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

July 11, 2019

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

SUBJECT: HOPE CREEK NUCLEAR GENERATING STATION – ISSUANCE OF RELIEF REQUEST NO. HC-I3R-08, REVISION 0, RE: RELIEF FROM THE REQUIREMENTS OF THE ASME CODE (EPID L-2018-LLR-0124)

Dear Mr. Sena:

By letter dated September 24, 2018, as supplemented by letter dated February 22, 2019 (Agencywide Documents Access and Management System Accession Nos. ML18268A116 and ML19053A615, respectively), PSEG Nuclear LLC (the licensee) requested relief from the inservice inspection (ISI) requirements of the American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code, Section XI, for ISIs that apply to ASME Code Class 1 and 2 components at the Hope Creek Generating Station (Hope Creek).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii), the licensee requested relief from the ISI requirements of the specified ASME Code Class 1 and 2 welds on the basis that conformance with the ISI requirements of the ASME Code, Section XI, for the components is impractical.

The U.S Nuclear Regulatory Commission (NRC) staff has reviewed the subject request and concluded that it is impractical for the licensee to fully comply with the ASME Code, Section XI requirements; that the subject ISI examinations performed on the welds during the third 10-year ISI interval provide reasonable assurance of structural integrity and leaktightness; and that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Accordingly, the NRC staff concludes that the licensee has adequately addressed all the regulatory requirements set forth in 10 CFR 50.55a(g)(6)(i). Therefore, the NRC staff grants Relief Request No. HC-I3R-08, Revision 0, for Hope Creek for the third 10-year ISI interval, which commenced on December 13, 2007, and ended on December 12, 2017.

If you have any questions, please contact the Hope Creek 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 No. 50-354

Enclosure:
Safety Evaluation

cc: Listserv

SUBJECT: HOPE CREEK NUCLEAR GENERATING STATION – ISSUANCE OF RELIEF REQUEST NO. HC-I3R-08, REVISION 0, RE: RELIEF FROM THE REQUIREMENTS OF THE ASME CODE (EPID L-2018-LLR-0124) DATED JULY 11, 2019

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UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NO. HC-I3R-08

REGARDING ASME CODE CLASS 1 AND 2 COMPONENTS

PSEG NUCLEAR LLC

HOPE CREEK GENERATING STATION

DOCKET NO. 50-354

1.0 INTRODUCTION

By letter dated September 24, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18268A116), as supplemented by letter dated February 22, 2019 (ADAMS Accession No. ML19053A615), PSEG Nuclear LLC (the licensee) requested relief from the inservice inspection (ISI) requirements of the American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code, Section XI, for ISIs that apply to ASME Code Class 1 and 2 components at the Hope Creek Generating Station (Hope Creek).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii), the licensee requested relief from the ISI requirements of the specified ASME Code Class 1 and 2 welds on the basis that conformance with the ISI requirements of the ASME Code, Section XI, for the components is impractical.

2.0 REGULATORY EVALUATION

Components (including supports) that are classified as ASME Code Class 1, 2, and 3 must meet the requirements in 10 CFR 50.55a(g)(4) throughout the service life of a boiling- or pressurized-water reactor. The exception is the design and access provisions and preservice examination requirements set forth in Section XI of editions and addenda of the ASME Code that become effective subsequent to editions specified in 10 CFR 50.55a(g)(2) and (g)(3), which are incorporated by reference in 10 CFR 50.55a (a)(1)(ii) to the extent practical within the limitations of design, geometry, and materials of construction of the components.

Pursuant to 10 CFR 50.55a(g)(4)(ii), inservice examination of components and system pressure tests conducted during successive 120-month inspection intervals must comply with the requirements of the latest edition and addenda of the ASME Code, incorporated by reference in 10 CFR 50.55a(a), 12 months before the start of the 120-month inspection interval (or the optional ASME Code cases listed in U.S. Nuclear Regulatory Commission (NRC or the Commission) Regulatory Guide (RG) 1.147, “Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1,” when using the ASME Code, Section XI, as incorporated by reference in 10 CFR 50.55a(a)(3)(ii)), subject to the conditions listed in 10 CFR 50.55a(b).

Pursuant to 10 CFR 50.55a(g)(5)(iii), if the licensee has determined that conformance with the ASME Code requirements is impractical for its facility, the licensee must notify the NRC and submit, as specified in 10 CFR 50.4, information to support the determinations. Determinations of impracticality in accordance with 10 CFR 50.55a must be based on the demonstrated limitations experienced when attempting to comply with the ASME Code requirements during the ISI interval for which the request is being submitted. Requests for relief made in accordance with 10 CFR 50.55a must be submitted to the NRC no later than 12 months after the expiration of the initial or subsequent 120-month inspection interval for which relief is sought.

Pursuant to 10 CFR 50.55a(g)(6)(i), the Commission will evaluate determinations under 10 CFR 50.55a(g)(5) that ASME Code requirements are impractical. The Commission may grant such relief and may impose such alternative requirements as it determines are authorized by law and will not endanger life or property or the common defense and security, and are otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

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

The NRC staff has evaluated Relief Request No. HC-I3R-08, Revision 0, in accordance with the regulatory provisions of 10 CFR 50.55a(g)(5)(iii) to determine whether the applicant's relief request proposal may be granted in accordance with the provisions in 10 CFR 50.55a(g)(6)(i). The NRC staff's evaluation focused on the following: (1) whether a technical justification exists to support the determination that compliance with the ASME Code requirement for ISI weld volume or surface area coverage is impractical, (2) that imposition of the Code-required inspections would result in a burden to the licensee, and (3) that the licensee's proposed alternative (accepting the reduced inspection coverage in this case) provides reasonable assurance of structural integrity and leaktightness of the subject welds. The NRC staff finds that, if these three criteria are met, the requirements of 10 CFR 50.55a(g)(6)(i) for granting relief under an impracticality determination will also be met. Specifically, the rule requires that, in order for the Commission to grant relief under an "impracticality" basis, the licensee must demonstrate that the requested relief will not endanger life or property or the common defense and security, and is otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

