



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

August 17, 2017

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 GENERATING STATION – RELIEF FROM THE
REQUIREMENTS OF THE ASME CODE FOR ALTERNATIVE TO
NOZZLE-TO-VESSEL WELD AND INNER RADIUS EXAMINATIONS
(CAC NO. MF9554)

Dear Mr. Sena:

By letter dated March 31, 2017 (Agencywide Documents Access and Management System Accession No. ML17090A186), PSEG Nuclear LLC (the licensee), submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for relief from certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI requirements at the Hope Creek Generating Station (Hope Creek).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee requested approval to implement the alternative of ASME Code Case N-702, "Alternative Requirements for Boiling Water Reactor (BWR) Nozzle Inner Radius and Nozzle-to-Shell Welds," in lieu of the ASME Code, Section XI requirements on the basis that the alternative provides an acceptable level of quality and safety.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that PSEG Nuclear LLC has adequately addressed all of the regulatory requirements set forth in Relief Request HC-I4R-170. Based on the licensee's demonstration of compliance with the criteria in Section 5.0 of the NRC's safety evaluation for BWRVIP-241, the NRC staff verifies that the proposed ASME Code Case N-702 alternative provides an acceptable level of quality and safety and applies to the reactor pressure vessel nozzles and inner radii listed in Table 1 of this safety evaluation for the fourth inservice interval at Hope Creek. Therefore, the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(z)(1) for the fourth 10-year inservice inspection interval at Hope Creek.

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.

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

Sincerely,

A handwritten signature in black ink, appearing to read "James G. Danna". The signature is fluid and cursive, with a large initial "J" and "D".

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 w/enclosure: Distribution via Listserv



UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST HC-I4R-170 REGARDING

FOURTH 10-YEAR INTERVAL INSERVICE INSPECTION

PSEG NUCLEAR LLC

HOPE CREEK GENERATING STATION

DOCKET NO. 50-354

1.0 INTRODUCTION

By letter dated March 31, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17090A186), PSEG Nuclear LLC (the licensee), submitted a request to the U.S. Nuclear Regulatory Commission (NRC or the Commission) for relief from certain American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section XI requirements at the Hope Creek Generating Station (Hope Creek).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee requested approval to implement the alternative of ASME Code Case N-702, "Alternative Requirements for Boiling Water Reactor (BWR) Nozzle Inner Radius and Nozzle-to-Shell Welds," in lieu of the ASME Code, Section XI requirements to volumetrically examine all Category B-D, Item B3.90 nozzle-to-vessel welds and all Category B-D, Item B3.100 nozzle inside radius sections. The licensee also proposed to be allowed to elect VT-1 visual examination of Item B3.100 nozzle inside radius section in lieu of volumetric examination, as permitted by ASME Code Case N-702, and to meet the conditions specified for ASME Code Case N-648-1, "Alternative Requirements for Inner Radius Examinations of Class 1 Reactor Vessel Nozzles," in Regulatory Guide 1.147, Revision 17, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1" (ADAMS Accession No. ML13339A689), when performing the VT-1 visual examination.

This request applies to the fourth 10-year inservice inspection (ISI) interval in which Hope Creek adopted the 2007 Edition through the 2008 Addenda of ASME Code, Section XI as the code of record. The fourth 10-year ISI interval for Hope Creek is scheduled to begin on December 13, 2017, and end on December 31, 2026.

2.0 REGULATORY REQUIREMENTS

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI to the extent practical within the limitations of design, geometry, and materials of construction of the components.

The ISI of Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code, and applicable addenda, as required by 10 CFR 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Pursuant to 10 CFR 50.55a(z), alternatives to the requirements of 10 CFR 50.55a(g) may be used when authorized by the Director, Office of Nuclear Reactor Regulation. A proposed alternative must be submitted and authorized prior to implementation. The licensee must demonstrate (1) the proposed alternative would provide an acceptable level of quality and safety, or (2) 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.

The ASME Code, Section XI, Table IWB-2500-1 requires volumetric examination of all (100 percent) Examination Category B-D reactor pressure vessel (RPV) nozzle to-vessel welds and nozzle inside radii during each 10-year ISI interval. The ASME Code Case N-702 alternative reduces the examinations of RPV nozzle-to-shell welds and nozzle inner radius sections from 100 percent (all nozzles) to 25 percent of the nozzles for each nozzle type during each 10-year interval. ASME Code Case N-702 also allows VT-1 visual examination to be used in lieu of volumetric examination for Item B3.100 nozzle inside radius sections.

