



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

April 25, 2018

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

SUBJECT: DUANE ARNOLD ENERGY CENTER; POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2; SEABROOK STATION, UNIT NO. 1; ST. LUCIE PLANT, UNIT NOS. 1 AND 2; TURKEY POINT NUCLEAR GENERATING UNIT NOS. 3 AND 4 – PROPOSED ALTERNATIVE TO USE ENCODED PHASED ARRAY ULTRASONIC EXAMINATION TECHNIQUES (EPID L-2017-LLR-0081)

Dear Mr. Nazar:

By application dated July 24, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17208A058), NextEra Energy Resources/Florida Power & Light Company (together considered the "licensee") submitted a request in accordance with paragraph 50.55a(z)(1) of Title 10 of the *Code of Federal Regulations* (10 CFR) for a proposed alternative to the requirements of 10 CFR 50.55a, "Codes and standards," for Duane Arnold Energy Center; Point Beach Nuclear Plant, Units 1 and 2; Seabrook Station, Unit No. 1; St. Lucie Plant, Unit Nos. 1 and 2; and Turkey Point Nuclear Generating Unit Nos. 3 and 4.

The proposed alternative would allow the licensee to use encoded phased array ultrasonic testing in lieu of radiographic testing, required by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (ASME Code), for ferritic piping butt welds during repair and replacement activities at each of the requested facilities. Specifically, pursuant to 10 CFR 50.55a(z)(1), the licensee requested to use the alternative on the basis that it will provide an acceptable level of quality and safety.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Therefore, the NRC staff authorizes the use of the proposed alternative at the requested facilities for the duration of the applicable 10-year inservice inspection interval as specified in the licensee's application dated July 24, 2017.

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

M. Nazar

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If you have any questions regarding this issue, please contact the project manager, Justin Poole at (301) 415-2048 or via e-mail at Justin.Poole@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "James G. Danna". The signature is fluid and cursive, with the first name "James" and last name "Danna" clearly distinguishable.

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

Docket Nos. 50-250, 50-251, 50-266, 50-301
50-331, 50-335, 50-389, and 50-443

Enclosure:
Safety Evaluation

cc: Listserv



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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
PROPOSED ALTERNATIVE FOR THE USE OF ENCODED PHASED ARRAY
ULTRASONIC EXAMINATION TECHNIQUES IN LIEU OF RADIOGRAPHY
NEXTERA ENERGY RESOURCES/FLORIDA POWER & LIGHT COMPANY, ET AL.
DUANE ARNOLD ENERGY CENTER
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2
SEABROOK STATION, UNIT NO. 1
ST. LUCIE PLANT, UNIT NOS. 1 AND 2
TURKEY POINT NUCLEAR GENERATING UNIT NOS. 3 AND 4
DOCKET NOS. 50-250, 50-251, 50-266, 50-301, 50-331, 50-335, 50-389, AND 50-443

1.0 INTRODUCTION

By application dated July 24, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17208A058), NextEra Energy Resources/Florida Power & Light Company (together considered the "licensee") submitted a request in accordance with paragraph 50.55a(z)(1) of Title 10 of the *Code of Federal Regulations* (10 CFR) for a proposed alternative to the requirements of 10 CFR 50.55a, "Codes and standards," for Duane Arnold Energy Center; Point Beach Nuclear Plant, Units 1 and 2; Seabrook Station, Unit No. 1; St. Lucie Plant, Unit Nos. 1 and 2; and Turkey Point Nuclear Generating Unit Nos. 3 and 4.

The proposed alternative would allow the licensee to use encoded phased array ultrasonic testing (PA-UT) in lieu of radiographic testing (RT), required by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (ASME Code), for ferritic piping butt welds during repair and replacement activities at each of the requested facilities. Specifically, pursuant to 10 CFR 50.55a(z)(1), the licensee requested to use the alternative on the basis that it will provide an acceptable level of quality and safety.

2.0 REGULATORY EVALUATION

The regulations in 10 CFR 50.55a(g)(4), "Inservice inspection standards requirement for operating plants," state, in part, that ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in Section XI of the applicable editions and

addenda of the ASME Code to the extent practical within the limitations of design, geometry, and materials of construction of the components.

Additionally, the regulation in 10 CFR 50.55a(b)(2)(xx)(B), "System leakage tests: Second provision," requires, in part, that the nondestructive examination provision in paragraph IWA-4540(a)(2) of the 2002 Addenda of the ASME Code, Section XI, must be applied when performing system leakage tests after repair and replacement activities performed by welding or brazing on a pressure retaining boundary.

