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

October 1, 2009

Mr. J. R. Morris
Site Vice President
Catawba Nuclear Station
Duke Energy Carolinas, LLC
4800 Concord Road
York, SC 29745

SUBJECT: CATAWBA NUCLEAR STATION, UNIT 2, RELIEF 08-CN-001 REGARDING THIRD 10-YEAR INTERVAL INSERVICE INSPECTION (TAC NOS. MD9877, MD9879, MD9880, MD9881 AND MD9882)

Dear Mr. Morris:

By letter dated October 9, 2008, Duke Energy Carolinas, LLC (the licensee), submitted Request for Relief 08-CN-001 to allow relief from certain examination requirements of the American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code* (Code), at Catawba Nuclear Station, Unit 2, (Catawba 2). Specifically, the licensee requested approval of limited weld examinations during inservice inspection (ISI) activities for the end-of-cycle 15 refueling outage which provided coverage that was less than ASME Code ISI coverage requirements. The request is for the third 10-year interval ISI which began October 15, 2005, and is scheduled to end August 19, 2016. The ASME Code of record for the current third 10-year ISI interval at Catawba 2 is Section XI, 1998 Edition, through 2000 addenda.

The NRC staff has reviewed the licensee's submittal and, based on the information provided in the licensee's request for relief, the NRC staff grants relief from ASME Code, Section XI pursuant to Title 10 of the *Code of Federal Regulations*, Part 50, Section 50.55a(g)(6)(i), as granting relief 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 would result if the requirements were imposed on Catawba 2. This approval is only for the third ISI interval examinations listed in Relief Request 08-CN-001.

The NRC staff's evaluation and conclusions are contained in the enclosed safety evaluation.

All other requirements of ASME Code, Section XI for which relief has not been specifically requested remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

If you have any questions, please call me at 301-415-1119.

Sincerely,

Thomas H. Boyce, Chief
Plant Licensing Branch II-2
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-414

Enclosure:
As stated

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

OF THIRD 10-YEAR INTERVAL INSERVICE INSPECTION

RELIEF NO. 08-CN-001

DUKE ENERGY CAROLINAS, LLC

CATAWBA NUCLEAR STATION, UNIT 2

DOCKET NOS. 50-414

1.0 INTRODUCTION

By letter dated October 9, 2008 (Agencywide Documents Access and Management System Accession No. ML082890566), Duke Energy Carolinas, LLC (the licensee), submitted Request for Relief 08-CN-001 to allow relief from certain examination requirements of the American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code* (Code), at Catawba Nuclear Station, Unit 2, (Catawba 2). Specifically, the licensee requested approval of limited weld examinations during inservice inspection (ISI) activities for the end-of-cycle 15 refueling outage which provided coverage that was less than ASME Code ISI coverage requirements. The request is for the third 10-year interval ISI which began October 15, 2005, and is scheduled to end August 19, 2016.

2.0 REGULATORY EVALUATION

ISI of ASME Code, Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable addenda, as required by 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 Nuclear Regulatory Commission (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.

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), 12 months prior to the start of the 120-month

interval, subject to the limitations and modifications listed therein. The ASME Code of record for Catawba 2 third 10-year interval ISI program, is the 1998 Edition, through the 2000 Addenda, of Section XI of the ASME Code.

3.0 TECHNICAL EVALUATION

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

3.1 Examination Category B-J, Item B9.11, Pressure Retaining Welds in Piping

Licensee's ASME Code Relief Request:

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100% of the ASME Code-required inspection volume(s) for the piping welds listed in Table 3.1.1 below:

Table 3.1.1

Component No.	Description	Item	Interference	Coverage
2NC25-5	6" Elbow to Valve	B9.11	Valve side taper	64.6%
2NC43-13	12" Pipe to Nozzle	B9.11	Nozzle blend radius proximity	62.5%
2NI59-1	10" Pipe to Valve	B9.11	Valve side taper	42.6%

ASME Code Requirement:

Examination Category B-J, Item B9.11, requires essentially 100% surface and volumetric examination, as defined by Figure IWB-2500-8, of the length of selected Class 1 circumferential welds in piping systems. "Essentially 100%", as clarified by ASME Code Case N-460 (N-460), Alternative Examination Coverage for Class 1 and Class 2 Welds, is greater than 90% coverage of the examination volume, or surface area, as applicable. N-460 has been approved for use by the NRC in Regulatory Guide (RG) 1.147, Revision 14, Inservice Inspection Code Case Acceptability.

