



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

May 13, 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, UNIT 1, RELIEF 08-MN-003, FOR REACTOR VESSEL HOT LEG NOZZLE TO SAFE END AND SAFE-END TO PIPE WELDS EXAMINATIONS (TAC NO. MD9614)

Dear Mr. Hamilton:

By letter dated September 9, 2008, Duke Energy Carolinas LLC (the licensee), submitted Relief Request No. 08-MN-003, for examination of reactor vessel hot leg nozzle to safe-end and safe-end to pipe welds during the third 10-year inservice inspection (ISI) interval at McGuire Nuclear Station, Unit 1 (McGuire 1). The licensee proposed alternatives to the American Society of Mechanical Engineers *Boiler and Pressure Vessel Code* which involve application of an alternative depth sizing criteria during the ultrasonic examination of the reactor vessel hot leg to safe-end and safe-end to pipe welds during the September 2008 outage of of the third 10-year ISI interval for McGuire 1.

The Nuclear Regulatory Commission (NRC) staff has reviewed the licensee's submittal and, based on the information provided, concludes that the proposed alternative provides an acceptable level of quality and safety. Therefore, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(a)(3)(i), the NRC staff authorizes the use of the proposed alternative for the remainder of the third 10-year ISI interval for McGuire 1, which began on December 1, 2001 and ends on November 30, 2011.

Verbal relief was authorized by the NRC staff for McGuire 1 during a teleconference with the licensee on October 24, 2008.

B. Hamilton

- 2 -

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

Sincerely,

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

Docket No. 50-369

Enclosure:  
As stated

cc w/encl: Distribution via Listserv



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-MN-003

DUKE ENERGY CAROLINAS, LLC

MCGUIRE NUCLEAR STATION, UNIT 1

DOCKET NO. 50-369

1.0 INTRODUCTION

By letter dated September 9, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML082600580), Duke Energy Carolinas LLC, (the licensee) submitted Request for Relief 08-MN-003 requesting use of proposed alternatives to the requirements of the American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code* (Code), which involve application of an alternative depth sizing criteria during the ultrasonic examination of the reactor vessel hot leg nozzle to safe-end (dissimilar metal) and safe-end to pipe (similar metal) welds during the September 2008 outage of the third 10-year inservice inspection (ISI) interval for McGuire Nuclear Station, Unit 1 (McGuire 1).

2.0 REGULATORY REQUIREMENTS

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 55a(g), ISI of nuclear power plant components is 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). Section 50.55a(a)(g)(6)(i) states that relief from the requirements of paragraph (g) may be granted by the NRC, if 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.

Section 50.55a(a)(3) states that alternatives to the requirements of the 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. Section 50.55a(g)(5)(iii) states that if the licensee has determined that 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 the pre-service

Enclosure

examination requirements, set forth in 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(b) twelve 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 third 10-year interval inservice inspection program, which began on December 1, 2001, and will end on December 1, 2011, is the 1998 edition with the 2000 addenda of Section XI of the ASME Code. In addition, as required by 10 CFR 50.55a, ASME Code, Section XI, 1998 Edition through the 2000 Addenda, is used for Appendix VIII, Performance Demonstration for Ultrasonic Examination System.

### 3.0 EVALUATION

#### 3.1 Applicable Code Edition and Addenda

The code of record for the third 10-year ISI program at McGuire 1 is the ASME Code, Section XI, 1998 Edition through the 2000 addenda. In addition, volumetric examinations are to be conducted in accordance with ASME Code, Section XI, Appendix VIII, Supplements 2 and 10, 1998 Edition through the 2000 Addenda. The third 10-year ISI interval for MNS-1 began on December 1, 2001 and is scheduled to end on November 30, 2011.

