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Serial: RA-19-0026 10 CFR 50.55a
February 11, 2019

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

CATAWBA NUCLEAR STATION, UNIT NO. 2
DOCKET NO. 50-414 / RENEWED LICENSE NO. NPF-52

MCGUIRE NUCLEAR STATION, UNIT NOS. 1 AND 2
DOCKET NOS. 50-369, 50-370 / RENEWED LICENSE NOS. NPF-9 AND NPF-17

OCONEE NUCLEAR STATION, UNIT NOS. 1, 2 AND 3
DOCKET NOS. 50-269, 50-270, 50-287 / RENEWED LICENSE NOS. DPR-38, DPR-47 AND DPR-55

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT NO. 1
DOCKET NO. 50-400 / RENEWED LICENSE NO. NPF-63

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261 / RENEWED LICENSE NO. DPR-23

SUBJECT: Response to Request for Additional Information (RAI) Regarding Proposed Alternative to the Depth Sizing Qualification Requirement of Appendix VIII, Supplements 2 and 10 (18-GO-001)

REFERENCES:

1. Duke Energy Letter, *Relief Request in Accordance with 10 CFR 50.55a(g)(5)(iii) for an Alternative to the Depth Sizing Qualification Requirement of Appendix VIII, Supplements 2 and 10 (18-GO-001)*, dated September 6, 2018 (ADAMS Accession No. ML19011A137)
2. Duke Energy Letter, Supplement to *Relief Request for an Alternative to the Depth Sizing Qualification Requirement of Appendix VIII, Supplements 2 and 10 (18-GO-001)*, dated November 2, 2018 (ADAMS Accession No. ML18316A035)
3. NRC email, *Duke Energy Fleet RAIs – Relief Request 18-GO-001 - Proposed Alternative for Depth Sizing Qualification Examination of Welds (L-2018-LLR-0117)*, dated January 10, 2019 (ADAMS Accession No. ML19011A137)

Ladies and Gentlemen:

In Reference 1, pursuant to 10 CFR 50.55a(g)(5)(iii), Duke Energy Carolinas, LLC and Duke Energy Progress, LLC (Duke Energy) submitted Relief Request 18-GO-001 requesting U.S. Nuclear Regulatory Commission (NRC) approval to use an alternative weld depth sizing qualification at Catawba Nuclear Station Units 1 and 2 (CNS), McGuire Nuclear Station Units 1 and 2 (MNS), Oconee Nuclear Station Units 1, 2, and 3 (ONS), Shearon Harris Nuclear Power Plant, Unit 1 (HNP) and H. B. Robinson Steam Electric Plant, Unit 2 (RNP). In Reference 2, Duke Energy submitted a supplement that superseded the Reference 1 request in its entirety. In Reference 3, the NRC requested additional information regarding this proposed alternative. The Duke Energy response to the Reference 3 RAI is provided in Enclosure 1. As part of the RAI response, changes are needed to the Reference 2 request; therefore, Enclosure 2 provides a revised request that supersedes Reference 2, Enclosure 1 in its entirety. Changes from Reference 2, Enclosure 1 are denoted with revision bars in the margin. Finally, during development of this RAI response, a change was identified for the listed nozzle wall thickness shown in Tables 1A and 1B. Specifically, the wall thickness for the "Reactor Vessel Closure Head to Upper Head Injection Lower Tube Welds (Auxiliary Head Adapter Welds)" were stated as 0.88 inches, but this should be 0.65 inches. This has been revised in Enclosure 2.

This submittal contains no new regulatory commitments. Should you have any questions concerning this letter, or require additional information, please contact Art Zaremba, Manager – Nuclear Fleet Licensing, at 980-373-2062.

