January 6, 2009

Mr. Dave Baxter
Vice President, Oconee Site
Duke Energy Carolinas, LLC
7800 Rochester Highway
Seneca, SC 29672

SUBJECT: OCONEE NUCLEAR STATION, UNIT 1 - FOURTH 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN REQUEST FOR RELIEF NO. 07 ON-002 FOR OCONEE NUCLEAR STATION, UNIT 1 (TAC NO. MD8085)

Dear Mr. Baxter:

We have, with the assistance of Pacific Northwest National Laboratory, reviewed and evaluated the information that you provided in your letter dated February 11, 2008, which proposed Interval Inservice Inspection Program Plan Request for Relief (RR) No. 07-ON-002 for the fourth 10-year interval at Oconee Nuclear Station (ONS), Unit 1. The request for relief is to allow you to take credit for 16 ultrasonic examinations that did not meet the coverage requirements of the American Society of Mechanical Engineers (ASME) Code Case N-460. We have found RR No. 07-ON-002 acceptable, and our evaluation and conclusions are contained in the enclosed Safety Evaluation.

Based on the information provided in the licensee's request for relief, the NRC staff has determined that it is impractical for the identified welds to be examined to the extent required by the ASME Code. The NRC staff has also concluded that the examinations performed by the licensee provide reasonable assurance of structural integrity of the identified welds.

Therefore, relief is granted pursuant to 10 CFR 50.55a(g)(6)(i) for the fourth 10-year ISI interval at Oconee 1 for the referenced welds. Granting relief is authorized by law and will not endanger life, 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.

Sincerely,

/RA/

Melanie C. Wong, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-269

Enclosure:
Safety Evaluation

cc w/encl: Distribution Via Listserv

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Vice President, Oconee Site
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ON THE FOURTH 10-YEAR INTERVAL INSERVICE INSPECTION

PROGRAM PLAN REQUEST FOR RELIEF NO. 07-ON-002

DUKE ENERGY CAROLINAS, LLC

OCONEE NUCLEAR STATION, UNIT 1

DOCKET NO. 50-269

1.0 INTRODUCTION

The U.S. Nuclear Regulatory Commission (NRC) staff, with technical assistance from its contractor, the Pacific Northwest National Laboratory (PNNL), has reviewed and evaluated the information provided by Duke Energy Carolinas, LLC (the licensee) in its letter dated February 11, 2008 (Agencywide Documents Access & Management System (ADAMS) (ML080450172), that proposed its Fourth 10-Year Interval Inservice Inspection (ISI) Program Plan Request for Relief No. 07-ON-002 for Oconee Nuclear Station, Unit 1 (Oconee 1). The request for relief is to allow the licensee to take credit for 16 ultrasonic examinations that did not meet the coverage requirements of the American Society for Mechanical Engineers (ASME) Code Case N-460. The NRC staff adopts the evaluations and recommendations for granting relief contained in PNNL's Technical Letter Report (TLR) that has been incorporated into this safety evaluation (SE) and can be found in ADAMS at ML082460357. Enclosure 1 to this SE lists each relief request and the status of approval.

2.0 REGULATORY REQUIREMENTS

Inservice inspection of ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME *Boiler and Pressure Vessel Code* (ASME Code), and applicable addenda, as required by Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). The regulation at 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The regulation at 10 CFR 50.55a(g)(5)(iii) requires that if the licensee has determined that conformance with certain [ASME Code, Section XI] requirements is impractical for its facility, the licensee shall notify the NRC and submit, as specified in 10 CFR 50.4, information to support the determination.

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) twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed there in. The ASME Code of record for the Oconee 1 Fourth 10-year Interval ISI Program, which began on January 1, 2004, is the 1998 Edition, including the 2000 Agenda, of Section XI of the ASME Code.

3.0 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 ASME Code Examination Category.

3.1 Request for Relief 07-ON-002, Part A, ASME Code, Section XI, Examination Category B-D, Items B3.110 and B3.150, Full Penetration Welded Nozzles in Vessels

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 Figure IWB-2500-7(a), of Class 1 nozzle-to-shell welds in vessels. ASME Code Case N-460, *Alternative Examination Coverage for Class 1 and Class 2 Welds*, as an alternative approved for use by the NRC in Regulatory Guide (RG) 1.147, Revision 15, *Inservice Inspection Code Case Acceptability* (RG 1.147), 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 examining 100 percent of the ASME Code-required inspection volume(s) shown in Figure IWB-2500-7(a) for the nozzle-to-shell welds listed in Table 3.1.1 below:

Table 3.1.1 – Examination Category B-D Limited Volumetric Examinations

Component Number	Weld Description	Coverage Obtained
1-PZR-WP15	Pressurizer lower head-to-surge nozzle	56.9%
1-PZR-WP34	Pressurizer upper head-to-spray nozzle	67.5%
1-PZR-WP33-3	Pressurizer upper head-to-relief nozzle	62.8%
1-PZR-WP33-2	Pressurizer upper head-to-relief nozzle	62.8%
1-PZR-WP33-1	Pressurizer upper head-to-relief nozzle	62.8%
1-51A-18792-1-V-2	Letdown cooler inlet nozzle-to-channel body	60.6%
1-51A-18792-1-V-6	Letdown cooler outlet nozzle-to-channel body	60.6%

Licensee's Basis for Relief Request

The licensee requested relief from the ASME Code 100-percent volumetric examination requirement based on the design geometry of the subject nozzles, which limit angle beam examination to the shell side of the nozzle-to-vessel weld only.

