



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

February 9, 2017

Mr. Steven D. Capps
Vice President
McGuire Nuclear Station
Duke Energy Carolinas, LLC
12700 Hagers Ferry Road
Huntersville, NC 28078-8985

SUBJECT: MCGUIRE NUCLEAR STATION, UNIT 1 - RELIEF REQUEST 16-MN-001,
LIMITED WELD EXAMINATIONS DURING FOURTH 10-YEAR INTERVAL
INSERVICE INSPECTION INTERVAL (CAC NO. MF7632)

Dear Mr. Capps:

By letter dated April 28, 2016, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16125A133), Duke Energy Carolinas, LLC (Duke Energy, the licensee) submitted Relief Request (RR) 16-MN-001 to the U. S. Nuclear Regulatory Commission (NRC) for American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, for relief from requirements for certain inservice inspections (ISI) of component welds. This relief was requested for McGuire Nuclear Station (MNS), Unit 1 for the fourth 10-year ISI interval which began on December 1, 2011 and ends on November 30, 2021.

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 RR 16-MN-001. Furthermore, based on the examination techniques used, the volumetric coverage obtained, and the system leakage tests performed each refueling outage, it is reasonable to conclude that, if significant service-induced degradation was present, evidence of it would have been detected by the examinations that were performed.

The NRC staff has determined, as set forth in the enclosed safety evaluation, the examinations exams were performed to the extent practical and provide reasonable assurance of structural integrity of the subject areas. The NRC staff has concluded that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) for RR 16-MN-001, 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. Therefore, for the items in the licensee's requests, relief is granted, pursuant to 10 CFR 50.55a(g)(6)(i) for the subject welds during the fourth 10-year ISI interval at MNS, Unit 1.

All other ASME Code, Section XI, requirements, for which relief was not specifically requested and authorized herein by the NRC staff, remain applicable, including the third party review by the Authorized Nuclear In-service Inspector.

S. Capps

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If you have any questions, please contact the Project Manager, Michael Mahoney at 301-415-3867 or via e-mail at Michael.Mahoney@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael T. Markley". The signature is fluid and cursive, with the first name "Michael" and last name "Markley" being the most prominent parts.

Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-369

Enclosure:
Safety Evaluation

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

FOURTH 10-YEAR INTERVAL INSERVICE INSPECTION

RELIEF REQUEST 16-MN-001

MCGUIRE NUCLEAR STATION, UNIT 1

DUKE ENERGY CAROLINAS, LLC.

DOCKET NO. 50-369

1.0 INTRODUCTION

By letter dated April 28, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession Number ML16125A133), Duke Energy Carolinas, LLC (Duke Energy, the licensee), submitted Relief Request (RR) 16-MN-001 to the U. S. Nuclear Regulatory Commission (NRC) for relief from the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, requirements for certain inservice inspections (ISI) of component welds. This relief was requested for McGuire Nuclear Station (MNS), Unit 1 for the fourth 10-year ISI interval which began on December 1, 2011 and ends on November 30, 2021.

2.0 REGULATORY REQUIREMENTS

Pursuant to Title 10 of the *Code of Federal Regulations* (CFR) 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components.

The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(a), 12 months prior to the start of the 120-month interval, subject to the conditions listed in 10 CFR 50.55a(b). The ASME Code of Record for MNS, Unit 1's fourth 10-year ISI interval, which began on December 1, 2011 and ends on November 30, 2021, is the 1998 Edition through the 2000 Addenda of the ASME Code.

Regulations in 10 CFR 50.55a(g)(5)(iii) states, in part, that licensees may determine that conformance with certain ASME Code requirements is impractical and that the licensee shall

notify the NRC and submit information in support of the determination. Determination of impracticality in accordance with this section must be based on the demonstrated limitations experienced when attempting to comply with the code requirements during the ISI interval for which the request is being submitted. Requests for relief made in accordance with this section must be submitted to the NRC no later than 12 months after the expiration of the initial 120-month inspection interval or subsequent 120-month inspection interval for which relief is sought.

