Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

December 12, 2017
NOC-AE-17003532
10 CFR 50.55a

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

South Texas Project Unit 1 and 2
Docket No. STN 50-498, STN 50-499
Proposed Alternative for the use of Encoded Phased Array Ultrasonic Examination Techniques in Lieu of Radiography (Relief Request RR-ENG-3-22)

In accordance with the provisions of 10 CFR 50.55a(z)(1), STP Nuclear Operating Company (STPNOC) requests Nuclear Regulatory Commission (NRC) approval of a proposed alternative to radiography performed on repair replacement welds in ferritic piping. American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel code requires that certain ferritic pipe welds be examined using radiographic examination techniques to satisfy nondestructive examination requirements. STPNOC requests approval to use encoded Phased Array Ultrasonic Examination Techniques (PAUT) as an alternative to radiographic examination. STPNOC considers the proposed alternative would provide an acceptable level of quality and safety. The supporting basis for this request is contained in the enclosure to this letter.

STPNOC requests NRC review and approval of this alternative request by August 31, 2018, to support the use of the proposed alternative, as required by 10 CFR 50.55a(z)(1).

There are no commitments in this letter.

If there are any questions, please contact Craig Younger at 361-972-8186.

Michael Page
General Manager
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rjg

Enclosure:
Proposed Alternative for the Use of Encoded Phased Array Ultrasonic Examination Techniques in Lieu of Radiography in Accordance with 10 CFR 50.55a(z)(1) (Relief Request RR-ENG-3-22)

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Enclosure 1

Proposed Alternative for the Use of Encoded Phased Array Ultrasonic Examination Techniques in Lieu of Radiography in Accordance with 10 CFR 50.55a(z)(1) (Relief Request RR-ENG-3-22)

SOUTH TEXAS PROJECT UNIT 1 and Unit 2
Proposed Alternative for the Use of Encoded Phased Array Ultrasonic Examination Techniques in Lieu of Radiography in Accordance with 10 CFR 50.55a(z)(1) (Relief Request RR-ENG-3-22)

A. ASME Code Component(s) Affected

All American Society of Mechanical Engineers (ASME), Boiler & Pressure Vessel (B&PV) Code, Section XI, ferritic piping welds requiring radiography during repair/replacement activities.

B. Applicable ASME Code Edition and Addenda

Table 1 - Applicable ASME Code Edition and Addenda

Units	Interval	Edition	Start	End
STP Unit 1	3	2004 Edition	September 25, 2010	September 24, 2020
STP Unit 2	3	2004 Edition	October 19, 2010	October 18, 2020

C. Applicable ASME Code Requirement

The 2004 Edition of ASME Section XI (Reference 1), paragraph IWA-4221 requires that items used for repair/replacement activities meet the applicable Owner's Requirements and Construction Code requirements when performing repair/replacement activities. IWA-4520 requires that welded joints made for installation of items be examined in accordance with the Construction Code identified in the Repair/Replacement Plan.

D. Reason for Relief from Code Requirements

Replacement of piping is periodically performed in support of the Flow Accelerated Corrosion program as well as other repair and replacement activities. Encoded PAUT is equivalent or superior to the code-required RT examination for ASME ferritic piping repair/replacement welds for detecting and sizing critical (planar) flaws, such as cracks and lack of fusion. PAUT provides sizing capabilities for both depth and length dimensions of the flaw which are required to apply the acceptance criteria of the applicable code case; whereas, RT does not provide depth sizing capabilities.

The use of encoded Phased Array Ultrasonic Examination Techniques (PAUT) in lieu of radiography (RT) to perform the required examinations of the replaced welds reduces both safety and radiological risk to plant workers by eliminating the threat of inadvertent radiation exposures and unintended entries into areas posted for radiography use. In addition, the hazards associated with the transport and control of the radioactive source(s) would be eliminated as well. PAUT also minimizes the impact on other outage activities normally involved with performing RT such as limited access to work locations.

This proposed alternative is requested to support anticipated piping repair and replacement activities starting in the fall 2018 outage season. The duration of the proposed alternative request is for the remainder of the inservice inspection intervals for STP Unit 1 and STP Unit 2.

E. Proposed Alternative and Basis for Use:

The use of the encoded PAUT examination technique in accordance with ASME Code Case N-831, Ultrasonic Examination in Lieu of Radiography for Welds in Ferritic Pipe (Reference 2) is proposed in lieu of the code required RT examination for ASME ferritic piping repair/replacement welds. Similar techniques are being used throughout the nuclear industry for examination of dissimilar metal welds, overlaid welds, and other applications including B31.1 piping replacements. This

proposed alternative request includes requirements that provide an acceptable level of quality and safety that satisfies the requirements of 10 CFR 50.55a(z)(1). The examinations will be performed using procedures, equipment, and qualified personnel as defined in ASME approved Code Case N-831.

Basis for Use

The overall basis for this proposed alternative is that encoded PAUT is equivalent or superior to RT for detecting and sizing critical (planar) flaws. In this regard, the basis for the proposed alternative was developed from numerous codes, code cases, associated industry experience, articles, and the results of RT and encoded PAUT examinations. The examination procedure and personnel performing examinations are qualified using representative piping conditions and flaws that demonstrate the ability to detect and size flaws that are both acceptable and unacceptable to the defined acceptance standards. The demonstrated ability of the examination procedure and personnel to appropriately detect and size flaws provides an acceptable level of quality and safety alternative as allowed by 10 CFR 50.55a(z)(1).

