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PSEG Nuclear LLC

10 CFR 50.55a

LR-N22-0005

January 7, 2022

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

Hope Creek Generating Station
Renewed Facility Operating License Nos. NPF-57
NRC Docket No. 50-354

Subject: Proposed Relief Request Associated with Reactor Pressure Vessel Water Level Instrumentation partial Penetration Nozzle Repairs

In accordance with 10 CFR 50.55a, “Codes and standards.” Paragraph (z)(2), PSEG Nuclear LLC (PSEG) hereby requests approval of the attached relief request associated with the repair of water level instrumentation (WLI) partial penetration nozzles on the Reactor Pressure Vessel (RPV).

This relief request provides a repair technique for the WLI partial penetration nozzles. PSEG would repair these nozzles by installing a weld pad in accordance with ASME Code Case N-638-x, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique, Section XI, Division 1," ASME Code Case N-839-x, "Similar and Dissimilar Metal Welding Using Ambient Temperature SMAW Temper Bead Technique, Section XI, Division 1" or similar code case, as approved or conditionally approved by the NRC in the latest revision of Regulatory Guide 1.147, and installing a new half nozzle on to the weld pad using a partial penetration weld. This repair technique is referred to as a “half nozzle repair.” (Note: “-x” refers to the ASME Code Case revision approved or conditionally approved by the NRC in the latest revision of Regulatory Guide 1.147.)

In support of the flaw evaluation and applicable acceptance criteria associated with the repair, ASME Code Paragraph IWB-3420 and Subarticle IWB-3600 require characterization of the flaw in the partial penetration weld or nozzle. Currently, there is not a Performance Demonstration Initiative (PDI) qualified technique to perform volumetric Non-Destructive Examination (NDE) of the partial penetration weld or nozzle in this configuration that can be used to accurately characterize the location, orientation, or size of a flaw. As an alternative to performing the NDE required to characterize the flaw in the partial penetration weld or nozzle, PSEG is proposing to analyze a maximum postulated flaw that bounds the range of flaw sizes that could exist in the original J-groove weld and nozzle, as discussed in Attachment 2.

In accordance with 10 CFR 50.55a(z)(2), PSEG proposes the following alternative on the basis that performing a Code required repair results in a hardship without a compensating increase in quality and safety. PSEG concludes that the proposed alternative provides reasonable assurance of structural integrity and leak tightness for the duration of one operating cycle.

PSEG requests approval of the proposed alternative by September 30, 2022.

Attachment 1 contains a summary of commitments associated with this request.

Should you have any questions concerning this matter, please contact Mike Wiwel at 856-339-7907.

Sincerely,

Rich Montgomery
Manager - Licensing
PSEG Nuclear LLC

Attachments: 1 Summary of Commitments
2 Relief Request HC-I4R-220

cc: Administrator, Region I, NRC
NRC Senior Resident Inspector, Hope Creek
Project Manager, USNRC
A. Pfaff, Manager, NJBNE
Corporate Commitment Tracking Coordinator
Station Commitment Tracking Coordinator

bcc: Manager – Hope Creek Programs
Director - Regulatory Compliance
Hope Creek ISI Program Owner
Corporate ISI Program Owner
Records Management

Attachment 1

Summary of Commitments

LR-N22-0005
Attachment 1

Summary of Commitments

The following table identifies commitments made in this document. (Any other actions discussed in the submittal represent intended or planned actions. They are described for the NRC's information and are not regulatory commitments.)

COMMITMENT	COMMITTED DATE OR OUTAGE	COMMITMENT TYPE	
		One-Time Action (Yes/No)	Programmatic (Yes/No)
The final one-cycle flaw analytical evaluation, evaluation of repair, and corrosion evaluation will be submitted within 14 days following the end of the refueling outage in which the flaw is identified	Within 14 days following the end of the refueling outage in which the flaw is identified	Yes	No

ATTACHMENT 2

RELIEF REQUEST HC-I4R-220

10 CFR 50.55A RELIEF REQUEST
HC-I4R-220

Proposed Alternative Associated with One-Cycle Reactor Pressure Vessel (RPV) Water Level Instrument (WLI) Nozzle Repair in Accordance with 10 CFR 50.55a(z)(2)

1. ASME Code Component(s) Affected

Code Class:	ASME Section XI Code Class 1
Examination Category:	B-P
Item Number:	B15.10
Description:	Reactor Pressure Vessel (RPV) Water Level Instrument (WLI) Partial Penetration Nozzles

2. Applicable Code Edition and Addenda

The current edition for the Fourth 10 year Inservice Inspection (ISI) Interval for Hope Creek is the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection and Testing of Components of Light-Water Cooled Plants," 2007 Edition through the 2008 Addenda. The Interval began on December 13, 2017 and is scheduled to end on December 31, 2026. The code of construction for the RPV is the ASME Code Section III, 1968, Including Addenda through Winter 1969.

