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

January 17, 2014

Mr. Scott Batson
Site Vice President
Oconee Nuclear Station
Duke Energy Carolinas, LLC
7800 Rochester Highway
Seneca, SC 29672-0752

SUBJECT: OCONEE NUCLEAR STATION, UNITS 1 AND 2, FOURTH 10-YEAR INTERVAL INSPECTION PROGRAM REQUESTS FOR RELIEF (TAC NOS. MF0648 AND MF0649)

Dear Mr. Batson:

By letters dated January 31, 2013, as supplemented by letter dated August 11, 2013, Duke Energy Carolinas, LLC (Duke or the licensee) submitted Request for Relief (RR) 12-ON-001, Sections 2 through 20 (ONS, Unit 1) and RR 12-ON-002, Sections 2 through 16 (ONS, Unit 2) from the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI for Oconee Nuclear Station, Units 1 and 2 (ONS, Units 1 and 2). Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(g)(6)(i), the licensee requested relief for certain in-service inspection items on the basis that the code requirement is impractical.

As set forth in the enclosed safety evaluation, the NRC staff has determined 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 given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Furthermore, the staff concluded that the examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject components. 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 for the subject examinations of the components as stated in the attached safety evaluation for the fourth 10-year in-service inspection interval for Oconee Nuclear Station, Units 1 and 2.

If you have any questions, please contact the Project Manager, Richard Guzman, at 301-415-1030, or via email at Richard.Guzman@nrc.gov.

Sincerely,

Robert J. Pascarelli, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-269 and 50-270

Enclosure:
As stated

cc w/encl: Distribution via Listserv

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

# SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

# REQUEST FOR RELIEF NO. 12-ON-001, SECTIONS 2 THROUGH 20 AND

# REQUEST FOR RELIEF NO. 12-ON-002, SECTIONS 2 THROUGH 16

# DUKE ENERGY CAROLINAS, LLC

# OCONEE NUCLEAR STATION, UNITS 1 AND 2

# DOCKET NOS. 50-269 AND 50-270

## 1.0 INTRODUCTION

By letters dated January 31, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13038A152 and ML13038A150), as supplemented by letter dated August 11, 2013 (ADAMS Accession No. ML13228A263), Duke Energy Carolinas, LLC (the licensee), submitted Requests for Relief (RR) 12-ON-001 and 12-ON-002 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 Oconee Nuclear Station, Units 1 and 2 (ONS, Units 1 and 2). These requests apply to the fourth 10-year inservice inspection (ISI) interval, in which ONS, Units 1 and 2 adopted the 1998 Edition through the 2000 Addenda of ASME Code, Section XI as the code of record.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(g)(5)(iii), the licensee requested relief from the requirement to examine 100% of the volume specified by the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1998 Edition with 2000 Addenda (as modified by Code Case N-460) on the basis that the code requirements are impractical.

## 2.0 REGULATORY 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, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components," 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) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

10 CFR 50.55a(g)(5)(iii), states, in part, that licensees may determine that conformance with certain ASME Code requirements is impractical and that the licensee shall notify the Commission and submit information in support of the determination. A 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 interval for which the request is being submitted. Requests for relief made in accordance with this section must be submitted to the Nuclear Regulatory Commission (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.

10 CFR 50.55a(g)(6)(i), states 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 ONS, Units 1 and 2, fourth 10-year interval inservice inspection programs is the 1998 Edition, including the 2000 Addenda, of Section XI of the ASME Boiler and Pressure Vessel Code. The fourth 10-year ISI intervals for ONS, Units 1 and 2 are projected to end on July 15, 2014.

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 grant the relief requested by the licensee.

## 3.0 TECHNICAL EVALUATION

The information provided by the licensee in support of the request for relief from ASME Code requirements has been evaluated and the basis for disposition is documented below. For clarity, the request has been evaluated in several parts according to their ASME Code Section XI Examination Categories.

### 3.1 Request for Relief 12-ON-001, Part A, ASME Code, Section XI, Examination Category B-B, Item B2.51, Pressure Retaining Welds in Vessels Other than Reactor Vessels, ONS, Unit 1

#### ASME Code Requirement

ASME Code, Section XI, Examination Category B-B, Item B2.51, requires essentially 100 percent volumetric examination, as defined by ASME Code, Section XI, Figures IWB-2500-1 and IWB-2500-3, of the length of heat exchanger (primary side) circumferential head 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 16, *Inservice Inspection Code Case Acceptability* (RG 1.147, Revision 16).

