



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

July 24, 2018

Mr. G. T. Powell
Interim President and CEO/CNO
STP Nuclear Operating Company
South Texas Project
P.O. Box 289
Wadsworth, TX 77483

**SUBJECT: SOUTH TEXAS PROJECT, UNITS 1 AND 2 – RELIEF REQUEST RR-ENG-3-22
FOR THE USE OF ENCODED PHASED ARRAY ULTRASONIC EXAMINATION
TECHNIQUES IN LIEU OF RADIOGRAPHY (EPID L-2017-LLR-0154)**

Dear Mr. Powell:

By letter dated December 12, 2017, STP Nuclear Operating Company (STPNOC, the licensee) requested relief from the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, to use an alternative to the required radiographic testing for South Texas Project (STP), Units 1 and 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 50.55a(z)(1), the licensee requested to use Phased Array Ultrasonic Examination Testing instead of radiographic examinations for repaired and replaced components on the basis that the proposed alternative provides 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 STPNOC has demonstrated that the proposed alternative to use ultrasonic testing in lieu of radiographic testing by using encoded phased array ultrasonic examinations in accordance with ASME Code Case N-831, "Ultrasonic Examination in Lieu of Radiography for Welds in Ferritic Pipe Section XI, Division 1," provides reasonable assurance of structural integrity and leak tightness of Class 1 and 2 ferritic piping welds. Thus, ultrasonic testing using the procedure described in the submittals of the subject welds, provides an adequate 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 Relief Request RR-ENG-3-22 at STP, Units 1 and 2, for the remainder of the third 10-year inservice inspection interval, which ends on September 24, 2020, for Unit 1 and October 18, 2020, for Unit 2.

All other requirements of the ASME Code, Section XI, for which relief has not been specifically requested remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

If you have any questions, please contact the Project Manager, Lisa Regner, at 301-415-1906 or via e-mail at Lisa.Regner@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "R. Pascarelli".

Robert J. Pascarelli, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-498 and 50-499

Enclosure:
Safety Evaluation

cc: Listserv



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NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST RR-ENG-3-22 REGARDING

PROPOSED ALTERNATIVE FOR THE USE OF ENCODED PHASED ARRAY ULTRASONIC

EXAMINATION TECHNIQUES IN LIEU OF RADIOGRAPHY

STP NUCLEAR OPERATING COMPANY

SOUTH TEXAS PROJECT, UNITS 1 AND 2

DOCKET NOS 50.-498 and 50-499

1.0 INTRODUCTION

By letter dated December 12, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17346B279), STP Nuclear Operating Company (STPNOC or the licensee) requested relief from the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, to use an alternative to the required radiographic testing for South Texas Project (STP), Units 1 and 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 50.55a(z)(1), the licensee requested to use a Phased Array Ultrasonic Testing (PAUT) instead of radiographic testing (RT) for repaired and replaced components on the basis that the proposed alternative provides an acceptable level of quality and safety.

2.0 REGULATORY EVALUATION

Adherence to Section XI of the ASME Code is mandated by 10 CFR 50.55a(g)(4), "Inservice inspection standards requirements for operating plants," which states, in part, that ASME Code Class 1, 2, and 3 components will meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in Section XI of the ASME Code.

Section 50.55a(z) of 10 CFR, "Alternatives to codes and standards," 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 [this authorization has been delegated to the

Enclosure

management of the Division of Operating Reactor Licensing].... A proposed alternative must be submitted and authorized prior to implementation. The applicant or licensee must demonstrate that:

(1) *Acceptable level of quality and safety.* The proposed alternative would provide an acceptable level of quality and safety; or

(2) *Hardship without a compensating increase in quality and safety.* 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

Relief Request RR-ENG-3-22, "Proposed Alternative for the Use of Encoded Phased Array Ultrasonic Examination Techniques in Lieu of Radiography," was submitted in accordance with 10 CFR 50.55a(a)(z)(1), which covers requests for alternatives on the basis that the proposed alternative would provide an acceptable level of quality and safety.

The licensee has requested relief from the requirements of ASME Code Section XI, paragraphs IWA-4221 and IWA-4520. ASME Code Section XI, Section IWA-4200, 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. IWA-4520 requires that welded joints made for installation of items be examined in accordance with the Construction Code identified in the Repair and Replacement Plan.

Based on the above, and subject to the following technical evaluation, the U.S. Nuclear Regulatory Commission (NRC) staff finds that regulatory authority exists for the licensee to request the use of an alternative and the NRC to authorize the proposed alternative.