Regulations in 10 CFR 50.55a(g)(6)(i), states that the NRC will evaluate determinations under paragraph (g)(5) of this section (10 CFR 50.55a) to determine if code requirements are impractical. The NRC may grant such relief and may impose such alternative requirements as it determines is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

3.0 TECHNICAL EVALUATION

3.1 RR 16-MN-001 - Code Class 1 Welds

3.1.1 ASME Code Component Identification

Exam Category: B-D, Full Penetration Welded Nozzles in Vessels

Item Numbers: B3.110, Pressurizer, Nozzle-to-Vessel Welds

Weld Identification: 1PZR-12 - Spray Nozzle to Head Circumferential Weld
1PZR-15 - Safety Nozzle to Head Circumferential Weld
1PZR-16 - Relief Nozzle to Head Circumferential Weld

Weld Thickness: 2.5 inches (in)

3.1.2 ASME Code Requirement

ASME Code, Section XI, Examination Category B-D, requires 100 percent volumetric examination coverage of the weld volume as defined in Table IWB-2500-1 and shown in Figure IWB-2500-7.

ASME Code, Section XI, Examination Category B-P, requires system leakage tests of the pressurizer pressure retaining boundary, with a VT-2 visual examination in accordance with IWA-5240, and acceptance standards in accordance with IWB-3522.

ASME Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds, Section XI, Division 1", as approved for use by the NRC in Regulatory Guide (RG) 1.147, Revision 17, "Inservice Inspection Code Case Acceptability, Section XI, Division 1," states, in part, that a reduction in examination coverage due to part geometry or interference for any ASME Class 1 or 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

ASME Code, Section XI, Mandatory Appendix I, Article I-2120, requires that ultrasonic examination of vessels other than reactor vessels and which are greater than two inches in thickness shall be conducted in accordance with Article 4 of Section V.

3.1.3 Licensee's Request for Relief

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief on the basis that compliance with the ASME Code requirement is impractical. The licensee stated that the impracticality was caused by the configuration of the nozzle radius that does not allow meaningful interrogation from the nozzle side. The licensee further stated that in order to scan all of the required volume for these welds, the head to nozzle welds would have to be redesigned and replaced. The licensee considered other ultrasonic examination alternatives, but stated that no other ultrasonic alternative for these welds are available which would provide better coverage due to the limitation created by the component configuration. The licensee also stated that radiography is not a desired option because it is limited in its ability to detect service-induced flaws.

The licensee stated that the subject welds were scanned manually with conventional methods and that the subject weld was scanned to the extent possible to meet the requirements of the ASME Code, Section V, Article 4. The examination coverages and results as documented in the licensee request are as follows:

<u>Weld</u>	<u>Aggregate Coverage</u>	<u>Results</u>
1PZR-12	81.7%	No recordable indications
1PZR-15	81.7%	No recordable indications
1PZR-16	81.7%	No recordable indications

Additionally, the licensee stated that a VT-2 visual examination is performed at the end of each refueling outage during the system leakage tests, as required by the ASME Code for Table IWB-2500-1, Category B-P components.

3.1.4 NRC Staff Evaluation

As described in the licensee's submittal, the examinations of the pressurizer nozzle-to-vessel welds are limited by the geometry and configuration of the nozzles. The licensee examined these welds using zero-degree longitudinal waves and 35-degree, 45-degree, and 60-degree shear waves. For the angle beam inspections using the 45-degree and 60-degree shear waves, the licensee performed the scans in two directions perpendicular to the weld and in two circumferential directions parallel to the weld, as required by Section V of the ASME Code. After averaging the coverages from all of the scans, the licensee determined that it had achieved an examination coverage of greater than 81% of the required examination volume. For the scans performed parallel to the weld and for the perpendicular scans performed from the head-side, the licensee was able to achieve a coverage of 100 percent

The NRC staff has determined that the scans attempted and the coverages achieved are acceptable based on the limitations imposed by the geometry and configuration of the nozzles.

No recordable indications were detected.

The ASME Code requires 100 percent volumetric examination of the Category B-D nozzle-to-vessel welds. However, the geometry and configuration of the nozzles limit access for ultrasonic scanning from the nozzle side. In order to effectively increase the scanning coverage, the nozzle-to-vessel welds would require design modifications and the existing nozzles would need to be removed and replaced with redesigned nozzles. Therefore, obtaining 100 percent volumetric examination of the nozzle-to-vessel welds would be impractical.

