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

March 17, 2020

Mr. Don Moul
Executive Vice President, Nuclear Division
and Chief Nuclear Officer
Florida Power & Light Company
NextEra Energy Seabrook, LLC
Mail Stop: NT3/JW
15430 Endeavor Drive
Jupiter, FL 33478

SUBJECT: SEABROOK STATION, UNIT NO. 1 – RELIEF FROM THE REQUIREMENTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS BOILER AND PRESSURE VESSEL CODE (EPID L-2019-LLR-0042)

Dear Mr. Moul:

By letter dated May 6, 2019 (Agencywide Documents Access and Management System Accession No. ML19127A259), NextEra Energy Seabrook, LLC (the licensee) submitted Relief Request PR-1 to the U.S. Nuclear Regulatory Commission (NRC) for relief from the requirements of the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code) to propose an alternative to the containment building spray (CBS) pump periodic testing on the recirculation flow path due to impractical requirements at Seabrook Station, Unit No. 1 (Seabrook).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(f)(6)(i), the licensee requested relief from the ASME OM Code, Mandatory Appendix V, "Pump Periodic Verification Test Program," to allow the performance of CBS pump testing using an existing recirculation line due to impractical requirements at Seabrook. This would reduce the required full flow test to approximately 68 percent of the required design-basis flow rate. The licensee requested this relief for the fourth 10-year inservice testing program interval, which begins on August 18, 2020, and ends in August 2030.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that granting relief request PR-1 for CBS pumps CBSP9A and CBS-P9B at Seabrook, pursuant to 10 CFR 50.55a(f)(h)(i), is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest, given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

All other ASME OM Code requirements for which relief was not specifically requested and approved remain applicable. The NRC grants relief PR-1 for the CBS pumps for the fourth 10-year inservice testing program interval at Seabrook, which begins on August 18, 2020, and ends in August 2030.

If you have any questions, please contact the Seabrook Project Manager, Justin Poole, at 301-415-2048 or by e-mail to Justin.Poole@nrc.gov.

Sincerely,

/RA/

James G. Danna, Chief
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosure:
Safety Evaluation

cc: Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

PR-1 RELIEF REQUEST ASSOCIATED WITH

CONTAINMENT BUILDING SPRAY PUMP PERIODIC VERIFICATION TESTING ON

RECIRCULATION FLOW PATH

NEXTERA ENERGY SEABROOK, LLC, ET AL.*

SEABROOK STATION, UNIT NO. 1

DOCKET NO. 50-443

1.0 INTRODUCTION

By letter dated May 6, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19127A259), NextEra Energy Seabrook, LLC (the licensee) submitted Relief Request PR-1 to the U.S. Nuclear Regulatory Commission (NRC or the Commission) for relief from the requirements of the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code), to propose an alternative to the containment building spray (CBS) pump periodic testing on the recirculation flow path due to impractical requirements at Seabrook Station, Unit No. 1 (Seabrook).

In its request, the licensee proposed an alternative test plan in lieu of certain inservice testing (IST) requirements of the 2012 Edition of the ASME OM Code. Specifically, the licensee proposes relief from ASME OM Code, Mandatory Appendix V, "Pump Periodic Verification Test Program," by allowing the performance of CBS pump testing using an existing recirculation line. This would reduce the required full flow test to approximately 68 percent of the required design-basis flow rate. The Seabrook fourth 10-year IST program interval begins on August 18, 2020, and ends in August 2030.

2.0 REGULATORY EVALUATION

The NRC regulations at Title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 55a(f)(4)(ii) state that inservice tests to verify operational readiness of pumps and valves whose function is required for safety conducted during successive 120-month intervals must comply with the requirements of the latest edition and addenda of the ASME OM Code incorporated by reference in 10 CFR 50.55a(a)(1)(iv) 12 months before the start of the 120-month interval (or the optional ASME Code Cases listed in NRC Regulatory Guide 1.147 or NRC Regulatory Guide 1.192, as incorporated by reference in 10 CFR 50.55a(a)(3)(ii) and (iii), respectively), subject to the conditions listed in 10 CFR 50.55a(b).