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 Letdown Cooler N32389-1 Inlet and Outlet Channel Body-to-Chemical Connector Welds WJ-32 and WJ-35.

Licensee's Basis for Relief Request (as stated)

> The impracticality was caused by the taper configuration of the chemical connector and the proximity of a nozzle within the scan area from the inlet/outlet channel body. In order to scan all of the volume for this weld, the chemical connector and location of the adjacent nozzle would have to be redesigned and replaced, which is impractical.

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.

Staff Evaluation

The ASME Code requires essentially 100 percent volumetric examination of Class 1 heat exchanger circumferential head welds. However, for the subject welds at ONS, Unit 1, complete ultrasonic testing (UT) examinations are restricted by weld geometric configuration and scan limitations caused by adjacent appurtenances. In order to effectively increase the examination coverage, the heat exchanger and adjacent appurtenances would require design modifications or replacement. This would place a burden on the licensee; thus, examining 100 percent of the ASME Code-required volume is considered impractical.

As shown in the sketches and technical descriptions included in the licensee's submittals, examination of the Letdown Cooler N32389-1 inlet and outlet channel body-to-chemical connector Welds WJ-32 and WJ-35 have been performed to the extent practical, with the licensee obtaining 87.7 percent coverage of the ASME Code-required inspection volume. The taper configuration of the chemical connector to the channel body and the close proximity of a nozzle on the channel body side limited the ASME Code-required volumetric examination for the stainless steel letdown cooler circumferential head welds. These welds were examined with UT techniques using 45-degree shear and 45-, 60-, and 70-degree longitudinal waves in accordance with applicable requirements of the ASME Code Section XI, Appendix III. Seven indications were observed on the subject welds; 4 indications on WJ-32 and 3 indications on WJ-35. All indications were evaluated and determined to be reflections from geometric sources, i.e., from the weld root and ID surface offset. The licensee stated that no indications of service degradation were observed.

The subject welds are new welds on a replacement vessel installed during the fourth 10-year inservice inspection interval. The licensee's request for relief is for volumetric limitations experienced on these replacement welds during preservice examinations. The vessel

manufacturer performed surface and visual examinations during the construction activities. These fabrication examinations were performed in accordance with the 1989 Edition of ASME Code, Section III. There were no indications observed during fabrication or preservice examinations that are known to interfere with inservice UT examinations to be performed in the future.

The licensee has shown that it is impractical to meet the ASME Code-required preservice volumetric examination coverage for the subject replacement welds due to the design geometry of the letdown cooler and adjacent components. Based on the UT results and the significant volumetric coverage obtained, it is reasonable to conclude that the subject welds will meet their intended design functions, and that the preservice examinations provide an adequate baseline for comparison of future inservice examinations. Furthermore, the staff determined that the examinations obtained provide reasonable assurance of structural integrity of the subject welds.

3.2 Requests for Relief 12-ON-001 and 12-ON-002, Part B ASME Code, Section XI, Examination Category B-D, Items B3.110 and B3.150, Full Penetration Welded Nozzles in Vessels, ONS, Units 1 and 2

ASME Code Requirement

ASME Code, Section XI, Examination Category B-D, Items B3.110 and B3.150 require 100 percent volumetric examination, as defined by ASME Code, Section XI, Figures IWB-2500-7 (a) through (d), as applicable, of full penetration Class 1 pressurizer (PZR) and heat exchanger (primary side) nozzle-to-vessel welds, respectively. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, Revision 16, 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 PZR and letdown cooler nozzle-to-vessel welds listed below in Tables 3.2.1 (ONS, Unit 1) and 3.2.2 (ONS, Unit 2).

