

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

October 26, 2015

Mr. K. Henderson Site Vice President Catawba Nuclear Station Duke Energy Carolinas, LLC 4800 Concord Road York, SC 29745

SUBJECT: CATAWBA NUCLEAR STATION, UNIT 1: PROPOSED RELIEF REQUEST 14-CN-003, AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) BOILER AND PRESSURE VESSEL CODE (ASME CODE), CODE CASE N-695 (CAC NO. MF5447)

Dear Mr. Henderson:

By letter dated December 17, 2014, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14352A261), Duke Energy Carolinas, LLC (Duke Energy, the licensee) submitted Relief Request (RR) 1-14-CN-003 to the U.S. Nuclear Regulatory Commission (NRC) requesting the use of an inspection at the Catawba Nuclear Station, Unit 1 with a depth sizing error that is greater than the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Case N-695, "Qualification Requirements for Dissimilar Metal Piping Welds," for the third 10-year inservice-inspection (ISI) interval at the Catawba Nuclear Station, Unit 1.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g)(5)(iii), the licensee requested relief from the depth-sizing uncertainty qualification requirement for ultrasonic examinations conducted from the inside diameter (ID) of pipes (i.e., root mean square (RMS) error not greater than 0.125 inches), contained in ASME Code Case N-695. The licensee requested relief from the requirements for ISI items on the basis that the ASME Code requirement is impractical.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, the examinations were performed to the extent practical and provide reasonable assurance of structural integrity of the subject areas. Therefore, the NRC staff grants relief as requested in 14-CN-003.

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. K. Henderson

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If you have any questions, please contact the Project Manager, Ed Miller at 301-415-2481 or via e-mail at Ed.Miller@nrc.gov.

Sincerely,

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Robert J. Pascarelli, Chief Plant Licensing Branch II-1 Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation

Docket No. 50-413

Enclosure: Safety Evaluation

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

RELIEF REQUEST FOR CATAWBA 14-CN-003

FOR THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

DUKE ENERGY CAROLINAS, LLC

CATAWBA NUCLEAR STATION, UNIT 1

DOCKET NO. 50-413 (TAC NO. MF5447)

1.0 INTRODUCTION

By letter dated December 17, 2014, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14352A261), Duke Energy Carolinas, LLC (Duke Energy, the licensee) submitted relief request (RR) 1-14-CN-003 to the U.S. Nuclear Regulatory Commission (NRC or Commission) requesting the use of an inspection at the Catawba Nuclear Station (CNS), Unit 1, with a depth sizing error that is greater than the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Case N-695, "Qualification Requirements for Dissimilar Metal Piping Welds," for the third 10-year inservice-inspection (ISI) interval at the Catawba Nuclear Station, Unit 1.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g)(5)(iii), the licensee requested relief from the depth-sizing uncertainty qualification requirement for ultrasonic examinations conducted from the inside diameter (ID) of pipes (i.e., root mean square (RMS) error not greater than 0.125 inches), contained in ASME Code Case N-695. The licensee requested relief from the requirements for ISI items on the basis that the ASME Code requirement is impractical.

2.0 REGULATORY EVALUATION

In its letter, the licensee requested relief from the 0.125 inch RMS error depth-sizing acceptance criteria contained in ASME Code Case N-695 pursuant to 10 CFR 50.55a(g)(5)(iii).

ASME Code Case N-695 is accepted for use in NRC Regulatory Guide (RG) 1.147, Revision 17, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," and incorporated by reference in 10 CFR 50.55a(a).

Enclosure

Section 50.55a(g)(4)(ii) of 10 CFR states, in part, that "Inservice examination of components and system pressure tests conducted during successive 120-month inspection intervals must comply with the requirements of the latest edition and addenda of the Code incorporated by reference in paragraph (a) of this section 12 months before the start of the 120-month inspection interval (or the optional ASME Code cases listed in NRC Regulatory Guide (RG) 1.147."

Section 50.55a(g)(5)(iii) of 10 CFR states, in part, that licensees may determine that conformance with certain ASME Code requirements is impractical and that the licensee shall notify the Commission and submit information in support of the determination.

Section 50.55a(g)(6)(i) of 10 CFR states, in part, that the Commission will evaluate determinations under paragraph (g)(5) of this section that ASME Code requirements are impractical and that 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.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request, and the Commission to grant, the relief requested by the licensee.