The regulations in 10 CFR 50.55a(z), "Alternatives to codes and standards requirements," state, in part, that alternatives to the requirements in paragraphs (b) through (h) of 10 CFR 50.55a may be authorized by the NRC if the licensee demonstrates that: (1) the proposed alternative provides an acceptable level of quality and safety, or (2) compliance with the specified requirements 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 the licensee to request and the Commission to authorize the alternative requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1 Licensee's Proposed Alternative

ASME Code Components Affected

For each requested facility, the proposed alternative is for ferritic piping butt welds that require radiography during repair and replacement activities per the ASME Code, Section XI.

ASME Code Requirement

The licensee has requested an alternative to the requirements in paragraphs IWA-4221 and IWA-4540(a)(2) of the ASME Code, Section XI. Subarticle IWA-4200 of the ASME Code, Section XI, covers repair and replacement activities, and paragraph IWA-4221 requires that when the licensee replaces an existing item, the replacement shall meet the requirements of the construction code to which the original item was constructed.

As stated previously, the regulation in 10 CFR 50.55a(b)(2)(xx)(B) requires that the nondestructive examination provision in paragraph IWA-4540(a)(2) of the 2002 Addenda of the ASME Code, Section XI, must be applied when performing system leakage tests after repair and replacement activities performed by welding or brazing on a pressure retaining boundary. Paragraph IWA-4540(a)(2) of the 2002 Addenda of the ASME Code, Section XI, requires that the nondestructive examination method and acceptance criteria of the 1992 or later editions of the ASME Code, Section III, be met prior to returning the component to service in order to perform a system leakage test in lieu of a system hydrostatic test.

The examination requirements for ASME Section III, circumferential butt welds are contained in the ASME Code, Section III, Subarticle NB-5200, NC-5200 and ND-5200. The acceptance standards for radiographic examination are specified in Subarticle NB-5300, NC-5300, and ND-5300.

Licensee’s Proposed Alternative and Basis for Use

The licensee is proposing the use of encoded PA-UT in lieu of the ASME Code-required RT examinations for ferritic piping repair/replacement welds. The proposed alternative qualification program is nearly identical to ASME Code Case N-831 “Ultrasonic Examination in Lieu of Radiography for Welds in Ferritic Pipe,” with some small changes in wording for clarification.

The encoded PA-UT procedures, equipment, and personnel will be qualified using performance demonstration testing. The flaw acceptance standards for the PA-UT will consider all flaws to be planar and are evaluated against the preservice acceptance standards of ASME Code, Section XI, IWB-3400, IWC-3400, or IWD-3400 for ASME Code Class 1, 2, or 3 welds, respectively.

The licensee states that the basis for the proposed alternative is that encoded PA-UT is adequate compared to RT for detecting and sizing planar flaws. The basis for the proposed alternative was developed from numerous codes, code cases, associated industry experience, articles, and the results of RT and encoded PA-UT examinations. The examination procedure and personnel performing examinations will be qualified using representative piping conditions and flaws that demonstrate the ability to detect and size flaws.

The licensee stated that all remaining repair/replacement activities will satisfy the applicable Owner’s and Construction Code requirements including the System Leakage Test requirements as modified by 10 CFR 50.55a(b)(2)(xx)(B).

Applicable Code Edition and Addenda

The licensee identified the applicable ASME Code editions and addenda for each plant as shown in the table below. In addition, the table shows the applicable 10-year inservice inspection (ISI) interval, including the start and end dates.

Table 1

Plant	Interval	Edition	Start	End
Duane Arnold Energy Center	Fifth	2007 Edition through 2008 Addenda	November 1, 2016	October 31, 2026
Point Beach Nuclear Plant Units 1 and 2	Fifth	2007 Edition through 2008 Addenda	August 1, 2012	July 31, 2022
St. Lucie Nuclear Plant Unit 1	Fifth	2007 Edition through 2008 Addenda	February 11, 2018	February 10, 2028
St. Lucie Nuclear Plant Unit 2	Fourth	2007 Edition through 2008 Addenda	January 20, 2013	January 19, 2023
Seabrook Station	Third	2004 Edition No Addenda	August 19, 2010	August 18, 2020
Turkey Point Nuclear Plant Unit 3	Fifth	2007 Edition through 2008 Addenda	February 22, 2014	February 21, 2024
Turkey Point Nuclear Plant Unit 4	Fifth	2007 Edition through 2008 Addenda	April 15, 2014	April 14, 2024

Duration of Proposed Alternative

The licensee is requesting that this proposed alternative be applied for the duration of the 10-year ISI intervals for each of the facilities as described in Table 1.