**Table 3.2.1- ASME Code, Section XI, Examination Category B-D (ONS, Unit 1)**

| ASME Code Item | Weld ID | Weld Type | Coverage Obtained Percent |
|---|---|---|---|
| B3.110 | 1-PZR-WP26-3 | PZR Heater Belt Shell-to-Sampling Nozzle | 34.7 |
| B3.110 | 1-PZR-WP26-7 | PZR Heater Belt Shell-to-Sampling Nozzle | 34.7 |
| B3.150 | WJ-33 | Letdown Cooler N32389-1 Inlet Nozzle-to-Channel Body | 54.6 |
| B3.150 | WJ-36 | Letdown Cooler N32389-1 Outlet Nozzle-to-Channel Body | 54.6 |

| Table 3.2.2- ASME Code, Section XI, Examination Category B-D (ONS, Unit 2) | | | |
|---|---|---|---|
| **ASME Code Item** | **Weld ID** | **Weld Type** | **Coverage Obtained Percent** |
| B3.110 | 2-PZR-WP33-2 | PZR Upper Head-to-Relief Nozzle | 25.2 |
| B3.150 | WJ-33 | Letdown Cooler 1-N-37804-2 Inlet Nozzle-to-Channel Body | 60.6 |
| B3.150 | WJ-36 | Letdown Cooler 1-N-37804-2 Outlet Nozzle-to-Channel Body | 60.6 |

Licensee's Basis for Relief Request (as stated)

**PZR Nozzle-to-Vessel Welds (ONS, Unit 1)** - The impracticality was caused by the weld taper configuration of the sampling nozzle to the shell that does not allow meaningful interrogation from Surface 2, the sampling nozzle side. In order to scan all of the required volume for this weld, the shell to sampling nozzle weld would have to be redesigned or replaced to allow scanning from both sides of the weld, which is impractical.

**PZR Nozzle-to-Vessel Welds (ONS, Unit 2)** - The impracticality was caused by the weld taper configuration of the relief nozzle to the head that does not allow meaningful interrogation from Surface 2, the nozzle side. There was also a lifting lug positioned on the Surface 1 side that attributed to the limitation. In order to scan all of the required volume for this weld, the head to relief nozzle weld would have to be redesigned and replaced, and the lifting lug would have to be repositioned to allow full scanning from both sides of the weld, which is impractical.

**Letdown Cooler Nozzle-to-Vessel Welds (ONS, Units 1 and 2)** - The impracticality was caused by the weld taper configuration of the nozzle to channel body that does not allow meaningful interrogation from Surface 2, the nozzle side. In order to scan all of the required volume for this weld, the channel body to nozzle weld would have to be redesigned and replaced to allow scanning from both sides of the weld, which is impractical.

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.

Staff Evaluation

The ASME Code requires 100 percent volumetric examination of ASME Code, Class 1 nozzle-to-vessel welds. However, the design configuration of the subject welds and curvature of the nozzles' blend radii limit access for ultrasonic scanning. In order to effectively increase the examination coverage, the nozzle-to-vessel welds would require design modifications. This would place a burden on the licensee; thus, obtaining 100 percent of ASME Code-required volumetric examinations is considered impractical.

The subject PZR nozzle-to-vessel welds in ONS, Unit 1 (Table 3.2.1) and ONS, Unit 2 (Table 3.2.2) are constructed of carbon steel material with stainless steel inside diameter surface cladding. The letdown cooler nozzle-to-vessel welds in ONS, Unit 1 (Table 3.2.1) and ONS, Unit 2 (Table 3.2.2) are constructed of wrought stainless steel material. 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 restricts ultrasonic scanning mainly to the vessel side of the welds. In addition, ultrasonic scans cannot be performed from the curved outside diameter (OD) surface in the nozzle blend radius regions, further limiting the volumetric examinations.

As shown on the sketches and technical descriptions included in the licensee's submittals, examinations of the subject PZR and letdown cooler nozzle-to-vessel welds have been completed to the extent practical with volumetric coverage ranging from approximately 25.2 to 60.6 percent (see above Tables 3.2.1 and 3.2.2) 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 PZR and letdown cooler nozzle-to-vessel weld examinations were performed with manual ultrasonic techniques in accordance with the applicable requirements of the ASME Code, Section V, Article 4 and ASME Code Section XI, Appendix III, respectively. The welds were examined using 35-, 45-, and 60-degree shear, and 0-, 45-, 60-, and 70-degree longitudinal waves (L-waves), as applicable. There were no indications detected on the subject nozzles.

Although ultrasonic scans were primarily 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 PZR nozzle-to-vessel welds 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.

Additionally, L-waves have been shown to provide enhanced detection on the far-side of austenitic stainless steel welds[2,3,4]. 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 letdown cooler nozzle-to-vessel welds.

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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.

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 P. Lemaitre, 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 M. T. Anderson, 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.

