

April 16, 2009

Mr. Bruce H. Hamilton
Vice President
McGuire Nuclear Station
Duke Energy Carolinas, LLC
12700 Hagers Ferry Road
Huntersville, NC 28078

SUBJECT: MCGUIRE NUCLEAR STATION, UNITS 1 AND 2, REQUEST FOR RELIEF 08-MN-001, FOR THIRD 10-YEAR INSERVICE INSPECTION (ISI) INTERVAL PROGRAM PLAN REGARDING VOLUMETRIC EXAMINATION REQUIREMENTS FOR WELDS 2RPV-W08, 1PZR-10, 2PZR-10, 2PZR-12 AND 2PZR-16 (TAC NOS. MD8858, MD8859, MD8860, MD8861 AND MD8862)

Dear Mr. Hamilton:

By letter dated May 16, 2008, Duke Energy Carolinas, LLC (the licensee), submitted Relief Request No. 08-MN-001, for its Third 10-Year ISI Interval Program Plan for McGuire Nuclear Station, Units 1 and 2 (McGuire 1 and 2). The licensee requested relief from the American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code* (Code), 1998 with the 2000 addenda, for welds 2RPV-W08, 1PZR-10, 2PZR-10, 2PZR-12, and 2PZR-16. The licensee submitted the relief request as a result of limited weld coverage following ISI examinations during refueling outages.

The Nuclear Regulatory Commission (NRC) staff has reviewed the licensee's submittal and, based on the information provided, concludes that compliance with the specified ASME Code requirements for welds 2RPV-W08, 1PZR-10, 2PZR-10, 2PZR-12, and 2PZR-16 is impractical and that the volumetric examinations performed during refueling outage 18 for McGuire 1 and refueling outage 17 for McGuire 2 provide reasonable assurance of structural integrity of the subject welds. Therefore, relief is granted pursuant to Title 10 of the *Code of Federal Regulations*, Part 50, Section 50.55a(g)(6)(i) for the Third 10-year ISI interval at McGuire Nuclear Station, Units 1 and 2. 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 giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

B. Hamilton

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The enclosed Safety Evaluation contains the NRC staff's evaluation and conclusions.

Sincerely,

/RA/

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

Docket Nos. 50-369 and 50-370

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv

B. Hamilton

- 2 -

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*memo dated September 18, 2008 ML08266073
**concurrence on memo dated September 18, 2009
***concurrence by E-mail

ADAMS Accession No. ML091050008

OFFICE	NRR/LPL2-1/PM***	NRR/LPL2-1/PM	NRR/LPL2-1/LA	CPNB/BC**	CVIB/BC*	NRR/LPL2-1/BC
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DATE	4/15/09	4/16/09	4/15/09	9/10/08	9/18/08	4/16/09

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

OF THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

REQUEST FOR RELIEF NO. 08-MN-001

DUKE ENERGY CAROLINAS, LLC

MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-369 AND 370

1.0 INTRODUCTION

By letter dated May 16, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML081490471), Duke Energy Carolinas, LLC, (the licensee) submitted Request for Relief 08-MN-001 requesting relief from the requirements of the American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code* (Code), Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*, 1998 with the 2000 addenda, for the Third 10-year Inservice Inspection (ISI) Interval Program Plan for McGuire Nuclear Station, Units 1 and 2 (McGuire 1 and 2). The licensee requested relief from the ASME Code for welds 2RPV-W08, 1PZR-10, 2PZR-10, 2PZR-12, and 2PZR-16. The licensee submitted the relief request as a result of limited weld coverage following ISI examinations during refueling outages.

The NRC staff adopts the evaluations and recommendations for granting relief contained in the Pacific Northwest National Laboratory's Technical Letter Report which has been incorporated into this safety evaluation (SE) (ADAMS Accession No. ML082660586). The attachment to this SE lists each part of the relief request and the status of approval.

2.0 REGULATORY REQUIREMENTS

Inservice inspection of the 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 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

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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 the McGuire 1 and 2 third 10-year interval ISI programs, which began on December 1, 2001, for McGuire 1 and March 1, 2004, for McGuire 2, is the 1998 Edition, including the 2000 Addenda, 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 08-MN-001, Part A, Examination Category B-A, Item B1.40, Pressure Retaining Welds in Reactor Vessel, (McGuire 2)

ASME Code Requirement:

ASME Code, Section XI, Examination Category B-A, Item B1.40 requires essentially 100% surface and volumetric examination, as defined by Figure IWB-2500-5, of the length of Class 1 circumferential head-to-flange welds on the reactor pressure vessel (RPV). "Essentially 100%," as clarified by ASME Code Case 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. ASME Code Case N-460 has been approved for use by the NRC in Regulatory Guide (RG) 1.147, Revision 15, Inservice Inspection Code Case Acceptability.

Licensee 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 shown in Figure IWB-2500-5 for RPV head-to-flange Weld 2RPV-W08.

Licensee's Basis for Relief Request:

The licensee stated that interference caused by the flange blend radius and RPV head lifting lugs limited ultrasonic scans.

Licensee's Proposed Alternative Examination:

No alternatives were proposed. The licensee stated:

Radiography (RT) is not a desired option because RT is limited in the ability to detect expected degradation mechanisms such as thermal fatigue and stress corrosion cracks. Additionally, RT has not been qualified through performance demonstration.

NRC Staff's Evaluation

The ASME Code requires essentially 100% volumetric examination of RPV Head-To-Flange Weld 2RPV-W08. In addition, the ASME Code requires that the accessible length of the subject RPV weld be volumetrically examined using ultrasonic angle beams passing through the weld and adjacent base material from both sides. However, the design configuration of the subject head-to-flange weld limits complete examinations due to the geometric configuration of the flange-to-head weld blend radius and integral lifting lugs. In order to effectively increase the examination coverage, the head-to-flange weld and lifting lugs would require design modifications or replacement. This would place a burden on the licensee; thus, essentially 100% ASME Code-required volumetric examination is impractical.

