



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

March 4, 2010

Mr. Regis T. Repko
Vice President
McGuire Nuclear Station
Duke Energy Carolinas, LLC
12700 Hagers Ferry Road
Huntersville, NC 28078

SUBJECT: MCGUIRE NUCLEAR STATION, UNIT 1 – RELIEF 09-MN-007 FOR REACTOR VESSEL CORE FLOOD NOZZLE WELD EXAMINATIONS DURING THE THIRD 10-YEAR INSERVICE INSPECTION (ISI) INTERVAL (TAC NO. ME2383)

Dear Mr. Repko:

By letter dated September 15, 2009, Duke Energy Carolinas LLC (the licensee), submitted relief request (RR) 09-MN-007 for McGuire Nuclear Station, Unit 1 (McGuire 1) related to the third 10-year ISI interval pertaining to utilization of an alternate depth-sizing criteria during the ultrasonic examination of the reactor vessel core flood nozzle to safe-end (dissimilar metal) welds during the next scheduled refueling outage (March 2010). The third 10-year ISI interval for McGuire 1 ends on December 1, 2011. The licensee requested approval of a proposed alternative to the American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code* (Code) requirements for flaw depth-sizing criteria. The Code requires that the root mean square error (RMSE) for flaw depths estimated by ultrasonic testing shall not exceed 0.125 inch; and states that the RMSE of the flaw depths estimated by ultrasonics, as compared to true depths, is less than the 0.125-inch RMSE. The Code of Record for McGuire 1 is the 1998 Edition through the 2000 Addenda of the ASME Code.

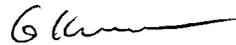
The NRC staff has reviewed the licensee's submittal and, based on the information provided in the licensee's request for relief, the NRC staff has determined that the proposed alternative provides an acceptable level of quality and safety. Therefore, pursuant to Title 10 of the *Code of Federal Regulations*, Part 50, Section 50.55a(a)(3)(i), the NRC staff authorizes the use of the proposed alternative to add the difference between the ASME Code-required RMSE and the demonstrated RMSE to the measured through-wall extent, in addition to the use of the acceptance standards specified in Section IWB-3600 of the ASME Code.

R. Repko

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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.

Sincerely,



Gloria Kulesa, 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
OF THIRD 10-YEAR INTERVAL INSERVICE INSPECTION

RELIEF NO. 09-MN-007

DUKE ENERGY CAROLINAS, LLC

MCGUIRE NUCLEAR STATION, UNIT 1

DOCKET NO. 50-369

1.0 INTRODUCTION

By letter dated September 15, 2009 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML092720862), Duke Energy Carolinas, LLC (the licensee), submitted Request for Relief 09-MN-007 for McGuire Nuclear Station, Unit 1 (McGuire 1) related to the third 10-year Inservice Inspection (ISI) interval pertaining to utilization of an alternate depth-sizing criteria during the ultrasonic examination of the reactor vessel core flood nozzle to safe-end (dissimilar metal) welds during the next scheduled refueling outage (March 2010). The third 10-year ISI interval for McGuire 1 ends on December 1, 2011. The licensee requested approval of a proposed alternative to the American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code* (Code) requirements for flaw depth-sizing criteria. The Code requires that the root mean square error (RMSE) for flaw depths estimated by Ultrasonic Testing (UT) shall not exceed 0.125 inch; and states that the RMSE of the flaw depths estimated by ultrasonics, as compared to true depths, is less than the 0.125-inch RMSE. The Code of Record for McGuire 1 is the 1998 Edition through the 2000 Addenda of the ASME Code.

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(g) specifies that ISI of nuclear power plant components shall be performed in accordance with the requirements of ASME Code, Section XI, except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). As stated in 10 CFR 50.55a(g)(6)(i) the Commission may grant such relief and may impose such alternative requirements as it determines is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest, giving due consideration of the burden upon the licensee. As stated in 10 CFR 50.55a(a)(3) alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if (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. As stated in 10 CFR 50.55a(g)(5)(iii) if the licensee has determined that

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conformance with certain code requirements is impractical for its facility, the licensee shall notify the Commission and submit, as specified in Section 50.4, information to support the determinations.

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 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 ISI 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(b) twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable ASME Code, Section XI, of record for the third 10-year inservice inspection (ISI) interval for McGuire 1 is the 1998 Edition through the 2000 Addenda. In addition, as required by 10 CFR 50.55a, the ASME Code, Section XI, 1998 Edition through the 2000 Addenda is used for Appendix VIII, Performance Demonstration for Ultrasonic Examination System.