3.0 TECHNICAL EVALUATION

3.1 Licensee's Proposed Alternative

ASME Code Components Affected

The licensee's request covers ASME Code, Section XI, ferritic piping butt welds requiring radiography during repair or replacement activities at the nuclear power reactors listed in this safety evaluation (SE) Table 1 "ASME Code Section XI Applicable Codes of Record."

ASME Code Requirement

The ASME Code Section XI, paragraph IWA-4221, requires the owner to use the requirements of the Construction Code for repair or replacement activities. The examination requirements for ASME Section III, circumferential butt welds are contained in the ASME Code, Section III, Subarticles NB-5200, NC-5200 and ND-5200. The acceptance standards for RT are specified in Subarticles NB-5300, NC-5300 and ND-5300.

ASME Code of Record

The editions and addenda for each STP unit covered by this request for alternative are listed in SE Table 1 below, along with the dates of the current inservice inspection (ISI) interval for each unit.

Table 1: ASME Code Section XI Applicable Codes of Record

Plant/Unit	Interval	Edition	Start	End
STP, Unit 1	Third	2004	September 25, 2010	September 24, 2020
STP, Unit 2	Third	2004	October 19, 2010	October 18, 2020

Proposed Alternative

The licensee proposes to perform encoded PAUT using demonstrated procedures, equipment and personnel in accordance with the process defined in ASME-approved Code Case N-831, "Ultrasonic Examination in Lieu of Radiography for Welds in Ferritic Pipe, Section XI, Division 1" dated October 20, 2016.

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

Basis for Use

The basis for the licensee's request for alternative is that encoded PAUT is equivalent to or superior for detecting and sizing planar flaws as compared to the required radiographic examination. 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 procedures and personnel performing examinations are qualified via performance demonstration testing 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.

Ultrasonic testing (UT) techniques are being used throughout the nuclear industry for examination of dissimilar metal welds and overlaid welds, as well as other applications, including ASME B31.1 piping replacements.

Duration of Proposed Alternative

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

3.2 NRC Staff Evaluation

The licensee proposed to use encoded PAUT in lieu of RT for repair and replacement activities at STP for the remainder of the current 10-year inspection intervals in accordance with ASME Code Case N-831. Ultrasonic testing, like radiographic testing, is a volumetric inspection technique that is 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 been assessing the effectiveness of the use of UT in lieu of RT since 2009, 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 the NRC's evaluation of the use of UT in lieu of RT for welded pipes and plates with thicknesses ranging from 0.844 inches to 2.2 inches.

In NUREG/CR-7204, the NRC staff stated, in part:

Considering overall detections/non-detections for the piping specimens, as well as the Navy plates, it appears that [PAUT], 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 [PAUT] parameters applied were shown to be more effective for planar flaws, but slightly less effective for small volumetric flaws, than RT.

Based on this research, 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 using ASME Code Case N-831 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 PAUT examinations will be stored as archival-quality records. In addition, hard copy prints of the data will be included as part of the PAUT 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 IWB-3400, IWC-3400 or IWD-3400. 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 a/l (flaw aspect ratio) 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 of ASME Section XI, IWB-3400, IWC-3400, or IWD-3400 for ASME Code Class 1, 2, or 3 welds, respectively.

Based on the inspection and qualification requirements described in the licensee's request for alternative and the evaluation results reported in NUREG/CR-7204, the NRC staff concludes that there is reasonable assurance that the encoded PAUT, applied and qualified as proposed by the licensee, will provide an adequate level of quality and safety.

4.0 CONCLUSION

As set forth above, the NRC staff concludes that the licensee's proposed alternative to use ultrasonic testing in lieu of radiographic testing by using encoded phased array ultrasonic examinations in accordance with ASME Code Case N-831, provides reasonable assurance of structural integrity and leak tightness of Class 1 and 2 ferritic piping welds. Thus, ultrasonic testing using the procedure described in the submittals of the subject welds would provide an adequate 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 Relief Request RR-ENG-3-22, "Proposed Alternative for the Use of Encoded Phased Array Ultrasonic Examination Techniques In Lieu of Radiography," at STP Units 1 and 2 for the remainder of the third 10-year inservice inspection interval, which ends on September 24, 2020, for Unit 1 and October 18, 2020, for Unit 2.

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Principal Contributors: Bart Fu,
Stephen Cumblidge

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DATE	7/16/2018	7/17/2018	5/10/2018	7/24/2018

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