The letdown cooler nozzle-to-vessel welds are new welds on a replacement vessel installed during the fourth 10-year inservice inspection interval. The licensee's request for relief is for volumetric limitations experienced on these replacement welds during preservice examinations. The vessel manufacturer performed surface and visual examinations during the construction activities. These fabrication examinations were performed in accordance with the 1989 Edition of ASME Code, Section III. There were no indications observed during fabrication and preservice examinations that are known to interfere with the inservice UT examinations to be performed in the future.

The licensee has shown that it is impractical to meet the ASME Code-required 100 percent volumetric examination coverage for the subject nozzle-to-vessel welds due to nozzles' design and curvature of the nozzles' blend radii. 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. Additionally, the preservice examinations for the letdown cooler nozzle-to-vessel welds provide an adequate baseline for comparison of future inservice examinations. Furthermore, the staff determined that the examinations obtained provide reasonable assurance of structural integrity of the subject welds.

3.3 Requests for Relief 12 -ON-001 and 12-ON-002, Part C, ASME Code, Section XI, Examination Category B-J, Item B9.11, Pressure Retaining Welds in Piping, ONS, Units 1 and 2

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 ASME Code, Section XI, Figure IWB-2500-8, for circumferential piping welds NPS 4 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, Revision 16.

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 ASME Code, Class 1 stainless steel piping welds shown in Tables 3.3.1 (ONS, Unit 1) and 3.3.2 (ONS, Unit 2).

**Table 3.3.1 – ASME Code, Section XI, Examination Category B-J (ONS, Unit 1)**

| ASME Code Item | Weld ID | Weld Type | Coverage Obtained Percent |
|---|---|---|---|
| B9.11 | 1-PIB1-9 | RCP 1B1 Casing Nozzle-to-Safe End | 37.5 |
| B9.11 | 1-PDB1-1 | RCP 1B1 Casing Nozzle-to-Safe End | 37.5 |

| Table 3.3.2 – ASME Code, Section XI, Examination Category B-J (ONS, Unit 2) | | | |
|---|---|---|---|
| **ASME Code Item** | **Weld ID** | **Weld Type** | **Coverage Obtained Percent** |
| B9.11 | 2-PDA1-1 | RCP 2A1 Discharge Casing Nozzle-to-Safe End | 37.5 |
| B9.11 | 2- PIA2-8 | RCP 2A2 Casing Inlet Nozzle-to-Safe End | 37.5 |
| B9.11 | 2HP-215-3 | High Pressure Injection System Tee-to-Reducer | 89.4 |
| B9.11 | 2-53A-8-61 | Low Pressure Injection System, Pipe-to-Valve | 37.5 |

Licensee's Basis for Relief Request (as stated)

**Reactor Coolant Pump (RCP) Casing Nozzle-to-Safe End Welds (ONS, Unit 1 and ONS, Unit 2)** The impracticality was caused by the nozzle taper configuration and cast stainless steel material which cannot be effectively interrogated by ultrasound. There are currently no examination techniques that have been qualified for examining cast stainless steel through [ASME Code, Section XI,] Appendix VIII. Therefore no coverage could be obtained by scanning from the nozzle side. In order to scan all of the volume for this weld, the nozzle would have to be redesigned and replaced, which is impractical.

**High Pressure Injection System Tee-to-Reducer Weld (ONS, Unit 2)** – The impracticality was caused by the configuration of the tee, which did not allow access to the full volume of the weld. Therefore no coverage could be obtained by scanning from the radius of the intersecting branch on the tee side. In order to scan all of the volume for this weld, the tee would have to be redesigned and replaced, which is impractical.

**Low Pressure Injection System, Pipe-to-Valve Weld (ONS, Unit 2)** - The impracticality was caused by the tapered configuration and cast stainless material of the valve which cannot be effectively interrogated by ultrasound. There are currently no examination techniques that have been qualified for examining cast stainless steel through [ASME Code, Section XI] Appendix VIII. Therefore no coverage could be obtained by scanning from the valve side of the weld. In order to scan all of the volume for this weld, the valve would have to be redesigned and replaced, which is impractical.

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.

Staff Evaluation

The ASME Code requires essentially 100 percent volumetric and surface examinations for selected ASME Code, Section XI, Examination Category B-J pressure retaining welds in piping. However, complete volumetric examinations are restricted by component design, materials and weld configurations. These conditions preclude the licensee from obtaining full volumetric examinations from both sides of these welds. To gain access for examination, the welds would require design modifications. This would place a burden on the licensee; thus, obtaining 100 percent of ASME Code-required volumetric examinations is considered impractical.