Sincerely,

Steve Snider
Vice President – Nuclear Engineering

JBD

Enclosures:
1. Response to Request for Additional Information
2. Revised Relief Request Serial #18-GO-001

cc: (all with Enclosures unless otherwise noted)

C. Haney, Regional Administrator USNRC Region II
G. A. Hutto, III, USNRC Resident Inspector – MNS
J. Zeiler, USNRC Resident Inspector – HNP
J. D. Austin, USNRC Resident Inspector – CNS
E. L. Crowe, USNRC Resident Inspector – ONS
J. Rotton, USNRC Resident Inspector – RNP
M. C. Barillas, NRR Project Manager – HNP

N. Jordan, NRR Project Manager – RNP
A. L. Klett, NRR Project Manager – ONS
M. Mahoney, NRR Project Manager – CNS & MNS
D. Galvin, NRR Project Manager – Fleet

Enclosure 1

Response to Request for Additional Information

NRC RAI-1:

In the proposed relief request, the licensee discusses Code Cases N-695 and N-695-1 (or N-696 and N-696-1). For example, Section 4 of the relief request discusses ASME Code Case N-695. Section 5.1 of the relief request discusses ASME Code Case N-695-1 and N-696-1. Section 5.2 discusses Code Case N-695.

The NRC staff has approved Code Cases N-695 and N-696, but not N-695-1 and N-696-1, in Regulatory Guide 1.147, Revision 18. The NRC staff notes that the ASME Code has limited the use of Code Cases N-695 and N-696 to the 2003 Addenda or earlier editions and addenda as stated in the Code Cases for Nuclear Components of the 2015 Edition of the ASME Code. The code of record for all the plants covered under the proposed relief request is the 2007 edition through the 2008 addenda of the ASME Code, Section XI. Regulatory Guide 1.147, Revision 18 does not have the ASME Code Edition limitation on the use Code Cases N-695 and N-696.

While the proposed relief request in Section 5, "Proposed Alternative and Basis for Use," describes the proposed alternative use of Code Cases N-695-1 and N-696-1, the proposed relief request does not describe the basis for use. As the NRC staff has not approved Code Cases N-695-1 and N-696-1 in Regulatory Guide 1.147, Revision 18, provide the basis for the use of Code Cases N-695-1 and N-696-1.

Duke Energy Response to RAI-1:

To support the basis for use of ASME Code Cases N-695-1 and N-696-1, the changes from the NRC approved versions of these Codes Cases (N-695 and N-696, respectively) are described and justified below.

The following summarizes the changes from Code Case N-695 to N-695-1
1. Allowance of a root-mean square error (RMSE) up to 0.250 in. for components 2.1 in. or greater in wall thickness. Further justification is below.
2. Other editorial changes

The following summarizes the changes from Code Case N-696 to N-696-1
1. Allowance of a root-mean square error (RMSE) up to 0.250 in. for components 2.1 in. or greater in wall thickness. Further justification is below.
2. Deletion of a requirement for the specimen set for Supplement 3 qualification to include at least three flaws in ferritic material. A statement was added that depth sizing qualification for ferritic piping shall be performed in accordance with Supplement 3.
3. Other editorial changes

To date, for components 2.1 in or greater in wall thickness, no process has met the ASME Section XI, Appendix VIII qualification requirements of a root-mean square error (RMSE) smaller than or equal to 0.125 in. for the depth-sizing of flaws from the inner surface (ID) in reactor pressure vessel (RPV) nozzles, according to Supplements 2, 10 or 14. These efforts have shown the impracticality of obtaining the RMSE of 0.125", given the challenges of weld geometry, rough surfaces, multiple materials, and microstructural anisotropies.

The Electric Power Research Institute (EPRI) implemented an alternate criterion which has been used by utilities in relief requests to the Nuclear Regulatory Commission (NRC), who have reviewed the criterion performance on multiple occasions. ASME Code Case N-695-1 and

N-696-1 have been approved by the ASME Code to allow a maximum RMSE of 0.250 in. for components 2.1 in. or greater in wall thickness as a permanent solution to this issue. EPRI Technical Report 3002000612 (Reference RAI-1.1) contains the basis for this change. Deterministic and probabilistic approaches were applied in EPRI Technical Report 3002000612, which is Publicly Available, to show the acceptability of alternative depth-sizing RMSE requirements. As shown in Enclosure 2 (Paragraph 5.1 and Reference 8.6), Duke Energy is revising the proposed relief request to include this EPRI Technical Report.

In a Deterministic Assessment, each input is set to a conservative value to account for uncertainty and variability. This methodology compounds various conservative margins in a fashion that can lead to unrealistic results and mask the true extent of conservatism in the final calculation results. These deterministic evaluations demonstrate that a depth-sizing RMSE of 0.250" provides a structural margin for large-diameter PWR piping welds compared to that for large-diameter BWR piping welds inspected with a depth-sizing RMSE of 0.125". The RMSE of 0.125" currently required for the qualification of UT depth-sizing in accordance with Supplements 2, 10, and 14 of ASME Sec. XI, App. VIII was originally a deterministic assessment based on the depth-sizing error that was achievable for UT of BWR piping welds in the 1980s.