Licensee's Basis for Relief Request:

The licensee stated that physical limitations due to geometric configuration of the welded areas restricted coverage of the examination volume as required by Figure IWB-2500-8(c). The examinations were performed to the maximum extent possible in accordance with ASME Code, Section XI, Appendix VIII qualified personnel, equipment and procedures. The root of the welds were interrogated with both a 45° shear wave and a 60° refracted longitudinal wave looking for circumferential cracking. In addition, surface examination prior to the ultrasonic testing (UT) and VT-2 visual examinations associated with the Class 1 leakage test are performed each refueling outage for the welds listed in Table 3.1.1. The licensee also stated that radiographic testing (RT) on the far side of the welds was not considered to be a viable alternative because radiography has not been qualified through performance demonstration.

Licensee's Alternative Examination:

No alternative examinations were proposed.

Evaluation:

The ASME Code requires 100% coverage for the volumetric and surface examination of selected 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 welded components limit UT scanning to a single side. In order to effectively increase the examination coverage, the configurations would require design modifications or replacement. This would place a significant burden on the licensee; thus, 100% coverage for volumetric examinations is impractical.

As shown on the sketches and technical descriptions included in the licensee's submittal, examinations of the subject piping welds have been completed to the extent practical with aggregate volumetric coverage ranging from 42.6% to 64.6% of the ASME Code required volumes (see Table 3.1.1 above). The UT examinations included 45-degree shear wave and 60-degree refracted longitudinal waves from the pipe side of the welds. The UT examinations performed were qualified to the performance demonstration requirements of ASME Code, Section XI, Appendix VIII. The licensee has not credited coverage of the weld for the far-side (inspection through the weld material) because the inspection procedure is only considered a "best effort" for detection of far side flaws in austenitic welds. However, refracted longitudinal waves (L wave) are capable of detecting planar inside diameter (ID) surface-breaking flaws on the far-side of wrought stainless steel welds. Recent studies 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 UT and surface examinations. In addition, surface examination prior to UT and VT-2 visual examinations associated with the Class 1 leakage test are performed each refueling outage for the welds listed, which provide additional assurance of weld structural integrity prior to plant startup.

The licensee has shown that it is impractical to meet the ASME Code-required 100% volumetric examination coverage for the subject piping welds due to outside diameter (OD) surface configurations. Based on the volumetric coverage obtained for the subject welds, and considering the licensee's performance of both UT shear and L-wave methods to maximize this coverage, it is reasonable for the NRC staff to conclude that if significant service-induced degradation were occurring, evidence of it would have been detected by the examinations that were performed. The examinations performed provide reasonable assurance of structural integrity of the subject welds.

3.2 Examination Category B-D, Item B3.110, Pressurizer Nozzle-to-Head Welds

Licensee's ASME Code Relief Request:

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from 100% volumetric examination coverage for Class 1 ferritic metal piping welds 2PZR-W2 and 2PZR-W4C.

ASME Code Requirement:

Examination Category B-D, Item B1.22, requires essentially 100% surface and volumetric examination, as defined by Figure IWB-2500-7(a), of the length of selected Class 1 welds. "Essentially 100%", as clarified by N-460, Alternative Examination Coverage for Class 1 and Class 2 Welds, is greater than 90% coverage of the examination volume, or surface area, as applicable. N-460 has been approved for use by the NRC in RG 1.147, Revision 14, Inservice Inspection Code Case Acceptability.

Licensee's Basis for Relief Request:

The licensee stated that the coverage of the required examination volumes were limited to 81.7% and 81.2% for welds 2PZR-W2 and 2PZR-W4C, respectively, due to nozzle blend radius proximity, which prevents scanning from the nozzle side. In order to effectively increase the examination coverage, the configurations would require design modifications or replacement. This would place a significant burden on the licensee; thus, 100% coverage for volumetric examinations is impractical. In addition, RT is not a viable option because no access exists in order for film placement.

Licensee's Alternative Examination:

No alternative examinations were proposed.

