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

May 1, 2015

Mr. Bryan C. Hanson
President and Chief Nuclear Officer
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: OYSTER CREEK GENERATING STATION, FOURTH 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN REQUEST FOR RELIEF R-44 AND R-45 (TAC NOS. MF3406 AND MF3407)

Dear Mr. Hanson:

By letter dated January 7, 2014, as supplemented by letters dated November 14, 2014, and January 29, 2015, Exelon Generation Company, LLC (the licensee) submitted Requests for Relief (RR) R-44 and R-45 for the U.S. Nuclear Regulatory Commission's (NRC's) approval. The RRs requested relief from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI for Oyster Creek Nuclear Generating Station (OCNGS). Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii), the licensee requested relief from the "essentially 100 percent" volumetric coverage requirements of ASME Code Section XI for the subject welds on the basis that the code requirement is impractical.

The NRC staff has reviewed the subject request and has concluded, as set forth in the enclosed safety evaluation, that the licensee's proposed alternative as described in R-44 and R-45, has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(iii), and is in compliance with the requirements of 10 CFR 50.55a with the granting of these reliefs. Therefore, the NRC staff grants relief pursuant to 10 CFR 50.55a(g)(6)(i) for the subject examinations of the components contained in R-44 and R-45, for the fourth inservice inspection interval at OCNGS. The NRC staff has further determined that granting R-44 and R-45, in accordance with 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 given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in the subject requests for relief remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector

If you have any questions regarding this matter, please contact the Senior Project Manager, John G. Lamb at (301) 415-3100 or by e-mail at John.Lamb@nrc.gov.

Sincerely,

for

Douglas A. Broaddus, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-219

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

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

FOR THE FOURTH 10-YEAR INTERVAL INSERVICE INSPECTION

REQUEST FOR RELIEF NOS. R-44 AND R-45

EXELON GENERATION COMPANY, LLC

OYSTER CREEK NUCLEAR GENERATING STATION

DOCKET NO. 50-219

1.0 INTRODUCTION

By letter dated January 7, 2014, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14028A579) Exelon Generation Company, LLC (Exelon or the licensee), submitted Requests for Relief (RRs) R-44 and R-45 from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," for Oyster Creek Nuclear Generating Station (OCNGS). Additionally, in response to U.S. Nuclear Regulatory Commission (NRC) Requests for Additional Information (RAI), the licensee submitted further information in letters dated November 14, 2014 (ADAMS Accession No. ML14321A044), and January 29, 2015 (ADAMS Accession No. ML15082A163). Based on an NRC RAI dated September 17, 2014, the licensee withdrew requests for relief for welds originally listed in R-44 Category B-A, Items B1.21 and B1.22, and those listed in Category C-F-2, Item C5.81, in R-45, by letter dated November 14, 2014.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii), the licensee requested relief from the "essentially 100 percent" volumetric coverage requirements of ASME Code Section XI for the subject welds on the basis that the code requirement is impractical.

2.0 REGLATORY EVALUATION

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 regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code, which was incorporated by reference in 10 CFR 50.55a(b) (retitled paragraph 50.55a(a)(1)(ii) by 79 FR

65776, dated November 5, 2014), 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

The regulations in 10 CFR 50.55a(g)(5)(iii), state, in part, that that licensees may determine that conformance with certain code requirements is impractical and that the licensee shall notify the Commission and submit information in support of the determination. Determination of impracticality in accordance with this section must be based on the demonstrated limitations experienced when attempting to comply with the code requirements during the inservice inspection (ISI) interval for which the request is being submitted. RRs made in accordance with this section must be submitted to the NRC no later than 12 months after the expiration of the initial 120-month inspection interval or subsequent 120-month inspection interval for which relief is sought.

The regulations in 10 CFR 50.55a(g)(6)(i), state, in part, that the Commission will evaluate determinations under paragraph (g)(5) of this section that code requirements are impractical. The Commission may grant such relief and may impose such alternative requirements as it determines 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.

The licensee has requested relief from ASME Code requirements pursuant to 10 CFR 50.55a(g)(5)(iii). The ASME Code of Record for OCNGS, fourth 10-year interval ISI program, which ended on January 14, 2013, is the 1995 Edition, including the 1996 Addenda, of Section XI of the ASME Boiler and Pressure Vessel Code.

3.0 TECHNICAL EVALUATION

The RR applies to the fourth 10-year ISI interval. The ASME Code of Record for OCNGS, fourth 10-year ISI interval, which ended on January 14, 2013, was the 1995 Edition, including the 1996 Addenda, of Section XI of the ASME Boiler and Pressure Vessel Code.

The information provided by the licensee in support of the RRs from ASME Code requirements has been evaluated and the bases for disposition are documented below. For clarity, the requests have been evaluated in several parts according to ASME Code Examination Category.

3.1 Request for Relief R-44, Part A, ASME Code, Section XI, Examination Category B-A, Items B1.12, B1.21, B1.22, and B1.40, Pressure Retaining Welds in Reactor Vessels

ASME Code Requirement

ASME Code, Section XI, Examination Category B-A, Items B1.12, B1.21, B1.22, and B1.40, require essentially 100 percent volumetric examination, as defined by Figures IWB-2500-2, IWB-2500-3 and IWB-2500-5, of the length of Class 1 Reactor Pressure Vessel (RPV) longitudinal shell welds, circumferential and meridional head welds, and head-to-flange welds. A surface examination is also required for Item B1.40 welds. "Essentially 100 percent," as clarified by ASME Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds," is greater than 90 percent coverage of the examination volume, or surface area, as applicable. ASME Code Case N-460 has been approved for use by the NRC in

Regulatory Guide 1.147, Revision 17, "Inservice Inspection Code Case Acceptability" (RG 1.147, R17).

