



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

January 4, 2018

Mr. Mano Nazar
President and Chief Nuclear Officer
Nuclear Division
Florida Power & Light Company
Mail Stop: EX/JB
700 Universe Blvd.
Juno Beach, FL 33408

SUBJECT: ST. LUCIE PLANT, UNIT NO. 1 – RELIEF FROM THE REQUIREMENTS OF
THE ASME CODE REGARDING RELIEF REQUEST NO. 17, REVISION 0,
FOR THE FOURTH 10-YEAR INSERVICE INSPECTION INTERVAL
(CAC NO. MF9826; EPID L-2017-LLR-0043)

Dear Mr. Nazar:

By letter dated June 12, 2017 (Agencywide Documents Access and Management System Accession No. ML17163A362), Florida Power & Light Company (FPL) requested an alternative to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) for ultrasonic (UT) examination of an ASME Code Class 1 reactor pressure vessel upper shell-to-flange weld at the St. Lucie Plant, Unit No. 1.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), FPL requested the use of procedures, personnel, and equipment qualified to the requirements of ASME Section XI, Appendix VIII, Supplements 4 and 6 of the 2001 Edition with No Addenda, as administered by the Electric Power Research Institute's Performance Demonstration Initiative program to conduct the reactor vessel upper shell-to-flange weld examination.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that FPL has addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1), and that the proposed alternative to the ASME Code UT examination of reactor pressure vessel welds requirement provides reasonable assurance of structural integrity. Therefore, pursuant to 10 CFR 50.55a(z)(1), the NRC authorizes the use of Relief Request No. 17, Revision 0, at the St. Lucie Plant, Unit No. 1, for the fourth 10-year inservice inspection interval, which ends on February 10, 2018.

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

If you have any questions, please contact the Project Manager, Perry H. Buckberg, at 301-415-1383 or Perry.Buckberg@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "Undine Shoop" followed by a stylized flourish and the word "for".

Undine Shoop, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-335

Enclosure:
Safety Evaluation

cc w/Enclosure: Distribution via Listserv



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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NO. 17, REVISION 0, REGARDING

EXAMINATION OF REACTOR VESSEL UPPER SHELL-TO-FLANGE WELD

FLORIDA POWER & LIGHT COMPANY

ST. LUCIE PLANT, UNIT NO. 1

DOCKET NO. 50-335

1.0 INTRODUCTION

By letter dated June 12, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17163A362), Florida Power & Light Company (FPL, the licensee) submitted Relief Request No. 17, Revision 0, requesting the use of an alternative to the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) for ultrasonic (UT) examination of the ASME Code Class 1 reactor pressure vessel (RPV) upper shell-to-flange weld (weld number 7-203) at the St. Lucie Plant, Unit No. 1.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee requested the use of procedures, personnel, and equipment qualified to the requirements of ASME Section XI, Appendix VIII, Supplements 4 and 6 of the 2001 Edition with No Addenda, as administered by the Electric Power Research Institute's (EPRI's) Performance Demonstration Initiative (PDI) program to conduct the reactor vessel upper shell-to-flange weld UT examination.

2.0 REGULATORY REQUIREMENTS

Section 50.55a(g) of 10 CFR requires that inservice inspection (ISI) of ASME Code Class 1, 2, and 3 components is performed in accordance with Section XI of the ASME Code and applicable addenda as a way to detect anomalies and degradation so that structural integrity of these components can be maintained. Section 50.55a(z) of 10 CFR states that alternatives to the requirements of paragraphs (b) through (h) of 10 CFR 50.55a, or portions thereof, may be used when authorized by the Director, Office of Nuclear Reactor Regulation. A proposed alternative must be submitted and authorized prior to implementation. The applicant or licensee must demonstrate that (1) the proposed alternative would provide an acceptable level of quality and safety, or (2) compliance with the specified requirements of this section would result in hardship or unusual difficulty, without a compensating increase in the level of quality and safety.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for FPL to request the use of an alternative and the NRC to authorize the proposed alternative.

Enclosure

3.0 TECHNICAL EVALUATION

3.1 ASME Code Components Affected

Components for Which Alternative is Requested (ASME Code Class 1)

RPV upper shell-to-flange weld number 7-203

Examination Category

B-A, "Pressure Retaining Welds In Reactor Vessel"

Examination Item Number

B1.30, "Shell-to-Flange Weld"

3.2 Applicable Code Edition and Addenda

The ASME Code of record for the St. Lucie Plant, Unit No. 1, fourth 10-year ISI interval program is the 2001 Edition with Addenda through 2003 of Section XI of the ASME Code. The Code of record for ASME Section XI, Appendix VIII, is the 2001 Edition with No Addenda.

3.3 Applicable Code Requirement

The applicable requirements are contained in Table IWB-2500-1, "Pressure Retaining in Reactor Vessel," Examination Category B-A, Item Number B1.30, "Shell-to-Flange Weld." ASME Section XI, paragraph IWA-2232 states that UT examinations shall be conducted in accordance with Appendix I. Appendix I, Article I-2110(b) requires UT examination of reactor vessel-to-flange welds, closure head-to-flange welds, and integral attachment welds be conducted in accordance with Article 4 of Section V, except that alternative beam angles may be used, and that these examinations shall be further supplemented by Table I-2000-1.