- 3.0 TECHNICAL EVALUATION
- 3.1 Licensee's Request

3.1.1 Component Descriptions

Relief Request 1-14-CN-003 covers four Reactor Vessel Hot-Leg Nozzle-to-Safe End and four Cold-Leg Nozzle-to-Safe End Dissimilar Metal Welds. The welds are all ASME Code, Class 1, Inspection Category B-F, Item Number B5.10.

Description	Nominal ID Size (inches)	Weld No.
Hot-Leg Nozzle 1A to Safe End Weld	29.0	1RPV-W15-SE
Hot-Leg Nozzle 1B to Safe End Weld	29.0	1RPV-W16-SE
Hot-Leg Nozzle 1C to Safe End Weld	29.0	1RPV-W17-SE
Hot-Leg Nozzle 1D to Safe End Weld	29.0	1RPV-W18-SE
Cold-Leg Nozzle 1A to Safe End Weld	27.5	1RPV-W11-SE
Cold-Leg Nozzle 1B to Safe End Weld	27.5	1RPV-W12-SE
Cold-Leg Nozzle 1C to Safe End Weld	27.5	1RPV-W13-SE
Cold-Leg Nozzle 1D to Safe End Weld	27.5	1RPV-W14-SE

3.1.2 Applicable Code Requirement

The code of record for the third 10-year ISI interval is the ASME Code, Section XI, 1998 Edition through the 2000 Addenda.

ASME Code, Section XI, Paragraph IWA-2232, requires that ultrasonic (UT) examinations be conducted in accordance with Mandatory Appendix I. Appendix 1, 1-2220 requires that UT examinations be qualified by performance demonstration in accordance with Mandatory Appendix VIII, Supplement 10.

ASME Code Case N-695 provides alternatives to the requirements of Appendix VIII, Supplement 10. Paragraph 3.3(c) of ASME Code Case N-695 requires that "Examination procedures, equipment, and personnel are qualified for depth-sizing when the RMS error of the flaw depth measurements, as compared to the true flaw depths, do not exceed 0.125 in. (3 mm)." Code Case N-695 has been accepted by the NRC without condition and is listed in Table 1 "Acceptable Section XI Code Cases" of RG 1.147, Revision 17.

3.1.3 Proposed Alternative

The licensee proposes to use the following alternative for flaw depth sizing when dissimilar metal welds are examined from the inside surface:

- 1. Examinations shall be performed using UT techniques that are qualified for flaw detection and sizing using procedures, personnel and equipment qualified by demonstration in all aspects except depth sizing.
- 2. A correction factor of 0.064 inches (the RMS Error (0.189 inches) 0.125 inches) shall be added to the depths of any measured flaws. The correction factor shall be applied to the most critical location on the flaw in relation to surface proximity.
- 3. Eddy current (EC) examinations shall be used to confirm whether any detected flaws are surface-breaking.
- 4. If any inner diameter (ID) surface-breaking flaws are detected and measured as 50 percent through-wall depth or greater, Duke Energy shall repair the indications or shall perform flaw evaluations and shall submit the evaluations to the NRC for review and approval prior to reactor startup.

These flaw evaluations shall include the following:

- a. Information concerning the mechanism which caused the flaw.
- b. Information concerning the surface roughness/profile in the area of the pipe/weld required to perform the examination, and an estimate of the percentage of potential surface areas with UT probe "lift-off".

3.1.4 Basis for the Request

Because compliance with the applicable requirements is impractical, this request is submitted pursuant to 10 CFR 50.55a(g)(5)(iii). The licensee believes that the proposed alternative

provides reasonable assurance that flaws detected during examination will be sufficiently sized to disposition in accordance with acceptance standards of the ASME Code, Section XI.

3.1.5 Duration of the Proposed Relief

The proposed alternative is applicable for the third 10-year ISI Interval which began on June 29, 2005, and is currently scheduled to end on June 29, 2016.

4.0 NRC STAFF EVALUATION

4.1 CNS, Unit 1, Reactor Vessel Head-to-Flange Weld

The licensee will use NRC-approved Code Case N-695 to satisfy the requirements of ASME Code, Section XI, Appendix VIII, Supplement 10. Code Case N-695 requires that procedures used to inspect welds from the inside surface of the pipe be qualified by performance demonstration. The acceptance criterion in Code Case N-695 specifies that the RMS error of the examination procedures shall not be greater than 0.125 inches. The licensee's inspection vendor was able to depth size with an RMS error of 0.189 inches. The licensee is requesting relief from the 0.125 inch depth sizing requirement in ASME Code Case N-695 in accordance with 10 CFR 50.55a(g)(5)(iii).