The subject RCP casing nozzle-to-safe end components in ONS, Unit 1 (Table 3.3.1) and ONS, Unit 2 (Table 3.3.2) are constructed of a cast austenitic stainless steel (CASS) nozzle with a forged stainless steel safe end. The High Pressure Injection System Tee-to-Reducer components in ONS, Unit 2 (Table 3.3.2) are constructed of a forged stainless steel material. The Low Pressure Injection System, Pipe-to-Valve components in ONS, Unit 2 (Table 3.3.2) are constructed of a CASS valve and a forged stainless steel pipe. The nozzle and valve design geometries restrict ultrasonic scanning mainly to the pump side of the welds. In addition, ultrasonic scans cannot be performed from the curved outside diameter (OD) surface in the nozzle blend radius regions, further limiting the volumetric examinations.

Volumetric examinations on the subject welds were conducted with equipment, procedures and personnel that were qualified to a performance demonstration process outlined in ASME Code Section XI, Appendix VIII. These techniques have been qualified through the industry's Performance Demonstration Initiative (PDI), which meets ASME Code Section XI, Appendix VIII requirements for flaws located on the near-side of the welds; far-side detection of flaws is considered to be a "best effort." No ASME Code, Section XI, Appendix VIII requirements currently exist for demonstrating ultrasonic scanning through CASS.

The components were scanned manually with conventional methods using the requirements described in 10 CFR 50.55a(b)(2)(xv)(A)(1). As shown on the sketches and technical descriptions included in the licensee's submittals, examinations of the subject RCP casing nozzle-to-safe end, tee-to-reducer, and pipe-to-valve welds have been completed to the extent practical with volumetric coverage ranging from approximately 37.5 to 89.4 percent (see Tables 3.3.1 and 3.3.2) of the ASME Code-required volumes. The limitations encountered during the performance of the ultrasonic examinations were caused by CASS materials and curvature in the taper of the transition region from the nozzle-to-safe end, pipe-to-valve and tee-to-reducer weld configurations. These configurations limit the volumetric examinations primarily to the wrought stainless steel side of these welds.

The licensee's ultrasonic scanning techniques included combinations of 45-, 60-, and 70-degree shear, and/or 60- and 70-degree refracted longitudinal waves (L-waves), as applicable, for ASME Code, Class 1 piping welds listed in Tables 3.3.1 and 3.3.2, from the accessible wrought side of the welds. One indication was detected on the Low Pressure Injection System pipe-to-valve Weld 2-53A-8-61. The indication was evaluated to be component geometry and found acceptable without further evaluation.

Additionally, L-waves have been shown to provide enhanced detection on the far-side of austenitic stainless steel welds; 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. For ONS, Units 1 and 2, the licensee implemented ASME Code Case N-663[5], *Alternative Requirements for Classes 1 and 2 Surface Examination, Section XI, Division 1*; therefore, no surface examinations were required for the welds listed in Tables 3.3.1 and 3.3.2. The staff has determined that there is no known operational experience showing cracking in similar stainless steel welds, and the only forms of cracking that are expected to occur are thermal fatigue due to the very low oxygen concentration in pressurized water reactor coolant. Given the location of these welds, it is expected that thermal fatigue cracking would progress relatively slowly though the weld.

System pressure and leakage tests are performed each inspection period in accordance with ASME Code, Section XI, Table IWC-2500-1, under examination category C-H. This requires a VT-2 visual examination to detect evidence of leakage. Additionally, visual inspection during normal operator rounds, ONS reactor building normal sump monitoring and other leakage detection systems provide additional assurance that, in the event that leakage did occur through a weld, it would be detected and proper action taken.

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 and materials of construction. Based on the volumetric 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. Furthermore, the staff determined that the examinations obtained provide reasonable assurance of structural integrity of the subject welds.

### 3.4 Request for Relief 12-ON-001 and 12-ON-002, Part D, ASME Code, Section XI, Examination Category C-F-1, Items C5.11 and C5.21, Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping, ONS, Units 1 and 2

#### ASME Code Requirement

ASME Code, Section XI, Examination Category C-F-1, Items C5.11 and C5.21, require 100 percent surface and volumetric examination, as defined by ASME Code, Section XI, Figure IWC-2500-7, of selected ASME Code, 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, Revision 16, states that a reduction in examination coverage due to part geometry or interference for any ASME Code, 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 100 percent volumetric examination of the ASME Code, Class 2 austenitic stainless steel welds shown in Tables 3.4.1 (ONS, Unit 1) and 3.4.2 (ONS, Unit 2).