Licensee's Justification for Relief (As Stated)

> Ultrasonic examination[s] of [Weld Numbers 1-PZR-WP15, 1-PZR-WP34, 1-PZR-WP33-3, 1-PZR-WP33-2, 1-PZR-WP33-1 1-51A-18792-1-V-2, and1-51A-18792-1-V-6 were] conducted using personnel, qualified in accordance with ASME [Code,] Section XI, Appendix VII of the 1998 Edition with the 2000 Addenda. Ultrasonic procedures complied with the requirements of ASME [Code,] Section V, Article 4 of the 1998 Edition with the 2000 Addenda as amended by Section XI, Appendix I.
>
> [ASME Code, Section XI, Paragraph] IWB-2500, Table IWB-2500-1, Examination Category B-P System Leakage Tests and VT-2 visual examinations performed each refueling outage provide adequate assurance of pressure boundary integrity.
>
> In addition to the above [ASME] Code required examinations (volumetric and pressure test), there are other activities which provide a high level of confidence that, in the unlikely event that leakage did occur through this weld, it would be detected and proper action taken. Specifically, system leak rate limitations imposed by Technical Specifications 3.4.13, "Reactor Coolant System Leakage," as well as reactor building normal sump rate monitoring, provide additional assurance that any leakage would be detected prior to gross failure of the component.
>
> The component weld was rigorously inspected by volumetric [none destructive examination (NDE)] methods during construction and verified to be free from unacceptable fabrication defects. Based on the coverage and results of the volumetric and the pressure testing VT-2 examinations performed, it is Duke's position that this combination of examinations provides a reasonable assurance of quality and safety.

Licensee's Proposed Alternative Examination:

No alternatives were proposed. The licensee stated:

> Radiography [(RT)] as an alternative is not feasible because access is not available for [inside surface] film placement. No alternative examinations are planned for the welds during the current inspection interval.

NRC Staff's Evaluation

The ASME Code requires 100-percent volumetric examination of ASME Code Class 1 nozzle-to-shell welds in vessels. In addition, the ASME Code requires that the volumetric examination be conducted from both sides of these pressure retaining welds. However, the design configurations of the subject nozzle-to-vessel welds limit access for ultrasonic scanning to the shell side of the welds only. In order to effectively increase the examination coverage, the nozzle-to-shell/head welds would require design modifications

or replacement. This would place a burden on the licensee; thus, 100% ASME Code-required volumetric examinations are impractical.

Welds 1-PZR-WP15, -WP34, and -WP33-1, -2, and -3 are nozzle-to-shell welds on the pressurizer (PZR) surge, spray and relief nozzles, respectively. The welds are on the lower and upper heads of the PZR, which was manufactured from SA-212, Grade B carbon steel with stainless steel cladding on the inside surface. The nozzles are forged SA-508 Class 1 carbon steel and range in outside diameter (OD); 6.875 inches (relief nozzles), 7.75 inches (spray nozzle) and 15.25 inches (surge nozzle). The welds on the subject nozzles extend the full thickness of the PZR upper and lower head, which are approximately 4.75 inches. The nozzles are of the "set-on", or barrel, design which essentially makes the welds concentric rings aligned parallel with the nozzle axes in the through-wall direction of the shell. This design geometry limits ASME Code-required ultrasonic angle beam examinations such that they can only be performed only from the shell side of the welds.

Welds 1-51A-18792-1-V-2 and -6 are inlet and outlet nozzle-to-channel body welds on the letdown heat exchanger. The nozzles and channel body are both fabricated of SA-182, Grade 316L stainless steel. These welds are approximately 3 inches in OD with wall thicknesses of about 0.875 inches. The nozzles are a "set-in" design, however, due to their small diameter, tapered OD surfaces, and the geometry of the channel body, the welds have a large transition between the shell and the nozzle OD which limits ultrasonic scanning to the channel body and weld crown region.

As shown on the sketches and technical descriptions[1] included in the licensee's submittal, examinations of the subject nozzle-to-shell welds have been completed to the extent practical with aggregate volumetric coverage ranging from 56.9% to 67.5% of the ASME Code-required volumes (see Table 3.1.1 above). The ultrasonic examinations on the PZR carbon steel nozzle welds included 45- and 60-degree shear waves from the shell side, including most of the weld and base materials near the inside surface of the vessel, which are the highest regions of stress and where one would expect degradation sources to be manifested should they occur. Although ultrasonic scans were primarily limited to the shell side only, recent 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[2]. Therefore, it is expected that the ultrasonic techniques employed by the licensee would detect structurally significant flaws that might occur on either side of the subject welds due to their fine-grained carbon steel microstructures.