The licensee's submittal states that the ultrasonic examination procedure was written in accordance with ASME Section V, Article 4. The NRC staff finds the licensee's response acceptable, since the ultrasonic examination procedure is in accordance with the requirements of ASME Code, Section XI, Mandatory Appendix I, Article I-2120, for ultrasonic examination of vessels other than reactor vessels and which are greater than two inches in thickness.

The licensee submittal also states that the VT-2 visual examination required by the ASME Code for Category B-P pressure retaining components is a factor in their conclusion that service-induced degradation would be detected. Table IWB-2500-1 requires a system leakage test for all Category B-P pressure retaining components every refueling outage. The VT-2 visual examination specified in Table IWB-2500-1 and IWA-5240 for these leakage tests requires, in part, that:

- accessible external exposed surfaces be examined for evidence of leakage, and
- the surrounding areas of inaccessible surfaces be examined for evidence of leakage.

The acceptance criteria specified in Table IWB-2500-1 and IWB-3522 for these leakage tests requires, in part, that:

- corrective action be taken for identified leakage (unless within defined permissible limits), and
- the source of leakage from insulated or inaccessible components be determined.

Based on the examination techniques used, the volumetric coverage obtained, and the system leakage tests performed each refueling outage, it is reasonable to conclude that, if significant service-induced degradation was present in these welds, evidence would have been detected by the examinations performed. Based on operational experience and the extent to which the examinations were performed, the NRC staff has determined with reasonable assurance that the structural integrity of these welds will be maintained throughout the fourth 10-year ISI interval.

3.2 RR 16-MN-001 - Code Class 2 Welds

3.2.1 ASME Code Component Identification

Exam Category: C-A, Pressure Retaining Welds in Pressure Vessels

Item Numbers: C1.10, Shell Circumferential Welds

Weld Identification: 1ASWINJF-2 - Seal Water Injection Filter Shell to Lower Flange Weld

Weld Thickness: 0.438 in.

3.2.2 ASME Code Requirement

ASME Code, Section XI, Examination Category C-A, requires 100 percent volumetric examination coverage of the weld volume as defined in Table IWC-2500-1 and shown in Figure IWC-2500-1.

ASME Code, Section XI, Examination Category C-H, requires system leakage tests of all pressure retaining components with a VT-2 visual examination in accordance with IWA-5240 and acceptance standards in accordance with IWC-3516. ASME Code Case N-460, approved for use by the NRC in RG 1.147, Revision 17, states that a reduction in examination coverage due to part geometry or interference for any ASME Class 1 or 2 weld is acceptable provided that the reduction is less than 10 percent, i.e., greater than 90 percent examination coverage is obtained.

ASME Code, Section XI, Mandatory Appendix I, Article I-2210, requires that ultrasonic examination of vessels not greater than two inches in thickness shall be conducted in accordance with Mandatory Appendix III. Mandatory Appendix III Article III-4420 requires examination of the volume in two beam directions for reflectors parallel to the weld seam, and Mandatory Appendix III Article III-4430 requires scanning of the weld crown in two beam directions for reflectors transverse to the weld seam.

3.2.3 Licensee's Request for Relief

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief on the basis that compliance with the ASME Code requirement is impractical. The licensee stated that the impracticality was caused by the configuration of the vessel flange surface that limited scanning flange side. The licensee further stated that in order to scan all of the required volume for this weld, the vessel flange would have to be redesigned and replaced. The licensee considered other ultrasonic examination alternatives, but stated that no other ultrasonic alternative for this weld is available which would provide better coverage due to the limitation created by the component configuration. Additionally, the licensee stated that radiography is not a desired option because it is limited in its ability to detect service-induced flaws.