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5 ASME Code Case N-663 was approved for use in RG 1.147, Revision 16

| Table 3.4.1 – ASME Code, Section XI Examination Category C-F-1 (ONS, Unit 1) | | | | |
|---|---|---|---|---|
| **ASME Code Item** | **Weld ID** | **Weld Type** | **Pipe Size-Thickness Inches** | **Coverage Obtained Percent** |
| C5.11 | 1LP-128-80 | Reducer-to-Valve | 12.0 – 1.168 | 37.5 |
| C5.11 | 1LP-209-17 | Pipe-to-Flow Restrictor | 10.0 – 1.0 | 37.5 |
| C5.11 | 1LP-209-18 | Pipe-to-Flow Restrictor | 10.0 – 1.0 | 37.5 |
| C5.21 | 1HP-192-15 | Flange Orifice-to-Pipe | 4.0 – 0.531 | 37.5 |
| C5.21 | 1-51A-01-91A | Pipe-to- Valve | 4.0 – 0.531 | 75.0 |
| C5.21 | 1HP-324-118B | Tee-to-Valve | 2.5 – 0.375 | 66.7 |
| C5.21 | 1-51A-02-34B | Elbow-to-Valve | 4.0 – 0.531 | 61.525 |
| C5.21 | HP-193-12 | Tee-to-Valve | 4.0 – 0.531 | 37.5 |
| C5.21 | 1-51A-01-103A | Pipe-to-Valve | 3.0 – 0.438 | 75.0 |

| Table 3.4.2 – ASME Code, Section XI, Examination Category C-F-1 (ONS, Unit 2) | | | | |
|---|---|---|---|---|
| **ASME Code Item** | **Weld ID** | **Weld Type** | **Pipe Size-Thickness Inches** | **Coverage Obtained Percent** |
| C5.11 | 2LP-150-70 | Reducer-to-Valve | 12.75 – 1.168 | 37.5 |
| C5.11 | 2LP-189-15 | Pipe-to-Valve | 10.75 – 1.0 | 37.5 |
| C5.11 | 2LP-216-17 | Pipe-to-Valve | 10.75 – 1.0 | 62.5 |
| C5.11 | 2LP-216-18 | Pipe-to-Valve | 10.75 – 1.0 | 62.5 |
| C5.11 | 2LPS-723-1 | Pipe-to- Flange | 6.625 – 0.432 | 37.5 |
| C5.11 | 2LPS-723-2 | Pipe to Flange | 6.625 – 0.432 | 37.5 |
| C5.11 | 2LPS-723-3 | Pipe to Flange | 6.625 – 0.432 | 37.5 |
| C5.21 | 2-51A-17-20A | Pipe-to-Valve | 3.5 – 0.216 | 73.25 |

Licensee's Basis for Relief Request (as stated)

**Reducer-to-Valve, Pipe-to-Flow Restrictor, and Tee-to-Valve Welds (1LP-128-80, 1LP-209-17, 1LP-209-18, and HP-193-12, ONS, Unit 1)** - The impracticality was caused by the cast stainless steel material which cannot be effectively interrogated by ultrasound. There are currently no examination techniques that have been qualified through [ASME Code, Section XI,] Appendix VIII for cast stainless steel. Therefore, coverage could not be obtained by scanning from the valve/flow restrictor side. In order to scan all the required volume for this weld, the valve/flow restrictor would have to be redesigned and replaced, which is impractical.

**Flange Orifice-to-Pipe and Pipe-to-Flange Welds (1HP-192-15, ONS 1 and 2LPS-723-1, 2LPS-723-2, and 2LPS-723-3, ONS, Unit 2)** - The impracticality was caused by the flanged taper configuration, which did not allow access to the full volume of the weld. Therefore coverage could not be obtained by scanning from

the flange side of the weld. In order to scan all of the required volume for this weld, the flange would have to be redesigned and replaced, which is impractical.