Ultrasonic examinations on the letdown heat exchanger inlet/outlet stainless steel nozzle-to-shell welds included 45-, 60-, and 70-degree shear and refracted longitudinal waves. The examinations also covered most of the weld and base materials near the inside surface of the vessel, which are the highest regions of stress and where one would expect degradation sources to be manifested should they occur. In addition, the licensee employed longitudinal wave (L-wave) techniques for these stainless steel welds.

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1 Sketches and technical descriptions provided by the licensee are not included in this report.

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

The L-wave method is capable of detecting planar inside diameter (ID) surface-breaking flaws on the far-side of the stainless steel welds. Recent studies[3,4] recommend the use of both shear and L-waves to obtain the best detection results, with minimum false calls, in austenitic welds. No recordable flaw indications were observed during the ultrasonic examinations.

The licensee has shown that it is impractical to meet the ASME Code-required 100% volumetric examination coverage for the subject nozzle-to-shell welds due to the nozzle designs and OD surface configurations. 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 were occurring, evidence of it would have been detected by the examinations that were performed.

3.2 Request for Relief 07-ON-002, Part B, ASME Code, Section XI, Examination Category B-J, Item B9.11, Pressure Retaining Welds in Piping

Component Identification

Lower Pressure Injection System Pipe-to-Valve 1CF-11 Weld ID 1-53A-02-69L

ASME Code Requirement

ASME Code, Section XI, Examination Category B-J, Item B9.11, requires essentially 100-percent surface and volumetric examination, as defined by Figure IWB-2500-8(c), of the length of selected Class 1 circumferential welds in piping systems. "Essentially 100%", as clarified by ASME Code Case N-460, and Class 2 Welds, is greater than 90% 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 15.

Licensee ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100 percent of the ASME Code-required inspection volume shown in Figure IWB-2500-8(c) for pipe-to-valve Weld 1-53A-02-68L in the Low Pressure Safety Injection System.

Licensee's Basis for Relief Request

The licensee requested relief from the ASME Code 100-percent volumetric examination requirement based on the design taper of the valve and the cast stainless steel valve body which limited examination to the pipe side of the weld only.

Licensee's Justification for Relief As Stated

> Ultrasonic examination of [Lower Pressure Injection System Pipe-to-Valve 1CF-11 Weld ID 1-53A-02-69L] was conducted using personnel, equipment and procedures

3 Ammirato, F.V., 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.

4 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.

qualified in accordance with ASME [Code,] Section XI, Appendix VIII Supplement 2 of the 1998 Edition with the 2000 Addenda as administered by the Performance Demonstration Initiative (PDI). In the case of this piping weld NRC has imposed requirements for coverage of stainless steel piping welds in 10 CFR 50.55a(b)(2)(xvi)(A)(1). This requires scanning of the weld and adjacent base material from four orthogonal directions. If this requirement cannot be met then the NRC will not allow credit for coverage on the far side of the weld unless a demonstration test is passed with all flaws being on the far side of the weld. The demonstration requires detection, length sizing and through wall sizing of flaws with the sound beam passing through the austenitic weld metal. Performance demonstration qualifications for cast stainless steel (Appendix VIII, Supplement 9) are in the course of preparation and current qualifications for piping do not address cast stainless steel components such as the valve body. Therefore, credit for ultrasonic coverage is not claimed. Use of [RT] to achieve more coverage has been evaluated and discarded because RT is less sensitive to service induced cracking and has not been subjected to the performance demonstration requirements in a manner similar to the ultrasonic method. While RT could in most cases provide more coverage the loss of sensitivity and lack of performance demonstration militates against its use.

In addition to [Weld ID 1-53A-02-69L] that relief is being requested for limited volume coverage, there were 15 additional [identical] welds that surface and volumetric examinations were performed on. The examinations didn't identify any recordable indications and 100% coverage was obtained on each of them. Twelve of the fifteen additional welds were from the Reactor Coolant System and three of the additional welds were from the Low Pressure Injection System.

[ASME Code, Section XI, Paragraph] IWB-2500, Table IWB-2500-1, Examination Category B-P System Leakage Tests and VT-2 visual examinations performed each refueling outage provide adequate assurance of pressure boundary integrity. In addition to the above [ASME] Code required examinations (volumetric, surface, and pressure test), there are other activities which provide a high level of confidence that, in the unlikely event that leakage did occur through this weld it would be detected and proper action taken. Specifically, reactor building normal sump rate monitoring, provides additional assurance that any leakage would be detected prior to gross failure of the component.

The component weld was rigorously inspected by volumetric NDE methods during construction and verified to be free from unacceptable fabrication defects. Based on the coverage and results of the volumetric, surface, and the pressure testing VT-2 examinations performed, it is Duke's position that this combination of examinations provides a reasonable assurance of quality and safety.