The regulation at 10 CFR 50.55a(f)(5)(iii) states that if the licensee has determined that conformance with certain ASME Code requirements is impractical for its facility, the licensee

must notify the Commission and submit, as specified in 10 CFR 50.4, information to support the determination.

The regulation at 10 CFR 50.55a(f)(5)(iv) states that where a pump or valve test requirement by the ASME Code or addenda is determined to be impractical by the licensee and is not included in the revised IST program (as permitted by 10 CFR 50.55a(f)(4)), the basis for this determination must be submitted for NRC review and approval not later than 12 months after the expiration of the initial 120-month interval of operation from the start of facility commercial operation and each subsequent 120-month interval of operation during which the test is determined to be impractical.

The regulation at 10 CFR 50.55a(f)(6)(i) states that the Commission will evaluate determinations under 10 CFR 50.55a(f)(5) that ASME Code requirements are impractical. The regulation also states that the Commission may grant relief and may impose such alternative requirements as it determines are authorized by law, will not endanger life or property or the common defense and security, and are otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

The NRC staff provides guidance in NUREG-1482, Revision 2, “Guidelines for Inservice Testing at Nuclear Power Plants” (ADAMS Accession No. ML13295A020), for preparing relief requests for ASME OM Code requirements.

3.0 TECHNICAL EVALUATION

3.1 System Description

The CBS at Seabrook is designed to provide cooling to the containment in the event of certain accidents to prevent containment pressure and temperature from exceeding acceptable limits by discharging water through the containment spray nozzles. The CBS consists of two trains, with each train containing one motor-driven, horizontal, centrifugal CBS pump. The CBS pumps are designed to take suction from either the refueling water storage tank (RWST) or the containment recirculation sump, depending on mode-dependent alignment.

3.2 List of Affected Components

- 1-CBS-P-9A - Containment Building Spray Pump A
- 1-CBS-P-9B - Containment Building Spray Pump B

3.3 Applicable ASME OM Code Requirements

The applicable ASME OM Code edition for the fourth IST program interval at Seabrook is ASME OM Code, 2012 Edition.

Paragraph ISTB-1400(d) of ASME OM Code, 2012 Edition, states that the owner’s responsibility includes:

> (d) establishing a pump periodic verification test program in accordance with Division 1, Mandatory Appendix V.

Mandatory Appendix V defines the pump periodic verification test as:

> a test that verifies a pump can meet the required (differential or discharge) pressure as applicable, at its highest design basis accident flow rate.

The purpose of the above ASME OM Code requirements is to detect mechanical or hydraulic degradation and to validate the ability of each pump to meet the design-basis accident flow rates.

3.4 Licensee's Proposed Alternative

The licensee asserts that performing the test of the CBS pumps at full flow is impractical, as it would require significant temporary modifications to provide adequate piping pathways. The licensee proposes an alternative approach of testing the CBS pumps using the existing recirculation flow path, which achieves approximately 68 percent of the required design-basis flow rate of 2,808 gallons per minute (gpm).

3.5 Licensee's Basis for Alternative

The licensee provided the following description of the impracticality associated with performing full flow testing.