Evaluation:

The ASME Code requires 100% coverage for the volumetric and surface examination of examination category B-D welds. However, the design configurations of the subject welded components limit UT scanning on one side due to the weld blend radius proximity. In order to effectively increase the examination coverage, the configurations would require design modifications or replacement. This would place a significant burden on the licensee; thus, 100% coverage for volumetric examinations is impractical.

As shown on the sketches and technical descriptions included in the licensee's submittal, examinations of the subject welds have been completed to the extent practical with aggregate volumetric coverage of 81.7% and 81.2% of the ASME Code-required volumes for the two welds. The UT examinations included 35, 45, and 60-degree shear wave and longitudinal wave examinations of the welds. The UT examinations performed were qualified to the ASME Code, Section V, Appendix I with the UT examiners qualified to Appendix VII of ASME Code, Section XI. The licensee completed the ASME Code required surface examinations on the subject welds with no limitations. No recordable indications were observed during the UT and surface examinations. In addition, surface examination prior to UT and VT-2 visual examinations associated with the Class 1 leakage test are performed each refueling outage for the welds listed, which provide additional assurance of weld structural integrity prior to plant startup.

The licensee has shown that it is impractical to meet the ASME Code-required 100% volumetric examination coverage for the subject welds due to OD surface configurations. Based on the volumetric coverage obtained for the subject welds, and considering the licensee's performance of both UT shear and L-wave methods to maximize this coverage, it is reasonable for the NRC

staff to conclude that if significant service-induced degradation were occurring, evidence of it would have been detected by the examinations that were performed. The examinations performed provide reasonable assurance of structural integrity of the subject welds.

3.3 Examination Category B-A, Item B1.22, Reactor Vessel Head Meridian Weld

Licensee's ASME Code Relief Request:

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the volumetric examination coverage requirements for reactor vessel head meridian weld 2 RPV-101-104A.

ASME Code Requirement:

Examination Category B-A, Item B1.22, requires essentially 100% of the volume identified in Fig. IWB-2500-3. The licensee's ISI Plan allows the use of ASME Code Case N-460, which requires greater than 90% coverage of the examination volume. N-460 has been approved for use by the NRC in RG 1.147, Revision 14, Inservice Inspection Code Case Acceptability.

Licensee Basis for Relief:

Physical limitations due to the proximity of a lifting lug prevented 100% UT coverage. The UT coverage obtained during the second interval was 30.23% coverage. The third interval coverage was increased to 63.9% due to use of phased array UT technology. The UT examinations were performed by personnel qualified to ASME Code, Section XI, Appendix VIII and to procedures which complied with the requirements of ASME Code, Section V, Article 4, as amended by ASME Code, Section XI, Appendix I. Refracted longitudinal beams between 10 and 55 degrees were used for the examination. In order to scan all the required volume for this weld, the lifting lug would have to be removed. RT was not considered to be a viable alternative because access does not exist for the placement of radiographic film.

Licensee's Alternative Examination:

No alternative examinations were proposed.

Evaluation:

The ASME Code requires 100% coverage for the volumetric and surface examination of examination category B-A welds. However, the design configuration of the subject weld limits UT scanning on one side due to the proximity of a lifting lug. In order to effectively increase the examination coverage, the configuration would require design modifications or replacement. This would place a significant burden on the licensee; thus, 100% coverage for volumetric examinations is impractical. In addition, RT was not proposed as a viable alternative because the proximity of the lifting lug prevented film placement, according to the information provided by the licensee.

The NRC staff noted that the licensee increased the second interval aggregate volumetric coverage from 30.23% to 63.9% during the third interval testing through the use of phased array UT technology. As shown on the sketches and technical descriptions included in the licensee's

submittal, examinations of the subject weld has been completed to the extent practical with aggregate volumetric coverage of 63.9%. The UT examinations found no recordable indications. In addition to the above, VT-2 examinations were performed prior to startup, and reactor coolant leakage is monitored every 24 hours, providing additional assurance of the structural integrity of the weld.