3.1 Applicable Code Edition and Addenda

For reactor pressure vessel (RPV) welds and the Class 1 and Class 2 components welds inspected using ultrasonic test (UT) methods, the applicable ASME Section XI requirements are those given in the 2001 Edition of ASME Section XI, inclusive of the 2003 Addenda, which are the most current edition and addenda of ASME Section XI, incorporated by reference in 10 CFR 50.55a, 12 months prior to entry into the third 10-year ISI interval for Hope Creek. Additionally, the inspections were performed in accordance with the performance demonstration initiative (PDI) requirements specified in the 2001 Edition of ASME Section XI, as conditioned by the requirements specified in 10 CFR 50.55a(b)(2)(xv) and (b)(2)(xxiv), and in ASME Section XI, Appendix VIII.

For the specified RPV nozzle-to-vessel welds that were inspected using alternative ASME Section XI Code case requirements, the licensee performed the alternative enhanced visual testing (EVT-1) inspections in accordance with the alternative criteria defined in ASME Code Case N-648-1, as referenced for use in 10 CFR 50.55a(b)(5) and Table 2 of RG 1.147, Revision 18.

3.2 Applicable ISI Interval and Duration of the ISI Interval

The relief request apples to inspection or alternative inspection coverage requirements that applied to component inspections performed during the third 10-year ISI interval for the reactor unit. The plant's third 10-year ISI interval commenced on December 13, 2007, and ended on December 12, 2017.

3.3 Impacted ASME Code Class 1 RPV Components

The scope of the relief request includes specified ASME Code Class 1 pressure-retaining RPV welds that are included in the Hope Creek design and are required to be inspected during the third 10-year ISI interval of the facility. The licensee identifies that these components are part of the reactor coolant pressure boundary in the plant-specific design. The scope of the request includes separate relief request proposals for the RPV shell-to-flange weld and for component-specific RPV shell longitudinal welds and RPV nozzle-to-shell welds specified in the relief request.

3.3.1 Summary of Third Interval Inspections Performed on Class 1 Pressure-Retaining RPV Longitudinal Shell Welds and Basis for Relief

Impacted Welds

The scope of the relief request includes the following pressure-retaining RPV longitudinal shell welds:

- Weld No. 1.1/RPV1-W12-1, RPV longitudinal weld seam at 110º (Weld W12-1)
- Weld No. 1.2/RPV1-W12-2, RPV longitudinal weld seam at 230º (Weld W12-2)
- Weld No. 1.3/RPV1-W12-3, RPV longitudinal weld seam at 350º (Weld W12-3)

Applicable ASME Section XI Requirements

The ISI requirements set forth in ASME Section XI for performing volumetric inspections of full penetration, pressure-retaining, longitudinal welds in the RPV are given in ASME Section XI, Table IWB-2500-1, Examination Category B-A, Inspection Item B1.12. For weld coverages, the licensee applied the criteria in ASME Section XI, Code Case N-460, as the basis for performing the volumetric examinations of the welds. This Code case, as referenced in RG 1.147, Revision 18, defines essentially 100 percent weld coverages as equating to more than 90 percent of the examination volume or required surface area of each weld where the reduction in coverage is due to interference by another component or part geometry.

ISI Methods Used for Compliance with Code Requirements and Achieved Weld Coverages

The licensee identified that it performed phased-array ultrasonic (PA-UT) inspections of the welds from the inside surfaces of the welds to comply with the volumetric inspection

requirements of ASME Section XI, Table IWB-2500-1, Examination Category B-A, Inspection Item B1.12. The licensee stated that examinations were performed to comply with the inspection volume defined for RPV longitudinal shell weld examinations as given in ASME Section XI, Figure IWB-2500-2. The licensee stated that it qualified the volumetric examinations to the PDI requirements in ASME Section XI, Appendix VIII, using the procedure ISwT-PDI-AUT5, Revision 2, "Automated Inside Surface Ultrasonic Examination of Pressure Vessel Welds Using Phased Array."

For these examinations, the licensee said the PA-UT examinations achieved weld coverages ranging from 71.7 percent - 72.4 percent of the weld volumes. This is less than the 90 percent weld volume coverage referenced for UT inspection acceptability in ASME Code Case N-460.

Component-Specific Basis for Impracticality and Burden of Compliance

The licensee stated that the UT inspections of the specified RPV longitudinal shells could not achieve the 90 percent weld volume coverage defined in ASME Code Case N-460 due to accessibility restrictions caused by the presence of the feedwater spargers or core spray spargers located in the vicinity of the weld seams.

The licensee stated that, overall, components and fittings associated with the specified ASME Code Class 1 and 2 welds in the relief request are constructed of standard design items and materials meeting typical national standards that specify required configurations and dimensions. The licensee stated that, to replace these items with items of alternative configurations or materials for the purpose of achieving additional examination coverages would require unique redesign and refabrication of the components. The licensee stated that, because the welds are in either the ASME Code Class 1 or 2 boundaries, any efforts to redesign and refabricate the components would require an overly extensive effort on behalf of the licensee, given the requirements and limitations that exist.

Additionally, for the examinations that were applied to the RPV longitudinal shell welds, the licensee stated that the internal feedwater or core spray piping configurations would need to be removed or modified in order to be capable of achieving the minimum weld coverage criterion specified in ASME Code Case N-460.

3.3.2 Summary of the Third Interval Inspection Performed on the Class 1 Pressure-Retaining RPV Shell-to-Flange Weld and Basis for Relief

Impacted Weld

The scope of the relief request includes the RPV shell-to-flange weld (RPV Weld No. 1.4/ RPV1-W3).