The use of Probabilistic Evaluations facilitates the incorporation of uncertainties, variability, and randomness important in the evaluation of leakage risk. Probabilistic assessment provides a direct uncertainty estimate for key outputs so the specific degree of conservatism in the result can be assessed. Probabilistic evaluations show that alternative depth-sizing RMSE requirement of 0.250" has little effect on probability of through-wall penetration of a PWSCC flaw. The probability of leakage due to through-wall PWSCC is a key indication of the effect of PWSCC on structural integrity as large flaws are necessary to produce both leakage and pressure-boundary rupture.

The effect of uncertainty in flaw sizing on structural integrity of piping systems were assessed directly through net section collapse calculation given the presence of a circumferential flaw. The calculations of net section collapse are based on standard equations included in ASME Section XI for evaluating acceptability for continued service of piping systems with circumferential planar flaws connected to the ID surface.

Based on these facts, EPRI recommended and ASME approved changes incorporated in N-695-1 and N-696-1 that allow RMSE depth-sizing qualification to be changed from 0.125" to 0.250" for large-diameter PWR piping welds having a nominal wall thickness of at least 2.1" examined from the ID.

This recommended change to the UT qualification requirement continues to provide reasonable assurance of structural integrity and, thus, an acceptable level of quality and safety as described above.

RAI-1 References:

RAI-1.1. EPRI Technical Report 3002000612, Materials Reliability Program: Technical Basis for Change to American Society of Mechanical Engineers (ASME) Section XI Appendix VIII Root-Mean-Square Error (RMSE) Requirement for Qualification of Depth-Sizing for Ultrasonic Testing (UT) Performed from the Inner Diameter (ID) of Large-Diameter Thick-Wall Supplement 2, 10, and 14 Piping Welds (MRP-373), October 2013

NRC RAI-2:

Paragraph 4.3 of the relief request states that the vendors have demonstrated RMS errors between 0.179 inches and 0.212 inches. Paragraph 5.2.2 of the relief request states that a correction factor equal to the difference between the procedure qualification RMS error and 0.125 inches shall be added to the depths of any measured flaws. It is not evident the exact RMS error that will be used to calculate the correction factor.

Discuss whether different vendors will be used to examine welds at different plants in the fleet. If yes, confirm that the vendor-specific RMS error will be used to calculate the correction factor for the specific plant in the fleet that the vendor performs weld examinations.

Duke Energy Response to RAI-2:

Duke Energy intends to utilize only vendors who have demonstrated acceptable RMSE in accordance with the limits specified in N-695-1 and N-696-1. RMS error correction factors will not be necessary with these cases. As shown in Enclosure 2, Duke Energy is revising the proposed relief request by deleting Paragraph 5.2 in its entirety (and updating paragraphs 4.1 and 5.1 to align with this deletion).

NRC RAI-3:

Note 1 to Table 1E of the relief request states that "…Oconee Unit 1 is in the process of implementing Code Case N-716-1. Category B-F, Item B5.10 will be replaced by the applicable Category R-A, Item Numbers for welds 1-RPV-WR-53 and 1-RPV-WR-53A when the inservice inspection plan and schedule are revised to implement this case…."

Note 2 of Table 1F of the relief request states that "…Robinson Unit 2 is in the process of implementing Code Case N-716-1. Category B-F, Item B5.10 will be replaced by the applicable Category R-A, Item Numbers for the welds listed in Table 1F when the inservice inspection plan and schedule are revised to implement this case…"

Paragraph 3.3 of the relief request states that "…For Category R-A welds (Oconee only), examinations are performed in accordance with ASME Code Case N-716-1. This code case does not provide alternative requirements to those specified in IWA-2232, so the requirements of IWA-2232 apply…"

The NRC staff understands that paragraph 3.3 currently applies to Oconee Unit 2 and 3 and would apply to Oconee Unit 1 when Code Case N-716-1 is implemented. However, since paragraph 3.3 states "(Oconee Only)", it would not apply to Robinson when Code Case N-716-1 is implemented. Therefore, the proposed relief request does not address the applicable Code requirement for when Code Case N-716-1 is implemented at Robinson.