The licensee has shown that it is impractical to meet the ASME Code required 100% volumetric examination coverage for the subject weld due to the as-designed configuration. Based on the volumetric coverage obtained for the subject welds, and considering the licensee's performance of state of the art ultrasonic technology to effectively increase the coverage since the last ISI interval, and the results showing no recordable indications, it is reasonable for the NRC staff to conclude that if significant service-induced degradation were occurring, evidence of it would have been detected by the examinations that were performed. The examinations performed provide reasonable assurance of structural integrity of the subject welds.

3.4 Examination Category C-A, Item Nos. C1.10, C1.20, and C1.30 Welds

Licensee's ASME Code Relief Request:

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from 100% volumetric examination for the following ASME Code Category C-A welds shown in Table 3.4.1:

Table 3.4.1

Component No.	Description	Item	Interference	Coverage
2ARHRHX-5-9	Shell-to-flange weld	C1.10	Outside geometry	60.9%
2ELDHX-HD-FLG	Head-to-flange weld	C1.20	Nozzle drain line proximity	30.6%
2VCT-LH-SH	Head-to-shell weld	C1.20	Support lugs proximity	89.4%
2BNSHX-2B-51C	Tubesheet-to-shell weld	C1.30	Tubesheet design	58.4%
2BNSHX-2A-50	Tubesheet-to-shell weld	C1.30	Tubesheet design	38.6%

ASME Code Requirement:

Examination Category C-A, Items C1.10, 1.20, and 1.30 requires 100% volumetric examination, as defined by Figures IWC-2500-1(a) and IWC 2500-2. "Essentially 100%", as clarified by N-460, Alternative Examination Coverage for Class 1 and Class 2 Welds, is greater than 90% coverage of the examination volume, or surface area, as applicable. N-460 has been approved for use by the NRC in RG 1.147, Revision 14, Inservice Inspection Code Case Acceptability.

Licensee's Basis for Relief Request:

Physical limitations due to the geometry, close proximity of drain lines or design, as listed in Table 3.4.1, prevents access to complete the volumetric examinations required under Tables IWC-2500-1(a) and IWC-2500-2. The licensee stated that in all cases, the examinations were performed to the maximum extent possible and that substitution with another component was not feasible because of the ASME Code, Section XI requirement to inspect 100% of the required exams in Category C-A. In order to obtain 100% volumetric coverage, the licensee stated that the components would have to be redesigned or replaced, which is impractical. The results of the examinations showed that there were either no recordable indications or

geometric indications. In instances where alternative volumetric examinations could be performed, radiography has not been qualified through performance demonstration. The licensee stated that in addition to the volumetric, surface (where required), and VT-2 pressure testing of each component, visual examinations performed during operator rounds, provide additional assurance that any leakage would be detected prior to gross failure of the components.

Licensee's Alternative Examination:

No alternative examinations were proposed.

Evaluation:

The ASME Code requires 100% volumetric examination of selected Class 2 components for ASME Code Category C-A, as defined by Figures IWC-2500-1(a) and IWC-2500-2. However, interferences due to geometry and design, prevent access to allow full examination of the components listed in Table 3.4.1. As shown on the sketches and technical descriptions included in the licensee's submittal, the component would need to be redesigned or replaced to obtain 100% of the ASME Code-required volume. This would place a significant burden on the licensee; thus, 100% coverage for volumetric examinations is impractical.

As shown on the sketches and technical descriptions included in the licensee's submittal, volumetric examination of the components listed in Table 3.4.1 have been completed to the extent practical with 30.6% - 89.4% aggregate coverage of the ASME Code-required volumes. No reportable indications were noted during the performance of the volumetric examination on the portion of welds completed, and geometric indications were noted on two components, which indicate to the NRC staff that no active degradation mechanism is present.

The licensee has shown that it is impractical to meet the ASME Code-required volumetric examination coverage for the subject welds due to the proximity of other components, design, or lack of a suitably demonstrated radiographic procedure. Based on the limited examinations performed, the NRC staff concludes that if significant service-induced degradation were occurring in the subject welds, there is reasonable assurance that evidence of it would have been detected. The examinations performed provide reasonable assurance of structural integrity of the subject welds.