Licensee's Proposed Alternative Examination

No alternatives were proposed. The licensee stated:

[RT] is not a desired option because RT is limited in the ability to detect expected degradation mechanisms such as thermal fatigue cracking and stress corrosion cracking initiating at the pipe inside surface. Additionally, [RT] has not been qualified through performance demonstration.

NRC Staff's Evaluation

The ASME Code requires essentially 100-percent volumetric and surface examination of selected ASME Code Class 1 circumferential piping welds. In addition, the ASME Code requires that the volumetric examination be conducted from both sides of these pressure retaining circumferential welds. However, the austenitic stainless steel materials and design configurations of the subject weld limit ultrasonic scanning to a single side. In order to effectively increase the examination coverage, the pipe-to-valve configuration would require design modifications or replacement. This would place a burden on the licensee; thus, 100-percent ASME Code-required volumetric examinations are impractical.

Weld 1-53A-02-68L is a valve-to-pipe circumferential butt weld in 14-inch outside diameter (OD) Nominal Pipe Size (NPS) piping with a wall thickness of approximately 1.25 inches. This weld joins austenitic stainless steel piping to a stainless steel valve, where the OD surface of the valve casting has an extreme taper and surface curvature which prevents performing ultrasonic scans from the valve side. These geometric conditions limit examination to only the pipe side of the weld.

As shown on the sketches and technical descriptions[5] included in the licensee's submittal, examination of the subject piping weld has been completed to the extent practical with aggregate volumetric coverage of 36.7 percent of the ASME Code-required volume. The ultrasonic examinations included 45- and 60-degree shear waves from the pipe side of the weld, which account for the aggregate coverage reported. In addition, the licensee performed 60-degree refracted longitudinal wave (L-wave) examinations from the accessible side of this weld. The L-wave examinations covered additional weld/base metal volume on the valve side of the weld, however, this additional volume has not been credited in the licensee's reported coverage because the L-wave technique has not been fully qualified for flaw detection on the far-side of austenitic welds by the industry's Performance Demonstration Initiative (PDI). However, the L-wave method is believed capable of detecting planar inside diameter (ID) surface-breaking flaws on the far-side of wrought stainless steel welds. Recent studies as noted above in Foot Notes 3 and 4 on page 4 of this SE recommend the use of both shear and L-waves to obtain the best detection results, with minimum false calls, in austenitic welds.

The licensee completed the ASME Code-required surface examination on the subject weld with no limitations. Further, the licensee reported that 15 additional Examination Category B-J, Item B9.11 piping welds were examined with 100-percent ASME Code volumetric and surface coverage having been obtained. No recordable indications were observed during the ultrasonic and surface examinations.

The licensee has shown that it is impractical to meet the ASME Code-required 100-percent volumetric examination coverage for the subject pipe-to-valve weld due to the OD surface configuration and cast material on the valve side of the weld. Based on the volumetric coverage obtained for the subject weld, the licensee's performance of both ultrasonic shear and L-wave methods to maximize this coverage, and 100-percent examinations of similar ASME Code Class 1 piping welds, it is reasonable to conclude that if significant service-induced degradation were occurring, evidence of it would have been detected by the examinations that were performed.

5 Sketches and technical descriptions provided by the licensee are not included in this report.

3.3 Request for Relief 07-ON-002, ASME Code, Section XI, Part C, Examination Category C-A, Item C1.20, Pressure Retaining Welds in Pressure Vessels

Component Identification

Letdown Storage Tank Lower Head Weld ID 1-LST-HD-SH-2

ASME Code Requirement

ASME Code, Section XI, Examination Category C-A, Item C1.20 requires essentially 100-percent volumetric examination, as defined by Figure IWC-2500-1(a), of the length of circumferential head welds on Class 2 vessels. "Essentially 100%", as clarified by ASME Code Case N-460 is greater than 90% 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 15.

Licensee's Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining essentially 100 percent of the ASME Code-required inspection volume shown in Figure IWC-2500-1(a) for lower head-to-shell Weld 1-LST-HD-SH-2 on the Letdown Storage Tank.

Licensee's Basis for Relief Request (As Stated)

> During the ultrasonic examination of this weld, 80.26 percent coverage of the required examination volume was obtained. The percentage of coverage represents the aggregate coverage from all scans performed on the weld and adjacent base material. The coverage from each scan was as follows: 60-degree shear wave circumferential scans, both clockwise and counter-clockwise covered 80.26 percent of the weld and base material; 60-degree shear wave scans perpendicular to the weld covered 80.26 percent of the weld and base material from two axial directions. The limitation was caused by four equally spaced-pads for support legs that prevented scanning in these areas. In order to scan all of the required volume for this weld, the support legs would have to be removed to allow scanning from both sides of the weld, which is impractical. There were no recordable indications found during the inspection of this weld.

