

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

March 23, 2012

Mr. Mano Nazar Executive Vice President, Nuclear and Chief Nuclear Officer Florida Power and Light Company P.O. Box 14000 Juno Beach, Florida 33408-0420

SUBJECT: ST. LUCIE UNIT NO. 2 – RELIEF FROM THE REQUIREMENTS OF THE ASME CODE, RELIEF REQUEST NO. 12 (TAC NO. ME6745)

Dear Mr. Nazar:

By letter dated July 13, 2011, Florida Power and Light Company (the licensee) submitted Relief Request (RR)-12, requesting the use of an alternative to certain requirements of the American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code* (ASME Code) at the St. Lucie, Unit No. 2. Specifically, the licensee requested the use of procedures, personnel, and equipment qualified to the requirements of ASME Code, Section XI, Appendix VIII, Supplements 4 and 6, as an alternative for ultrasonic examination of the ASME Code Class 1 reactor pressure vessel (RPV) upper shell-to-flange weld.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the subject request and has concluded, as set forth in the enclosed safety evaluation, that the proposed alternative described in RR-12 provides an acceptable level of quality and safety for the RPV upper shell-to-flange weld inservice inspection (ISI). Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in Title 10 of the *Code of Federal Regulations*, Section 50.55a(a)(3)(i), and is in compliance with the requirements of Section XI of the ASME Code. Therefore, the NRC authorizes the alternative described in RR-12 for the remainder of the St. Lucie, Unit No. 2 third 10-year ISI program interval, which began on August 8, 2003, and ends on August 7, 2013.

All other ASME Code requirements for which relief was not specifically requested and approved in the subject request remain applicable.

M. Nazar

If you have any questions regarding this matter, please contact Project Manager, Tracy Orf at (301) 415-2788 or by e-mail at <u>Tracy.Orf@nrc.gov</u>.

Sincerely,

/RA by Eva Brown for/

Douglas A. Broaddus, Chief Plant Licensing Branch II-2 Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation

Docket No. 50-389

Enclosure: Safety Evaluation

cc w/enclosure: Distribution via Listserv



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ON REQUEST FOR RELIEF

THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

ST. LUCIE NUCLEAR POWER PLANT, UNIT NO. 2

FLORIDA POWER AND LIGHT COMPANY, ET AL.

DOCKET NO. 50-389

1.0 INTRODUCTION

By letter dated July 13, 2011 (Agencywide Documents and Access Management System Accession No. ML11202A009), Florida Power & Light Company (the licensee) submitted Relief Request (RR)-12, 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 at St. Lucie, Unit No. 2.

Specifically, pursuant to Title 10 of the *Code Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i), the licensee requested the use of procedures, personnel, and equipment qualified to the requirements of ASME Code, Section XI, Appendix VIII, Supplements 4 and 6 of the 1998 Edition with Addenda through 2000, as administered by the Electric Power Research Institute (EPRI)'s performance demonstration initiatives (PDI), as an alternative to the ASME Code, Section XI, Appendix I requirements for UT examination for Class 1 RPV upper shell-to-flange weld.

2.0 REGULATORY EVALUATION

Title 10 CFR, Part 50, Section 50.55a(g), "Inservice Inspection [ISI] Requirements" requires, in part, that ISI of ASME Class 1, 2, and 3 components must meet the inspection examinations requirements set forth in the applicable editions and addenda of the ASME Code, except where specific relief has been granted in accordance with to 10 CFR 50.55a(g)(6)(i) or alternatives have been authorized in accordance with to 10 CFR 50.55a(a)(3) by the Nuclear Regulatory Commission (NRC).

Pursuant to 10 CFR 50.55a(a)(3), alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if: (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 regulations also require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

The ASME Code of record for the St. Lucie Third 10-Year ISI Interval Program is the 1998 Edition through the 2000 Addenda of Section XI of the ASME Code.

The NRC's findings with respect to authorizing the proposed alternative to the ASME Code are given below:

3.0 TECHNICAL EVALUATION

3.1 The Licensee's Basis for the Proposed Alternative

ASME Code Class 1 RPV Shell-to-Flange Weld (Weld Number 101-102) is affected by the licensee's proposed alternative.