Applicable ASME Section XI Requirements

The ISI requirements set forth in ASME Section XI for performing volumetric inspections of full penetration, pressure-retaining RPV shell-to-flange welds are given in ASME Section XI, Table IWB-2500-1, Examination Category B-A, Inspection Item B1.30. The licensee applied the criteria in ASME Section XI, Code Case N-460, as the basis for establishing the minimum volume coverage requirement for the examinations. This Code case, as referenced in RG 1.147, Revision 18, defines essentially 100 percent weld coverages as equating to more

than 90 percent of the examination volume or required surface area of each weld where the reduction in coverage is due to interference by another component or part geometry.

ISI Methods Used for Compliance with Code Requirements and Achieved Weld Coverages

The licensee identified that it performed a PA-UT inspection of the weld from the inside weld surface as the basis for complying with the volumetric inspection requirements of ASME Section XI, Table IWB-2500-1, Examination Category B-A, Inspection Item B1.30. The licensee stated that the intent of the PA-UT inspection performed was to comply with the inspection volume defined for RPV shell-to-flange weld examinations as given in in ASME Section XI, Figure IWB-2500-4. The licensee stated that it qualified the volumetric examination to the PDI requirements in ASME Section XI, Appendix VIII, using the procedure ISwT-PDI-AUT5, Revision 2, "Automated Inside Surface Ultrasonic Examination of Pressure Vessel Welds Using Phased Array."

For this examination, the licensee said the PA-UT examination achieved a weld coverage of 86.2 percent of the weld's volume. This is less than the 90 percent weld volume coverage referenced for UT inspection acceptability in ASME Code Case N-460. The licensee also stated that the examination resulted in identification of two recordable subsurface indications that were determined to be acceptable for service without the need for repair.

Component-Specific Basis for Impracticality and Burden of Compliance

For the UT inspection of the RPV shell-to-flange welds, the licensee identified that the inspection could not achieve 90 percent volume coverage criterion defined in ASME Code Case N-460 due to accessibility restrictions caused by the proximity and configuration of the N3 main steam line nozzle located near the weld seam and the presence of the rod guides at 0º and 180º radial locations.

The licensee stated that, overall, components and fittings associated with the specified ASME Code Class 1 and 2 welds in the relief request are constructed of standard design items and materials meeting typical national standards that specify required configurations and dimensions. The licensee stated that, to replace these times with items of alternative configurations or materials for the purpose of achieving additional examination coverages would require unique redesign and refabrication of the components. The licensee stated that, because the welds are in either the ASME Code Class 1 or 2 boundaries, any efforts to redesign and refabricate the components would require an overly extensive effort on behalf of the licensee, given the requirements and limitations that exist.

3.3.3 Summary of Third Interval Inspections Performed on Specified Class 1 RPV Nozzle-to-Vessel Welds Not Subject to ASME Section XI Inner-Bend Radii Rules and Basis for Relief

Impacted Welds

The scope of the relief request includes the following RPV nozzle-to-vessel welds that are not subject to ASME Section XI inner bend radii rules:

- Weld No. 1.5/RPV1-N3D, RPV main steam D nozzle-to-vessel weld (Weld N3D)
- Weld No. 1.6/RPV1-N4A, RPV feedwater A nozzle-to-vessel weld (Weld N4A)

- Weld No. 1.7/RPV1-N4B, RPV feedwater B nozzle-to-vessel weld (Weld N4B)
- Weld No. 1.8/RPV1-N4C, RPV feedwater C nozzle-to-vessel weld (Weld N4C)
- Weld No. 1.9/RPV1-N4D, RPV feedwater D nozzle-to-vessel weld (Weld N4D)
- Weld No. 1.10/RPV1-N4E, RPV feedwater E nozzle-to-vessel weld (Weld N4E)
- Weld No. 1.11/RPV1-N4F, RPV feedwater F nozzle-to-vessel weld (Weld N4F)
- Weld No. 1.12/RPV1-N8A, RPV jet-pump instrumentation A nozzle-to-vessel weld (Weld N8A)
- Weld No. 1.13/RPV1-N7, RPV head vent nozzle-to-vessel weld (Weld N7)

Applicable ASME Section XI Requirements

The ISI requirements set forth in ASME Section XI for performing volumetric inspections of these types of full penetration, pressure-retaining RPV nozzle-to-vessel welds are given in ASME Section XI, Table IWB-2500-1, Examination Category B-D, Inspection Item B3.90. For the weld coverage, the licensee applied the criteria in ASME Section XI, Code Case N-460, as the basis for performing the volumetric examinations of the welds. This Code case, as referenced in RG 1.147, Revision 18, defines essentially 100 percent weld coverages as equating to more than 90 percent of the examination volume or required surface area of each weld where the reduction in coverage is due to interference by another component or part geometry.

ISI Methods Used for Compliance with Code Requirements and Achieved Weld Coverages

The licensee identified that it performed UT inspections of these RPV nozzle-to-vessel welds to comply with the volumetric inspection requirements of ASME Section XI, Table IWB-2500-1, Examination Category B-A, Inspection Item B1.12. The licensee stated that examinations were performed to comply with the inspection volume defined in ASME Section XI, Figure IWB-2500-7(b) for these types of RPV nozzle-to-vessel welds. The licensee applied the criteria in ASME Section XI, Code Case N-460, as the basis for establishing the minimum volume coverage requirement for the examinations. This Code case, as referenced in RG 1.147, Revision 18, defines essentially 100 percent weld coverages as equating to more than 90 percent of the examination volume or required surface area of each weld where the reduction in coverage is due to interference by another component or part geometry.

The licensee stated that the UT examinations were performed in accordance with 10 CFR 50.55a(b)(2)(xv)(G) and that the inspections were performed to the maximum extent possible. The licensee states the examinations were performed using ASME Section XI, Appendix VIII, qualified personnel, procedures, and equipment, as conditioned by the requirements specified in 10 CFR 50.55a(b)(2)(xv). The licensee stated that ASME Code Case N-613-1 was used to reduce the surface area examined for the weld plus 0.5 inch on each side of the weld.

