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of these pool water level conditions by trained personnel: (1) level that is adequate to support operation of the normal fuel pool cooling system, (2) level that is adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck, and (3) level where fuel remains covered and actions to implement makeup water addition should no longer be deferred. The order further specified the design features associated with the instrumentation, arrangement, mounting qualification, power supplies, independence, accuracy

testing, and display. The order also required the development of programs for training, procedures and maintenance of the instrumentation.

The NRC-endorsed industry implementation document specifically addresses the availability of the new SFP instrumentation. NEI 12-02 states:

> The primary or back-up instrument channel can be out of service for testing, maintenance and/or calibration for up to 90 days provided the other channel is functional. Additionally, compensatory actions must be taken if the instrumentation channel is not expected to be restored or is not restored within 90 days. If both channels become non-functioning then initiate actions within 24 hours to restore one of the channels of instrumentation and implement compensatory actions (e.g., use of alternate suitable equipment or supplemental personnel) within 72 hours.

III. Conclusion

The NRC staff evaluated the petitioners' requests against the requirements and guidance for modifying the operating license. The staff's conclusions are discussed in the following paragraphs.

Requested Action 1— Addition of an SFP Level Safety Limit:

Section 50.36(c)(1)(i)(A) of 10 CFR describes the requirements for SLs for nuclear reactors as limits on important process variables that are found to be necessary to reasonably protect the integrity of the physical barriers that guard against the uncontrolled release of radioactivity. If any safety barrier is exceeded, the reactor must be shut down. Fuel cladding integrity SLs, as discussed in Section 2.1.1, "General Electric Plants, BWR/4, Rev. 4, Standard Technical Specification (NUREG-1433), Vol. 2, Bases," for the establishment of reactor core SLs, ensure that specified acceptable fuel design limits are not exceeded during steady state operation, normal operational transients, and anticipated operational occurrences. SLs are set such that no significant fuel damage is calculated to occur if the limit is not violated. The regulations do not require fuel SLs for fuel that is not in a reactor and which cannot undergo sustained nuclear fission. A nuclear reactor, as defined in 10 CFR 50.2, is an apparatus, other

than an atomic weapon, designed or used to sustain nuclear fission in a self-supporting chain reaction. The definition of a nuclear reactor does not apply to SFPs. Therefore, it would be inappropriate to establish a SL for SFP level in the Brunswick TSs. While establishing SLs for stored irradiated fuel is not appropriate, measures to prevent a significant loss of coolant inventory under accident conditions which could challenge the cooling of the stored fuel, consistent with General Design Criterion 61 of Appendix A to 10 CFR Part 50, are documented in the UFSAR. Prevention of significant inventory loss below the top of irradiated fuel stored in the SFP has been principally achieved through the design and construction of the SFP. The necessary restrictions on the design and construction of the SFP are provided in TS 4.3, "Fuel Storage," in the design features section of the Brunswick TSs. With these design features in place and with consideration of the large coolant inventory change necessary to produce even a small change in water level, the water level in the SFP cannot be substantially changed in a short period of time. In consideration of the above, the proposed safety limit is not appropriate, and would be redundant to TSs already in place. Therefore, the NRC denies the petitioners' request.

Requested Actions 2 through 12— Modify the applicability of each LCO to apply whenever irradiated fuel is stored in the SFP rather than during movement of irradiated fuel:

The purpose of TSs is to impose those conditions or limitations on 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 that cannot be changed without prior Commission approval. The cited TSs ensure the immediate availability of systems designed to mitigate the radiological effects of fuel damage occurring during the movement of irradiated fuel assemblies within secondary containment based on evaluation of that postulated event in Chapter 15 of the Brunswick UFSAR. Evaluations demonstrating the

prevention of abnormal situations and events related to storage of irradiated fuel in the SFP have been included in Chapter 9 of the Brunswick UFSAR. After transfer from the vessel, and with the irradiated fuel seated in the SFP racks, no abnormal situations or events are described in the safety analysis report that would require the systems described in Requested Actions 2 through 12 to be available. Therefore, the systems and functions described in the petitioners' Requested Actions 2 through 12 would not need to have conditions or limitations established in the TSs when all irradiated fuel is seated in the SFP storage racks or in the reactor vessel. For these reasons, the NRC staff denies the petitioners' Requested Actions 2 through 12.

Requested Action 13— The petitioners requested that the NRC revise TS 3.9.7, "Residual Heat Removal (RHR)–High Water Level," and/or TS 3.9.8, "Residual Heat Removal (RHR)–Low Water Level," or add a new LCO to require one RHR subsystem to be operable whenever the entire reactor core is offloaded into the SFP:

Brunswick TS 3.9.7 requires one RHR shutdown cooling subsystem to be operable and in operation during refueling mode with irradiated fuel in the vessel and reactor vessel water level greater than or equal to 21 feet 10 inches (6.65 meters). Brunswick TS 3.9.8 requires two RHR shutdown cooling subsystems to be operable, and one RHR shutdown cooling subsystem to be in operation during refueling mode with irradiated fuel in the vessel and reactor vessel water level less than 21 feet 10 inches (6.65 meters). The RHR system in each of the plant configurations described in TS 3.9.7 and TS 3.9.8 is required to remove heat from the reactor coolant when irradiated fuel is in the vessel. RHR is not required to mitigate any events or accidents evaluated in the safety analysis while the reactor is in refueling mode. However, the decay heat levels can be high and near continuous circulation of coolant is necessary to accurately monitor reactor coolant system temperature. LCOs 3.9.7 and 3.9.8 each satisfy Criterion 4 of 10 CFR 50.36(c)(2)(ii)(D).

Once the fuel is transferred to the SFP, the decay heat levels have decreased, the natural circulation of coolant is enhanced by the reduction of interfering structures, and several systems (e.g., the RHR, the fuel pool cooling and cleanup, and the supplemental SFP cooling systems) are available to remove decay heat from the irradiated fuel. As evaluated in Chapter 9 of the Brunswick UFSAR, the significant heat sink provided by the volume of coolant in the SFP would provide substantial time for implementation of alternate cooling before SFP temperature limits could be reached following a loss of forced cooling. For this reason, requested Action 13 does not satisfy the TS policy and the requested action is denied.

As provided in 10 CFR 2.206(c), a copy of this director's decision will be filed with the Secretary of the Commission for the Commission to review. As provided for by this regulation, the decision will constitute the final action of the Commission 25 days after the date of the decision unless the Commission, on its own motion, institutes a review of the decision within that time.

Dated at Rockville, Maryland, this 30 day of December 2013.

FOR THE NUCLEAR REGULATORY COMMISSION.

/RA/ Jennifer Uhle for

Eric J. Leeds, Director,
Office of Nuclear Reactor Regulation.