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required volumetric examination for the RPV welds listed below in Table 3.1.1 (below).

Table 3.1.1- ASME CODE, Section XI, Examination Category B-A

ASME Code Item	Weld ID	Weld Type	Coverage Obtained (Percent)
B1.12	NR02 2-563D	Upper Intermediate Shell Course	64.3
B1.12	NR02 2-563E	Upper Intermediate Shell Course	67.6
B1.12	NR02 2-563F	Upper Intermediate Shell Course	53.0
B1.12	NR02 2-564A	Lower Intermediate Shell Course	50.7
B1.12	NR02 2-564C	Lower Intermediate Shell Course	49.4
B1.12	NR02 2-564D	Lower Shell Course Assembly	55.2
B1.12	NR02 2-564E	Lower Shell Course Assembly	48.3
B1.12	NR02 2-564F	Lower Shell Course Assembly	67.9
B1.40	NR02 1-574	Reactor Head-to-Flange	58.0

Note: In the licensee's response dated November 14, 2014, to the first NRC RAI, Exelon withdrew the RR for volumetric examination of the Examination Category B-A, Items B1.21 and B1.22 RPV circumferential and meridional head welds listed in Table 3.1.2 below. For Examination Category B-A, Items B1.21 and B1.22, circumferential and meridional head welds, Table IWB-2500-1 requires volumetric examination of the accessible length of all welds. The licensee indicated that essentially 100 percent of the accessible length was examined for the subject Item B1.21 and B1.22 welds.

Table 3.1.2 – ASME Code, Section XI, Examination Category B-A, Items B1.21 and B1.22

ASME Code Item	Weld ID	Weld Type
B1.21	NR02 2-562	Lower Head Circumferential Weld
B1.22	NR02 4-562A	Lower Head Meridional
B1.22	NR02 4-562D	Lower Head Meridional
B1.22	NR02 4-562F	Lower Head Meridional

Licensee's Basis for Relief Request

RPV Longitudinal Shell Welds – The completed examinations were limited due to the feedwater spargers, core spray piping, core spray risers, surveillance specimen basket, shroud repair tie rod, proximity of recirculation outlet nozzle, and conical supports, as applicable.

RPV Head-to-Flange Welds - The completed examination coverage was limited due to the closure head flange configuration.

Licensee's Proposed Alternative Examination

The licensee did not propose any alternative examinations for the subject welds. However, the licensee's examinations were performed to the maximum extent practical.

NRC Staff Evaluation

The ASME Code requires essentially 100 percent volumetric and surface examination, as applicable, of pressure retaining welds in the RPV. However, for the subject welds at OCNGS, complete examinations are restricted by their design geometry and the proximity of surrounding appurtenances. In order to effectively increase the examination coverage, the RPV and adjacent components would require design modifications or replacement. Therefore, examining essentially 100 percent of the ASME Code-required volumes is impractical.

The design of the OCNGS RPV limits the examination of the subject welds as shown in technical descriptions and sketches provided by the licensee. The RPV longitudinal shell and head-to-flange welds listed in Table 3.1.1 (above) were examined using 45-degree shear and 60 or 70-degree refracted longitudinal wave scans with equipment, procedures and personnel that were qualified by performance demonstration according to ASME Code, Section XI, Appendix VIII.

For the subject RPV longitudinal shell welds at OCNGS, ultrasonic examinations were restricted due to the feedwater spargers, core spray piping, core spray risers, surveillance specimen basket, shroud repair tie rod, proximity of recirculation outlet nozzle, and conical supports, as applicable. The licensee was able to obtain between 49.4 percent and 67.9 percent of the required ASME Code volume to be completed as shown in Table 3.1.1 (above). For the subject RPV head-to-flange Weld NR02 1-574, the ultrasonic examinations were restricted due to the closure head flange configuration. The licensee was able to obtain 58.0 percent of the required ASME Code volume to be completed. A magnetic particle (MT) surface examination was also completed for head-to-flange Weld NR02 1-574. No unacceptable indications were observed during any volumetric or surface examinations.

For RPV longitudinal shell and head-to-flange welds at OCNGS, the licensee has shown that it is impractical to meet the ASME Code-required 100 percent volumetric examination coverage due to their design geometries and proximity of integral RPV appurtenances. Based on the volumetric coverage obtained, along with the examination of other RPV pressure retaining welds, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that were performed. Therefore, the NRC staff determined that based on the ASME Code examinations performed, it provides reasonable assurance of structural integrity of the subject components.

3.2 Request for Relief R-44, Part B, ASME Code, Section XI, Examination Category B-D, Items B3.90 and B3.100, Full Penetration Welded Nozzles in Vessels

ASME Code Requirement

ASME Code, Section XI, Examination Category B-D, Items B3.90 and B3.100 require 100 percent volumetric examination, as defined by Figures IWB-2500-7 (a) through (d), as applicable, of full penetration Class 1 reactor pressure vessel (RPV) nozzle-to-shell welds and nozzle inside radius sections, respectively. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, R17, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent (i.e., greater than 90 percent examination coverage is obtained).