For these examinations, the licensee said the UT examinations achieved weld coverages ranging from 74.7 percent - 89.6 percent of the weld volumes. This is less than the 90 percent weld volume coverage referenced for UT inspection acceptability in ASME Code Case N-460.

Component-Specific Basis for Impracticality and Burden of Compliance

For the UT inspections of these RPV nozzle-to-vessel welds (including the six feedwater nozzle welds), the licensee identified that the inspection could not achieve 90 percent volume coverage

criterion defined in ASME Code Case N-460 due to accessibility restrictions caused by either the geometric design configuration of the nozzles or by the presence of other components located in close proximity to nozzles that limited access to nozzle welds being inspected.

Specifically, for the specified relief that was requested for the N3D main steam nozzle, the licensee stated that UT equipment access to the nozzle-to-vessel weld is limited by the design configuration of the nozzle itself and by the presence of one of the N8 jet pump instrumentation nozzles located in close proximity to the N3D nozzle. For the specified relief that was requested for the N4A–N4F feedwater nozzles, the licensee stated that UT equipment access to the nozzle-to-vessel welds is limited by the design configurations of the nozzles, which include internal thermal sleeves. For the specified relief that was requested for the N8A RPV jet pump instrumentation nozzle and the N7 RPV head vent nozzles, the licensee stated that UT equipment access to the nozzle-to-vessel welds is limited by the design configurations of the nozzles.

The licensee stated that, overall, components and fittings associated with the specified ASME Code Class 1 and 2 welds in the relief request are constructed of standard design items and materials meeting typical national standards that specify required configurations and dimensions. The licensee stated that, to replace these items with items of alternative configurations or materials for the purpose of achieving additional examination coverages would require unique redesign and refabrication of the components. The licensee stated that, because the welds are in either the ASME Code Class 1 or 2 boundaries, any efforts to redesign and refabricate the components would require an overly extensive effort on behalf of the licensee, given the requirements and limitations that exist.

The licensee stated that achievement of the required coverage for the welds would require design modifications of the nozzle or weld configurations.

3.3.4 Summary of Third Interval Inspections Performed on Specified Class 1 RPV Nozzle-to-Vessel Welds Subject to ASME Section XI Inner-Bend Radii Rules and Basis for Relief

Impacted Welds

The scope of the relief request includes the following RPV nozzle-to-vessel welds that are subject to ASME Section XI inner bend radii rules:

- Weld No. 1.14/RPV1-N2AIR, RPV recirculation inlet A nozzle-to-vessel weld (Weld N2A)
- Weld No. 1.14/RPV1-N2BIR, RPV recirculation inlet B nozzle-to-vessel weld (Weld N2B)
- Weld No. 1.14/RPV1-N2KIR, RPV recirculation inlet K nozzle-to-vessel weld (Weld N2K)
- Weld No. 1.14/RPV1-N5BIR, RPV core spray B nozzle-to-vessel weld (Weld N5B)
- Weld No. 1.14/RPV1-N17AIR, RPV low pressure coolant injection (LPCI) A nozzle-to-vessel weld (Weld N17A)

Applicable ASME Section XI Requirements

The ISI requirements set forth in ASME Section XI for performing volumetric inspections of these types of RPV nozzle-to-vessel welds are given in ASME Section XI, Table IWB-2500-1, Examination Category B-D, Inspection Item B3.100. However, for these welds, the licensee used the alternative ASME inspection requirements in ASME Code N-648-1 as the basis for inspecting the welds during the third 10-year ISI interval. This Code case is endorsed for use in 10 CFR 50.55a(b)(5) and RG 1.147, Revision 18. The code case permits the licensee to perform alternative inspections of the nozzle-defined inner bend radii areas using an enhanced visual testing (EVT-1) method, as subject to the limitations set forth on use of the Code case in Table 2 of the RG.

For the weld coverage, the licensee applied the criteria in ASME Section XI, Code Case N-460, as the basis for performing the EVT-1 examinations of the welds. This Code case, as referenced in RG 1.147, Revision 18, defines essentially 100 percent weld coverages as equating to more than 90 percent of the examination volume or required surface area of each weld where the reduction in coverage is due to interference by another component or part geometry.

ISI Methods Used for Compliance with Code Requirements and Achieved Weld Coverages

The licensee identified that it performed the EVT-1 inspections of these RPV nozzle-to-vessel welds to comply with the alternative ISI requirements specified in ASME Code Case N-648-1. The licensee stated that examinations were performed to comply with the inspection area defined in ASME Section XI, Figure IWC-2500-7(b), for these types of RPV nozzle-to-vessel welds.

The licensee applied the criteria in ASME Section XI, Code Case N-460, as the basis for establishing the minimum area coverage requirement for the examinations. This Code case, as referenced in RG 1.147, Revision 18, defines essentially 100 percent weld coverages as equating to more than 90 percent of the examination volume or required surface area of each weld where the reduction in coverage is due to interference by another component or part geometry.

The licensee's regulatory basis for performing the EVT-1 inspections of these welds is further defined and described in Section 1.14 of Attachment 1 of the relief request submittal. For these examinations, the licensee said the EVT-1 examinations achieved weld coverages ranging from 25.0 percent - 50 percent of the weld surface areas. This is less than the 90 percent weld surface area coverage referenced for EVT-1 inspection acceptability in ASME Code Case N-460.

Component-Specific Basis for Impracticality and Burden of Compliance

For the EVT-1 visual inspections performed on the inner bend radii of these RPV nozzle-to-vessel welds, the licensee identified that the inspection could not achieve the 90 percent surface area coverage criterion defined in ASME Code Case N-460 due to accessibility restrictions caused by either the design of the nozzles or by the proximity of other components that restricted equipment access to the welds being inspected. Specifically, the licensee stated that the visual inspections of these nozzle welds were limited due to presence and configuration of the thermal sleeves that were included in the nozzle designs.