**Pipe-to-Valve, Tee-to-Valve, and Elbow-to-Valve Welds (1-51A-01-091A, 1HP-324-118B, 1-51A-02-34B, 1-51A-01-103A, ONS 1 and 2LP-216-17, 2LP-216-18, 2-51A-17-20, ONS, Unit 2)** - The impracticality was caused by the tapered configuration of the valve, which did not allow access to the full volume of the weld in the circumferential direction. Therefore coverage could not be obtained by scanning from the valve side. In order to scan all of the required volume for this weld, the valve would have to be redesigned and replaced, which is impractical.

**Reducer-to-Valve and Pipe-to-Valve Welds (2LP-150-70, 2LP-189-15, ONS 2)** - The impracticality was caused by the tapered configuration and cast stainless steel material of the valve which cannot be effectively interrogated by ultrasound. There are currently no examination techniques that have been qualified for cast stainless steel through [ASME Code, Section XI,] Appendix VIII. Therefore no coverage could be obtained by scanning from the valve side of the weld. In order to scan all of the volume for this weld, the valve would have to be redesigned and replaced, which is impractical.

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.

Staff Evaluation

The ASME Code requires 100 percent volumetric and surface examination for selected ASME Code, Class 2 pressure-retaining welds in austenitic stainless steel or high alloy circumferential piping. However, volumetric examinations are limited by the design geometry, material of the welds, and associated piping configurations. To gain access for examination, the welds and piping would require design modifications. This would place a burden on the licensee; thus, obtaining 100 percent of ASME Code-required volumetric examinations is considered impractical.

The components were scanned manually with conventional methods using the requirements described in 10 CFR 50.55a(b)(2)(xv)(A)(1). As shown on the sketches and technical descriptions included in the licensee's submittal, access for examination of the subject welds is limited to primarily one side of these welds due to the presence of CASS materials, flange configurations, and/or valve taper configurations, with volumetric coverage ranging from approximately 37.5 to 75 percent of the ASME Code-required volumes (see above Tables 3.4.1 and 3.4.2). The ultrasonic techniques employed for these welds have been qualified through the industry's PDI, which meets ASME Code Section XI, Appendix VIII requirements. These techniques have been qualified for flaws located on the near-side of the welds; far-side detection of flaws is considered to be a "best effort." No ASME Code, Section XI, Appendix VIII requirements currently exist for demonstrating ultrasonic scanning through CASS materials. For these reasons, the licensee has only taken credit for obtaining limited volumetric examination coverage from the wrought side of the welds. For the subject welds listed in above Tables 3.4.1 (ONS, Unit 1) and 3.4.2 (ONS, Unit 2), the licensee implemented ASME Code Case N-663,

therefore, no surface examinations were required. There was one indication detected during volumetric examinations of flange orifice-to-pipe Weld 1HP-192-15 that was determined to be a result of component geometry and accepted without further evaluation.

The licensee's ultrasonic techniques included 45-, 60-, and/or 70- degree shear waves, and in some cases, 60- and 70-degree refracted longitudinal waves (L-waves). L-waves have been shown to provide enhanced detection on the far-side of austenitic stainless steel welds. 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. The staff has determined that there is no known operational experience showing cracking in similar stainless steel welds, and the only forms of cracking that are expected to occur are thermal fatigue due to the very low oxygen concentration in pressurized water reactor coolant. Given the location of these welds, it is expected that thermal fatigue cracking would progress relatively slowly though the weld.

System pressure and leakage tests are performed each inspection period in accordance with ASME Code, Section XI, Table IWC-2500-1, under examination category C-H. This requires a VT-2 visual examination to detect evidence of leakage. Additionally, visual inspection during normal operator rounds, ONS reactor building normal sump monitoring and other leakage detection systems provide additional assurance that, in the event that leakage did occur through a weld, it would be detected and proper action taken.

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 and materials. 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, 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 subject welds, evidence of it would have been detected. Furthermore, the staff determined that the examinations obtained provide reasonable assurance of structural integrity of the subject welds.