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required volumetric examinations for the RPV nozzle-to-vessel welds and nozzle inside radius sections listed below in Table 3.2.1 (below).

Table 3.2.1-ASME Code, Section XI, Examination Category B-D

ASME Code Item	Weld ID	Weld Type	Coverage Obtained (Percent)	Angle Modes
B3.90	NR02 3-565A	N1A Recirculation Outlet Nozzle	45.2	45S, 60L
B3.90	NR02 3-565B	N1B Recirculation Outlet Nozzle	45.2	45S, 60L
B3.90	NR02 3-565C	N1C Recirculation Outlet Nozzle	22.0	45S, 60L,70L,60S
B3.90	NR02 3-565D	N1D Recirculation Outlet Nozzle	22.0	45S, 60L,70L,60S
B3.90	NR02 3-565E	N1E Recirculation Outlet Nozzle	47.9	45S,60L
B3.90	NR02 6-566A	N3A Main Steam Nozzle	52.9	45S,60L
B3.90	NR02 6-566B	N3B Main Steam Nozzle	52.9	45S,60L
B3.90	NR02 4-566A	N4A Feedwater Nozzle	51.8	60L
B3.90	NR02 4-566B	N4B Feedwater Nozzle	52.5	60L
B3.90	NR02 4-566C	N4C Feedwater Nozzle	49.5	60L
B3.90	NR02 4-566D	N4D Feedwater Nozzle	52.5	60L
B3.90	NR02 2-566A	N5A Isolation Condenser Nozzle	29.0	45S,60L,70L,60S
B3.90	NR02 2-566B	N5B Isolation Condenser Nozzle	22.0	45S, 60L,70L,60S
B3.90	NR02 2-567A	N6A Core Spray Nozzle	28.1	45S, 60L
B3.90	NR02 2-567B	N6B Core Spray Nozzle	61.7	45S, 60L
B3.90	NR02 1-576	N7A Closure Head Nozzle	76.0	45S, 60S, 60L
B3.90	NR02 3-576	N7B Closure Head Nozzle	78.0	45S, 60S, 60L

Table 3.2.1-ASME Code, Section XI, Examination Category B-D				
ASME Code Item	**Weld ID**	**Weld Type**	**Coverage Obtained (Percent)**	**Angle Modes**
B3.90	NR02 5-576	N8 Closure Head Nozzle	89.0	60L
B3.90	NR02 6-567	N9 CRD Return Nozzle	69.0	55S, 60L
B3.100	NR02 2-566A	N5A Isolation Condenser Nozzle Inner Radius	78.9	60S, 65S, 70S
B3.100	NR02 2-566B	N5B Isolation Condenser Nozzle Inner Radius	68.8	60S, 65S, 70S
B3.100	NR02 2-567A	N6A Core Spray Nozzle Inner Radius	44.0	45S, 60L
B3.100	NR02 2-567B	N6B Core Spray Nozzle Inner Radius	60.9	60S, 66S, 70S
B3.100	NR02 1-576	N7A Closure Head Nozzle Inner Radius	74.0	60S, 70S, 80S
B3.100	NR02 3-576	N7B Closure Head Nozzle Inner Radius	88.0	60S, 70S, 80S

Licensee's Basis for Relief Request

RPV Nozzle-to-Vessel Welds - The completed examinations were limited due to nozzle configuration, proximity of insulation support ring, optimized UT scanner arm length, proximity of N6A, B6B, N13, N13B, and N14 nozzles, N15B and N16B instrumentation nozzles, proximity of N4C feedwater nozzle, and bio-shield access limitations, as applicable.

RPV Nozzle Inside Radius Sections – The completed examination was limited due to nozzle configuration, and proximity of N13 and N14 nozzles, N15B and N16B instrumentation nozzles, insulation support ring, bio-shield access limitations, and offset nozzle configuration, as applicable.

Licensee's Proposed Alternative Examination:

The licensee did not propose any alternative examinations for the subject welds. However, the licensee's examinations were performed to the maximum extent practical.

NRC Staff Evaluation

The ASME Code requires 100-percent volumetric examination of ASME Class 1 nozzle-to-shell welds and inside radius sections. However, the design configuration of the subject RPV welds, the curvature of the nozzle blend radii, and the proximity of surrounding appurtenances limit access for ultrasonic scanning. In order to effectively increase the examination coverage, the nozzle-to-shell welds would require design modifications. Therefore, obtaining 100 percent of ASME Code-required volumetric examinations is impractical.

The RPV nozzle-to-shell welds and inside radius sections listed in Table 3.2.1 are constructed of carbon steel material with stainless steel inside diameter surface cladding to minimize corrosion. These full penetration butt welds extend the full thickness of the vessel head, and the nozzle configurations are of the "set-in" design, which essentially makes the welds concentric rings aligned parallel with the nozzle axes in the through-wall direction of the vessel. This nozzle design geometry limits ASME Code-required ultrasonic angle beam examinations to be performed from the vessel side of the welds. Other interferences or issues that caused scanning limitations were the insulation support ring, limited scanner arm length, and proximity to surrounding nozzles.