The design of the McGuire 2 RPV has lifting lugs at 0°, 120°, and 240°. The lifting lugs limit ultrasonic scanning of the subject weld for approximately six total inches of weld length. The blend radius of the flange-to-head weld also limits ultrasonic scanning. As shown in the sketches and technical descriptions included in the licensee's submittal, examinations of Weld 2RPV-W08 have been performed to the extent practical, with the licensee obtaining approximately 82% coverage of the ASME Code-required inspection volume. The licensee did not detect any recordable indications for the weld volume that was examined. In addition, the licensee completed the ASME Code-required surface examination on this weld.

The licensee has shown that it is impractical to meet the ASME Code-required volumetric examination coverage for the subject weld due to the design and proximity of integral RPV head lifting lugs. Based on the volumetric coverage obtained, along with the full ASME Code-required 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. In addition, the NRC staff determined that volumetric examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject welds.

3.2 Request for Relief 08-MN-001, Part B, Examination Category B-D, Items B3.110, Full Penetration Welded Nozzles in Vessels (McGuire 1 and 2)

ASME Code Requirement:

ASME Code, Section XI, Examination Category B-D, Item B3.110 requires 100% volumetric examination, as defined by Figure IWB-2500-7, of Class 1 nozzle-to-shell welds in vessels. ASME Code Case N-460, as an alternative approved for use by the NRC staff 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%, i.e., greater than 90% 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% of the ASME Code-required inspection volume(s) for the nozzle-to-shell welds shown in Table 3.2.1 of their submittal.

Table 3.2.1 - Examination Category B-D			
Code Item	Weld ID	Unit	Weld Type
B3.110	1PZR-10	1	Pressurizer surge nozzle to vessel
B3.110	2PZR-10	2	Pressurizer surge nozzle to vessel
B3.110	2PZR-12	2	Pressurizer spray nozzle to vessel
B3.110	2PZR-16	2	Pressurizer spray nozzle to vessel

Licensee's Basis for Relief Request:

The licensee stated that volumetric examinations were limited due to the design geometry of the subject nozzles, which limit angle beam examinations to the shell side of the nozzle-to-vessel welds only.

Licensee's Proposed Alternative Examination:

No alternatives were proposed. The licensee stated:

No additional examinations are planned for this weld during the current interval because increased coverage cannot be obtained using available examination techniques.

NRC Staff's Evaluation:

The ASME Code requires 100% volumetric examination of 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.

The subject nozzle-to-vessel welds are on the lower and upper heads of the McGuire 1 and 2, pressurizers, which consist of SA-212, Grade B carbon steel with stainless steel cladding on the inside surface. The nozzles are forged SA-508 Class 1 carbon steel. The welds on the subject nozzles extend the full thickness of the pressurizers upper and lower head. 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 be performed only from the shell side of the welds. In addition, the design of the pressurizers

includes heater wells which also limit the available scanning area for surge line welds 1PZR-10 and 2PZR-10.

As shown on the sketches and technical descriptions 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(s) of approximately 81% of the ASME Code-required volumes. The ultrasonic examinations on the pressurizer carbon steel nozzle welds included 35- and 45-degree shear waves from the shell side, including most of the volumes of 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. Therefore, it is expected that due to their fine-grained carbon steel microstructures the ultrasonic techniques employed by the licensee would detect structurally significant flaws that might occur on either side of the subject welds.

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 outside diameter 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. In addition, the staff determined that volumetric examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject welds.

4.0 CONCLUSION

The NRC staff has reviewed the licensee's submittal and, based on the information provided, the NRC concludes that the licensee has demonstrated reasonable assurance of the structural integrity of weld 2RPV-W08, 1PZR-10, 2PZR-10, 2PZR-12, and 2PZR-16 and that compliance with the specified ASME Code requirements is impractical for these welds. In order for the licensee to perform the ASME Code-required volumetric examinations, the subject component welds would require redesign, placing a burden on the licensee. Further, based on the coverage obtained, 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. In addition, the staff concludes that volumetric examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject welds. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), for the third 10-year ISI interval at McGuire 2, relief from ASME Code, Section XI, Examination Category B-A, Item B1.40 is granted for valve 2RPV-W08. Pursuant to 10 CFR 50.55a(g)(6)(i), for the third 10-year ISI interval at McGuire 1, relief from ASME Code, Section XI, Examination Category B-D, Item B3.110 is granted for valve 1PZR-10. Pursuant to 10 CFR 50.55a(g)(6)(i), for the third 10-year ISI interval at McGuire 2, relief from ASME Code, Section XI, Examination Category B-D, Item B3.110 is granted for valves 2PZR-10, 2PZR-12, and 2PZR-16.

The NRC staff has determined that granting Request for Relief 08-MN-001, Parts A and B pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law and will not endanger 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.

Attachment: Summary of Relief Requests

Principal Contributors: T. McLellan
D. Naujock

Date: April 16, 2009

**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
Relief 08-MN-001, Part A	3.1	Class 1 RPV Weld	B-A	B1.40	100% of vessel to flange weld	Volumetric and Surface	Use the percentage of volumetric coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)
Relief 08-MN-001, Part B	3.2	Class 1 pressurizer nozzle to vessel welds	B-D	B3.110	100% of nozzle to vessel welds	Volumetric	Use the percentage of volumetric coverage achieved	Granted 10 CFR 50.55a(g)(6)(i)