Licensee's Justification for Relief (As Stated)

> Ultrasonic examination of [Letdown Storage Tank Lower Head Weld ID 1-LST-HD-SH-2] for was conducted using personnel qualified in accordance with ASME [Code,] Section XI, Appendix VII of the 1998 Edition with the 2000 Addenda. The procedure complied with the requirements of ASME [Code,] Section XI, Appendix III, 1998 Edition with the 2000 Addenda.
>
> In addition to [Weld ID 1-LST-HD-SH-2] that relief is being requested for limited volume coverage, there was [one] additional [identical] weld that a volumetric examination was performed on. The examination didn't identify any recordable indications and 100% coverage was obtained on it. The additional [identical weld] was the Letdown Storage Tank upper head to shell weld.

> [ASME Code, Section XI, Paragraph] IWC-2500, Table IWC-2500-.1, Examination Category C-H System Leakage Tests and VT-2 visual examinations performed once each period provide adequate assurance of pressure boundary integrity.
>
> In addition to the above [ASME] Code required examinations (volumetric and pressure test), there are other activities which provide a high level of confidence that, in the unlikely event that leakage did occur through this weld it would be detected and proper action taken. Specifically, system leak rate limitations imposed by Technical Specifications 3.4.13, "Reactor Coolant System Leakage" provide additional assurance that any leakage would be detected prior to gross failure of the component.
>
> The component weld was rigorously inspected by volumetric NDE methods during construction and verified to be free from unacceptable fabrication defects. Based on the coverage and results of the volumetric and the pressure testing VT-2 examinations, performed, it is Duke's position that this combination of examinations provides a reasonable assurance of quality and safety.

Licensee's Proposed Alternative Examination (As Stated)

> [RT] as an alternative is not feasible because access is not available for film placement. No alternative examinations are planned for the weld during the current inspection interval.

NRC's Staff's Evaluation

The ASME Code requires essentially 100-percent volumetric examination of head circumferential welds in ASME Code Class 2 vessels. In addition, the ASME Code requires that the volumetric examination be conducted from both sides of these pressure retaining circumferential vessel welds. However, the design configuration of the subject Letdown Storage Tank includes welded support leg pads covering a portion of this pressure retaining weld. In order to effectively increase the examination coverage, the tank would require design modifications or replacement. This would place a burden on the licensee; thus, essentially 100-percent ASME Code-required volumetric examinations are impractical.

Weld 1-LST-HD-SH-2 is a circumferential shell-to-bottom head weld on the Letdown Storage Tank. The tank head and shell are fabricated of SA-240/T-304 stainless steel plate approximately 0.375 inches in thickness. This is a vertical tank that has four equally spaced welded reinforcing pads located over portions of the bottom head-to-shell weld. These pads are used for attaching vertical support legs, and limit ultrasonic examination of Weld 1-LST-HD-SH-2 to areas outside the reinforcing pads.

As shown on the drawing and technical description[6] included in the licensee's submittal, examination of the subject weld has been completed to the extent practical with substantial volumetric coverage of approximately 80.3 percent of the ASME Code-required volume. The ultrasonic examination on Weld 1-LST-HD-SH-2 consisted of 60-degree shear waves from both the head and shell sides of the weld. No recordable indications were observed during the ultrasonic examination.

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6 Sketches and technical descriptions provided by the licensee are not included in this report.

Based on the 80.3 percent volumetric coverage obtained for the subject lower head-to-shell weld, it is reasonable to conclude that if significant service-induced degradation were occurring, evidence of it would have been detected by the examination that was performed.

3.4 Request for Relief 07-ON-002, Part D, ASME Code, Section XI, Examination Category C-B, Item C2.21, Pressure Retaining Nozzle Welds in Vessels

Component Identification

Steam Generator 1A Main Steam Nozzle-to-Shell Weld ID 1-SGA-W128

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), of circumferential nozzle-to-shell or -head welds on Class 2 vessels. ASME Code Case N-460, an alternative approved for use by the NRC in RG 1.147, Revision 15, 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 Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100 percent of the ASME Code-required inspection volume shown in Figure IWC-2500-4(a) for main steam outlet nozzle-to-head Weld 1-SGA-W128 on Steam Generator 1A.

Licensee's Basis for Relief Request (As Stated)

> During the ultrasonic examination of this weld, 85.66 percent coverage of the required examination volume was obtained. The percentage of coverage represents the aggregate coverage from all scans performed on the weld and adjacent base material. The coverage from each scan was as follows: 45 degree and 35 degree shear wave scans perpendicular and parallel to the weld in one axial direction and two circumferential directions and 0 degree longitudinal wave scans covered 73.14 percent of the base material from the head side. [Shear wave scans done at 45 degree and 35 degrees] perpendicular and parallel to the weld in one axial direction and two circumferential directions and 0 degree longitudinal wave scans covered 98.17 percent of the weld volume from the head side. The limitation was caused by the nozzle design which limits the base material coverage in the parallel direction. There were no recordable indications found during the inspection of this weld.