Identify the applicable Code requirement upon implementing Code Case N-716-1 at Robinson regarding the proposed relief request.

Duke Energy Response to RAI-3:

The Category R-A weld examination requirements specified in Paragraph 3.3 of the relief request applies to both Oconee and Robinson. This is reflected in the revised relief request, Enclosure 2, Paragraph 3.3.

NRC RAI-4:

Paragraph 5.3 of the relief request states that "…For all welds listed in this relief request, if any ID surface-breaking flaw is detected and measured (from the ID surface) as 50 percent throughwall depth or greater, the flaw shall be considered to be of indeterminate depth. The licensee shall repair the component, or shall perform a volumetric examination from the OD surface of the component to determine the flaw depth and shall evaluate the component for continued service in accordance with the ASME Code, Section XI, IWB-3132.3…"

Paragraph 5.5 of the relief request states that "The proposed alternative for welds less than 2.1 in. (54 m[m]) in thickness is essentially identical to that approved for use during the Catawba Unit 1 Third Inservice Inspection Interval (Precedent 7.4)…"

By letter dated December 17, 2014 (ADAMS Accession No. ML14352A261), Duke Energy submitted a similar relief request 1-14-CN-003, for Catawba Nuclear Station Unit 1. In the submittal, Duke Energy stated "If any inner diameter (ID) surface-breaking flaws are detected and measured as 50% 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." Duke Energy stated that the submitted flaw evaluation will include: (a) information concerning the mechanism that caused the flaw, (b) information concerning the surface roughness and/or profile in the area of the examined pipe and/or weld, and (c) an estimate of the percentage of potential surface areas with UT probe "lift off' from the surface of the pipe and/or weld. By letter dated October 26, 2015 (ADAMS Accession No. ML15286A326), the NRC approved the relief request at Catawba.

Further, previous approval of relief requests with the alternative use of Code Cases N-695-1 and N-696-1, for Salem Nuclear Generating Station, Unit Nos. 1 and 2 (Salem) (ADAMS Accession No. ML17219A186) and Beaver Valley Power Station, Unit No. 2 (Beaver Valley) (ADAMS Accession No. ML18075A096) included the submittal of flaw evaluations for NRC review and approval prior to reactor startup for detected flaws to be left in service with depths measured greater than or equal to 50 percent through wall thickness.

However, the proposed relief request Serial # 18-GO-001, paragraph 5.3, does not discuss submitting the flaw evaluation to the NRC or what information will be involved in the flaw evaluation as discussed above and specified in the aforementioned Catawba, Salem, and Beaver Valley relief requests.

Discuss whether a flaw evaluation will be submitted to the NRC for review and approval prior to reactor startup and if it will include the aforementioned information if the detected flaw is 50 percent through-wall depth or greater and the flaw is not repaired. If not, provide justification.

Duke Energy Response to RAI-4:

For all welds listed in this request, if any inner diameter (ID) surface-breaking flaws are detected and measured (from the ID surface) as 50% through-wall depth or greater, Duke Energy shall repair the indications or shall perform a volumetric examination from the OD surface of the component to determine the flaw depth and shall perform flaw evaluations and shall submit the evaluations to the NRC for review and approval prior to reactor startup. The submitted flaw evaluation will include: (a) information concerning the mechanism that caused the flaw, (b) information concerning the surface roughness and/or profile in the area of the examined pipe and/or weld, and (c) an estimate of the percentage of potential surface areas with UT probe "lift off' from the surface of the pipe and/or weld. This is reflected in the revised relief request, Enclosure 2, Paragraph 5.3.