The licensee stated that, overall, components and fittings associated with the specified ASME Code Class 1 and 2 welds in the relief request are constructed of standard design items and materials meeting typical national standards that specify required configurations and dimensions. The licensee stated that, to replace these items with items of alternative

configurations or materials for the purpose of achieving additional examination coverages would require unique redesign and refabrication of the components. The licensee stated that, because the welds are in either the ASME Code Class 1 or 2 boundaries, any efforts to redesign and refabricate the components would require an overly extensive effort on behalf of the licensee, given the requirements and limitations that exist.

The licensee stated that achievement of the required coverage for these RPV nozzle-to-vessel welds would require design modifications of the thermal sleeve configurations in the nozzles. The licensee stated that such modifications are considered impractical. The licensee also stated that the structural integrity of the nozzle forgings themselves is not in question at this time because they were non-destructively examined during initial fabrication and have been previously examined using ultrasonic techniques specific to the nozzle configurations. The licensee stated that no indications of fabrication or service-induced cracking have been observed as a result of these examinations.

3.3.5 Proposed Alternatives for RPV Weld Volumes or Surface Areas Not Inspected

The licensee proposed the following alternative ISI criteria for the specified RPV weld volumes or surface areas not covered by the third interval examination of the components:

(1) Continued performance of periodic system pressure and leak-rate testing of the components in accordance with the requirements in ASME Section XI, Table IWB-2500-1, Examination Category B-P, each refueling outage.

(2) Continued performance of reactor coolant system (RCS) leakage monitoring in accordance with the technical specification (TS) limiting conditions for operation (LCOs) specified in TS Section 3.4.3 and surveillance requirements in TS Section 4.4.3.

(3) Continued performance of required surface and/or volumetric examinations to the maximum extent possible as required by ASME Section XI.

3.3.6 NRC Staff Evaluation

The NRC staff evaluated the limited coverage relief request bases for specified RPV weld components in Relief Request No. HC-I3R-08, Revision 0, pursuant to provisions specified in 10 CFR 50.55a(g)(5)(iii) and (6)(i). The NRC staff's evaluation focused on: (1) whether a technical justification exists to support the determination that the ASME Code requirement is impractical; (2) that imposition of the Code-required inspections would result in a burden to the licensee; and (3) that the licensee's proposed alternative (accepting the reduced inspection coverage in this case) provides reasonable assurance of structural integrity and leaktightness of the subject welds. The NRC staff finds that, if these criteria are met, the regulatory criteria in 10 CFR 50.55a(g)(6)(i) for granting approval of ASME Section XI Code relief impracticality requests will also be met.[1]

[1] The provisions in 10 CFR 50.55a(g)(6)(i) give the Director of the Office of Nuclear Reactor Regulation authority to approve such requests if the licensee can demonstrate the basis for the requested relief will not "endanger life or property or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility."

Specifically, the NRC staff considered whether the licensee's proposed alternative provided reasonable assurance of structural integrity and leaktightness of the subject welds based on staff verification of the following factors: (1) adequate demonstration by the applicant that it has achieved maximum UT, PA-UT, or EVT-1 examination coverages achievable during the third 10-year ISI interval and that inspections from the opposite component surfaces are impractical as well; (2) adequate demonstration by the applicant that it is impractical to achieve the weld volume or surface area coverages required by either ASME Section XI or ASME Code Case N460-1 during the third 10-year ISI interval; (3) adequate demonstration by the applicant that a burden exists if compliance with the applicable weld coverage requirements were imposed on the licensee during the third 10-year ISI interval; (4) adequate demonstration by the applicant that it has proposed an acceptable alternative for portions of the welds that were uninspected using the applicable UT, PA-UT, or EVT-1 methods; and (5) adequate demonstration by the applicant that the results of alternative inspection methods performed on the welds when taken into account with the results of the UT, PA-UT, or EVT-1 performed on welds provide adequate assurance of the structural integrity of the welds during the third 10-year ISI interval.

Examination Coverage Achieved

In evaluating the licensee's proposed alternative coverage, the NRC staff assessed whether the licensee obtained as much coverage as reasonably possible and the manner in which the licensee reported the coverage achieved. From its review of the submittal and the supporting figures, tables, and sketches provided in Relief Request No. HC-I3R-08, Revision 0, the NRC staff verified that:

- For RPV welds subject to UT or PA-UT inspections, the welds were examined using the appropriate equipment, ultrasonic modes of propagation, probe angles, frequencies, and scanning directions to obtain maximum coverage.
- For the RPV nozzle-to-shell welds that were inspected using alternate EVT-1 visual techniques, the inspections were performed in accordance with ASME Section XI, Code Case N-648-1, as endorsed for use in 10 CFR 50.55a(b)(5), and RG 1.147, Revision 18.
- The licensee calculated the inspection coverages in a reasonable manner.
- The UT or alternative EVT-1 examinations were qualified as required by the regulation and were performed using qualified personnel, equipment, and procedures.
- Acceptance criteria for needed inspection coverages were established through the use of the minimum volume or surface area coverage criterion established for the applicable inspection method in ASME Code Case N-460; this Code case has been endorsed for use in 10 CFR 50.55a(b)(5) and RG 1.147, Revision 18.
- Achievement of the required inspection coverage was limited by physical access (i.e., the configuration of one side of the weld did not permit access for scanning).
- The inspections did not identify the presence of any active degradation mechanisms or defects in the components.

Specifically, for the RPV weld components that were subjected to either a UT or PA-UT examination during the third 10-year ISI interval, the NRC staff observed that the welds were inspected by qualified UT or PA-UT methods using qualified personnel, equipment, and procedures. The staff also observed that the UT or PA-UT inspections achieved a weld coverage of at least 70 percent by volume. The staff noted that the inspections did not identify any evidence of active degradation mechanisms or unacceptable, recordable indications in the portions of the welds that were subject to the inspections. Therefore, for licensee's "best effort"

examinations of the welds and the weld volumes covered, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that the licensee performed.