ASME Code Case N-702 has been conditionally accepted for use in Regulatory Guide 1.147, Revision 17, with the following condition:

The technical basis supporting the implementation of this Code Case is addressed by BWRVIP-108: BWR [Boiling-Water Reactor] Vessel and Internals Project, "Technical Basis for the Reduction of Inspection Requirements for the Boiling Water Reactor Nozzle-to-Vessel Shell Welds and Nozzle Blend Radii," EPRI [Electric Power Research Institute] Technical Report 1003557, October 2002 (ML023330203) and BWRVIP-241: BWR Vessel and Internals Project, "Probabilistic Fracture Mechanics Evaluation for the Boiling Water Reactor Nozzle-to-Vessel Shell Welds and Nozzle Blend Radii," EPRI Technical Report 1021005, October 2010 (ML11119A041). The applicability of Code Case N-702 must be shown by demonstrating that the criteria in Section 5.0 of NRC Safety Evaluation regarding BWRVIP-108 dated December 18, 2007 (ML073600374) or Section 5.0 of NRC Safety Evaluation regarding BWRVIP-241 dated April 19, 2013 (ML13071A240) are met. The evaluation demonstrating the applicability of the Code Case shall be reviewed and approved by the NRC prior to the application of the Code Case.

ASME Code Case N-648-1 has been conditionally accepted for use in Regulatory Guide 1.147, Revision 17, with the following condition:

In lieu of a UT [ultrasonic testing] examination, licensees may perform a VT-1 examination in accordance with the code of record for the Inservice Inspection Program utilizing the allowable flaw length criteria of Table IWB-3512-1 with limiting assumptions on the flaw aspect ratio.

3.0 TECHNICAL EVALUATION

3.1 Background

For all RPV nozzle-to-vessel shell welds and nozzle inner radii, ASME Code, Section XI requires 100 percent inspection during each 10-year ISI interval. However, ASME Code

Case N-702 proposes an alternative that reduces the inspection of RPV nozzle-to-vessel shell welds and nozzle inner radii from 100 percent to 25 percent of the nozzles for each nozzle type during each 10-year interval. Regulatory Guide 1.147, Revision 17, conditionally accepts the use of ASME Code Case N-702, provided that the applicability is shown by demonstrating that the criteria in either Section 5.0 of the NRC safety evaluation (SE) regarding BWRVIP-108 or Section 5.0 of the NRC SE regarding BWRVIP-241 are met.

The NRC SE of BWRVIP-241 specified plant-specific requirements that must be met for applicants proposing to use this alternative. Licensees can demonstrate the plant-specific applicability of the BWRVIP-241 report by meeting the following general and nozzle-specific criteria in Section 5.0 of the BWRVIP-241 SE, as follows:

1. The maximum RPV heatup/cool-down rate is limited to less than 115 °F [degrees Fahrenheit]/hour;

For recirculation inlet (N2) nozzles:

2. $(pr/t)/C_{RPV} \leq 1.15$

where

p = RPV normal operating pressure (psi),
r = RPV inner radius (inch),
t = RPV wall thickness (inch), and
 $C_{RPV} = 19332$;

3. $[p(r_o^2 + r_i^2) / (r_o^2 - r_i^2)] / C_{NOZZLE} \leq 1.47$

where

p = RPV normal operating pressure (psi),
 r_o = nozzle outer radius (inch),
 r_i = nozzle inner radius (inch), and
 $C_{NOZZLE} = 1637$;

For recirculation outlet (N1) nozzles:

4. $(pr/t)/C_{RPV} \leq 1.15$

where

p = RPV normal operating pressure (psi),
r = RPV inner radius (inch),
t = RPV wall thickness (inch), and
 $C_{RPV} = 16171$;

5. $[p(r_o^2 + r_i^2) / (r_o^2 - r_i^2)] / C_{NOZZLE} \leq 1.59$

where

p = RPV normal operating pressure (psi),
 r_o = nozzle outer radius (inch),
 r_i = nozzle inner radius (inch), and
 $C_{NOZZLE} = 1977$

3.2 Licensee's Proposed Alternative

ASME Code Components Affected

Code Class: ASME Section XI Code Class 1
Examination Category: B-D

Item Numbers: B3.90 and B3.100

The RPV nozzle-to-vessel welds and inner radii subject to this request provided in the licensee's letter dated March 31, 2017, are listed in the table below.

TABLE 1 - RPV Nozzle-to-Vessel Welds and Inner Radii Subject to this Request			
Identification Number	Description	Total Number	Minimum Number to be examined
N2	Recirculation Inlet	10	3
N3	Main Steam Outlet	4	1
N5	Core Spray	2	1
N6	Head Spray	2	1
N7	Head Vent	1	1
N8	Jet Pump Instrumentation	2	1
N17	Low Pressure Coolant Injection (LPCI)	4	1

Licensee's Proposed Alternative to ASME Code

In accordance with 10 CFR 50.55a(z)(1), the licensee proposed an alternative to the ASME Code, Section XI required volumetric examinations for the RPV nozzle-to-vessel welds and nozzle inner radius sections listed in Table 1 above. The proposed alternative would implement ASME Code Case N-702 and reduce the ASME Code-required volumetric examinations for all RPV nozzle-to-shell welds and inner radii to a minimum of 25 percent of the nozzle inner radii and nozzle-to-shell welds, including at least one nozzle from each system and nominal pipe size during each inspection interval. The required examination volume for the reduced set of nozzles remains at 100 percent of that depicted in Figures IWB-2500-7 (a) through (d), as applicable in the ASME Code.

