



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

March 29, 2012

Mr. Paul Freeman  
Site Vice President  
c/o Michael O'Keefe  
Seabrook Station  
NextEra Energy Seabrook, LLC  
P.O. Box 300  
Seabrook, NH 03874

SUBJECT: SEABROOK STATION, UNIT NO. 1 - RELIEF REQUEST, 3IR-3, FOR  
REACTOR PRESSURE VESSEL SHELL TO FLANGE WELD EXAMINATION  
FOR THE THIRD INSERVICE INSPECTION INTERVAL (TAC NO. ME7259)

Dear Mr. Freeman:

By letter dated September 26, 2011, NextEra Energy Seabrook, LLC (NextEra or licensee) submitted a relief request from certain examination requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) at the Seabrook Station, Unit 1 (Seabrook). Specifically, the licensee proposed examining the reactor pressure vessel (RPV) upper shell-to-flange weld with procedures and personnel qualified to ASME Code, Section XI, performance demonstration initiative (PDI) Appendix VIII, Supplements 4 and 6 requirements. The request is for the remainder of the third 10-year inservice inspection (ISI) interval. The Seabrook third 10-year ISI interval is projected to end August 18, 2020.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the subject request, and concludes that the proposed alternative provides an acceptable level of quality and safety. Therefore, the NRC staff authorizes the proposed alternative in accordance with paragraph 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* for Seabrook's third 10-year ISI interval.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

The NRC staff's safety evaluation is enclosed.

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

Sincerely,

A handwritten signature in black ink, appearing to read "Meena Khanna". The signature is fluid and cursive, with a large loop at the end.

Meena Khanna, Chief  
Plant Licensing Branch I-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosure:  
Safety Evaluation

cc w/encl: Distribution via Listserv



UNITED STATES  
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WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF 3IR-3

REACTOR PRESSURE VESSEL FLANGE-TO-UPPER SHELL WELD

NEXTERA ENERGY SEABROOK, LLC

SEABROOK STATION, UNIT NO. 1

DOCKET NO. 50-443

1.0 INTRODUCTION

By letter dated September 26, 2011, NextEra Energy Seabrook, LLC (NextEra or licensee) submitted a relief request from certain examination requirements of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (Code) at the Seabrook Station, Unit 1 (Seabrook). Specifically, the licensee proposed examining the reactor pressure vessel (RPV) upper shell-to-flange weld with procedures and personnel qualified to ASME Code, Section XI, performance demonstration initiative (PDI) Appendix VIII, Supplements 4 and 6 requirements. The request is for the remainder of the third 10-year inservice inspection (ISI) interval. The Seabrook third 10-year ISI interval is projected to end August 18, 2020.

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(g), "Inservice inspection requirements," requires, in part, that ASME Class 1, 2, and 3 components must meet the inspection examination requirements set forth in the applicable editions and addenda of the ASME Code, except where alternatives have been authorized by the U.S. Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 50.55a(a)(3)(i) or (a)(3)(ii).

10 CFR 50.55a(a)(3) states in part that alternatives to the requirements of paragraph (g) may be authorized by the NRC, if the applicant demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The Code of Record for the third 10-year ISI interval at the Seabrook is the 2004 Edition of the ASME Code, Section XI.

Enclosure

### 3.0 TECHNICAL EVALUATION

#### 3.1 Affected Component

ASME Code Class 1, RPV upper vessel shell-to-flange weld, Table IWB-2500-1, Category B-A, Item Number B1.30, Seabrook ISI Component identification RC RPV-101-121.

#### 3.2 Applicable Code

ASME Code, Section XI, 2004 Edition, Appendix I, Article 1-2100, paragraph (b) requires "Ultrasonic examination of reactor vessel-to-flange welds shall be conducted in accordance with Article 4 of ASME Section V, except that alternative examination beam angles may be used. These examinations shall be further supplemented by Table 1-2000-1."

#### 3.3 Proposed Alternative

The licensee proposes using the procedures, personnel, and equipment qualified to the requirements of ASME Code, Section XI, Appendix VIII, Supplements 4 and 6, of the 2004 Edition as administered by the Electric Power Research Institute's (EPRI) Performance Demonstration Initiative (PDI) program to conduct the vessel-to-flange weld examination.

#### 3.4 Licensee Basis for the Alternative

ASME Code, Section XI, Appendix I, paragraph 1-2100(b) requires that ASME Section V, Article 4 ultrasonic testing (UT) techniques shall be used for the RPV-to-flange weld. ASME Code Section V, Article 4 describes the required techniques to be used for UT examination of the welds in ferritic pressure vessels with wall thicknesses greater than 2 inches. The ASME Section V, Article 4 UT technique calibrations, recording criteria and flaw sizing capabilities are based upon the use of a distance-amplitude-correction curve (DAC) derived from machined reflectors in a basic calibration block. UT performed in accordance with Section V, Article 4, uses recording thresholds known as percent of DAC for recording and reporting of indications within the examination volume. Indications detected in the exam volume, with amplitudes below these thresholds, are not required to be recorded and/or evaluated. The recording thresholds in Section V, Article 4 are generic and do not take into consideration such factors as flaw orientation, which can influence the amplitude of UT responses.