Licensee's Justification for Relief (As Stated)

> Ultrasonic examination of [Steam Generator 1A Main Steam Nozzle-to-Shell Weld ID 1-SGA-W128] was conducted using personnel qualified in accordance with ASME [Code,] Section XI, Appendix VII of the 1998 Edition with the 2000 Addenda. The procedures used complied with the requirements of ASME Section V, Article 4 as amended by ASME [Code,] Section XI, Appendix I, 1998 Edition with the 2000 Addenda.

In addition to the volumetric examination with limited coverage, Duke performed a surface examination ([ASME Code] required) on [Weld 1-SGA-W128] and achieved 100% coverage. The result from the surface examination was acceptable.

[ASME Code, Section XI, Paragraph] IWC-2500, Table IWC-2500-1, Examination Category C-H System Leakage Tests and VT-2 visual examinations performed once each period provide adequate assurance of pressure boundary integrity.

In addition to the above [ASME] Code required examinations (volumetric, surface, and pressure test), there are other activities which provide a high level of confidence that, in the unlikely event that leakage did occur through this weld it would be detected and proper action taken. Specifically, reactor building normal sump rate monitoring, provides additional assurance that any leakage would be detected prior to gross failure of the component.

The component weld was rigorously inspected by volumetric NDE methods during construction and verified to be free from unacceptable fabrication defects. Based on the coverage and results of the volumetric, surface, and the pressure testing VT-2 examinations performed, it is Duke's position that this combination of examinations provides a reasonable assurance of quality and safety.

Licensee's Proposed Alternative Examination (as stated)

[RT] as an alternative is not feasible because access is not available for film placement. No alternative examinations are planned for the weld during the current inspection interval.

NRC's Staff Evaluation

The ASME Code requires 100-percent volumetric examination of nozzle-to-head circumferential welds in Class 2 vessels. In addition, the ASME Code requires that the volumetric examination be conducted from both sides of these pressure retaining welds. However, the design configuration of the subject main steam outlet nozzle prevents scanning of a portion of the adjacent base material due to the nozzle outside surface radius. In order to effectively increase the examination coverage, the nozzle-to-head weld would require design modifications or replacement. This would place a burden on the licensee; thus, 100-percent ASME Code-required volumetric examinations are impractical.

Weld 1-SGA-W128 is a full penetration main steam outlet nozzle-to-head weld on Steam Generator 1A. The main steam nozzle and steam generator head are fabricated of SA-508 Class 3a carbon steel approximately 5.125-inches in thickness; the nozzle is approximately 36-inches in outside diameter. The outside radius curvature restricted ultrasonic scans on a small portion of the adjacent base material on the nozzle side of the weld.

As shown on the sketches and technical description[7] included in the licensee's submittal, examination of the subject weld has been completed to the extent practical with substantial volumetric coverage of approximately 85.7 percent of the ASME Code-

7 Sketches and technical descriptions provided by the licensee are not included in this report.

required volume. The ultrasonic examination on Weld 1-SGA-W128 consisted of 35- and 45-degree shear waves from both the head and nozzle sides of the weld. In addition, 0-degree longitudinal wave examination was also completed. The licensee also performed the ASME Code-required surface examination with no limitation. No recordable flaw indications were observed during the ultrasonic and surface examinations.

Based on the 85.7-percent volumetric coverage obtained for the subject nozzle-to-head weld, in addition to the 100-percent surface examination completed, it is reasonable to conclude that if significant service-induced degradation were occurring, evidence of it would have been detected by the examinations that were performed.

3.5 Request for Relief 07-ON-002, Part E, 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 volumetric and surface examination, as defined by Figure IWC-2500-7(a), of selected circumferential piping welds on Class 2 systems fabricated of austenitic stainless steel or high alloy materials. ASME Code Case N-460, as an alternative approved for use by the NRC in RG 1.147, Revision 15, 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 Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100 percent of the ASME Code-required inspection volume shown in Figure IWC-2500-7(a) for the piping welds shown in Table 3.5.1 below on the Low Pressure Injection and Low Pressure Service Water Systems.

Table 3.5.1 – Examination Category C-F-1 Limited Volumetric Examinations

Weld Number	Description/Configuration	Coverage Obtained
1-53A-01-29L	Valve-to-pipe weld	37.5%
1-53A-02-64L	Valve-to-pipe weld	37.5%
1LP-210-72	Flow restrictor-to-pipe weld	37.5%
1LP-210-73	Flow restrictor-to-pipe weld	37.5%
1LPS-746-2	Valve-to-pipe weld	62.5%
1LPS-751-16	Flange-to-pipe weld	62.5%

Licensee's Basis for Relief Request

The licensee requested relief from the ASME Code 100-percent volumetric examination requirement based on the design geometry of the subject pipe-to-valve/flow restrictor/flange welds, which limit angle beam examination to the pipe side of the welds only.