Enclosure 2

Revised Relief Request Serial #18-GO-001

Duke Energy Carolinas, LLC
Duke Energy Progress, LLC

Revised Relief Request Serial #18-GO-001

RA-19-0026, Enclosure 2

Relief Requested in Accordance with 10 CFR 50.55a(g)(5)(iii)

Alternative to the Depth Sizing Qualification Requirement of Appendix VIII, Supplements 2 and 10

1. **ASME Code Component(s) Affected**

   1.1 Class 1 Dissimilar Metal and Alloy 82/182 Welds Listed in Tables 1A through 1G.

Table 1A
Catawba Unit 1 Welds

Component ID	ASME Category or Code Case/ Inspection Item	Description	Nominal Nozzle Wall Thickness at Weld (Approximate)
1RPV-W52-01 1RPV-W52-02 1RPV-W52-03 1RPV-W52-04	N-770-2/B	Upper Head Injection Upper Tube to Lower Tube Welds (Auxiliary Head Adapter Welds)	0.65”
1RPV-W51-01-SE 1RPV-W51-02-SE 1RPV-W51-03-SE 1RPV-W51-04-SE	N-770-2/B	Reactor Vessel Closure Head to Upper Head Injection Lower Tube Welds (Auxiliary Head Adapter Welds)	0.65”

Table 1B
Catawba Unit 2 Welds

Component ID	ASME Category or Code Case/ Inspection Item	Description	Nominal Nozzle Wall Thickness at Weld (Approximate)
2RPV-W79-101 2RPV-W80-101 2RPV-W81-101 2RPV-W82-101	N-770-2/B	Upper Head Injection Upper Tube to Lower Tube Welds (Auxiliary Head Adapter Welds)	0.65”
2RPV-W79-101SE 2RPV-W80-101SE 2RPV-W81-101SE 2RPV-W82-101SE	N-770-2/B	Reactor Vessel Closure Head to Upper Head Injection Lower Tube Welds (Auxiliary Head Adapter Welds)	0.65”
2RPV-201-121ASE 2RPV-201-121BSE 2RPV-201-121CSE 2RPV-201-121DSE	N-770-2/B	Reactor Vessel Cold Leg Nozzle to Safe End Welds	2.3”
2RPV-202-121ASE 2RPV-202-121BSE 2RPV-202-121CSE 2RPV-202-121DSE	N-770-2/A-2	Reactor Vessel Hot Leg Nozzle to Safe End Welds	2.4”

Table 1C
McGuire Unit 1 Welds

Component ID	ASME Category or Code Case/ Inspection Item	Description	Nominal Nozzle Wall Thickness at Weld (Approximate)
1RPV3-445E-SE 1RPV3-445F-SE 1RPV3-445G-SE 1RPV3-445H-SE	N-770-2/A-2	Reactor Vessel Hot Leg Nozzle to Safe End Welds	2.5”
1RPV3-445A-SE 1RPV3-445B-SE 1RPV3-445C-SE 1RPV3-445D-SE	N-770-2/B	Reactor Vessel Cold Leg Nozzle to Safe End Welds	2.4”
1RPV1-462C-SE 1RPV1-462B-SE 1RPV1-462A-SE 1RPV1-462D-SE	N-770-2/B	Reactor Vessel Closure Head to Upper Head Injection Lower Tube Welds (Auxiliary Head Adapter Welds)	0.63”
1NI1FW-38-1 1NI1FW-38-2 1NI1FW-38-3 1NI1FW-38-4	N-770-2/B	Upper Head Injection Upper Tube to Lower Tube Welds (Auxiliary Head Adapter Welds)	0.63”

Table 1D
McGuire Unit 2 Welds

Component ID	ASME Category or Code Case/ Inspection Item	Description	Nominal Nozzle Wall Thickness at Weld (Approximate)
2RPV-W51-01-SE 2RPV-W51-02-SE 2RPV-W51-03-SE 2RPV-W51-04-SE	N-770-2/B	Reactor Vessel Closure Head to Upper Head Injection Lower Tube Welds (Auxiliary Head Adapter Welds)	0.63”
2RPV-W52-01 2RPV-W52-02 2RPV-W52-03 2RPV-W52-04	N-770-2/B	Upper Head Injection Upper Tube to Lower Tube Welds (Auxiliary Head Adapter Welds)	0.63”