> Full flow testing of the subject pumps would require system alignment to containment spray headers and subsequent discharge to the containment. In order to perform full flow testing without alignment to the spray headers, temporary piping is required to recirculate water to/from the Emergency Core Cooling System (ECCS) containment sumps. This was performed previously, to verify CBS pump curve data during pre-operational test PT-11, Containment Recirculation Sump Operability Demonstration. 1-PT-11 required modification of the sump by means of building a dike around the top of the sump in order to hold the volume of water required to achieve the necessary pump net positive suction head without flooding the containment. The spray header piping also required modification by means of removing the spool pieces downstream of the spray ring isolation valves and connecting temporary pipe from the 25' elevation in containment to the ECCS Sumps at -26' elevation. In 2008 (during Seabrook Refueling Outage OR12), installation of the sump modifications installed flow interceptors, further reducing the available volume of the sump for testing. Performing these temporary modifications to the CBS system or enlarging the recirculation piping and components to achieve design basis accident flow rates are not warranted since there will be no improvement in the ability to detect pump degradation.
>
> Compliance with the Code will require reconfiguring the CBS recirculation line to meet design basis accident flow. A conceptual Engineering Change was completed to determine the best path for modifying the recirculation line. The preferred option interconnects the CBS heat exchanger outlet with the CBS suction from the RWST upstream of the suction check valves for each CBS pump. Installation of this system design change will require a plant shutdown and significant expenditures without a corresponding improvement in plant safety.

The licensee provided the following bases, in part, for the proposed alternative:

> Testing of the CBS pumps utilizing the existing recirculation flow path provides for substantial flow testing in a stable region of the pump curve, well above the minimum continuous flow rate of 1230 GPM specified by the original equipment manufacturer (Sulzer Pumps). Testing the CBS pumps at reference values established in the region of 1920 GPM has been validated for stable flow. Testing over the last ten years has shown consistent performance with both pumps and, compared to performance data in the first two intervals, no signs of mechanical or hydraulic degradation. The manufacturer reviewed historical performance data of both pumps, along with the original pre-service tests, and determined testing in this range is sufficient to identify potential pump performance degradation.
>
> Both CBS pumps were included as IST Group A pumps prior to the Third Testing Interval as a result of the pumps use in the Silica Removal Program. Group A pumps are required to have vibration monitoring performed during the quarterly surveillance runs. This resulted in a significantly larger pool of test data for monitoring and analyzing pump performance. In order to compensate for the inability to test the pumps at design flow as required by Mandatory Appendix V, the CBS pumps are included in the Predictive Maintenance (PdM) Monitored Equipment program. This program includes thermography, enhanced vibration monitoring and analysis of the pump, and periodic sampling and analysis of the lube oil. Station personnel also perform Static Motor Testing using the Baker Advanced Winding Analyzer Series IV (AW AIV) equipment and Dynamic Motor Monitoring utilizing the Baker EXP3000 equipment. Online testing using the EXP3000 utilizes a multitude of tests to determine power quality, motor operating conditions, motor performance, and load originated issues. The enhanced PdM program has been in place since the last Code update and has yielded satisfactory results for both pumps.
>
> Continued testing in a stable recirculation flow range combined with the enhanced PdM program provides reliable performance monitoring beyond those requirements prescribe in the Code that reliably validates the ability of each pump to meet the design basis accident flow rates. The testing is effective for detecting mechanical and hydraulic degradation as required by Subsection ISTB.

3.6 NRC Staff Evaluation

The licensee is preparing to enter the fourth 10-year IST program interval at Seabrook, scheduled to begin on August 18, 2020, and end in August 2030. The licensee asserts that flow testing of the CBS pumps CBS-P9A and CBS-P9B in accordance with ASME OM Code, Mandatory Appendix V, is impractical, and the licensee proposes an alternative test. Specifically, the current configuration of CBS pumps CBS-P9A and CBS-P9B cannot meet the test requirements of Mandatory Appendix V, which defines the pump periodic verification test as:

> a test that verifies a pump can meet the required (differential or discharge) pressure as applicable, at its highest design basis accident flow rate.

This requirement was included in the ASME OM Code to verify that pumps can meet the required pressure at its highest design-basis accident flow rate in lieu of the previous comprehensive test, which established a reference value within ±20 percent of a pump design flow rate. The 2012 Edition of the ASME OM Code allows the comprehensive test flow rates to be established by the owner and relies on the pump periodic verification tests to demonstrate full flow performance. The overall purpose of the ASME OM Code pump testing requirements is to detect mechanical or hydraulic degradation and to validate the ability of each pump to meet the design-basis accident flow rates.