3. Applicable Code Requirements

Flaw Removal

- Paragraph IWA-4412 states "Defect removal shall be accomplished in accordance with the requirements of IWA-4420."

- Subparagraph IWA-4611.1(a) states “Defects shall be removed in accordance with IWA-4422.1. A defect is considered removed when it has been reduced to an acceptable size.”

- Subarticle IWA-5250(a)(3) states “Components requiring corrective action shall have repair/replacement activities performed in accordance with IWA-4000 or corrective measures performed where the relevant condition can be corrected without a repair/replacement activity.”

- Subarticle N-532 of the ASME Code Section III 1968 Edition up to and including the Winter 1970 Addenda, or Subarticle NB-4620 of the ASME Code Section III 1971 Edition up to and including the 2019 Edition, contains requirements for postweld heat treatment.

Flaw Evaluation

- Subparagraph IWB-3142.1(b) states "A component whose visual examination detects the relevant conditions described in the standards of Table IWB-3410-1 shall be unacceptable for continued service, unless such components meet the requirements of IWB-3142.2, IWB-3142.3, or IWB-3142.4."

- Subarticle IWA-3300(a) states, in part, "Flaws detected by the preservice and inservice examinations shall be sized ... "

- Subarticle IWA-3300(b) states, in part, "Flaws shall be characterized in accordance with IWA-3310 through IWA-3390, as applicable ... "

- Subarticle IWB-3420 states "Each detected flaw or group of flaws shall be characterized by the rules of IWA-3300 to establish the dimensions of the flaws. These dimensions shall be used in conjunction with the acceptance standards of IWB-3500."

- Subparagraph IWB-3522.1 states, in part, "A component whose visual examination (IWA-5240) detects any of the following relevant conditions shall meet IWB-3142 and IWA-5250 prior to continued service ... "

- Subarticle IWB-3610(b) states, in part, "For purposes of evaluation by analysis, the depth of flaws in clad components shall be defined in accordance with Fig. IWB-3610-1 ..."

- ASME Code Case N-749-x, as approved or conditionally approved by the NRC in the latest revision of Regulatory Guide 1.147, allows for the use of elastic-plastic fracture mechanics (EPFM) methods in lieu of IWB-3610 and IWB-3620 acceptance criteria to evaluate flaws in ferritic steel components operating in the upper shelf temperature range.

4. Reason for Request

This relief request provides a repair technique for flawed or leaking RPV WLI partial penetration nozzles. This repair partially replaces the existing nozzle assembly with a nozzle that is resistant to Intergranular Stress Corrosion Cracking (IGSCC).

PSEG is proposing to apply a welded pad on the Outer Diameter (OD) of the RPV using IGSCC resistant nickel alloy filler metal (for example, 52M). The new weld pad will be welded using the machine Gas Tungsten Arc Welding (GTAW) or manual Shielded Metal Arc Welding (SMAW) Ambient Temperature Temper Bead (ATTB) welding processes. PSEG is proposing to attach an IGSCC resistant nozzle to the new weld pad with a partial penetration weld using a non-temper bead manual welding process and IGSCC resistant nickel alloy filler metal.

The original partial penetration J-groove weld and a remnant of the original nozzle will remain in place. A flaw evaluation will demonstrate the acceptability of leaving the original partial penetration J-groove weld and remnant nozzle, with a maximum postulated flaw, in place for one cycle (see "Flaw Analytical Evaluation" below). Paragraphs IWA-4412 and IWA-4611 contain requirements for the removal of, or reduction in size of defects. The defect on the WLI partial penetration nozzles will not be removed; therefore, relief is sought from these requirements.

Subarticles IWB-3400 and IWB-3600 were written with the expectation that volumetric Non-Destructive Examination (NDE) techniques such as Ultrasonic Testing (UT) would be used to determine the flaw size and shape. In support of the flaw evaluation, the Subarticles IWB-3420 and IWB-3610(b) require characterization of the flaw in the leaking nozzle. Although demonstrated, there is not a Performance Demonstration Initiative (PDI) qualified technique to perform NDE of the partial penetration weld or nozzle in this configuration that can be used to accurately characterize the location, orientation, or size of a flaw.