Table 1E
Oconee Units 1, 2, and 3 Welds

Component ID	ASME Category or Code Case/ Inspection Item	Description	Nominal Nozzle Wall Thickness at Weld (Approximate)
1-RPV-WR-53 1-RPV-WR-53A	N-770-2/B and B-F[1]/B5.10	Unit 1 Reactor Vessel Cold Leg Core Flood Nozzle-to-Safe End Welds	1.5”
2-RPV-WR-53 2-RPV-WR-53A	N-770-2/B and N-716-1, R-A/R1.11 and R1.15	Unit 2 Reactor Vessel Cold Leg Core Flood Nozzle-to-Safe End Welds	1.5”
3-RPV-WR-53 3-RPV-WR-53A	N-770-2/B and N-716-1, R-A/R1.11 and R1.15	Unit 3 Reactor Vessel Cold Leg Core Flood Nozzle-to-Safe End Welds	1.5”

Table 1F
Robinson Unit 2 Welds

Component ID	ASME Category or Code Case/ Inspection Item	Description	Nominal Nozzle Wall Thickness at Weld (Approximate)
107/01DM 107A/01DM 107B/01DM	N-770-2/A-2 B-F[2]/B5.10	Reactor Vessel Hot Leg Nozzle to Safe End Welds	2.4”
107/14DM 107A/14DM 107B/14DM	N-770-2/B B-F[2]/B5.10	Reactor Vessel Cold Leg Nozzle to Safe End Welds	2.4”

Table 1G
Harris Unit 1 Welds

Component ID	ASME Category or Code Case/ Inspection Item	Description	Nominal Nozzle Wall Thickness at Weld (Approximate)
II-RV-001 RVNOZAI-N-01SE II-RV-001 RVNOZBI-N-03SE II-RV-001 RVNOZCI-N-05SE	N-770-2/B	Reactor Vessel Cold Leg Nozzle to Safe End Welds	2.4”
II-RV-001 RVNOZAO-N-06SE II-RV-001 RVNOZBO-N-02SE II-RV-001 RVNOZCO-N-04SE	N-770-2/D	Reactor Vessel Hot Leg Nozzle to Safe End Welds	2.5”

[1] Oconee Unit 1 is in the process of implementing Code Case N-716-1. Category B-F, Item B5.10 will be replaced by the applicable Category R-A, Item Numbers for welds 1-RPV-WR-53 and 1-RPV-WR-53A when the inservice inspection plan and schedule are revised to implement this case.

[2] Robinson Unit 2 is in the process of implementing Code Case N-716-1. Category B-F, Item B5.10 will be replaced by the applicable Category R-A, Item Numbers for the welds listed in Table 1F when the inservice inspection plan and schedule are revised to implement this case.

2. Applicable Code Edition and Addenda

2.1 ASME Boiler and Pressure Vessel Code, Section XI, 2007 Edition with the 2008 Addenda

2.2 The inservice inspection intervals for plants included in this request are identified in Table 2.

Table 2

Plant/Unit(s)	ISI Interval	Interval Start Date	Current Interval End Date
Catawba Nuclear Station Units 1 and 2	Fourth	08/19/2015 (Unit 1) 08/19/2015 (Unit 2)	12/06/2024 (Unit 1) 02/24/2026 (Unit 2)
McGuire Nuclear Station Units 1 and 2	Fourth	12/1/2011 (Unit 1) 07/15/2014 (Unit 2)	11/30/2021 (Unit 1) 12/14/2024 (Unit 2)
Oconee Nuclear Station Units 1, 2 and 3	Fifth	07/15/2014	07/15/2024
Robinson Nuclear Plant Unit 2	Fifth	07/21/2012	02/19/2023
Shearon Harris Nuclear Plant Unit 1	Fourth	09/09/2017	09/08/2027

3. Applicable Code Requirement

3.1 ASME Code Case N-770-2, as referenced in 10 CFR 50.55a(g)(6)(ii)(F), requires ultrasonic examination of Category A-2, B, and D welds fabricated from Alloy 82/182 material. Table 1, Note 4 of this case requires that ultrasonic examinations meet the applicable requirements of Mandatory Appendix VIII.

3.2 For Category B-F welds, IWA-2232 requires that ultrasonic examinations be conducted in accordance with Mandatory Appendix I. Mandatory Appendix I, I-2220 requires that ultrasonic examinations be qualified by performance demonstration in accordance with Mandatory Appendix VIII.

3.3 For Category R-A welds (Oconee and Robinson), examinations are performed in accordance with ASME Code Case N-716-1. This case does not provide alternative requirements to those specified in IWA-2232, so the requirements of IWA-2232 apply, as described in 3.2 above.