The NRC staff has confirmed that since 2002, the industry has not been able to satisfy the RMS error acceptance criterion of less than 0.125 inches when qualifying the volumetric examination inspection procedures performed from the inside surface of a pipe. Developing new technology capable of meeting the 0.125 inch RMS error and qualifying the new technology to meet the requirements of ASME Code Case N-695 would be a burden on the licensee. The NRC staff concludes that this repeated inability to qualify inside surface UT inspection techniques in accordance with ASME Code Case N-695 constitutes an impracticality as described in 10 CFR 50.55a(g)(5)(iii).

To address the issue of increased potential for undersizing of flaws by inside surface UT inspection procedures that do not meet ASME Code Case N-695 acceptance criterion in 2012, the NRC staff, in conjunction with personnel from the Performance Demonstration Initiative, examined the proprietary UT examination data set compiled from all attempts to date to qualify inside surface UT inspection procedures to the acceptance criterion contained in ASME Code Case N-695. Based on this examination, the NRC staff concluded that:

- (a) For flaw depths less than or equal to 50 percent pipe wall thickness, a flaw could be appropriately depth sized if a correction factor is added to the measured flaw depth such that the adjusted flaw depth is equal to the measured flaw depth plus the difference between the vendor procedure qualification RMS error and 0.125 inches.
- (b) For flaw depths greater than 50 percent wall thickness, the variability of sizing errors is sufficiently large so that no single mathematic flaw size adjustment formula is sufficient to provide reasonable assurance of appropriate flaw depth-sizing. As a result, the NRC staff finds it necessary to evaluate the flaws that have depth greater than 50 percent through-wall on a case-by-case basis.

To provide reasonable assurance of the structural integrity of examined welds, the NRC staff determined that the following compensatory measures shall be applied to any inspection not meeting the 0.125 inch RMS error for depth sizing to address the measurement uncertainty in flaw depth-sizing when examining welds from the inside surface:

- (1) Examine the welds under consideration using a UT technique that is qualified for flaw detection and length sizing.
- (2) For flaw(s) with a measured depth of less than 50 percent of the wall thickness, the depth shall be adjusted by adding the measured flaw depth to the difference between the procedure qualification RMS error and 0.125 inches.
- (3) For flaw(s) with measured depth of greater than 50 percent of the wall thickness, either the degraded weld needs to be repaired in accordance with the ASME Code, or a flaw evaluation needs to be submitted to the NRC staff for review and approval prior to reactor startup.
- In addition to information normally contained in flaw evaluations performed in accordance with ASME Code, Section XI, IWB-3600, the submitted flaw evaluation shall include: (a) information concerning the degradation mechanism that caused the crack, (b) information concerning the surface roughness and/or profile in the area of the examined pipe and/or weld, and (c) information concerning areas in which the UT probe may "lift off" from the surface of the pipe and/or weld.
- (5) Perform EC examination(s) to confirm whether a flaw is connected to the inside surface of the pipe and/or weld.

The licensee stated that EC is used for the examination of the entire ID surface of the inspection area during the detection scans. The EC results will be used to help verify the ID surface connectivity of all reported flaws.

The NRC staff concludes that the licensee's alternative is consistent with the compensatory measures discussed above, because: (1) the licensee will add the correction factor to the crack tip(s); (2) the licensee will use eddy current testing to verify whether an embedded flaw is connected to the inside surface; and (3) the licensee will submit any flaw analysis for flaws greater than 50 percent through-wall to the NRC staff for review and approval prior to startup.

Therefore, the NRC staff determines relief from the depth-sizing RMS error acceptance criterion of ASME Code Case N-695 and using a vendor with a 0.189 inch RMS error for depth sizing provides reasonable assurance of the structural integrity and leak tightness in the subject welds.

5.0 <u>CONCLUSION</u>

As set forth above, the NRC staff determines that granting relief pursuant to 10 CFR 50.55a(g)(6)(i) is authorized by law, 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. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(5)(iii). Therefore, the NRC staff grants

the licensee's RR 1-14-CN-003 at CNS, Unit 1, for the third 10-year ISI Interval which began on June 29, 2005, and is currently scheduled to end on June 29, 2016.

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.

Principal Contributor: S. Cumblidge, NRR

Date of issuance: October 26, 2015

K. Henderson

If you have any questions, please contact the Project Manager, Ed Miller at 301-415-2481 or via e-mail at Ed.Miller@nrc.gov.

Sincerely,

· /RA/

Robert J. Pascarelli, Chief Plant Licensing Branch II-1 Division of Operating Reactor Licensing Office of Nuclear Reactor Regulation

Docket No. 50-413

Enclosure: Safety Evaluation

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