3.0 TECHNICAL EVALUATION

3.1 Applicable Code Edition and Addenda

The third 10-year ISI interval Code of Record for ultrasonic testing (UT) examinations is the 1998 Edition with 2000 addenda of the ASME Code, Section XI. Appendix VIII, Supplement 10, Paragraph 3.2(b) states that the RSME for flaw depths estimated by UT shall not exceed 0.125-inch; and Supplement 2, Paragraph 3.2(b) states that the RMSE of the flaw depths estimated by ultrasonics, as compared to the true depths, is less than 0.125-inch RMSE.

Code Case N-695 is an alternative to Supplement 10 that is endorsed by the NRC staff in Regulatory Guide (RG) 1.147, Revision 15. N-695, Paragraph 3.3(c) states that "Examination procedures, equipment, and personnel are qualified for depth-sizing when the RMSE of the flaw-depth measurements as compared to the true flaw depths, do not exceed 0.125 inch."

Code Case N-696 is endorsed by the NRC staff in RG 1.147, Revision 15. This Code Case provides alternatives for the requirements of Appendix VIII, Supplements 2, 3, and 10. Code Case N-696, Paragraph 3.3(d), states that, in part, "procedures equipment and personnel are qualified for depth-sizing when the flaw depths estimated by ultrasonics, as compared with the true depths, do not exceed 0.125-inch RMS."

3.2 Components for Which Relief is Requested

Code Class: Class 1
 System Welds: Reactor Coolant System (NC Pipe)
 Examination Categories: Category R-A for the dissimilar metal (DM) welds
 Category R-A for the stainless steel welds
 Code Item Numbers: R1.11, R1.15 for Reactor Vessel (RV) DM nozzle-to-safe end welds
 R1.11 for RV stainless steel safe end-to-pipe welds

McGuire 1	Description	Size	DM Weld No.	SS Weld No.	Equipment
NC Pipe	Cold Leg RV Nozzle A Loop	Nominal 27.5" ID with 2.281" wall	1RPV3-445A-SE	1NC1F1-8	LAS nozzle/Alloy 82-182 weld/SS safe end/SS weld
NC Pipe	Cold Leg RV Nozzle B Loop	Nominal 27.5" ID with 2.281" wall	1RPV3-445B-SE	1NC1F2-8	LAS nozzle/Alloy 82-182 weld/SS safe end/SS weld
NC Pipe	Cold Leg RV Nozzle C Loop	Nominal 27.5" ID with 2.281" wall	1RPV3-445C-SE	1NC1F3-8	LAS nozzle/Alloy 82-182 weld/SS safe end/SS weld
NC Pipe	Cold Leg RV Nozzle D Loop	Nominal 27.5" ID with 2.281" wall	1RPV3-445D-SE	1NC1F4-8	LAS nozzle/Alloy 82-182 weld/SS safe end/SS weld

Component Materials:

1. Low Alloy Steel (LAS) nozzles are SA-508 Class 2 Low Alloy Steel
2. Stainless Steel (SS) safe ends are SA-182 Type 316 austenitic stainless steel
3. Welds are Alloy 82/182 (F-43)

3.3 Applicable Code Requirement

The RV Nozzle-to-Safe End Butt Welds and the Safe End-to-Pipe Welds are part of the McGuire 1 Risk-Informed Inservice Inspection program. The RV Nozzle-to-Safe End Butt Welds are dissimilar metal welds and the Safe End-to-Pipe Welds are similar metal welds. These volumetric examinations are to be conducted in accordance with Appendix VIII, Supplements 10 and 2. Code Cases N-695 and N-696 are acceptable alternatives to Appendix VIII, Supplements 2 and 10.

3.4 Licensee's Proposed Alternative and Basis for Use

The licensee proposes to use a contracted examination vendor that has demonstrated the ability to meet a depth-sizing qualification requirement with an RMSE of 0.189 inch instead of the 0.125 inch required for Supplement 10 and an RMSE of 0.245 inch instead of the 0.125 inch for Supplements 10 and 2 combined. The licensee proposes to use approved Code Case N-695 with an RSME of 0.189 inch and approved Code Case N-696 with a combined RMSE of 0.245 inch instead of the 0.125 inch specified for depth sizing in the Code Cases. In the event an indication is detected that requires depth sizing, the difference between the required RMSE

and the proposed demonstrated RMSE, as applicable, will be added to the measured through-wall extent for comparison with applicable acceptance criteria. If the examination vendor demonstrates an improved depth-sizing RMSE prior to the examination, the excess of that improved RMSE over the 0.125 requirement, if any, will be added to the measured value for comparison with applicable acceptance criteria.