The flaw evaluation methods presented in Subarticle IWB-3610 and Non-Mandatory Appendix A of Section XI are based on Linear Elastic Fracture Mechanics (LEFM) methods. ASME Code Case N-749-x, as approved or conditionally approved by the NRC in the latest revision of Regulatory Guide 1.147, was developed to provide criteria for the use of EPFM methods as acceptable alternatives to the LEFM methods currently contained in Subarticle IWB-3610 and Non-Mandatory Appendix A, for operating conditions where ferritic vessel materials are operating on the material toughness upper shelf temperature range.

Since the Construction Code has requirements for postweld heat treatment, PSEG is proposing to install a welded pad in accordance with ASME Code Case N-638-x, N-839-x or similar code case, as approved or conditionally approved by the NRC in the latest revision of Regulatory Guide 1.147.

5. Proposed Alternative and Basis for Use

In accordance with 10 CFR 50.55a, "Codes and standards," paragraph (z)(2), PSEG proposes the following alternative to the requirements specified in Section 3 above on the basis that performing a Code required repair results in a hardship without a compensating increase in quality and safety. This relief request provides a repair technique for the instrument nozzles that will be initially demonstrated for one cycle. PSEG intends to follow-up with a relief request for the permanent acceptance of the repair prior to the end of the one cycle. A repair in accordance with the ASME Code, which would remove the flaw from the inner portion of the RPV, would require a full core offload to access the repair location, result in significant risk associated with the inclusion of loose parts and foreign material, and result in significant increase in radiological exposure. These areas of concern result in a significant hardship over the proposed modification.

In lieu of the ASME Code compliant repair, the following alternatives are proposed:

- As an alternative to flaw removal or reduction in size to meet the applicable acceptance standards per Paragraphs IWA-4412 and IWA-4611, PSEG proposes

to implement an OD repair of the RPV WLI partial penetration nozzles utilizing an OD weld pad and half nozzle as described in the repair of nozzle penetration section below.

- As an alternative to performing the NDE required to characterize the flaw under Subarticles IWB-3420 and IWB-3610(b) in the WLI partial penetration weld or nozzle, PSEG proposes analyzing a maximum postulated flaw that bounds the range of flaw sizes that could exist in the original J-groove weld and nozzle.

- As an alternative to the requirements of postweld heat treatment required by the Construction Code, PSEG is proposing to install a welded pad in accordance with ASME Code Case N-638-x, N-839-x or similar code case, as approved or conditionally approved by the NRC in the latest revision of Regulatory Guide 1.147.

Basis for Use

A. Component Information

The RPV and IGSCC susceptible WLI partial penetration nozzles for Hope Creek are fabricated as followed:

RPV Material (clad with stainless steel)	**Nozzle Number**	**Nozzle Material**	**J-Groove Weld Material**
SA-533 Gr. B Class 1	N11A, N11B, N11C, N11D, N12A, N12B, N12C, N12D, N16A, N16B, N16C, N16D	SA-541	Alloy 82/182 with Alloy 182 butter

There are 12 IGSCC susceptible WLI partial penetration nozzles. PSEG intends to repair these nozzles, as required, based on the discussion provided in the following sections.

B. Examination of the J-groove Weld

A volumetric (UT) examination will also be performed on the existing J-groove weld in accordance with BWRVIP-03 Revision 20 or later (Reference 1). The current RPV OD volumetric examination technique has been demonstrated to only interrogate the partial penetration J-groove welds and the surrounding RPV low alloy steel (LAS) material. This examination technique provides a method for crack detection, length sizing, and depth sizing of flaws that initiate within the partial penetration J-groove weld material and detects planar flaw indications in the LAS material.

C. Flaw Analytical Evaluation

A flaw evaluation for one cycle of operation in accordance with Subarticle IWB-3610 (LEFM method), as well as per ASME Code Case N-749-x (EPFM method) will be

performed. ASME Code Case N-749-x or similar code case will be used with all applicable conditions stated in the latest revision of Reg. Guide 1.147.

The ASME Section XI flaw evaluation requires a projection of crack growth for the flaw in the J-groove weld or nozzle being abandoned in-place, and potentially into the RPV LAS material. The potential crack propagation is into the LAS by fatigue and stress corrosion cracking. For this fracture mechanics analysis, a conservative evaluation will be performed. This evaluation will be used to demonstrate compliance with a combination of Subarticle IWB-3610 and ASME Code Case N-749-x or similar code case (as approved or conditionally approved by the NRC in the latest revision of Regulatory Guide 1.147), as applicable. This one-cycle flaw evaluation will be submitted to the NRC. Refer to Summary of Commitments section (Attachment 1) for timing of submittal of the flaw evaluation.