As shown on the sketches and technical descriptions included in the licensee's submittals, examinations of the subject RPV nozzle-to-shell welds and inside radius sections have been completed to the extent practical with volumetric coverage ranging from approximately 22.0 to 89.0 percent (see Table 3.2.1) of the ASME Code-required volumes. The examination volumes included the weld and base materials near the inside surface of the weld joint, which are high regions of stress, and where one would expect degradation sources to be manifested should they occur. The RPV nozzle-to-shell welds and inside radius sections used manual and/or automated ultrasonic examinations conducted with equipment, procedures and personnel that were demonstrated to the process outlined in ASME Code Section XI, Appendix VIII, using refracted shear and longitudinal wave examination modes listed in Table 3.2.1. No unacceptable indications were observed in these welds.

Although ultrasonic scans were limited to the vessel side, studies have found that inspections conducted through carbon steel are equally effective whether the ultrasonic waves have only to propagate through the base metal, or have to also propagate through the carbon steel weldment.[1] Therefore, it is expected that the ultrasonic techniques employed by the licensee on the RPV nozzle-to-shell welds and inside radius sections would detect structurally significant flaws that might occur on either side of the subject welds due to the fine-grained carbon steel microstructures present in these materials.

The licensee has shown that it is impractical to meet the ASME Code-required 100-percent volumetric examination coverage for the subject nozzle-to-shell welds and inside radius sections due to nozzle design, curvature of the nozzle blend radii, and adjacent obstructions. Based on the volumetric coverage obtained for the subject welds, and considering the licensee's performance of ultrasonic techniques employed to maximize this coverage, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that were performed. Therefore, the NRC staff determined that based on the ASME Code examinations performed, it provides reasonable assurance of structural integrity of the subject components.

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1 P.G. Heasler, and S. R. Doctor, 1996. *Piping Inspection Round Robin*, NUREG/CR-5068, PNNL-10475, U.S. Nuclear Regulatory Commission, Washington, DC.

3.3 Request for Relief R-44, Part C, ASME Code, Section XI, Examination Category B-F, Item B5.10, Pressure Retaining Dissimilar Metal Welds in Vessel Nozzles

ASME Code Requirement

ASME Code, Section XI, Examination Category B-F, Item B5.10, requires 100 percent volumetric and surface examinations, as defined by Figure IWB-2500-8, of Class 1 RPV nozzle-to-safe end butt welds, NPS 4 inch diameter, or larger. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, R17, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent (i.e., greater than 90 percent examination coverage is obtained).

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required volumetric examinations for the RPV nozzle-to-safe end butt welds listed below in Table 3.3.1 (below).

Table 3.3.1- ASME Code, Section XI, Examination Category B-F

ASME Code Item	Weld ID	Weld Type	Coverage Obtained (Percent)
B5.10	NR02 5-567	N9 CRD Return Nozzle-to-Safe End	67.4
B5.10	NR02 4-565D	N1D Recirculation Outlet Nozzle-to-Safe End	70.0

Licensee's Basis for Relief Request

The completed examinations were limited due to outside diameter (OD) safe end configuration for RPV nozzle-to-safe end Weld NR02 5-567, and the nozzle OD configuration for RPV nozzle-to-safe end Weld NR02 4-565D.

Licensee's Proposed Alternative Examination

The licensee did not propose any alternative examinations for the subject welds. However, the licensee's examinations were performed to the maximum extent practical.

NRC Staff Evaluation

The ASME Code requires essentially 100 percent volumetric and surface examinations for selected Examination Category B-F pressure retaining dissimilar metal welds in Class 1 vessel nozzles. Complete volumetric examinations are restricted by design configurations of the nozzle-to-safe end welds. This precludes the licensee from obtaining full volumetric examinations from both sides of these welds. To gain access for examination, the welds would require design modifications. Therefore, the ASME Code-required volumetric examinations are considered impractical.

As shown on the sketches and technical descriptions included in the licensee's submittals, examinations of the RPV dissimilar metal nozzle-to-safe end welds have been completed to the extent practical with volumetric coverage ranging from approximately 67.4 to 70.0 percent (see Table 3.3.1 (above)) of the ASME Code-required volumes. The RPV control rod drive (CRD) return and recirculation outlet nozzles are carbon steel with stainless steel cladding on the inside diameter connected to a stainless steel safe-end. In the November 14, 2014, response to an NRC RAI, the licensee clarified that for weld NR02 4-565D, downstream examinations were limited due to the nozzle to safe-end configuration. All scans were limited due to incomplete machining of the corrosion resistant cladding (CRC) on the OD surface. Machining of the OD surface CRC stopped near the weld centerline, and left a step approximately 0.020" to 0.040" in height, for 360 degrees. During a recent 2014 outage, this step was eliminated and the ASME Code-required volume was examined with 100 percent coverage. For weld NR02 5-567, the nozzle configuration and CRC geometry limited scanning. Surface preparation of this weld was limited due to its location close to the bioshield and the adjacent main steam line.

Volumetric examinations on the RPV nozzle-to-safe end welds were conducted with equipment, procedures and personnel that were certified to a performance demonstration process outlined in ASME Code Section XI, Appendix VIII. These techniques have been qualified for flaws located on the near and far-side of the welds using ASME Code, Appendix VIII, Supplement 10. The licensee's ultrasonic scanning techniques included 45-degree shear, and 45- and 60-degree refracted longitudinal waves (L-waves). L-waves have been shown to provide enhanced detection on the far-side of austenitic stainless steel welds[2,3,4]. Therefore, while the licensee has only taken credit for obtaining limited volumetric coverage, it is expected that the techniques employed would have provided coverage beyond the near-side of the welds. In addition, the licensee completed the ASME Code-required liquid penetrant surface examination to its full extent. No recordable indications were noted during the performance of the surface or volumetric examinations.