3.4 Mandatory Appendix VIII, Supplement 10, “Qualification Requirements for Dissimilar Metal Piping Welds”, Paragraph 3.3(c) 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).”[3]

3.5 Mandatory Appendix VIII, Supplement 2, “Qualification Requirements for Wrought Austenitic Piping Welds”, Paragraph 3.2(b) requires that examination procedures, equipment, and personnel are qualified for depth-sizing if the “RMS error of the flaw depths estimated by ultrasonics, as compared with the true depths, do not exceed 0.125 in. (3 mm).”

[3] RMS (root mean square) is defined in Mandatory Appendix VIII, VIII-3120.

4. Impracticality of Compliance:

4.1 ASME Code Case N-695, “Qualification Requirements for Dissimilar Metal Piping Welds, Section XI, Division 1,” is shown as acceptable for use in Regulatory Guide (RG) 1.147, Revision 18, dated March 2017. This case provides alternatives to the requirements of Appendix VIII, Supplements 2 and 10, but paragraph 3.3(c) of this case 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).” The requirement for the 0.125-inch RMS error depth sizing accuracy criteria of Code Case N- 695 is impractical because, although examination vendors have qualified for detection and length sizing in accordance with the requirements for examinations from the inside diameter (ID) surface, vendors have not met the established RMS error of 0.125 inch for indication depth sizing of welds 2.1 in. (54 mm) or greater in thickness. Several process enhancements including systems, new search units, and software modifications have been implemented, but these have not been successful in demonstrating the ability to meet the required measurement error accuracy. For these reasons, Duke Energy believes that achieving the RMS error of 0.125 inches is impractical for use with the ID ultrasonic examination technology employed in the qualification efforts.

4.2 Compliance with the requirements of Appendix VIII, Supplement 2, paragraph 3.2(b) and Supplement 10, paragraph 3.3(c) is possible for examinations performed from the outside diameter (OD) surface. However, Duke Energy has determined that examinations performed from the OD surface result in significant and unnecessary personnel radiation exposure that can be avoided by performing these examinations remotely from the ID surface.

4.3 Vendors that Duke Energy is using for performing these examinations have demonstrated RMS errors between 0.179" and 0.212".

5. Proposed Alternative and Basis for Use:

5.1 Duke Energy proposes to use ASME Code Cases N-695-1 and N-696-1 to perform qualified ultrasonic examinations from the ID surface of the welds. Electric Power Research Institute (EPRI) Technical Report 3002000612 (Reference 8.6) contains technical basis to support this requested relief.

5.1.1 Paragraph 3.3(d) of ASME Code Case N-695-1 states:

> “(d) For qualifications from the inside-surface, examination procedures, equipment, and personnel are qualified for depth sizing if the RMS error of the flaw depth measurements, as compared to the true flaw depths, does not exceed 0.125 in. (3 mm) for piping less than 2.1 in. (54 mm) in thickness, or 0.250 in. (6 mm) for piping 2.1 in. (54 mm) or greater in thickness.”

5.1.2 Paragraph 3.3(c) of ASME Code Case N-696-1 states:

> “(c) Supplement 2 examination procedures, equipment, and personnel are qualified for depth-sizing if the RMS error of the flaw depth measurements as compared to the true flaw depths, does not exceed 0.125 in. (3 mm) for piping less than 2.1 in. (54 mm) in thickness, or 0.250 in. (6 mm) for piping 2.1 in. (54 m) or greater in thickness, when they are combined with a successful Supplement 10 qualification.”

5.1.3 Personnel, procedures, and equipment shall satisfy all requirements of Code Cases N-695-1 and N-696-1.

5.1.4 Flaws detected and measured as less than 50 percent through-wall depth shall be sized using personnel, procedures, and equipment qualified to meet the requirements of ASME Code Cases N-695-1 and N-696-1.

5.2 (DELETED)

5.3 For all welds listed in this request, if any inner diameter (ID) surface-breaking flaws are detected and measured (from the ID surface) as 50% through-wall depth or greater, Duke Energy shall repair the indications or shall perform a volumetric examination from the OD surface of the component to determine the flaw depth and shall perform flaw evaluations and shall submit the evaluations to the NRC for review and approval prior to reactor startup. The submitted flaw evaluation will include: (a) information concerning the mechanism that caused the flaw, (b) information concerning the surface roughness and/or profile in the area of the examined pipe and/or weld, and (c) an estimate of the percentage of potential surface areas with UT probe "lift off' from the surface of the pipe and/or weld.