For the three RPV recirculation nozzles, the specified RPV LPCI nozzle, and specified RPV core spray nozzle that were inspected using the alternative EVT-1 methods defined in ASME Code Case N-648-1, the NRC staff observed that the welds were inspected by a qualified EVT-1 method using qualified personnel, equipment, and procedures. The staff also observed that the inspections achieved a coverage of 25 percent - 50 percent of the surface area coverage dictated by ASME Section XI, Figure IWB-2500-7(b). The staff noted that the inspections did not identify any evidence of active degradation mechanisms or unacceptable, recordable surface-breaking indications in the portions of the weld surfaces that were subject to the EVT-1 inspections during the third 10-year ISI interval. Therefore, the NRC staff found that the licensee made every effort to obtain as much coverage as reasonably possible using the UT or visual examination methods that were applied to welds.

Impracticality of Compliance

As described in Relief Request No. HC-I3R-08, Revision 0, and demonstrated in applicable tables and figures that were included in the submittal, the predominant limitations that prevented the licensee from meeting the minimum weld volume or surface area criterion specified in ASME Code Case N-460 resulted from either component design configurations that restricted access to the components or from the presence of other components in proximity of the welds that limited or restricted access to the welds.

For the PA-UT inspections of the RPV longitudinal shell welds and RPV intermediate shell-to-flange weld, the licensee's PA-UT examinations were performed only from the inside surfaces of the welds. For these welds, the staff confirmed that the inspections were qualified to the applicable PDI requirements and were performed using personnel, procedures, and equipment qualified to the ASME requirements. However, for these welds, the staff confirmed that the licensee would have difficulty performing analogous inspections of the outside weld surfaces due the presence of the insulation located on the outside of the RPV. The staff also determined that the supporting figures provided in the relief request submittal provided confirming evidence that access to the inside surfaces of these welds is restricted by the presence and proximity of specific RPV piping, nozzle components, or rod guides that limited access to the welds and prevented the licensee from achieving the minimum weld volume coverage dictated for the welds in ASME Code Case N-460. Therefore, the NRC staff finds that a technical justification exists to support the determination that achievement of the required coverage for these welds is impractical.

For the UT inspections of the eight RPV nozzle-to-shell welds subject to ASME Section XI, Inspection Item B3.90 requirements (i.e., the six feedwater nozzles, the main steam line D nozzle, jet pump instrumentation A nozzle, and RPV head vent nozzle), the staff observed that the licensee performed the UT inspections using various angle-beam UT transducers from the nozzle sides (outside surfaces) of the welds. The staff also noted that the request provided sufficient procedural evidence that the inspections were qualified to the applicable PDI requirements and were performed using personnel, procedures, and equipment that were qualified to the applicable ASME requirements.

In addition, for these nozzles, the staff noted the inspection-related tables and figures provided in the relief request submittal for the components provided sufficient evidence that access to

weld surfaces was restricted by either the component-specific design configuration of the nozzles or by the presence and proximity of nearby components that limited access to the welds and prevented the licensee from achieving the 90 percent minimum weld volume coverage specified for the welds in ASME Code Case N-460. The staff noted that the same restrictions (as indicated in the relief request diagrams) provided sufficient evidence that it was infeasible to perform additional UT inspections of the nozzle welds from the inside surfaces of the components. Therefore, the NRC staff finds that a technical justification exists to support the determination that achievement of the required coverage for these welds is impractical.

For the alternative EVT-1 visual inspections of the five RPV nozzle-to-shell welds that would otherwise be subject to the UT requirements in ASME Section XI, Examination Category B-D, Inspection Item B3.100 (i.e., for the three specified RPV recirculation nozzles, the specified RPV core spray nozzle, and the specified RPV LPCI nozzle), the staff confirmed that the licensee performed the inspections using the surface area coverage criteria defined in ASME Section XI, Figure IWB-2500-7(b), and the alternative rules in ASME Section XI, Code Case N-648-1.

The staff confirmed that use of this Code case has been endorsed through reference in 10 CFR 50.55a(b)(5) and RG 1.147, Revision 18, as an acceptable alternative to the UT requirements specified in ASME Section XI, Examination Category B-D, Inspection Item B3.100. For these nozzles, the staff determined that the supporting tables, figures, and diagrams for the nozzles in the relief request provided confirming evidence that the presence of the thermal sleeves in the nozzle configurations limited access to the weld surface areas requiring inspection. Therefore, the NRC staff finds that a technical justification exists to support the determination that achievement of the required surface area coverage for these welds is impractical.

Burden of Compliance

The licensee proposed that making the welds accessible for inspection from both sides or for additional coverage from a single-sided inspection would require replacement of the components or significant design modifications of the welds associated components located in close proximity to the welds or the plant design.

Based on the staff's review of the submittal and the tables, figures, and sketches provided in Relief Request No. HC-I3R-08, Revision 0, the NRC staff verified that the licensee's UT or EVT-1 examinations has covered, to the extent possible, the regions of the welds that are typically susceptible to higher stresses, and therefore, potential degradation. The staff also verified that that compliance with ASME Section XI or alternative ASME Section XI Code case requirements would impose a significant burden on the licensee because: (a) the licensee has provided sufficient demonstration that the portions of the welds are physically restricted from inspection, and (b) the staff has verified that, in order to comply with the Code requirements, the applicant would need to perform a costly modification of the subject component or a costly redesign of the plant. Therefore, the staff finds that a burden exists for the identified RPV shell axial weld, shell-to-flange weld, or RPV nozzle weld inspections, such that compliance with the applicable Code coverage requirement is impractical during the third 10-year ISI interval.