The licensee has shown that it is impractical to meet the ASME Code-required volumetric examination coverage for the subject welds due to the design geometry of the welds. Based on the volumetric and surface coverage obtained, and considering the licensee's performance of ultrasonic techniques employed to maximize this coverage, it is reasonable to conclude that, if significant service-induced degradation had occurred in the wrought and welded portions of the ASME-required volumes of the subject welds, evidence of it would have been detected by the examinations performed. Therefore, the NRC staff determined that based on the ASME Code examinations performed, it provides reasonable assurance of structural integrity of the subject components.

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2 F.V. Ammirato, X. Edelmann, and S.M. Walker, *Examination of Dissimilar Metal Welds in BWR Nozzle-to-Safe End Joints*, 8th International Conference on NDE in the Nuclear Industry, ASM International, 1987.

3 Lemaitre, P., T.D. Koble, and S.R. Doctor, PISC III Capability Study on Wrought-to-Wrought Austenitic Steel Welds: Evaluation at the Level of Procedures and Techniques, Effectiveness of Nondestructive Examination Systems and Performance Demonstration, PVP-Volume 317, NDE-Volume 14, ASME, 1995.

4 Anderson, M.T., A.A. Diaz, A.D. Cinson, S.L. Crawford, S.E. Cumblidge, S.R Doctor, K.M. Denslow, and S. Ahmed, 2011. *An Assessment of Ultrasonic Techniques for Far-Side Examinations of Austenitic Stainless Steel Piping Welds*, NUREG/CR-7113, PNNL-19353, U. S. Nuclear Regulatory Commission, Washington, DC.

3.4 Request for Relief R-45, ASME Code, Section XI, Part D, Examination Category B-J, Item B9.11, Pressure Retaining Welds in Piping

ASME Code Requirement

ASME Code, Section XI, Examination Category B-J, Item B9.11, requires essentially 100 percent volumetric and surface examinations, as defined by Figures IWB-2500-8 for Class 1 circumferential welds NPS 4 inch in diameter or larger. "Essentially 100 percent," as clarified by ASME Code Case N-460, is greater than 90 percent coverage of the examination volume, or surface area, as applicable. ASME Code Case N-460 has been approved for use by the NRC in RG 1.147, R17.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required volumetric examination of Class 1 circumferential welds shown in Table 3.4.1 (below).

Table 3.4.1- ASME Code, Section XI, Examination Category B-J

ASME Code Item	Weld ID	Weld Type	Coverage Obtained (Percent)
B9.11	NE-5-0002	Safe End-to-Elbow	50.0
B9.11	NE-5-0022A	Safe End-to-Elbow	50.0
B9.11	NG-D-0002	Elbow-to-Pipe	50.0
B9.11	NE-2-0061	Pipe-to-Valve V14-0167	50.0
B9.11	NE-2-0256	Pipe-to-Valve V14-0037	50.0
B9.11	NE-2-0255	V-14-0036-to-Pipe	50.0
B9.11	NE-2-0257	V-14-0037-to-Pipe	50.0
B9.11	NE-2-220	Valve-to-Pipe	50.0
B9.11	NE-2-240	Valve-to-Pipe	50.0
B9.11	NE-5-206	Valve-to-Pipe	50.0
B9.11	NE-5-214	Valve-to-Pipe	50.0
B9.11	NU-1-0001	Valve-to-Pipe	50.0
B9.11	ND-10-0005	Pipe-to-Valve V-16-0063	50.0
B9.11	ND-10-0009	Pipe-to-Valve	50.0
B9.11	NG-A-0007	Valve-to-Elbow	50.0
B9.11	NG-A-0006	Elbow-to-Valve	50.0
B9.11	NG-A-0014	Elbow-to-Pump	50.0
B9.11	NG-A-0018	Elbow-to-Valve	50.0
B9.11	NG-B-0006	Valve-to-Elbow	50.0

