



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

April 20, 2020

Mr. Eric Carr
President and Chief Nuclear Officer
PSEG Nuclear LLC - N09
P.O. Box 236
Hancocks Bridge, NJ 08038

SUBJECT: SALEM NUCLEAR GENERATING STATION, UNIT NOS. 1 AND 2 – ISSUANCE OF ALTERNATIVE REQUEST SC-I4R-192 FOR EXAMINATION OF ASME SECTION XI, STEAM GENERATOR AND PRESSURIZER NOZZLE INSIDE RADIUS SECTIONS (EPID L-2019-LLR-0092)

Dear Mr. Carr:

By letter dated September 10, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19253B644), PSEG Nuclear LLC (the licensee) submitted proposed alternative SC-I4R-192 to the nozzle inner-radius examination requirements of American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code (Code), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," for the fourth inservice inspection (ISI) interval at Salem Generating Station Unit Nos. 1 and 2 (Salem).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(2), the licensee requested to use the proposed alternative on the basis that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The U.S Nuclear Regulatory Commission (NRC) staff determined that the proposed alternative provides reasonable assurance that structural integrity and leaktightness of the subject components will be maintained during the fourth ISI interval at Salem. The NRC staff finds that complying with the nozzle inner-radius examination requirement would result in hardship or unusual difficulty without a compensating increase in quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the staff authorizes the use of Relief Request SC-I4R-192 for the fourth 10-year ISI intervals at Salem. The fourth ISI interval for Salem Unit No. 1, began on May 20, 2011, and is scheduled to end on December 31, 2020. The fourth ISI interval for Salem Unit No. 2, began on November 27, 2013, and is scheduled to end on December 31, 2021.

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.

E. Carr

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If you have any questions, please contact the Salem Project Manager, James Kim, at 301-415-4125 or by e-mail to James.Kim@nrc.gov.

Sincerely,

/RA/

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

Docket Nos. 50-272 and 50-311

Enclosure:
Safety Evaluation

cc: Listserv



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

ALTERNATIVE REQUEST SC-I4R-192

RELIEF FROM ASME CODE, SECTION XI, INSERVICE INSPECTION REQUIREMENTS

FOR NOZZLE INNER-RADIUS EXAMINATIONS

SALEM NUCLEAR GENERATING STATION, UNIT NOS. 1 AND 2

PSEG NUCLEAR LLC

EXELON GENERATION COMPANY, LLC

DOCKET NOS. 50-272 AND 50-311

1.0 INTRODUCTION

By letter dated September 10, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19253B644), PSEG Nuclear LLC (PSEG, the licensee), submitted proposed alternative SC-I4R-192 to the nozzle inner-radius examination requirements of American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code (Code), Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," for the fourth inservice inspection (ISI) interval at Salem Generating Station Unit Nos. 1 and 2 (Salem).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(2), the licensee requested to use the proposed alternative on the basis that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), "Inservice inspection standards requirement for operating plants," 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 the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components.

The regulation in 10 CFR 50.55a(b)(2)(xxi)(A) states, in part, that the provisions of Table IWB 2500-1, Examination Category B–D, Full Penetration Welded Nozzles in Vessels, Items B3.40 and B3.60 (Inspection Program A) and Items B3.120 and B3.140 (Inspection Program B) of the 1998 Edition must be applied when using the 1999 Addenda through the latest edition and addenda incorporated by reference in paragraph (a)(1)(ii) of this section.

The regulation in 10 CFR 50.55a(z)(2) states, in part, that alternatives to the requirements of paragraph (b) through (h) of 10 CFR 50.55a may be used, when authorized by the U.S. Nuclear Regulatory Commission (NRC), if the licensee demonstrates that 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 NRC to authorize the licensee's proposed alternative for Salem. Accordingly, the NRC staff reviewed and evaluated the licensee's request pursuant to 10 CFR 50.55a(z)(2).

3.0 TECHNICAL EVALUATION

3.1 Licensee's Request for Alternative

Components Covered by Proposed Alternative

Proposed alternative SC-I4R-192 covers several ASME Code, Section XI, Examination Category B-D, Item Number B3.120 and B3.140 (Inspection Program B) nozzle inside radius sections. The affected nozzles are described in Table 1.

Table 1: Nozzles Covered in Proposed Alternative

Component	ASME Code, Section XI Item Number
Unit 1 and Unit 2 Steam Generators Hot and Cold Leg Nozzles	B3.140
Unit 1 and Unit 2 Pressurizer Surge Line Nozzles	B3.120
Unit 1 and Unit 2 Pressurizer Safety and Relief Nozzles	B3.120
Unit 1 and Unit 2 Pressurizer Spray Nozzles	B3.120

Applicable Code Edition and Addenda

Both units use the 2004 Edition of the ASME Code, Section XI.

The use of the 1998 Edition of the ASME Code, Section XI, Table IWB-2500-1, Category B-D, is required by 10 CFR 50.55a(b)(2)(xxi)(A).