3.2 NRC Staff's Evaluation

The licensee is proposing the use of encoded PA-UT in lieu of the ASME Code-required RT for ferritic piping repair and replacement welds for the duration of each facility's 10-year ISI intervals, as shown in the Table 1 above. Ultrasonic testing (UT) and RT are volumetric inspection techniques that are commonly used to inspect welds in nuclear power plants and in other industries. Ultrasonic examinations are not equivalent to radiographic examinations as they use different physical mechanisms to detect and characterize discontinuities. These differences in physical mechanisms result in several key differences in sensitivity and discrimination capability.

The NRC staff has assessed the effectiveness of the use of ultrasound in lieu of radiography, including literature reviews, detailed evaluations of previous relief requests and proposed alternatives, and confirmatory experimental work to validate the findings. An assessment of the use of UT in lieu of RT by the NRC is described in NUREG/CR-7204, "Applying Ultrasonic Testing In Lieu of Radiography for Volumetric Examination of Carbon Steel Piping," dated September 2015 (ADAMS Accession No. ML15253A674). This report included an evaluation on the use of UT in lieu of RT for welded pipes and plates with thicknesses ranging from 0.844 inches to 2.2 inches.

NUREG/CR-7204 concludes, in part:

Considering overall detections/non-detections for the piping specimens, as well as the Navy plates, it appears that PA-UT, based on the techniques applied in this study, provides an equally effective examination for identifying the presence of fabrication flaws in carbon steel welds. The PA-UT parameters applied were shown to be more effective for planar flaws, but slightly less effective for small volumetric flaws, than RT.

Based on the assessment described in NUREG/CR-7204, the NRC staff finds that there is a sufficient technical basis for the use of UT in lieu of RT for ferritic steel welds. Given that UT in lieu of RT can be effective, the NRC staff considered whether the proposed alternative applies UT in a way that provides reasonable assurance of finding structurally-significant flaws.

Important aspects of this proposed alternative include:

- The examination volume shall include 100 percent of the weld volume and the weld- to-base-metal interface.
- The electronic data files for the PA-UT examinations will be stored as archival-quality records. In addition, hard copy prints of the data will also be included as part of the PA-UT examination records to allow viewing without the use of hardware or software.
- Ultrasonic examination procedures shall be qualified by using either a blind or a non-blind performance demonstration using a minimum of 30 flaws covering a range of sizes, positions, orientations, and types of fabrication flaws. The demonstration set shall

include specimens to represent the minimum and maximum diameter and thickness covered by the procedure.

- The flaw through-wall heights for the performance demonstration testing shall be based on the applicable acceptance standards for volumetric examination in accordance with Subarticles IWB-3400, IWC-3400, or IWD-3400 of the ASME Code, Section XI. At least 30 percent of the flaws shall be classified as acceptable planar flaws, with the smallest flaws being at least 50 percent of the maximum allowable size based on the applicable aspect ratio for the flaw.
- Ultrasonic examination personnel shall demonstrate its capability to detect and size flaws by performance demonstration using the qualified procedure. The demonstration specimen set shall contain at least 10 flaws covering a range of sizes, positions, orientations, and types of fabrication flaws.
- All flaws detected using angle-beam ultrasonic inspections will be treated as planar flaws and will be evaluated against the preservice acceptance standards in Subarticles IWB-3400, IWC-3400, or IWD-3400 of the ASME BVP Code, Section XI, for ASME Code Class 1, 2, or 3 welds, respectively.

Based on the inspection and qualification requirements described in the proposed alternative, and the results of NUREG/CR-7204, the NRC staff has reasonable assurance that the use of encoded PA-UT, qualified as proposed by the licensee, for ferritic piping repair and replacement welds will provide an adequate level of quality and safety.

4.0 CONCLUSION

As set forth above, the NRC staff determined that the licensee's proposed alternative to use encoded PA-UT in lieu of RT 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). Therefore, the NRC staff authorizes the use of the proposed alternative at the requested facilities for the remainder of the 10-year ISI intervals as described in Table 1 of this safety evaluation.

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

Principal Contributor: Stephen Cumblidge, NRR/DMLR/MPHB

Date: April 25, 2018

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LPL2-2 R/F	RidsNrrPMSeabrook Resource
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ADAMS Accession No.: ML18106B121

**by memorandum*

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DATE	04/20/18	04/18/18	03/08/18	04/25/18

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