Licensee's Justification for Relief (As Stated)

Ultrasonic examination of Weld Numbers 1-53A-01-29L, 1-53A-02-64L, 1LP-210-72, 1LP-210-73, 1LPS-746-2, and 1LPS-751-16] was conducted using personnel, equipment and procedures qualified in accordance with ASME Section XI, Appendix V1I1 Supplement 2 of the 1998 Edition with the 2000 Addenda as administered by the Performance Demonstration Initiative (PDI). In the case of this piping weld, NRC has imposed requirements for coverage of stainless steel piping welds in 10 CFR 50.55a (b) (2) (xvi) (A) (1). This requires scanning of the weld and adjacent base material from four orthogonal directions. If this requirement cannot be met then the NRC will not allow credit for coverage on the far side of the weld unless a demonstration test is passed with all flaws being on the far side of the weld. The demonstration requires detection, length sizing and through wall sizing of flaws with the sound beam passing through the austenitic weld metal. Performance demonstration qualifications for cast stainless steel, (Appendix VIII, Supplement 9) is in course of preparation and current qualifications for piping do not address cast stainless steel components such as the valve body. Therefore, credit for ultrasonic coverage is not claimed. Use of radiography (RT) to achieve more coverage has been evaluated and discarded because RT is less sensitive to service induced cracking and has not been subjected to the performance demonstration requirements in a manner similar to the ultrasonic method. While RT could in most cases provide more coverage the loss of sensitivity and lack of performance demonstration mitigates against its use.

In addition to the volumetric examination with limited coverage, Duke performed a surface examination ([ASME Code] required) on the [subject welds] and achieved 100% coverage. The result from the surface examination was acceptable.

In addition to the six welds of this relief request, there were seventeen additional [identical] welds that surface [liquid penetrant] (PT) and volumetric examinations were performed on during the outage. The examinations didn't identify any reportable indications. 100% coverage was obtained on all the surface examinations, fifteen of the volumetric examinations obtained 100% coverage and 97.20% coverage was obtained on two of the volumetric examinations. Two of the seventeen additional welds were from the Low Pressure Service Water System and fifteen of the additional welds were, from the Low Pressure Injection System.

[ASME Code, Section XI,] IWC-2500, Table IWC-2500-1, Examination Category C-H System Leakage Tests and VT-2 visual examinations performed once each period provides adequate assurance of pressure boundary integrity.

In addition to the above [ASME] Code required examinations (volumetric, surface, and pressure test), there are other activities which provide a high level of confidence that, in the unlikely event that leakage did occur through this weld it would be detected and proper action taken. Specifically, reactor building normal sump rate monitoring, provides additional assurance that any leakage would be detected prior to gross failure to the component.

The component weld was rigorously inspected by volumetric NDE methods during construction and verified to be free from unacceptable fabrication defects. Based on

the coverage and results of the volumetric, surface, and the pressure testing VT-2 examinations performed, it is Duke's position that this combination of examinations provides a reasonable assurance of quality and safety.

Licensee's Proposed Alternative Examination (as stated)

> No alternative examinations are planned for these welds during the current inspection interval.
>
> [RT] is not a desired option because RT is limited in the ability to detect expected degradation mechanisms such as thermal fatigue cracking and stress corrosion crack initiating at the pipe inside surface. Additionally, [RT] has not been qualified through performance demonstration.
>
> The [UT] techniques, though limited in coverage by virtue of the requirements in 10 CFR 50.55a, have been qualified through performance demonstration and are considered superior to RT for this application. Although the PDI does not offer a single sided qualification for stainless steel piping, circumferential flaws on the far side of stainless steel welds were detected during the [PDI based examination].

NRC's Staff Evaluation

The ASME Code requires 100-percent volumetric and surface examination of selected ASME Code Class 2 circumferential piping welds in high alloy piping systems. In addition, the ASME Code requires that the volumetric examination be conducted from both sides of these pressure retaining circumferential welds. However, the austenitic stainless steel materials and design configurations of the subject welded components limit ultrasonic scanning to a single side. In order to effectively increase the examination coverage, the pipe-to-valve/flow restrictor/flange configurations would require design modifications or replacement. This would place a burden on the licensee; thus, 100- percent ASME Code-required volumetric examinations are impractical.

Welds 1-53A-01-29L and 1-53A-02-64L are valve-to-pipe circumferential butt welds in 10-inch OD nominal pipe size (NPS) piping with a wall thickness of approximately 1.0-inches. Similarly, Welds 1LP-210-72 and 1LP-210-73 are pipe-to-flow restrictor circumferential butt welds in 10-inch OD NPS piping also having a wall thickness of approximately 1.0 inches. These welds join SA 376/TP 304 or 316 austenitic stainless steel piping to A351 Grade CF8M cast stainless steel valves and flow restrictors, respectively. The cast material and tapered OD surface of the valves and flow restrictors prevent performing ultrasonic scans from the valve/flow restrictor side of the welds.