3.5 Examination Category C-F-1, Item Nos. C5.11 and C5.21 Welds

Licensee's ASME Code Relief Request:

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100% of the ASME Code-required inspection volume for the following ASME Code Category C-F-1 welds listed in Table 3.5.1:

Table 3.5.1

Component No.	Description	Item	Interference	Coverage
2ND5-5	Pipe-to-flange weld	C5.11	Weld taper on flange side	53%
2ND5-8	Pipe-to-flange weld	C5.11	Weld taper on flange side	53%
2NS32-1	Pipe-to-valve weld	C5.11	Valve configuration	41.1%
2NV14-2	Pipe-to-tee weld	C5.21	Proximity of tee radius	86.9%
2NV14-3	Reducer-to-tee weld	C5.21	Proximity of tee radius	84.2%
2NV15-1	Pipe-to-tee weld	C5.21	Proximity of tee radius	86.9%

ASME Code Requirement:

Examination Category C-F-1, Items C5.11 and C5.21 requires 100% volumetric examination, as defined by Figure IWC-2500-7(a). "Essentially 100%", as clarified by N-460, is greater than 90% coverage of the examination volume, or surface area, as applicable. N-460 has been approved for use by the NRC in RG 1.147, Revision 14, Inservice Inspection Code Case Acceptability.

Licensee's Basis for Relief Request:

Physical limitations due to the geometry, close proximity of tee radius or weld taper, as listed in Table 3.5.1, prevent access to complete the examination of the volume specified under Table IWC-2500-7(a) and 10 CFR 50.55a(b)(2)(xv)(A)(1) for the welds listed in Table 3.5.1. The licensee stated that in all cases, the examinations were performed to the maximum extent possible. In order to obtain 100% volumetric coverage, the licensee stated that the components would have to be redesigned or replaced, which is impractical. Alternative RT volumetric examinations on the unexamined volume of the welds were not considered because RT has not been qualified through performance demonstration. The results of the examinations showed that there were no recordable indications. The licensee stated that in addition to the volumetric, surface, and VT-2 pressure testing of each component, visual examinations performed during operator rounds provide additional assurance that any leakage would be detected prior to gross failure of the components.

Licensee's Alternative Examination:

No alternative examinations were proposed.

Evaluation:

The ASME Code requires 100% volumetric and surface examination of welds for ASME Code Category C-F-1, Item Nos. C5.11 and C5.21, for full penetration welds as defined by Figure IWC-2500-7(a). However, interferences due to geometry and design prevent access to allow full examination of the welds per the ASME Code and 10 CFR 50.55a(b)(2)(xv)(A)(1). As shown on the sketches and technical descriptions included in the licensee's submittal, the components would need to be redesigned or replaced to obtain 100% of the ASME Code required volume. This would place a significant burden on the licensee; thus, 100% coverage for volumetric examinations is impractical.

As shown on the sketches and technical descriptions included in the licensee's submittal, volumetric examination of the components listed in Table 3.5.1 has been completed to the extent practical with 41.1% - 86.9% aggregate coverage of the ASME Code-required volumes. The examinations were completed with ASME Code, Section XI, Appendix VIII qualified personnel, equipment, and procedures. No reportable indications were noted during the performance of the volumetric examination on the portion of welds completed, which indicate to the NRC staff that no active degradation mechanism is present.

The licensee has shown that it is impractical to meet the ASME Code-required volumetric examination coverage for the subject welds due to the proximity of other components, design, or lack of a suitably demonstrated RT procedure. Based on the limited examinations performed, the completed surface and VT-2 examinations, and operator observations during operation, the NRC staff concludes that if significant service-induced degradation were occurring in the subject welds, there is reasonable assurance that evidence of it would have been detected. The examinations performed provide reasonable assurance of structural integrity of the subject welds.

4.0 CONCLUSION

The NRC staff concludes that the ASME Code examination coverage requirements are impractical for the subject welds listed in Relief Request 08-CN-001. Furthermore, 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. In addition, the examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject welds. Therefore, for the subject welds in this request for relief, relief is granted, pursuant to 10 CFR 50.55a(g)(6)(i), for the third 10-year ISI interval at Catawba 2.

The NRC staff has determined that granting of Relief Request 08-CN-001 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. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in the subject request for relief remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: T. Steingass

Date: October 1, 2009

If you have any questions, please call me at 301-415-1119.

Sincerely,

/RA/

Thomas H. Boyce, Chief
Plant Licensing Branch II-2
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-414

Enclosure:
As stated

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