## 3.5 Request for Relief 12-ON-001, Part E, ASME Code, Section XI, Examination Category C-F-2, Item C5.51, Pressure Retaining Welds in Carbon or Low Alloy Steel Piping, ONS, Unit 1

### ASME Code Requirement

ASME Code, Section XI, Examination Category C-F-2, Item C5.51, requires 100 percent surface and volumetric examination, as defined by Figure IWC-2500-7, of selected Class 2 carbon steel or low alloy steel circumferential piping welds. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, Revision 16, 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 100 percent volumetric examination of the Class 2 carbon steel welds shown in Table 3.5.1 (ONS, Unit 1).

| Table 3.5.1 – ASME Code, Section XI, Examination Category C-F-2 (ONS, Unit 1) | | | | |
|---|---|---|---|---|
| **ASME Code Item** | **Weld ID** | **Weld Type** | **Pipe Size-Thickness Inches** | **Coverage Obtained Percent** |
| C5.51 | 1LPS-563-14 | Valve-to-Pipe | 8.0 – 0.50 | 37.5 |
| C5.51 | 1LPS-702-50 | Valve-to-Pipe | 8.0 – 0.50 | 37.5 |

Licensee's Basis for Relief Request (as stated)

> The impracticality was caused by the cast stainless steel material which cannot be effectively interrogated by ultrasound. In order to scan all the required volume for this weld, the valve would have to be redesigned and replaced, which is impractical. There are currently no examination techniques that have been qualified through [ASME Code, Section XI,] Appendix VIII for cast stainless steel. Therefore, coverage could not be obtained by scanning from the valve side. In order to scan all the required volume for this weld, the valve would have to be redesigned and replaced, which is impractical.

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.

Staff Evaluation

The ASME Code requires 100 percent volumetric and surface examination for selected ASME Code, Class 2 pressure-retaining welds in carbon steel or low alloy steel circumferential piping. However, volumetric examinations are limited by the material of the welds and associated piping configurations. To gain access for examination, the welds and piping would require design modifications. This would place a burden on the licensee; thus, obtaining 100 percent of ASME Code-required volumetric examinations is considered impractical.

While these welds are dissimilar metal welds, they are Class 2 welds in the low-pressure service water system with correspondingly low temperatures. While primary water stress corrosion cracking is an ongoing issue in high-pressure and high-temperature dissimilar metal welds, PWSCC is not expected to be a problem for these service water welds.

The components were scanned manually with conventional methods using the requirements described in 10 CFR 50.55a(b)(2)(xv)(A)(1). As shown on the sketches and technical descriptions included in the licensee's submittal, access for examination of the subject welds is limited to primarily one side of these welds due to the presence of CASS materials and taper configurations on the valves. The valve-to-pipe welds have been completed to the extent

practical with volumetric coverage of 37.5 percent (see Table 3.5.1) of the ASME Code-required volumes. The ultrasonic techniques employed for these welds have been qualified through the industry's PDI, which meets ASME Code Section XI, Appendix VIII requirements. These techniques have been qualified for flaws located on the near-side of the welds; far-side detection of flaws is considered to be a "best effort." No ASME Code Section XI, Appendix VIII requirements currently exist for demonstrating ultrasonic scanning through cast stainless steel. For these reasons, the licensee has only taken credit for obtaining limited volumetric examination coverage from the wrought side of the welds. For ONS, Unit 1, the licensee implemented ASME Code Case N-663; therefore, no surface examinations were required for the welds listed in the above Table 3.5.1. No recordable indications were observed during the volumetric examinations.

The licensee's ultrasonic techniques included 45- and 60-degree shear waves, and 0-, 45-, and 60-degree refracted longitudinal waves (L-waves), as applicable. L-waves have been shown to provide enhanced detection on the far-side of austenitic stainless steel welds. 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.

System pressure and leakage tests are performed each inspection period in accordance with ASME Code, Section XI, Table IWC-2500-1, under examination category C-H. This requires a VT-2 visual examination to detect evidence of leakage. Additionally, visual inspection during normal operator rounds, ONS reactor building normal sump monitoring and other leakage detection systems provide additional assurance that, in the event that leakage did occur through a weld, it would be detected and proper action taken.

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 and materials. 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, 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 these welds, evidence of it would have been detected. Furthermore, the staff determined that the examinations obtained provide reasonable assurance of structural integrity of the subject welds.

## 4.0 CONCLUSION

As set forth above, the NRC staff has determined 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 given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Furthermore, the staff concluded that the examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject components. 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 for the subject examinations of the components contained in RR 12-ON-001 and 12-ON-002, Parts A through E for the fourth 10-year ISI interval at ONS, Units 1 and 2.

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: T. McLellan
S. Cumblidge

Date: January 17, 2014

If you have any questions, please contact the Project Manager, Richard Guzman, at 301-415-1030, or via email at Richard.Guzman@nrc.gov.

Sincerely,
***/RA/***

Robert J. Pascarelli, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-269 and 50-270

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