Applicable Code Requirement

Volumetric examination of the volumes depicted in ASME Code, Section XI, Figures IWB-2500-7(a) through (d), as applicable, once during the inspection interval for all steam generator nozzle inside radius sections and all pressurizer nozzle inside radius sections with acceptance standard IWB-3512 is required by the 1998 Edition, as referenced in 10 CFR 50.55a(b)(2)(xxi)(A).

Proposed Alternative

The licensee proposes to not perform any additional inside radius section examinations on the steam generator and pressurizer nozzles at Salem as currently specified in 10 CFR 50.55a(b)(2)(xxi)(A) during the current fourth ISI intervals.

Basis for Proposed Alternative

The licensee performed a review of the operating experience for steam generator and pressurizer nozzle inside radius sections and did not identify any detected flaw indications or the presence of any degradation mechanism. The operational experience has demonstrated that neither the volumetric nor the visual examinations have indicated any evidence of degradation that justifies personnel exposure to the industrial safety hazard and radiation dose inherent in performing these examinations.

Hardship

The estimated cumulative radiation exposure for the inspections is more than 1,000 millirem for each unit (2,000 millirem total), with the steam generator nozzle visual tests having an approximate dose of 600 millirem per unit and the pressurizer nozzle examinations having an approximate dose of 400 millirem per unit.

Duration of Proposed Alternative

The proposed alternative covers the remainder of the current fourth ISI intervals for Salem, Unit Nos. 1 and 2, which are scheduled to end on December 31, 2020, and December 31, 2021, respectively.

3.2 NRC Staff Evaluation

The NRC staff reviewed the proposed alternative to not perform the inside radius examinations at Salem. The staff evaluated the proposed alternative under 10 CFR 50.55a(z)(2) to determine if there is a hardship associated with the examinations and the associated reduction in the level of quality and safety associated with the proposed alternative.

The staff finds that the 2,000 mrem estimated dose to examination personnel provides a hardship for the examinations, meeting the first criterion in a review under 10 CFR 50.55a(z)(2).

To evaluate the second criterion, the staff evaluated the effects of not performing the inner-radius examinations. The requirements for examinations of inner nozzle radii in several components were developed in the ASME Code in reaction to the discovery of thermal fatigue cracks in the inner-radius section of boiling-water reactor (BWR) feedwater nozzles in the late 1970s. As described in NUREG/CR-7153, "Expanded Materials Degradation Assessment (EMDA), Volume 3: Aging of Reactor Pressure Vessels" (ADAMS Accession No. ML14279A349), and NUREG-0619, Revision 1, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking: Resolution of Generic Technical Activity A-10 (Technical Report)" (ADAMS Accession No. ML031600712), the service-induced flaws that have been observed are cracks at feedwater nozzles associated with mixing of lower-temperature water with hot water in a BWR vessel with rare instances of underclad and shallow cladding cracking appearing in pressurized-water reactor (PWR) nozzles. Feedwater nozzle inner-radius cracking has not been detected since the plants changed operation of the low flow feedwater controller. Significant inspections and repairs were required in the late 1970s and early 1980s to address these problems. The redesign of safe-end/thermal sleeve configurations and feedwater spargers, coupled with changes in operating procedures, have been effective to date. No further occurrences of nozzle fatigue cracking have been reported for PWRs or BWRs.

When the new designs and operating procedures appeared to have mitigated the nozzle inner-radius cracking, the ASME Code, Section XI requirements to inspect steam generator and pressurizer nozzle inner radii were removed in the 1999 Addenda of the ASME Code, Section XI. Since the NRC imposed the condition requiring that these areas be inspected in 2002, no new cracking has been identified in steam generator or pressurizer nozzle inner radii. In addition to operating experience, the staff has reviewed the nozzle inner radii examinations as part of approving alternatives and granting relief requests concerning inspections of the pressurizer and steam generator nozzle inner radii. In the safety evaluations for proposed alternatives, the staff has concluded that the fatigue analysis for a variety of plants shows that there is reasonable assurance that there will not be significant cracking at the steam generator or pressurizer nozzle inner radii before the end of the operating licenses of the nuclear power plants.

The staff finds that the reduction in the level of quality and safety associated with not performing the examinations is acceptable, given the hardship in performing the examinations.

4.0 CONCLUSION

As set forth above, the NRC staff determined that the proposed alternative provides reasonable assurance that structural integrity and leaktightness of the subject components will be maintained during the fourth ISI intervals at Salem. The NRC staff finds that complying with the nozzle inner-radius examination requirement would result in hardship or unusual difficulty without a compensating increase in quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the staff authorizes the use of Relief Request SC-I4R-192 for the fourth 10-year ISI intervals at Salem. The fourth ISI interval for Salem, Unit No. 1, began on May 20, 2011, and is scheduled to end on December 31, 2020. The fourth ISI interval for Salem, Unit No. 2, began on November 27, 2013, and is scheduled to end on December 31, 2021.

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Principal Contributor: S. Cumblidge

Date: April 20, 2020

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