3.4 Licensee Proposed Alternative

As an alternative to the requirements specified in ASME Section XI, Appendix I, Article I-2110(b), the licensee proposes to use procedures, personnel, and equipment qualified to the requirements of ASME Section XI, Appendix VIII, Supplements 4 and 6 of the 2001 Edition with No Addenda, as administered by the EPRI PDI program, to conduct the reactor vessel upper shell-to-flange weld examination.

The proposed examinations would be from the inside surface and will be implemented to achieve the maximum coverage possible, utilizing procedures and personnel qualified by the PDI program. The proposed alternative represents the best techniques, procedures, and qualifications available to perform UT examinations of RPV welds. The PDI program addresses qualification requirements for each of the supplements that are defined in ASME Section XI, Appendix VIII. The applicable vendor procedure has been qualified in accordance with the PDI's implementation of Supplements 4 and 6 of ASME Section XI, Appendix VIII.

3.5 Licensee Basis for Proposed Alternative

The licensee stated that ASME Code, Section XI, Appendix I, Article I-2110(b) identifies that ASME Code, Section V, Article 4 techniques be utilized for the examination of the reactor vessel-to-flange weld. The calibration techniques, recording criteria, and flaw-sizing methods are based upon the use of a distance-amplitude-correction curve derived from the ultrasonic responses to machined reflectors in a basic calibration block. Reflectors detected in the field require investigation only if they exceed 20 percent of the amplitude response of the distance-amplitude-correction curve obtained from the machined reflectors in the basic calibration block. Indications detected in the designated examination volume with amplitudes below this threshold are, therefore, not required to be recorded. The amplitude-based recording threshold is generic and does not take factors into consideration such as flaw orientation, which can influence the amplitude of the UT response.

Use of the ASME Section XI, Appendix VIII qualified techniques would enhance the quality of the examination. The ASME Section XI, Appendix VIII detection criterion is more conservative because the qualified procedure requires examiners to measure and evaluate all indications determined to be flaws, regardless of their amplitude response, in accordance with the applicable criteria.

Examination from the inside surface would provide the best access for examination of the reactor vessel upper shell-to-flange weld. The outside surface of the RPV is inaccessible due to its placement inside the biological-shield wall and the installed insulation. Although the reactor vessel upper shell-to-flange weld is specifically excluded from the requirement to utilize ASME Section XI, Appendix VIII qualified UT techniques by the referenced Code, the licensee believes that performing the UT examination with Appendix VIII/PDI qualified personnel and procedures from the inside surface will provide an acceptable level of quality and safety.

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 the UT flaw-sizing techniques based upon tip diffraction are the most accurate. ASME Section XI, Appendix VIII qualified detection and sizing methodologies use analysis tools based upon echo dynamics and tip diffraction. This methodology is considered more sensitive and accurate than amplitude only based comparisons.

For the RPV upper shell-to-flange weld examinations using ASME Section XI, Appendix VIII qualified techniques, the licensee anticipates obtaining essentially 100 percent Code volume coverage. However, if limitations are encountered that preclude obtaining essentially 100 percent examination coverage of the required volume, individual relief requests will be submitted. 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 previous ASME Section V, Article 4 reactor vessel weld examinations.

3.6 Duration of Proposed Alternative

The licensee stated that this relief request is applicable to the fourth 10-year ISI interval, which began February 11, 2008, and will conclude February 10, 2018. An interval extension is being utilized to complete the fourth 10-year ISI interval as allowed by IWA-2430(c)(1). The fifth ISI

interval will start on February 10, 2018. Credit for these examinations will only be applied to the fourth ISI interval.

3.7 NRC Staff Evaluation

The 2001 Edition through the 2003 Addenda of the ASME Code, Section XI, IWA-2232 states that UT examination shall be conducted in accordance with Appendix I. Article I-2110(b) of Appendix I requires, in part, UT examination of RPV shell-to-flange welds be conducted in accordance with Article 4 of Section V, except that alternative examination beam angles may be used and that these examinations shall be further supplemented by Table I-2000-1. ASME Code, Section V, Article 4 provides a prescriptive process for qualifying of UT 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 proposed 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. The NRC staff noted that ASME Code, Section XI, Appendix VIII, Supplements 4 and 6, are modified by 10 CFR 50.55a. This ASME Code, Section XI, Appendix VIII qualified examination would be used in lieu of the requirements of the ASME Code, Section V, Article 4. ASME Code, Section XI, Appendix VIII is a performance-based UT qualification method and has proven to be at least as effective as the prescriptive requirements of the ASME Code, Section XI, Appendix I. 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 and demonstrate the effectiveness of UT personnel and procedures.

In lieu of ASME Code, Section V, Article 4, 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, as documented in NUREG/CR-7165, Revision 2, "The Technical Basis Supporting ASME Code, Section XI, Appendix VIII: Performance Demonstration for Ultrasonic Examination Systems" (ADAMS Accession No. ML13144A107). The NRC staff finds that the procedures, equipment, and personnel qualified to ASME Code, Section XI, Appendix VIII, as modified by 10 CFR 50.55a, have 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 concludes that the licensee's proposed alternative is acceptable since it provides an acceptable level of quality and safety.

4.0 CONCLUSION

As set forth above, the NRC staff concludes that the proposed alternative provides an acceptable level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1) and is in compliance with the requirements of Section XI of the ASME Code. Therefore, the NRC authorizes the alternative described in Relief Request No. 17, Revision 0, for the remainder of the St. Lucie Plant, Unit No. 1, fourth 10-year ISI program interval, which began on February 11, 2008, and ends February 10, 2018.

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

Principal Contributor: On Yee

Date: January 4, 2018

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