The licensee stated that the subject weld was scanned manually with conventional methods and that the subject weld was scanned to the extent possible to meet the requirements of the ASME Code, Section XI, Appendix III. The examination coverages and results as documented in the licensee request are as follows:

<u>Weld</u>	<u>Aggregate Coverage</u>	<u>Results</u>
1ASWINJF-2	61.9%	No recordable indications

Additionally, the licensee stated that a VT-2 visual examination is performed at the end of each refueling outage during the system leakage tests as required by the ASME Code for Table IWC-2500-1, Category C-H components.

3.2.4 NRC Staff Evaluation

As described in the licensee's submittal, the configuration of the vessel flange surface limited scanning from the flange side. The licensee performed the examination of the shell to lower flange weld using 45-degree and 70-degree shear waves for the axial examinations and 45 degree shear waves for the circumferential examinations. The 45 degree scans were performed in two directions perpendicular to the weld and in two directions parallel to the weld, as required by Section XI, Appendix III of the ASME Code. For the axial scans (perpendicular to the weld), the licensee was only able to achieve 36.1 percent coverage from the flange side scans but was able to achieve 80.3 percent coverage from the shell side scans. For the circumferential scans (parallel to the weld), the licensee was able to achieve 65.6 percent coverage from two directions. The aggregate coverage was calculated by the licensee to be 61.9 percent. The NRC staff has determined that the scans attempted and the coverages achieved are acceptable based on the limitations imposed by the geometry and configuration of the nozzles. No recordable indications were detected.

The ASME Code requires 100 percent volumetric examination of Category C-A pressure retaining welds in pressure vessels. However, the geometry and configuration of this weld limits access for ultrasonic scanning. In order to effectively increase the scanning coverage, this weld would require design modifications and the existing component vessel flange would need to be removed and replaced with a redesigned component vessel flange. Therefore, obtaining 100 percent volumetric examination of this weld would be impractical.

The licensee submittal states, in part, that the ultrasonic examination procedure was written in accordance with ASME Section XI, Appendix III. The NRC staff finds the licensee response acceptable, since the ultrasonic examination procedure is in accordance with the requirements of ASME Code, Section XI, Mandatory Appendix I, Article I-2120, for ultrasonic examination of vessels not greater than two inches in thickness.

The licensee submittal also states that the VT-2 visual examination required by the ASME Code for Category C-H pressure retaining components is a factor in their conclusion that service-induced degradation would be detected. Table IWB-2500-1 requires a system leakage test for all Category C-H pressure retaining components every refueling outage. The VT-2 visual examination specified in Table IWB-2500-1 and IWA-5240 for these leakage tests requires, in part, that:

- accessible external exposed surfaces be examined for evidence of leakage, and
- the surrounding areas of inaccessible surfaces be examined for evidence of leakage.

The acceptance criteria specified in Table IWB-2500-1 and IWC-3516 for these leakage tests requires, in part, that:

- corrective action be taken for identified leakage (unless within defined permissible limits), and
- the source of leakage from insulated or inaccessible components be determined.

Based on the examination techniques used, the volumetric coverage obtained, and the system leakage tests performed each refueling outage, it is reasonable to conclude that, if significant service-induced degradation was present in these welds, evidence would have been detected by the examinations performed. Based on operational experience and the extent to which the examinations were performed, the NRC staff has concluded there is reasonable assurance that the structural integrity of these welds will be maintained throughout the fourth 10-year ISI interval.

4.0 CONCLUSION

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 RR 16-MN-001. Furthermore, based on the examination techniques used, the volumetric coverage obtained, and the system leakage tests performed each refueling outage, it is reasonable to conclude that, if significant service-induced degradation was present, evidence of it would have been detected by the examinations that were performed. Therefore, for the items in the licensee's requests, relief is granted, pursuant to 10 CFR 50.55a(g)(6)(i) for the subject welds during the fourth 10-year ISI interval at MNS, Unit 1, which began on December 1, 2011 and ends on November 30, 2021.

The NRC staff has concluded that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) for RR 16-MN-001, 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 relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: J.Jenkins, NRR

Date: February 9, 2017

S. Capps

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If you have any questions, please contact the Project Manager, Michael Mahoney at 301-415-3867 or via e-mail at Michael.Mahoney@nrc.gov.

Sincerely,

/RA/

Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-369

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Safety Evaluation

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