Therefore, the NRC staff finds that replacing or reconfiguring the components of the subject welds is the only reasonable means to achieve dual-sided coverage or expanded, single-side coverage of these welds and that replacement of the components or modification of the plant design will constitute a significant burden on the licensee.

Safety Significance of Unexamined Volumes or Surface Areas – Proposed Alternatives for Unachieved Weld Coverages and Confirmation of Adequate Component Structural Integrity During the Third 10-year ISI Interval

The NRC staff has verified that, in addition to the "best effort" UT, PA-UT or EVT-1 inspections performed on the specified RPV weld components, the licensee has performed the required VT-2 visual inspections of the welds (i.e., for evidence of system coolant leakage), as implemented during the applicable pressurized leak-rate test for the system; these leak-rate tests are performed each refueling outage in accordance with ASME's Examination Category B-P requirements specified in ASME Section XI, Table IWB-2500-1. The staff noted that the VT-2 examinations did not indicate any evidence of reactor coolant leakage from the welds. Based on its review, the NRC staff finds that the system leakage inspections of the welds provide additional assurance of structural integrity in the welds because: (a) the required VT-2 visual examinations are qualified and implemented to ensure that any pattern of degradation, if it was to occur and progress through the wall of the pressure boundary component, would be detected by the licensee, (b) the licensee's VT-2 inspections performed on specified RPV pressure boundary welds did not reveal any indications of through-wall RCS coolant leakage in the welds, and (c) the rules in ASME Section XI, Examination Category B-P, are designed to ensure that, if evidence of RCS coolant leakage is detected as a result of the leak-rate tests, the licensee will take appropriate correction action(s) in accordance with its 10 CFR Part 50, Appendix B quality assurance program and the applicable corrective action requirements specified in ASME Section XI, Subsection IWB.

Therefore, the NRC staff finds that the "best effort" UT, PA-UT, or EVT-1 examinations performed on the welds when taken into account with the results of the VT-2 visual examinations performed on the welds during the interval provide a reasonable assurance of structural integrity and leaktightness of the subject welds. The staff also finds that compliance with the weld volume coverage requirements in ASME Code Case N-460 for these welds would be a burden on the licensee.

3.4 Impacted ASME Code Class 1 and 2 Components Welds

3.4.1 ASME Class 1, Item No. B15.10, All Pressure-Retaining Components

Components Affected

The scope of the relief request includes the following pressure retaining components:

- Valve #AE-V9989
- Valve #AE-V9995

Applicable Code Requirement

The ISI requirements set forth in the ASME Code, Section XI, for performing system leakage tests for the pressure-retaining valves are given in the ASME Code, Section XI, Table IWB-2500-1, Examination Category B-P, Inspection Item B15.10.

Licensee's Reason for the Request

The licensee stated that access to these two valves is limited due to location between main steam lines, which would require excessive scaffolding and poses radiological and personnel

safety concerns. There were no indications of leakage identified in the area surrounding these valves during the system pressure test. The licensee also stated that Code Case N-798, "Alternative Pressure Testing Requirements for Class 1 Piping Between the First and Second Vent, Drain, and Test Isolation Devices Section XI, Division 1," approved in Revision 18 of RG 1.147, allows for the vent and drain inboard isolation valves to remain closed during the system pressure test.

Proposed Alternative and Basis for Use

The licensee's proposed alternative is as follows.

Periodic system pressure tests and associated VT-2 visual examinations will continue to be performed in accordance with the ASME Code, Section XI, Examination Category B-P, for Class 1 pressure-retaining welds and items during each refueling outage. The licensee stated that even though these examinations did not fully meet the Code-required pressure testing, there is instrumentation in place to assure early detection of any RCS pressure boundary leakage.

NRC Staff Evaluation

The staff noted that there have been no leaks detected in the area surrounding these valves during the system pressure tests. The staff verified that Code Case N-798 has been approved in Revision 18 of RG 1.147; and that it allows for the isolation valves to remain closed during the system pressure tests. The staff further noted that performing leakage tests on the valves in accordance with the Code requirements would incur excessive radiation and safety concerns. The NRC staff finds that the licensee's proposed alternative is acceptable because (1) the surrounding area of the valve showed no indication of leakage, (2) periodic system pressure tests and associated VT-2 visual examinations will continue to be performed during each refueling outage, (3) approved Code Case N-798 allows this type of valve to remain closed during a leakage test, and (4) instrumentation is in place to assure early detection of any RCS pressure boundary leakage.

3.4.2 Examination Category C-A, Item No. C1.10, Shell Circumferential Welds

Components Affected

The scope of the relief request includes the following pressure-retaining vessel-to-flange weld:

- 1.15/1-AE-205-RHXW4

Applicable Code Requirement

The ISI requirements set forth in the ASME Code, Section XI, for the components are essential 100 percent coverage of volumetric examinations in each 120-month (10-year) interval.

Licensee's Reason for the Request

The licensee stated that there is volumetric examination coverage limitation on the vessel-to-flange weld on the "A" RHR heat exchanger weld due to the taper of the flange side of the weld. To achieve full coverage would require a design modification to remove the taper.

Proposed Alternative and Basis for Use

The licensee stated that the heat exchanger shell-to-flange weld within the scope of the request is located outside of the containment. The licensee's proposed alternatives are as follows.

(1) Periodic system pressure tests and associated VT-2 visual examinations will continue to be performed in accordance with the ASME Code, Section XI, Examination Category C-H for Class 2 pressure-retaining welds and items during each inspection period.

(2) Conduct required surface and/or volumetric examinations to the maximum extent possible as required by the ASME Code, Section XI, or the RI-ISI programs.

NRC Staff Evaluation

The staff noted that the Code-required volumetric examination coverage is limited due to geometry of the weld. In order to achieve Code-required coverage, the weld would have to be redesigned, which is impractical. The staff also noted that the licensee's proposed alternative will perform system pressure tests and associated VT-2 visual examinations on the Vessel-to-flange weld during each inspection period.