As stated by the licensee, the current piping configuration for CBS pumps (BS-P9A and CBS-P9B) does not permit full flow testing without modifications. These pumps can only be tested on a recirculation flow path that is sized for approximately 1,900 gpm, which is 63 percent of the best efficiency point flow of 3,000 gpm, and approximately 68 percent of the required design flow of 2,808 gpm.

The licensee stated in its submittal that testing the CBS pumps at the required flow as specified by the ASME OM Code would require the building of a temporary dike system around the top of the containment sump. A dike system would be necessary to hold the needed volume of water for maintaining the net positive suction head (NPSH) for the CBS pumps without flooding the containment. In addition, intrusive temporary piping would need to be installed for completion of the full flow test loop. A preoperational test using this configuration verified the manufacturer's pump curve data and confirmed the ability of the pumps to deliver design flow. However, duplication of this test, by the standards today, would be more difficult to accomplish due to recent plant modifications to the containment sump and the temporary modification installation impact on other plant systems. In addition, installation of this system design change would require a plant shutdown and significant expenditures by the licensee.

The NRC staff agrees that the extensive modifications needed to reconfigure the CBS recirculation line to perform full flow testing without discharging into containment are impractical and a burden on the licensee that would not result in a corresponding improvement in plant safety.

The licensee has previously proposed to perform the full flow comprehensive pump test at reduced flow conditions. To compensate for the reduced flow testing in previous intervals, the licensee has been obtaining additional pump health data via its Predictive Maintenance Monitored Equipment Program. Predictive technologies such as thermography, vibration analysis, oil analysis, and static and dynamic motor monitoring and analysis were incorporated into the comprehensive pump test. The licensee submitted a sample of the performance data relating to the two subject CBS pumps for the last 20 years, which the NRC staff has reviewed and found no evidence to suggest any mechanical or hydraulic degradation. The licensee has proposed to continue the measurement of these parameters for analysis and trending. In cases where predictive parameters are found outside the normal range or are trending to an unfavorable condition, corrective actions would be performed.

The licensee proposes to test the CBS pumps utilizing the recirculation flow path. This fixed path provides flow testing in a stable region of the pump curve well above the minimum continuous flow rate specified by the manufacturer. The required ASME OM Code pump parameters such as differential pressure, discharge pressure, flow rate, and vibration will be captured, trended, analyzed and measured against established reference values. In addition, predictive technologies will be used to enhance the monitoring of component health of the pumps. Thermography is an effective tool for identifying faulty bearings, misaligned couplings,

electrical faults, and abnormal temperature increases. Vibration analysis can be used to detect bearing faults, motor and pump imbalances, impeller faults, motor faults, resonance problems, and system anomalies. Lube oil analysis can detect bearing wear and abnormal system operation such as water intrusion. Static motor testing and dynamic motor monitoring can detect power quality and motor performance issues. The performance of thermography and lube oil sampling and analysis exceeds the requirements of the 2012 Edition of the ASME OM Code and holistically provides reasonable assurance that mechanical or hydraulic degradation of the pump would be detected and is consistent with the intent of ASME OM Code, 2012 Edition, Subsection ISTB and Mandatory Appendix V. Accordingly, the NRC staff finds that the proposed alternative flow testing provides reasonable assurance that pumps CBS-P9A and CBS-P9B will be operationally ready.

4.0 CONCLUSION

Based on the above evaluation, the NRC staff finds that granting the relief request PR-1 for CBS pumps CBS-P9A and CBS-P9B at Seabrook, pursuant to 10 CFR 50.55a(f)(6)(i), is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest, given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. All other ASME OM Code requirements for which relief was not specifically requested and approved remain applicable. The NRC grants relief PR-1 for the CBS pumps for the fourth 10-year IST program interval at Seabrook, which begins on August 17, 2020, and ends in August 2030.

Principal Contributor: I. Tseng

Date: March 17, 2020

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