In addition, the proposed alternative would permit a VT-1 visual examination of Category B-D, Item 3.100 to be performed in lieu of a volumetric examination. The licensee proposes that if PSEG Nuclear LLC elects to apply the alternative VT-1 examination for Hope Creek, it will meet the NRC conditions specified for Code Case N-648-1 in Regulatory Guide 1.147, Revision 17.

Licensee's Basis for Use

The licensee's application states that all RPV nozzle to vessel penetration welds and nozzle inner radii sections, with the exception of the recirculation outlet nozzles, meet the general and nozzle-specific criteria in the BWRVIP-241 report. The licensee also provided plant-specific data and calculations to show that Criteria 1, 2, and 3 of Section 5.0 of the NRC SE for BWRVIP-241 are satisfied for the recirculation inlet nozzles. The licensee did not request relief for the outlet nozzles; therefore, Criteria 4 and 5 do not need to be met.

In Appendix B of its March 31, 2017, relief request, the licensee submitted a list of recent volumetric examinations performed on the components identified in Table 1 of this SE. The licensee indicated that there were no recordable indications.

3.3 NRC Staff Evaluation

The licensee submitted a proposed alternative to implement ASME Code Case N-702 and stated that all RPV nozzle-to-vessel shell penetration welds and nozzle inner radii sections, with the exception of the recirculation outlet nozzles, meet the general and nozzle-specific criteria in BWRVIP-241. As noted by the licensee, RPV feedwater nozzles and control rod drive return line nozzles are outside the scope of ASME Code Case N-702.

The applicability of the BWRVIP-241 report to an ASME Code Case N-702 alternative is demonstrated by showing that Criteria 2 through 5 in Section 5.0 of the NRC SE for BWRVIP-241 are met for the recirculation inlet and outlet nozzles since they are bounding with respect to fracture resistance, and that Criterion 1 is met for all components included in the proposed alternative.

The licensee stated that Criterion 1 is satisfied because Hope Creek Technical Specification (TS) Limiting Condition for Operation (LCO) 3.4.6.1 limits the maximum heatup and cooldown rate to less than or equal to 100 °F/hour, which is well below the 115 °F/hour Criterion 1 limit. The NRC staff notes that a March 27, 2017, PSEG Nuclear LLC license amendment request (ADAMS Accession No. ML17086A364), proposes to change the TS LCO 3.4.6.1 to a maximum heatup and cooldown rate "within limits proposed in the PTLR." The NRC staff recognizes that the licensee will verify it still meets the requirements of Criterion 1, should the TS LCO 3.4.6.1 be modified as proposed.

For Criteria 2 and 3 (applicable to the bounding recirculation inlet nozzles), the licensee provided plant-specific data and its evaluation of the driving force factors, or ratios, using the criteria established in Section 5.0 of the BWRVIP-241 SE. The NRC staff reviewed the licensee's calculations and confirms that they show Criterion 2 and 3 are satisfied for the recirculation inlet.

For Criterion 4 (applicable to the bounding recirculation outlet nozzles), the licensee provided plant-specific data and its evaluation of the driving force factors, or ratios, using the criteria established in Section 5.0 of the BWRVIP-241 SE. However, the licensee's calculations show that the recirculation outlet nozzles do not meet the nozzle-specific criteria of BWRVIP-241, and therefore, ASME Code Case N-702 is not applicable to the recirculation outlet nozzles. The licensee did not provide a plant-specific evaluation of Criterion 5. However, as the licensee is not requesting a proposed alternative for the recirculation outlet nozzles, a plant-specific evaluation of Criterion 5 is not necessary.

The results of the evaluations in the licensee's submittal for Criteria 1, 2, and 3 demonstrate the applicability of the BWRVIP-241 reports to Hope Creek by showing the criteria within Section 5.0 of the BWRVIP-241 SE are met. Since the recirculation inlet and outlet nozzles are limiting, as described above, the basis for using Code Case N-702 is demonstrated for the Hope Creek RPV nozzle-to-vessel welds and inner radii listed in Table 1 above. Since Criterion 4 is not met, the recirculation outlet nozzles are excluded from the Table 1 list and are not part of this relief request submittal.

4.0 CONCLUSION

The NRC staff reviewed the licensee's submittal for its proposed alternative contained in Relief Request HC-14R-170. Based on the licensee's demonstration of compliance with the criteria in Section 5.0 of the NRC SE for BWRVIP-241, the NRC staff verifies that the proposed ASME Code Case N-702 alternative provides an acceptable level of quality and safety and applies to the RPV nozzles and inner radii listed in Table 1 of this SE for the fourth ISI interval at Hope Creek. Therefore, the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(z)(1) for the fourth 10-year ISI interval at Hope Creek.

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.

Principal Contributor: J. Jenkins

Date: August 17, 2017

SUBJECT: HOPE CREEK GENERATING STATION – RELIEF FROM THE REQUIREMENTS OF THE ASME CODE FOR ALTERNATIVE TO NOZZLE-TO-VESSEL WELD AND INNER RADIUS EXAMINATIONS (CAC NO. MF9554) DATED AUGUST 17, 2017

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