Technical Basis

Pacific Northwest National Laboratory (PNNL) performed confirmatory research to assess the capability and effectiveness of using ultrasonic examinations in lieu of radiography for detecting welding fabrication flaws in ferritic piping welds. The results of this work were published in NUREG/CR-7204 (Reference 3), which provides a technical evaluation of the capabilities of phased-array ultrasonic testing to supplant traditional radiographic testing for detection and characterization of welding fabrication flaws in ferritic welds. Five different types of fabrication conditions have been evaluated, including planar (LOF-lack of fusion, LOP-lack of penetration, and cracks) and volumetric (POR-porosity and SLG-slag) flaws. Based on the techniques applied in this PNNL study, PAUT provides an equally effective examination for identifying the presence of fabrication flaws in ferritic welds.

An important capability for Ultrasonic Testing (UT), as opposed to RT, is an ability to identify through-wall depth and volumetric location information for detected flaws. This can be a significant advantage when one considers that UT can assess and discriminate the presence of over-laying, or stacked, flaws located through the thickness of a weld.

During this study by PNNL, it was observed that UT does not always provide a detectable response when interrogating flaws from both sides (opposing propagation directions). Therefore, single-sided examinations may not detect all potentially significant flaws, depending on flaw location and orientation. ASME Code Case N-831 requires the welds to be conditioned such that transducers properly couple with the scanning surface with no more than a 1/32 in. (0.8 mm) gap between the search unit and the scanning surface. This allows UT scans to be performed over the weld and increases the probability of detecting flaws throughout the weld volume by enabling scanning to be accomplished from opposing parallel and perpendicular directions to the weld, as well as allowing zero-degree data to be collected for assisting flaw characterization. Weld crown removal will result in enhanced scan area coverage and optimization of PAUT flaw responses using the first legs of sound, thus improving overall flaw detection and characterization.

PAUT tends to conservatively size porosity and LOF. Because volumetric flaws are assessed based on length, or diameter, as applicable, this could mislead evaluations of detected POR by making these flaws appear larger than they are in reality, thus causing fabrication acceptance criteria (such as found in ASME Section III) to be falsely exceeded. In addition, this study by PNNL indicates that PAUT tends to undersize planar flaws such as cracks and LOP in opposition to the above volumetric

flaws. While the cumulative sizing error for all fabrication flaws evaluated in this PNNL study did not exceed the length-sizing values required for ASME Code, Section XI UT performance demonstration (Appendix VIII), this criterion is typically meant for service-induced cracking, so this level of accuracy is not as significant to fabrication flaws.

While radiography is effective at discerning between different flaw types, it is less capable than PAUT at detecting planar flaws such as cracks and lack-of-fusion defects. ASME Section XI, IWB-3400, IWC-3400, and IWD-3400 allow larger flaws than Section III NB-5330, NC-5330, and ND-5300, however, the use of ASME Section XI acceptance standards has proven effective for piping welds for in-service inspections. STPNOC considers the use of ASME Section XI acceptance standards as required by Code Case N-831 is appropriate for repair/replacement activities as opposed to new plant construction. Based on the examination and qualification requirements described in Code Case N-831 and the findings of NUREG/CR-7204, there is reasonable assurance that the encoded PAUT will provide an adequate level of quality and safety.

F. Duration of Proposed Alternative

This alternative request will be applied for the remainder of the current inservice inspection intervals for STP Unit 1 and STP Unit 2.

G. Precedents

Relief from this examination requirement to apply the proposed alternative at the South Texas Project Unit 1 and Unit 2 based on ASME Code Case N-831 was previously approved by the NRC for the following other nuclear sites (with ADAMS Accession No. references):

- Palo Verde Nuclear Generating Station Relief Request 48, dated August 1, 2012 (ML12229A046). NRC approval dated April 12, 2013 (ML13091A177).
- Millstone Power Station Unit 2 Alternative Request RR-04-16, dated August 1, 2013 (ML13220A019). NRC approval dated April 4, 2014 (ML14091A973).
- Millstone Power Station Unit 2 Alternative Request RR-04-21 and IR-3-25, dated October 6, 2014 (ML14283A128). NRC approval dated September 21, 2015 (ML15257A005).
- Millstone Power Station Unit 2 Alternative Request RR-04-023 and Unit 3 Alternative Request IR-3-28, dated April 11, 2016 (ML16106A105). NRC approval dated January 23, 2017 (ML16363A089).
- Exelon Generation Company, LLC, "Proposed Alternative for the Use of Encoded Phased Array Ultrasonic Examination Techniques In Lieu of Radiography," dated November 2, 2016 and amended by letter dated March 13, 2017 (ML16307A253 and ML17072A385 respectively). NRC approval dated June 5, 2017 (ML17150A091).

H. References

1. ASME Sections III and XI, 2004 Edition, No Addenda.
2. ASME Section XI, Code Case N-831, "Ultrasonic Examination in Lieu of Radiography for Welds in Ferritic Pipe Section XI, Division 1," dated October 20, 2016.
3. US NRC, NUREG/CR-7204, "Applying Ultrasonic Testing in Lieu of Radiography for Volumetric Examination of Carbon Steel Piping", published September 2015 (ML15253A674).