The NRC staff finds that the licensee's alternative is acceptable because (1) the periodic system pressure tests and associated VT-2 visual examinations would detect any indication of leakage, (2) performing the Code-required essentially 100 percent examination coverage would require redesign of the weld, which is not feasible and would result in undue burden to the licensee.

3.4.3 Examination Category C-G, Pressure-Retaining Welds in Pumps and Valves, Item No. C6.10, Pump Casing Welds

Components Affected

The scope of the relief request includes the following pressure-retaining RHR pump welds:

- 1.16/1-CP-206-CSP-W2
- 1.17/1-CP-202-RHP-W2
- 1.18/1-DP-202-RHP-W2
- 1.19/1-DP-202-RHP-W3

Applicable Code Requirement

The ISI requirements set forth in the ASME Code, Section XI, for the components are surface examinations each 120-month (10-year) interval.

Licensee's Reason for the Request

The licensee stated that the pump casing welds within the scope of the request are located outside of the containment. Category C-G was removed from the ASME Code, Section XI, in the 2008 Addenda, and therefore, will no longer require examination. The licensee also stated the surface examination limitations were caused by the concrete pump pedestal obstructions. A design change would be required to remove the concrete pedestal.

Proposed Alternative and Basis for Use

The licensee's proposed alternatives are as follows:

(1) Periodic system pressure tests and associated VT-2 visual examinations will continue to be performed in accordance with the ASME Code, Section XI, Examination Category C-H, for these Class 2 pressure-retaining welds and items during each inspection period. The NRC staff notes that Examination Category C-H is the alternative to Examination Category C-G.

(2) Conduct required surface examinations to the maximum extent possible as required by the ASME Code, Section XI, or the RI-ISI programs.

NRC Staff Evaluation

The staff noted that the Code-required surface examination is limited due to geometry of concrete pedestal obstructions. In order to achieve Code-required examination coverage, the pedestals would have to be removed, which is impractical. The staff also noted that the license's proposed alternative will include performing system pressure tests and associated VT-2 visual examinations on these components during each inspection period, and that the licensee conducted the required surface examinations to the maximum extent possible. The NRC staff finds that the licensee's alternative is acceptable because (1) the periodic pressure tests and associated VT-2 visual examinations will detect any indication of leakage, (2) this Code Category was removed from the ASME Code, Section XI, in the 2008 Addenda, and therefore, the subject welds will no longer require examinations in the future, and (3) performing the Code-required essentially 100 percent examination coverage would require redesign of the pump pedestals, which is not feasible and would result in undue burden to the licensee.

3.4.4 Examination Category R-A, Risk-Informed Piping Examinations, Item No. R1.20-4, Elements Not Subject to a Degradation Mechanism

Component Affected

The scope of the relief request includes the following pressure-retaining component, reactor water cleanup, pipe-to-valve weld. No examinations were performed downstream due to valve configuration:

- 1.20/1-BG-6DBA-001-29

Applicable Code Requirement

The ISI requirements set forth in the ASME Code, Section XI, for the components are the volumetric examinations each 120-month (10-year) interval.

Licensee's Reason for the Request

The licensee stated that when examined, the subject weld did not receive the required Code volume or surface area coverage due to its component design configurations or interference by other items. These conditions resulted in scanning or surface area access limitations that prohibited obtaining essentially 100 percent examination coverage of the required examination

volumes or surface areas. However, in each of the situation, accessible volumes or surface areas of the weld were obtained to the extent possible.

The licensee also stated that component design configurations resulting in examination limitations may not allow the full required examination volume or surface area coverage with the latest inspection techniques available. The licensee further stated that when limited piping weld examinations are identified, an evaluation was performed with consideration given to whether a new weld location should be selected for examination to make up for these limited examinations. The licensee stated that, since the initial RI-ISI piping weld selections were based on consequence, failure probability, potential degradation mechanisms, and the design of the welds were all similar for examination under these parameters, it was determined that no or very little additional coverage could be obtained by selecting another weld with these same selection criteria. Therefore, the licensee has determined that obtaining essentially 100 percent coverage is not feasible without adding additional burden consisting of significant redesign work, increased radiation exposure, and/or potential damage to the plant or the component itself.

Proposed Alternative and Basis for Use

The licensee's proposed alternative is to conduct required surface examinations to the maximum extent possible as required by the ASME Code, Section XI, and the RI-ISI programs.

NRC Staff Evaluation

The staff noted that the Code-required surface examination is limited due to geometry of the subject welds and configuration of the subject components. The NRC staff reviewed the licensee's evaluation on each of the subject examination with less than Code-required coverage and determined that obtaining essentially 100 percent coverage is not feasible and would result in undue burden. The NRC staff also noted that the license's proposed alternative will perform system pressure tests and associated VT-2 visual examinations, which will detect any indication of leakage, and the licensee will conduct the required surface examinations to the maximum extent possible. The NRC staff further noted that, in order to achieve the Code-required coverage, welds would have to be redesigned, which is impractical. The NRC staff finds that the licensee's proposed alternative is acceptable because (1) the licensee has performed the Code-required examinations to the extent possible, (2) performing the Code-required essentially 100 percent examination coverage would require reconfiguration in design, which is not feasible and would result in undue burden to the licensee.

4.0 CONCLUSION

As set forth above, the NRC staff has concluded that it is impractical for the licensee to fully comply with the ASME Code, Section XI requirements; that the subject ISI examinations performed on the welds during the third 10-year ISI interval provide reasonable assurance of structural integrity and leaktightness; and that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest, giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(6)(i). Therefore, the NRC staff grants Relief Request No. HC-I3R-08, Revision 0, for Hope Creek for the third 10-year ISI interval, which commenced on December 13, 2007, and ended on December 12, 2017.

All other ASME Code, Section XI requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including the third-party review by the Authorized Nuclear Inservice Inspector.

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