The RPV-to-flange weld is the only circumferential shell weld in the RPV that is not examined with ASME Code Section XI, Appendix VIII, Supplement 4 and 6 UT techniques. Procedures, equipment and personnel qualified via the PDI Appendix VIII Supplement 4 and 6 programs have been demonstrated to have a high probability of detection and are generally considered superior to the techniques employed during earlier Section V, Article 4 RPV examinations. Use of the detection criterion is more conservative and the procedure requires the examiner to evaluate all indications determined to be flaws regardless of their amplitude.

EPRI Report NP-6273, "Accuracy of Ultrasonic Flaw Sizing Techniques for Reactor Pressure Vessels," dated March 1989, contains a comparative analysis of sizing accuracy for several

different techniques. The results show that UT flaw sizing techniques based on tip diffraction are the most accurate. The proposed alternative Appendix VIII UT qualified detection and sizing methodologies use analysis tools based upon echo dynamics and tip diffraction. This methodology is considered more sensitive and accurate than the Section V, Article 4 processes. Accordingly, approval of this alternative examination and evaluation process is requested pursuant to 10 CFR 50.55a(a)(3)(i).

### 3.5 NRC Staff Evaluation

The 2004 Edition with no Addenda of the ASME Code, Section XI, IWA-2232 states, "Ultrasonic examination shall be conducted in accordance with Appendix I." ASME Code, Section V, Article 4 provides a prescriptive process for qualifying UT of procedures and the scanning requirements for examinations. The UT performed to ASME Code, Section V, Article 4 uses detailed criteria for setting up and calibrating equipment, calculating coverage, and detecting indications. The capability of an ASME Code, Section V, Article 4 UT examination is demonstrated with calibration blocks made from representative material containing holes and notches.

The licensee proposes, in lieu of the ASME Code, Section V, Article 4 angle beam examination, to use an examination that will be performed using examination procedures, personnel, and equipment qualified in accordance with ASME Code, Section XI, Appendix VIII, Supplements 4 and 6, as modified by 10 CFR 50.55a. 10 CFR 50.55a limits the use of ASME Code, Section XI, Appendix VIII to the 2001 Edition of the ASME Code with no Addenda. ASME Code, Section XI, Appendix VIII is a performance-based UT method. Performance-based UT requires that detailed criteria be used for performance demonstration tests. The results for the tests are compared against statistically developed screening criteria. The tests are performed on representative mockups containing flaws similar to those found in operating plants. The performance-based tests demonstrate the effectiveness of UT personnel and procedures.

Examinations are performed with the scanning requirements for Supplements 4 and 6 that are provided in 10 CFR 50.55a(b)(2)(xv)(G), and the scanning volume identified in the ASME Code, Section XI, Figure IWB-2500-4 for the shell-to-flange weld. The scanning requirements in 10 CFR 50.55a(b)(2)(xv)(G) are: (1) for the examination of the inner 15 percent through-wall volume, scanning will be performed in four orthogonal directions to the maximum extent possible with procedures and personnel qualified to with ASME Code, Section XI, Appendix VIII, Supplement 4 or; (2) if the inner 15 percent through-wall volume examination is not possible as required above, the inner 15 percent through-wall volume is considered fully examined if coverage is obtained in at least one parallel and one perpendicular direction using personnel and procedures qualified for single side examination in accordance with ASME Code, Section XI, Appendix VIII, Supplement 4 and Supplement 6; and (3) the remaining 85 percent through-wall volume is considered fully examined if coverage is obtained in one parallel and one perpendicular direction using procedures and personnel qualified for single side examination.

The procedures, equipment, and personnel qualified to ASME Code, Section XI, Appendix VIII and scanning requirements in 10 CFR 50.55a(b)(2)(xv)(G) have shown a high probability of flaw detection, and have increased the reliability of examinations of weld configurations within the

scope of the PDI program. Therefore, the NRC staff has determined that the proposed alternative will provide an acceptable level of quality and safety.

Based on the above information, the NRC staff concludes that the Appendix VIII PDI program results in an increased reliability of inspections for weld configurations within the scope of the PDI program.

#### 4.0 CONCLUSION

The NRC staff has reviewed the licensee's proposed alternative to apply ASME Code, Section XI, Appendix VIII examination requirements when volumetrically examining the Seabrook RPV Shell-to-Flange Weld No. RPV-101-121 by UT, and concludes that the procedures, equipment, and personnel qualified to ASME Code, Section XI, Appendix VIII have shown a high probability of flaw detection, and have increased the reliability of examinations of weld configurations within the scope of the PDI program. Therefore, the licensee's proposed alternative provides an acceptable level of quality and safety and is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the Seabrook third 10-year ISI interval.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in the subject requests for relief remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: Chris Syndor

Date: March 29, 2012

The NRC staff's safety evaluation is enclosed. If you have any questions, please contact John G. Lamb at 301-415-3100 or via e-mail at [John.Lamb@nrc.gov](mailto:John.Lamb@nrc.gov).

Sincerely,

*/ra/*

Meena Khanna, Chief  
Plant Licensing Branch I-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosure:  
Safety Evaluation

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