Table 3.4.1- ASME Code, Section XI, Examination Category B-J			
ASME Code Item	**Weld ID**	**Weld Type**	**Coverage Obtained (Percent)**
B9.11	NG-B-0012	Pump-to-Elbow	50.0
B9.11	NG-B-0005	Pipe-to-Valve V-37-20	50.0
B9.11	NG-B-0016	Elbow-to-Valve	50.0
B9.11	NG-C-0005	Valve-to-Elbow	50.0
B9.11	NG-C-0012	Pump-to-Elbow	50.0
B9.11	NG-C-0016	Elbow-to-Valve	50.0
B9.11	NG-C-0004	Pipe-to-Valve	50.0
B9.11	ND-10-0020	Valve V-16-0061-to-Pipe	50.0
B9.11	ND-1-0029	Elbow-to-Valve	50.0
B9.11	NE-2-0124	Pipe-to-Valve V-14-0170	50.0
B9.11	NE-2-0254	Pipe-to-Valve V-14-36	50.0
B9.11	NU-4-0002	Tee-to-Valve	50.0
B9.11	NG-B-0017	Valve-to-Pipe	50.0
B9.11	NG-A-0019	Valve-to-Pipe	50.0
B9.11	ND-1-0209	Valve V-16-0001-to-Pipe	50.0
B9.11	ND-1-0208	Elbow-to-Valve	50.0
B9.11	MV-5-001	Flange-to-Tee	50.0
B9.11	ND-10-0008	Valve-to-Elbow	50.0
B9.11	NG-D-0004	Pipe-to-Valve	50.0
B9.11	NG-D-0005	Valve-to-Pipe	50.0
B9.11	NG-D-0011R1	Pump-to-Elbow WOL	52.0
B9.11	NG-D-0015	Elbow-to-Valve	75.0
B9.11	NG-D-0016	Valve-to-Pipe	75.0
B9.11	NG-D-0022A	Pipe-to-Safe End	75.0
B9.11	NG-E-0006	Pipe-to-Valve	75.0
B9.11	NG-E-0007	Valve-to-Elbow	50.0
B9.11	NG-E-0016A	Elbow-to-Valve	50.0
B9.11	NG-E-0017	Valve-to-Pipe	50.0
B9.11	NU-2-0001	Pipe-to-Valve	50.0
B9.11	NZ-3-0082	Valve-to-Elbow	75.0
B9.11	ND-10-0021	Pipe-to-V-16-0061	50.0
B9.11	NU-3-0006	Valve V-17-54-to-Pipe	50.0

Table 3.4.1- ASME Code, Section XI, Examination Category B-J			
ASME Code Item	**Weld ID**	**Weld Type**	**Coverage Obtained (Percent)**
B9.11	NU-4-0003	Tee-to-Valve	50.0
B9.11	NZ-3-0005	Valve-to-Tee	39.0
B9.11	NZ-3-0023	Pipe-to-V-20-0150	50.0
B9.11	NZ-3-0024	Valve-to-Tee	48.0
B9.11	NZ-3-0028	Elbow-to-Valve	50.0
B9.11	NZ-3-0029	Valve-to-Elbow	50.0
B9.11	NZ-3-0032	Tee-to-Valve	44.0
B9.11	NZ-3-0033	Valve-to-Elbow	50.0
B9.11	NZ-3-0052	Valve-to-Tee	43.0
B9.11	NZ-3-0056	Valve-to-Elbow	50.0
B9.11	NZ-3-0070	Valve-to-Tee	44.0
B9.11	NZ-3-0076	Pipe-to-Valve	50.0
B9.11	NZ-3-0077	Valve-to-Elbow	45.0
B9.11	NZ-3-0081	Pipe-to-V-20-0023	50.0
B9.11	RF-2-0115	Valve-to-Pipe	87.0

Licensee's Basis for Relief Request

The subject welds were examined from elbow, pipe or tee sides only due to safe end or elbow taper, valve, pump, flange taper, overlay, of pipe configurations.

Licensee's Proposed Alternative Examination:

The licensee did not propose any alternative examinations for the subject welds. However, the licensee's examinations were performed to the maximum extent practical.

NRC Staff Evaluation

The ASME Code requires essentially 100 percent volumetric and surface examinations for selected Examination Category B-J pressure retaining welds in piping. However, complete volumetric examinations are restricted by design geometries, material of the welds, adjacent components, weld crowns, associated piping configurations, and access, as applicable. To improve examination coverage, the welds and piping would require design modifications. Therefore, the ASME Code-required 100 percent volumetric examinations of the welds are impractical.

As shown on the sketches and technical descriptions included in the licensee's submittals, examinations of the subject welds have been performed to the extent practical with the licensee obtaining volumetric coverage ranging from approximately 39.0 to 87.0 percent. With one exception, weld RF-2-0115, access for examination of the subject piping welds is limited to one side of the weld due to design configurations such as elbow-to-pipe, pipe-to-valve, valve-to-elbow, elbow-to-pump, tee-to-valve, and others as listed in Table 3.4.1 above. Weld RF-2-0115 is a carbon steel valve to pipe weld for which 87 percent of the code required coverage was obtained.

Volumetric examinations on the subject welds were conducted with equipment, procedures and personnel that were certified to a performance demonstration process outlined in ASME Code Section XI, Appendix VIII. These techniques have been demonstrated for flaws located on the near-side of the welds; far-side detection of flaws is currently considered to be a "best effort." The licensee's ultrasonic techniques included 45-degree shear waves and in most cases, 45, 60- and/or 70-degree refracted longitudinal waves (L-waves), as applicable. For piping greater than 0.50-inches thick, longitudinal wave search units that provide supplemental coverage of the far-side of the weld are included in the industry's Performance Demonstration Initiative (PDI) approved techniques for flaw detection in austenitic stainless steel welds. L-waves have been shown to provide enhanced detection on the far-side of austenitic stainless steel welds[2, 3, 4]. Welds ND-10-0005, ND-10-0009, ND-1-0209, ND-1-0208, MV-5-001, ND-10-0020, ND-10-0021, ND-1-0029, and NZ-3-0082 were examined with only shear wave examination techniques, which included 45- and 70-degree shear waves and in some cases 60-degree shear waves, due to the thickness being equal to or less than 0.50-inches. PDI procedure demonstration has shown that the 70-degree shear wave technique is appropriate for opposite side flaw detection for thicknesses equal to or less than 0.50-inches when examination scanning is limited to one side of the weld. While the licensee has only taken credit for limited volumetric coverage obtained from primarily one side, it is expected that the techniques employed would have provided coverage beyond the near-side of the welds. No recordable indications were noted during the performance of the volumetric examinations. For Oyster Creek, the licensee implemented ASME Code Case N-663, "Alternative Requirements for Classes 1 and 2 Surface Examination;" therefore, no surface examinations were required for the welds listed in Table 3.4.1 (above).