The licensee states that the proposed alternative assures that the nozzle-to-safe end welds and the safe end-to-pipe welds will be fully examined by procedures, personnel and equipment qualified by demonstration in all aspects except depth sizing. The licensee states that for depth sizing, the proposed addition of the difference between the qualified and demonstrated sizing tolerance to any flaw required to be sized compensates for the potential variation and provides an acceptable level of quality and safety in accordance with 10 CFR 50.55a(a)(3)(i).

3.5 Duration of Proposed Alternative

The proposed alternative is requested for the remainder of the third 10-year ISI interval for McGuire 1, which ends on December 1, 2011.

4.0 NRC STAFF'S EVALUATION

ASME Code, Section XI, Appendix VIII, Supplement 10 and Code Case N-695 (Qualification Requirements for Dissimilar Metal Piping Welds) require that examination procedures, equipment and personnel be qualified for depth sizing such that the RMS error of the flaw-depth measurements, as compared to true depths, do not exceed 0.125 inch. Supplement 2 requires that the RMSE of the flaw depths estimated by ultrasonic examination, as compared with true depths, shall not exceed 0.125 inch. Code Case N-696 (Qualification Requirements for Appendix VIII Piping Examinations Conducted From the Inside Surface), which combines the requirements of Supplements 10 and 2, states that Supplement 2 examination procedures, equipment, and personnel are qualified for depth sizing when the flaw depths estimated by UT examination, as compared with the true depth, do not exceed 0.125 inch RMS, when they are combined with a successful Supplement 10 qualification. Note: ASME Code, Section XI, Code Case N-695 and Code Case N-696 are referenced in the licensee's ISI Program and have been determined to be acceptable alternatives to Appendix VIII, Supplements 2 and 10, as identified in Regulatory Guide 1.147, Rev. 15, Table 1, "Acceptable Section XI Code Cases."

The nuclear industry is in the process of qualifying personnel to Supplement 10, Code Case N-695 and Supplement 2, Code Case N-696 requirements, as implemented through industry's Performance Demonstration Initiative (PDI) Program as administered by Electric Power Research Institute (EPRI). However, for ultrasonic examinations performed from the inside surface of a pipe weld, personnel have been unsuccessful at achieving the ASME Code-required 0.125-inch RMSE flaw depth sizing criterion. At this time, the staff acknowledges that achieving the 0.125-inch RMSE appears not to be feasible. The examination vendor contracted by the licensee has proposed to use an RMSE of 0.189 inch instead of the 0.125 inch required by Supplement 10 for dissimilar metal welds, and an RMSE of 0.245 inch instead of the 0.125 inch required for Supplement 2 for similar metal welds. In the event an indication is detected that requires depth sizing, the 0.064 inch difference between the required RMSE and the demonstrated RMSE for Supplement 10 (0.189 inch - 0.125 inch) and 0.120-inch difference between the required RMSE and the demonstrated RMSE for Supplement 2 (0.245 inch - 0.125

inch) will be added to the measured through-wall extent. This total flaw depth will then be assessed against the applicable acceptance criteria specified in Section IWB-3600 of the ASME Code for flaw evaluation. Additionally, the licensee proposes that, if the examination vendor demonstrates an improved depth sizing RMSE prior to the examination, the excess of the improved RMSE over the 0.125-inch RMSE requirement, if any, will be added to the measured value for flaw evaluation with applicable acceptance criteria specified in Section IWB-3600 of the ASME Code.

The NRC staff finds that compliance with the ASME Code-required RMSE value is not feasible at this time. Also, the NRC staff finds that the licensee's proposed alternative of adding the difference between the ASME Code-required RMSE and the demonstrated RMSE to the measured through-wall extent, in addition to the use of the acceptance standards specified in Section IWB-3600 of the ASME Code, provides an acceptable level of quality and safety.

The NRC staff has reviewed the licensee's submittal and determined that Relief Request 09-MN-007 will provide an acceptable level of quality and safety for the operation of the subject reactor vessel core flood nozzles. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the use of Relief Request 09-MN-007 for the third 10-year ISI interval at McGuire 1.

5.0 CONCLUSION

The licensee's proposal of adding the difference between the ASME Code-required RMSE and the demonstrated RMSE to the measured through-wall extent, in addition to the use of the acceptance standards specified in Section IWB-3600 of the ASME Code, provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the proposed alternative is authorized for the remainder of the third 10-year ISI interval for McGuire 1, which ends on December 1, 2011. All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributors: M. Audrain, NRR
C. Nove, NRR

Date: March 4, 2010

R. Repko

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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.

Sincerely,

/RA/

Gloria Kulesa, 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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