#### 3.2 Components for Which Relief is Requested

Code Class: Class 1  
 System Welds: Reactor Coolant System  
 Examination Categories: Category B-F for dissimilar metal welds to reactor vessel nozzle  
 Category R-A for stainless steel safe-end to pipe welds  
 Code Item Numbers: B5.10 for dissimilar metal welds to reactor vessel nozzle  
 R1.11 for stainless steel safe-end to pipe welds

McGuire Unit 1	Description	Size	DM Weld Number	SS Weld Number	Comment
NC Pipe	Hot leg safe-end to RV Nozzle-A Loop	Nominal 29" ID with 2-5/8" wall	1RPV3-445E-SE	1NC1F1-1	LAS nozzle/Alloy 82-182 weld/SS safe-end/SS weld
NC Pipe	Hot leg safe-end to RV Nozzle-B Loop	Nominal 29" ID with 2-5/8" wall	1RPV3-445F-SE	1NC1F2-1	LAS nozzle/Alloy 82-182 weld/SS safe-end/SS weld
NC Pipe	Hot leg safe-end to RV Nozzle-C Loop	Nominal 29" ID with 2-5/8" wall	1RPV3-445G-SE	1NC1F3-1	LAS nozzle/Alloy 82-182 weld/SS safe-end/SS weld
NC Pipe	Hot leg safe-end to RV Nozzle-D Loop	Nominal 29" ID with 2-5/8" wall	1RPV3-445H-SE	1NC1F4-1	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 (P-3)
2. Stainless Steel (SS) safe-ends are SA-182 Type 316 austenitic stainless steel (P-8)
3. Welds are Alloy 82/182 (F-43)

### 3.3 Applicable Code Requirement

ASME Code Section XI, Table IWB-2500-1, Category B-F, Item B5.10, Reactor Vessel Nozzle to Safe-end Butt Welds, specifies volumetric examination for the dissimilar metal welds. The safe-end to pipe welds are part of the Risk-Informed program and will also be volumetrically examined due to the close proximity to the dissimilar metal welds. The volumetric examinations are to be conducted in accordance with the ASME Code, Section XI, Appendix VIII, Supplements 2 and 10, 1998 Edition through the 2000 Addenda.

### 3.4 Licensee Proposed Alternative and Basis for Use

The licensee stated that a request for relief from the required root mean square error (RMSE) in depth sizing is needed because, to date, examination vendors have not met the established RMSE of 0.125 inch for depth sizing when ultrasonic examinations are performed from the inside surface of the pipe. The licensee proposes to use a contracted examination vendor that has demonstrated ability to meet a depth-sizing qualification requirement with an RMSE of 0.224 inch instead of the 0.125 inch required for Supplement 10 to ASME Code, Section XI, Appendix VIII, for dissimilar metal welds, and an RMSE of 0.222 inch instead of the 0.125 inch required for Supplement 2 to ASME Code, Section XI, Appendix VIII, for similar metal welds.

The licensee states that in the event an indication is detected that requires depth sizing, the 0.099 inch difference between the required RMSE and the demonstrated RMSE for supplement 10 and 0.097 inch difference between the required RMSE and the demonstrated RMSE for supplement 2 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 inch RMSE requirement, if any, will be added to the measured value for comparison with applicable acceptance criteria.

### 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 began on December 1, 2001 and ends on November 30, 2011.

### 3.6 Technical 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 root mean square (RMS) error of the flaw depth measurements, as compared to true depths, do not exceed 0.125 inch. Supplement 2 requires that the RMS error of the flaw depths estimated by ultrasonic examination, as compared with true depths, shall not exceed 0.125 in. 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 ultrasonic 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, per 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 the Electric Power Research Institute (EPRI) Performance Demonstration Initiative (PDI) program. 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 NRC staff acknowledges that achieving the 0.125 inch RMSE is not feasible. The examination vendor contracted by the licensee has proposed to use an RMSE of 0.224 inch instead of the 0.125 inch required for Supplement 10 for dissimilar metal welds, and an RMSE of 0.222 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 0.099 inch difference between the required RMSE and the demonstrated RMSE for Supplement 10 (0.224 inch – 0.125 inch) and 0.097 inch difference between the required RMSE and the demonstrated RMSE for Supplement 2 (0.222 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-3500 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 that 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-3500 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-3500 of the ASME Code, provides an acceptable level of quality and safety.

#### 4.0 CONCLUSION

The NRC staff has reviewed the licensee's submittal and, based on the information provided, the NRC staff concludes that requiring the licensee to qualify procedures, personnel, and equipment to meet the maximum error of 0.125 inch RMSE for crack depth sizing is not feasible at the present time. 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-3500 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 began on December 1, 2001 and ends on November 30, 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: C. Nove  
J. Tsao

Date: May 13, 2009

B. Hamilton

- 2 -

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

Sincerely,

*/RA by RMartin for/*

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

Docket No. 50-369

Enclosure:  
As stated

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\*no substantial change from input sent by memo dated 9/24/08

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