The licensee has shown that it is impractical to meet the ASME Code-required 100 percent volumetric examination coverage for the subject piping welds due to their configurations, materials, and access restrictions. Although the ASME Code-required coverage could not be obtained, the ultrasonic techniques employed would have provided full volumetric coverage for the near-side of the welds and limited volumetric coverage for the weld fusion zone and base materials on the opposite side of the welds. Based on the aggregate coverage obtained for the subject welds, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected. Therefore, the NRC staff determined that based on the ASME Code examinations performed, it provides reasonable assurance of structural integrity of the subject components.

3.5 Request for Relief R-45, Part E, ASME Code, Section XI, Examination Category B-M-1, Item B12.40, Pressure Retaining Welds in Valve Bodies

ASME Code Requirement

ASME Code, Section XI, Examination Category B-M-1, Item B12.40, requires essentially 100 percent volumetric examination, as defined by Figure IWB-2500-17, of selected Class 1 valve body welds, NPS 4 inch in diameter, or larger. "Essentially 100 percent," as clarified by ASME Code Case N-460, is greater than 90 percent coverage of the examination volume, or surface area, as applicable. ASME Code Case N-460 has been approved for use by the NRC in RG 1.147, R17.

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required 100 percent volumetric examination of Class 1 valve body Weld V-1-173.

Licensee's Basis for Relief Request

The completed examinations were limited due to welded pilot valve and name plate interferences.

Licensee's Proposed Alternative Examination

The licensee did not propose any alternative examinations for the subject welds. However, the licensee's examinations were performed to the maximum extent practical.

NRC Staff Evaluation

The ASME Code requires 100 percent volumetric examination of Class 1 pressure retaining welds in valve bodies in piping 4-inches or greater in diameter. However, the valve design configuration and permanently attached appurtenances restrict access for ultrasonic scanning. In order to effectively increase the examination coverage, the valve body weld would require a design modification. Therefore, the ASME Code-required 100 percent volumetric examinations of the welds are considered impractical.

As shown on the sketches and technical descriptions included in the licensee's submittals, access for examination of the subject weld is limited due to the welded pilot valve configuration and an integrally welded name plate. The ultrasonic examination achieved 82 percent of the ASME Code required volumetric coverage of this carbon steel weld, using 45-degree shear wave examinations. The ultrasonic techniques employed for these welds have been certified through the industry's PDI, which meets ASME Code Section XI, Appendix VIII requirements. No unacceptable indications were noted during the volumetric examinations.

The licensee has shown that it is impractical to meet the ASME Code-required 100 percent volumetric examination coverage for the subject valve body weld due to the design configuration. However, based on the significant volumetric coverage obtained, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would

have been detected. Therefore, the NRC staff determined that based on the ASME Code examinations performed, it provides reasonable assurance of structural integrity of the subject components.

3.6 Request for Relief R-45, Part E, ASME Code, Section XI, Examination Category C-B, Item C2.21, Pressure Retaining Nozzle Welds in Class 2 Vessels

ASME Code Requirement

ASME Code, Section XI, Examination Category C-B, Item C2.21, requires 100 percent volumetric and surface examination, as defined by Figure IWC-2500-4(a) or (b), as applicable, of nozzle-to-shell (or head) welds in Class 2 vessels. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, R17, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent (i.e., greater than 90 percent examination coverage is obtained).

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required volumetric examination of Class 2 nozzle-to-head welds shown in Table 3.6.1 (below).

Table 3.6.1- ASME Code, Section XI, Examination Category C-B

ASME Code Item	Weld ID	Weld Type	Coverage Obtained Percent
C2.21	CD-14-001B-211-C-6	Hemi Head-to-Nozzle Weld	50.0
C2.21	CD-14-001B-211-S-6	Hemi Head-to-Nozzle Weld	50.0

Licensee's Basis for Relief Request

One sided examined from Hemi side due to nozzle configuration.

Licensee's Proposed Alternative Examination

The licensee did not propose any alternative examinations for the subject welds. However, the licensee's examinations were performed to the maximum extent practical.

NRC Staff Evaluation

The ASME Code requires 100 percent volumetric and surface examinations of Class 2 nozzle-to-shell (or head) welds. However, for the subject isolation condenser nozzle-to-head welds, complete examinations are limited due to the nozzles' configurations. In order to achieve greater volumetric coverage, the nozzles and vessels would have to be redesigned and modified. Therefore, the ASME Code volumetric examination is considered impractical.

The subject isolation condenser head-to-nozzle welds shown in Table 3.6.1 (above) are constructed of austenitic stainless steel materials. These full penetration butt welds extend the full thickness of the vessel head, and the nozzle configurations are of the "set in" design, which essentially makes the welds concentric rings aligned parallel with the nozzle axes. This nozzle design geometry restricts ultrasonic scanning mainly to the vessel side of the welds.