Welds 1LPS-746-2 and 1LPS-751-16 are pipe-to-valve/flange circumferential butt welds in 6-inch OD NPS piping with a wall thickness of approximately 0.432-inches. These welds are SA 312/TP 316L stainless steel pipe to forged SA 182/TP F316L valve and bolted flange, respectively. The tapered OD surface of the valve and flange limited a portion of the ultrasonic scans from the valve/flange side of the welds.

As shown on the sketches and technical descriptions[8] included in the licensee's submittal, examinations of the subject piping welds have been completed to the extent practical with aggregate volumetric coverage of approximately 37.5 percent

8 Sketches and technical descriptions provided by the licensee are not included in this report.

and 62.5 percent of the ASME Code-required volumes for the subject welds (see Table 3.5.1 above). The ultrasonic examinations on these welds included 45 and 60-degree shear waves from the pipe side of the welds, which account for the aggregate coverage reported.

In addition, the licensee performed 60 or 70-degree, as applicable, refracted longitudinal wave (L-wave) examinations from the accessible side of these welds. The L-wave examinations covered additional weld/base metal volumes on the valve/flow restrictor/flange sides of the welds but has not been credited in the licensee's reported aggregate coverage because the L-wave technique has not been fully qualified through the industry's PDI for flaw detection on the far-side of austenitic welds. However, the L-wave method is capable of detecting planar inside diameter (ID) surface-breaking flaws on the far-side of wrought stainless steel welds. Recent studies as noted above in Foot Notes 3 and 4 on page 4 of this SE recommend the use of both shear and L-waves to obtain the best detection results, with minimum false calls, in austenitic welds.

The licensee completed the ASME Code-required surface examinations on the subject welds with no limitations. No recordable indications were observed during the ultrasonic and surface examinations.

The licensee also reported that 17 additional Examination Category C-F-1 examinations were completed with full ASME Code-required volumetric and surface coverage being obtained. No reportable indications were detected during any of the examinations.

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 the OD surface configurations and material conditions. Based on the volumetric coverage obtained for the subject welds, considering the licensee's performance of both ultrasonic shear and L-wave methods to maximize this coverage, and 100-percent examinations of similar ASME Code Class 2 piping welds, it is reasonable to conclude that if significant service-induced degradation were occurring, evidence of it would have been detected by the examinations that were performed.

4.0 CONCLUSIONS

The NRC staff has reviewed the licensee's submittal and concludes that ASME Code examination coverage requirements are impractical for the subject welds listed in Request for Relief 07-ON-002, Parts A, B, C, D and E. Furthermore, the staff concludes that based on the coverage obtained, if significant service-induced degradation were occurring, there is reasonable assurance that evidence of it would have been detected by the examinations that were performed. Based on the coverage obtained by the licensee to the maximum extent practical the NRC staff concludes the examinations provide reasonable assurance of structural integrity of the subject components. Therefore, for the items in this request, relief is granted, pursuant to 10 CFR 50.55a(g)(6)(i), for the fourth inspection interval at Oconee 1.

The NRC staff has determined that granting relief for Request for Relief No. 07-ON-002, Parts A, B, C, D, and E pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger life or property, or the common defense and security, and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. 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.

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Date: January 6, 2009

Plant Name: Oconee Nuclear Station, Unit 1
Fourth 10-Year ISI Interval

TABLE 1
SUMMARY OF RELIEF REQUESTS

Relief Request Number	TLR RR Sec.	System or Component	Exam. Category	Item No.	Volume or Area to be Examined	Required Method	Licensee Proposed Alternative	Relief Request Disposition
07-ON-002 (Part A)	3.1	Class 1 Nozzle-to-Vessel Welds	B-D	B3.110 B3.150	100% of Class 1 nozzle-to-vessel welds	Volumetric	Use volumetric coverage(s) achieved 56.9% to 62.5%	Granted 10 CFR 50.55a(g)(6)(i)
07-ON-002 (Part B)	3.2	Class 1 Piping welds	B-J	B9.11	100% of selected Class 1 piping welds	Volumetric and Surface	Use achieved 36.7% volumetric coverage	Granted 10 CFR 50.55a(g)(6)(i)
07-ON-002 (Part C)	3.3	Class 2 Vessel shell welds	C-A	C1.20	100% of shell welds in Class 2 vessels	Volumetric	Use achieved 80.3% volumetric coverage	Granted 10 CFR 50.55a(g)(6)(i)
07-ON-002 (Part D)	3.4	Class 2 Nozzle-to-Vessel Welds	C-B	C2.21	100% of nozzle-to-vessel welds in selected vessels	Volumetric and Surface	Use achieved 85.7% volumetric coverage	Granted 10 CFR 50.55a(g)(6)(i)
07-ON-002 (Part E)	3.5	Class 2 Piping Welds	C-F-1	C5.11	100% of selected full penetration piping welds in high alloy systems	Volumetric and Surface	Use volumetric coverage(s) achieved 37% to 62.5%	Granted 10 CFR 50.55a(g)(6)(i)