ASME Code, Section XI, Category B-A, Item B1.30, Pressure Retaining Welds in RPV specifies that a volumetric examination must be performed once per each 10-year interval. The 1998 Edition, 2000 Addenda of ASME Code, Section XI, Subsection IWA-2232, requires ultrasonic (UT) examination of the RPV shell-to-flange weld to be conducted in accordance with ASME Code, Section V, Article 4, as supplemented by ASME Code, Section XI, Appendix I, Table I-2000-1.

As an alternative to the requirements specified in ASME Code, Section XI, Appendix I, Article 1-2110(b), the licensee proposes to use procedures, personnel, and equipment qualified to the requirements of ASME Code, Section XI, Appendix VIII, Supplements 4 and 6 of the 1998 Edition, with Addenda through 2000, as administered by the PDI program to conduct the RPV upper shell-to-flange weld examination. The licensee stated that the examinations from the inside surface will be implemented to achieve the maximum coverage possible utilizing procedures and personnel qualified by the PDI program. The PDI program addresses qualification requirements for each of the supplements that are defined in ASME Code, Section XI, Appendix VIII. The applicable vendor procedure has been qualified in accordance with PDI's implementation of ASME Code, Section XI, Appendix VIII, Supplements 4 and 6.

The licensee stated that the ASME Code, Section XI, Appendix I, Article 1-2110(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 (DAC) curve derived from the UT 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 DAC 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.

The licensee stated that it is performing volumetric examinations of all RPV welds during the upcoming 10-year ISI in accordance with the 10 CFR 50.55a requirements. The ASME Code requires that UT examination of RPV welds, excluding the reactor vessel upper shell-to-flange weld, shall be with techniques that have been demonstrated in accordance with ASME Code, Section XI, Appendix VIII.

The licensee stated that the listed weld (Weld Number 101-102) is the only circumferential shell weld in the RPV that is not examined with ASME Code, Section XI, Appendix VIII techniques, as mandated by 10 CFR 50.55a. Section 50.55a of 10 CFR mandates the use of ASME Code, Section XI, Appendix VIII, Supplements 4 and 6 for the conduct of all other reactor vessel weld examinations. The licensee stated that use of the ASME Code, Section XI, Appendix VIII, qualified techniques enhances the quality of the examination. The 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.

EPRI Report NP-6273, "Accuracy of Ultrasonic Flaw Sizing Techniques for Reactor 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 Code, 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.

The licensee also stated that examination from the inside surface provides 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.

Further, the licensee stated that procedures, equipment, and personnel qualified via the ASME Code, Section XI, 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 in accordance with the ASME Code, Section V, Article 4, RPV weld examinations.

The licensee concluded that performing the UT examination with the ASME Code, Section XI, Appendix VIII qualified personnel and procedures from the inside surface will provide an acceptable level of quality and safety.

The licensee further stated that for the RPV upper shell-to-flange weld examinations using ASME Code, 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.

3.2 NRC Staff's Evaluation

The 1998 Edition through the 2000 Addenda of the ASME Code, Section XI, IWA-2232 states, Ultrasonic examination shall be conducted in accordance with Appendix I. Article I-2110(b) of Appendix I requires, in part, ultrasonic examination of RPV shell-to flange to be conducted in accordance with Article 4 of Section V of the ASME Code, supplemented by Table I-2000-1 requirements. 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. Title 10 CFR, Section 50.55a(b)(2)(xv) limits the use of the 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 of 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 in accordance 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, Supplements 4 and 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 personnel and procedures and personnel at a for single side examination in accordance with ASME Code, Section XI, Appendix VIII, Supplements 4 and 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 NRC staff finds that the procedures, equipment, and personnel qualified to ASME Code, Section XI, Appendix VIII and scanning requirements of 10 CFR 50.55a(b)(2)(xv)(G) 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 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(a)(3)(i), and is in compliance with the requirements of Section XI of the ASME Code. Therefore, the NRC authorizes the alternative described in RR-12 for the remainder of the St. Lucie, Unit No. 2 third 10-year ISI program interval, which began on August 8, 2003, and ends on August 7, 2013.

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.

Principle Contributor: Thomas McLellan

Date: March 23, 2012

M. Nazar

If you have any questions regarding this matter, please contact Project Manager, Tracy Orf at (301) 415-2788 or by e-mail at <u>Tracy.Orf@nrc.gov</u>.

Sincerely,

/RA by Eva Brown for/

Douglas A. Broaddus, Chief Plant Licensing Branch II-2 Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation

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