As shown on the sketches and technical descriptions included in the licensee's submittals, examinations of the isolation condenser nozzle-to-head welds have been completed to the extent practical with volumetric coverage of 50.0 percent of the ASME Code-required volumes. The examination volumes included the weld and base materials near the inside surface of the weld joints which are high regions of stress, and where one would expect degradation sources to be manifested should they occur. The hemi head-to-nozzle weld examinations were performed with 45-degree shear and 60-degree longitudinal waves. No unacceptable indications were identified during the volumetric examination. The licensee completed the ASME Code-required surface examinations on the subject weld with no limitations. No recordable indications were identified during the surface examination.

The licensee has shown that it is impractical to meet the ASME Code-required 100 percent volumetric examination coverage for the subject nozzle-to-head welds due to the nozzles' design configuration. However, based on the volumetric and surface coverage obtained, it is reasonable to conclude that, if significant service-induced degradation had occurred, evidence of it would be have been detected by the examinations performed. Therefore, the NRC staff determined that based on the ASME Code examinations performed, it provides reasonable assurance of structural integrity of the subject components.

3.7 Request for Relief R-45 Part G, ASME Code, Section XI, Examination Category C-F-1, Item C5.11, Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping

ASME Code Requirement

ASME Code, Section XI, Examination Category C-F-1, Item C5.11, requires 100 percent surface and volumetric examination, as defined by Figure IWC-2500-7, of selected Class 2 austenitic stainless steel or high alloy circumferential piping welds. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, R17, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10 percent (i.e., greater than 90 percent examination coverage is obtained).

Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required volumetric examination of the Class 2 austenitic stainless steel pipe-to-valve Weld NZ-3-0004.

Licensee's Basis for Relief Request

The subject welds were examined from pipe side only due to valve configuration.

Licensee's Proposed Alternative Examination

The licensee did not propose any alternative examinations for the subject welds. However, the licensee's examinations were performed to the maximum extent practical.

NRC Staff Evaluation

The ASME Code requires 100 percent volumetric and surface examination for selected Class 2 pressure-retaining welds in austenitic stainless steel or high alloy circumferential piping. However, volumetric examinations are limited by the design geometry of the weld. To improve examination coverage, the weld and piping would require design modifications. Therefore, the ASME Code-required 100 percent volumetric examinations of the welds are considered impractical.

As shown on the sketch and technical descriptions included in the licensee's submittals, examinations of pipe-to-valve Weld NZ-3-0004 have been performed to the extent practical with the licensee obtaining volumetric coverage of approximately 50 percent. Access for examination of Weld NZ-3-0004 is limited to the piping side of this stainless steel weld due to the pipe-to-valve taper configuration.

Volumetric examinations on Weld NZ-3-0004 were conducted with equipment, procedures and personnel that were certified to a performance demonstration process outlined in ASME Code Section XI, Appendix VIII. The licensee's ultrasonic techniques included 45-, 60-, and/or 70-degree shear waves. PDI procedure demonstration has shown that the 70-degree shear wave technique is appropriate for opposite side flaw detection for thicknesses equal to or less than 0.50 inch when examination scanning is limited to one side of the wall. While the licensee has only taken credit for limited volumetric coverage obtained from one side, it is expected that the techniques employed would have provided coverage beyond the near-side of the welds. No recordable indications were noted during the performance of the volumetric examinations. OCNGS implemented Code Case N-663 for this weld during the fourth interval. Therefore, surface examinations were not required.

The licensee has shown that it is impractical to meet the ASME Code-required 100 percent volumetric examination coverage for the subject piping weld due to the design configuration. Although the ASME Code-required coverage could not be obtained, the ultrasonic techniques employed would have provided full volumetric coverage for the near-side of the welds and limited volumetric coverage for the weld fusion zone and base materials on the opposite side of the welds. Based on the aggregate coverage obtained for the subject welds, it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected. Therefore, the NRC staff determined that based on the ASME Code examinations performed, it provides reasonable assurance of structural integrity of the subject components.

3.8 Request for Relief R-45, Part H, ASME Code, Section XI, Examination Category C-F-2, Item C5.81, Pressure Retaining Welds in Carbon or Low Alloy Steel Piping

In the response dated November 14, 2014, to the NRC RAI, the licensee stated that, "A surface examination (magnetic particle) was performed on 100 percent of the required area of Weld NQ-2-0215 during 1R20 (2004). No indications were recorded during examination." The licensee further stated that, "In addition to a surface exam, Weld NQ-2-0215 was inadvertently examined with ultrasonic testing during the fourth interval. Accordingly, relief is no longer requested for this weld." Since the licensee satisfied the ASME Code, Section XI surface examination requirements for this weld, relief is not required.

4.0 CONCLUSIONS

Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(iii), and is in compliance with the requirements of 10 CFR 50.55a with the granting of these reliefs. Therefore, the NRC staff grants relief pursuant to 10 CFR 50.55a(g)(6)(i) for the subject examinations of the components contained in Requests for Relief RR-44 and RR-45, as amended by the letter dated November 14, 2014, for the fourth inservice inspection interval at OCNGS. The NRC staff has further determined that granting RRs R-44 and R-45, as amended by the letter dated November 14, 2014, in accordance with 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 given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in the subject requests for relief remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributors: J. Jenkins, S. Cumblidge, T. McLellan

Date: May 1, 2015

If you have any questions regarding this matter, please contact the Senior Project Manager, John G. Lamb at (301) 415-3100 or by e-mail at John.Lamb@nrc.gov.

Sincerely,

/RA REnnis For/

Douglas A. Broaddus, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

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