D. Repair of the WLI Partial Penetration Nozzle

PSEG will replace this existing nozzle assembly with a nozzle penetration that is resistant to IGSCC, using ASME Code Case N-638-x, N-839-x, or similar code case, as approved or conditionally approved by the NRC in the latest revision of Regulatory Guide 1.147, and in accordance with the construction code. A welded pad will be applied to the OD of the RPV using IGSCC resistant nickel alloy filler metal and will be welded using the machine GTAW or manual SMAW ATTB welding processes. The IGSCC resistant nozzle will be attached to the new weld pad with a partial penetration weld using a non-temper bead manual welding process and IGSCC resistant filler metal. The original partial penetration J-groove weld and a remnant of the original nozzle are planned to remain in place.

The new weld pad will be examined as required by ASME Code Case N-638-x, N-839-x or similar code case, as approved or conditionally approved by the NRC in the latest revision of Regulatory Guide 1.147. These examinations will verify there are no unacceptable indications in the newly installed weld pad or original base metal material.

A design analysis will be performed in accordance with the design requirements of the construction code. The new design will be reconciled to the original construction code and address all applicable loads to ensure all Code requirements are met. A one-cycle evaluation of the repair will be submitted to the NRC. Refer to the Summary of Commitments section (Attachment 1) for timing of the submittal of the evaluation of the repair.

The current accumulated Effective Full Power Years (EFPYs) and fluence values will be calculated to ensure the material in the area of this repair is not expected to have decreased fracture toughness or ductility associated with damage of the LAS in the beltline region; therefore, there will not be a weldability concern for the repair.

E. Corrosion Evaluation

A corrosion evaluation will be performed to consider potential material degradation due to the repair of the RPV WLI partial penetration nozzle. The repair will result in the RPV LAS being exposed to the reactor coolant. The corrosion evaluation will address general corrosion, crevice corrosion, and galvanic corrosion of the exposed

LAS in the gap. A review will be performed to determine implementation of the On-Line Noble Metal Chemical addition with Hydrogen Water Chemistry to mitigate corrosion for applicable nozzles. The reactor water chemistry of Hope Creek meets the requirements of the latest revision of BWRVIP-190 (currently under Revision 1), BWRVIP Water Chemistry Guidelines. The corrosion evaluation will be submitted to the NRC. Refer to Summary of Commitments section (Attachment 1) for timing of submittal of the corrosion evaluation.

F. Loose Parts Evaluations

Given the original WLI partial penetration nozzle is not intended to be entirely removed, PSEG will complete a lost-parts evaluation to assess the potential for nozzle segments to enter the RPV during power operation. Evaluations will be completed to address the potential impact on the fuel and the potential impact on internal RPV components.

Conclusion

Based on the above, in accordance with 10 CFR 50.55a(z)(2), PSEG has concluded that compliance with the ASME Code to perform the repair results in a hardship without a compensating increase in quality and safety. The proposed alternative provides reasonable assurance of structural integrity or leak tightness of the subject components(s) as discussed above.

6. Duration of Proposed Alternative

Relief is requested for the duration of the subsequent operating cycle following the outage in which the indication is identified.

A separate relief request will be submitted to justify continued use of the nozzle repair beyond the first cycle. Such relief request, which will contain the appropriate analyses and justification for the remainder of the plant operating life, will be submitted prior to the end of the subsequent operating cycle following the repair.

The requested use of the proposed alternative for Hope Creek is for its current 10-year ISI Interval.

7. Precedents

A similar relief request was submitted by Exelon Generation for several of the plants in its BWR fleet on August 12, 2021 (ML21224A123).

A similar relief request was previously approved via a verbal authorization on April 16, 2012 for Quad Cities Nuclear Power Station, Unit 2 (ML12107A472). The NRC Safety Evaluation was subsequently issued on January 30, 2013 (ML13016A454). A second similar relief request was previously approved via a verbal authorization on May 17, 2017 for Limerick Generating Station, Unit 2 (ML17137A307). The NRC Safety Evaluation was subsequently issued on August 14, 2017 (ML17208A090). A third similar relief request was previously approved via a verbal authorization on

November 6, 2020 for Peach Bottom Atomic Power Station, Unit 2 (ML20314A028). The NRC Safety Evaluation was subsequently issued on April 23, 2021 (ML21110A680).

8. References

1) BWRVIP-03, Revision 20: BWR Vessel and Internals Project, “Reactor Pressure Vessel and Internals Examination Guidelines”