5.4 All other requirements of the ASME Code, Section XI and Code Case N-770-2 [as conditioned by 10 CFR 50.55a(g)(6)(ii)(F)] for which relief was not specifically requested apply, including the third party review by the Authorized Nuclear Inservice Inspector.

5.5 The proposed alternative for welds less than 2.1 in. (54 m) in thickness is essentially identical to that approved for use during the Catawba Unit 1 Third Inservice Inspection Interval (Precedent 7.4).

5.6 The proposed alternative may be used in lieu of the alternative approved in Relief Request RR-08, for the Robinson Nuclear Plant, Unit 2 Fifth Inservice Inspection Interval (Precedent 7.5).

5.7 Because compliance with the applicable requirements is impractical, this request is submitted pursuant to 10 CFR 50.55a(g)(5)(iii). Duke Energy 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 and ASME Code Case N-770-2.

6. Duration of Proposed Alternative:

This alternative is requested for the inservice inspection intervals listed in Table 2 of this request.

7. Precedents:

The following requests for relief were granted by the NRC pursuant to 10 CFR 50.55a(g)(6)(i). These requests provide similar alternatives to those proposed above.

7.1 NRC letter to Entergy Operations, Inc., “Arkansas Nuclear One, Unit 1 - Relief Request NO. AN01-ISI-025, Relief From American Society Of Mechanical Engineers Section XI Table IWB-2500-1 Requirements (CAC No. MF7625)”, dated August 29, 2016 (ADAMS Accession No. ML16237A082)

7.2 NRC letter to Pacific Gas and Electric Company, “Diablo Canyon Power Plant, Unit No. 2 - Inservice Inspection Program Relief Request NDE-RCS-SE-2R19, Associated With The Use Of Alternate Sizing Qualification Criteria Through a Protective Clad Layer (CAC NO. MF5348)”, dated November 4, 2015 (ADAMS Accession No. ML15299A034)

7.3 NRC letter to Exelon Nuclear, “Three Mile Island Nuclear Station, Unit 1 - Relief Request RR-14-01 Regarding Alternative Root Mean Square Depth Sizing Requirements (TAC NO. MF4873)”, dated September 15, 2015 (ADAMS Accession No. ML15163A249)

7.4 NRC letter to Duke Energy Carolinas, LLC, “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 (TAC NO. MF5447)”, dated October 26, 2015 (ADAMS Accession No. ML15286A326)

7.5 NRC letter to Carolina Power & Light Company, H. B. Robinson Steam Electric Plant, Unit No.2 - Relief Request-08 From ASME Code Root Mean Square Error Value For the Fifth 10-Year Inservice Inspection Program Plan (TAC NO. MF1015), dated July 16, 2013 (ADAMS Accession No. ML13191A930)

8. References:

8.1 ASME Boiler and Pressure Vessel Code, Section XI, Division 1, 2007 Edition with the 2008 Addenda

8.2 ASME Code Case N-695, Qualification Requirements for Dissimilar Metal Piping Welds, Section XI, Division 1

8.3 ASME Code Case N-695-1, Qualification Requirements for Dissimilar Metal Piping Welds, Section XI, Division 1

8.4 ASME Code Case N-696-1, Qualification Requirements for Mandatory Appendix VIII Piping Examinations Conducted From the Inside Surface, Section XI, Division 1

8.5 ASME Code Case N-770-2, Alternative Examination Requirements and Acceptance Standards for Class 1 PWR Piping and Vessel Nozzle Butt Welds Fabricated With UNS N06082 or UNS W86182 Weld Filler Material With or Without Application of Listed Mitigation Activities, Section XI, Division 1

8.6 EPRI Technical Report 3002000612, Materials Reliability Program: Technical Basis for Change to American Society of Mechanical Engineers (ASME) Section XI Appendix VIII Root-Mean-Square Error (RMSE) Requirement for Qualification of Depth-Sizing for Ultrasonic Testing (UT) Performed from the Inner Diameter (ID) of Large-Diameter Thick-Wall Supplement 2, 10, and 14 Piping Welds (MRP-373), October 2013