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

June 20, 2023

Mr. Edward Pigott
Site Vice President
Duke Energy Carolinas, LLC
McGuire Nuclear Station
12700 Hagers Ferry Road
Huntersville, NC 28078-8985

SUBJECT: WILLIAM B. MCGUIRE NUCLEAR STATION, UNIT 1 – RELIEF REQUEST IMPRACTICAL REACTOR SYSTEM WELDS (EPID L-2020-LLR-0065)

Dear Mr. Pigott:

By letters dated September 21, 2022, and February 28, 2023, Duke Energy Carolinas, LLC (Duke Energy, the licensee) requested relief from the U.S. Nuclear Regulatory Commission (NRC) related to the examination requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, at McGuire Nuclear Station (MNS), Unit 1 for affected welds.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii)), the licensee submitted Relief Request RA-22-0024 for NRC on the basis that the required examination coverage for pressure vessel welds is impractical due to physical obstructions and limitations imposed by design and geometry of the affected welds.

The NRC staff has reviewed the subject request and concludes, as set forth in the safety evaluation, that Duke Energy has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(6)(i). Therefore, the NRC staff grants relief as requested by RA-22-0024.

All other ASME Boiler and Pressure Vessel (BPV) Code or ASME OM Code requirements for which relief was not specifically requested and approved remain applicable.

If you have any questions, please contact John Klos, MNS Licensing Project Manager, at (301) 415-5136 or via email at John.Klos@nrc.gov.

Sincerely,

/RA by Ed Miller for/

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

Docket No. 50-369

Enclosure:
Safety Evaluation

cc: Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NUMBER RA-22-0024

ALTERNATE EXAMINATION COVERAGE OF WELDS

DUKE ENERGY CAROLINAS, LLC

MCGUIRE NUCLEAR STATION, UNIT 1

DOCKET NO. 50-369

1.0 INTRODUCTION

By letter dated September 21, 2022 (Agencywide Documents and Access Management System (ADAMS) Accession No. ML22264A110) with a supplement dated February 28, 2023 (ML23059A340), Duke Energy Carolinas LLC (the licensee) requested relief from the examination requirement of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, at McGuire Nuclear Station (MNS), Unit 1. Pursuant to Title 10 of the *Code of Federal Regulations*, Part 50.55a (10 CFR 50.55a(g)(5)(iii)), the licensee submitted Relief Request RA-22-0024 to the U.S. Nuclear Regulatory Commission (NRC) for review and approval on the basis that the required examination coverage for pressure vessel welds is impractical due to physical obstructions and limitations imposed by design and geometry of the affected welds. Additionally, the relief request presented the welds that were able to be inspected during the fourth 10-year interval.

Enclosure 1 to the licensee's letter dated September 21, 2022, contains the relief request. Enclosure 2 to the licensee's letter contains examination data and coverage plots and is referred to in this safety evaluation as Enclosure 2.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), "Inservice inspection standards requirement for operating plants," states, in part, that ASME Code Class 1, 2, and 3 components (including supports) must 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 also 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),

18 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

The regulation in 10 CFR 50.55a(g)(5)(iii), “[In-service Inspection] ISI program update: Notification of impractical ISI Code requirements,” states that, “If the licensee has determined that conformance with a Code requirement is impractical for its facility the licensee shall notify the NRC and submit, as specified in § 50.4, information to support the determinations. Determinations 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 inservice inspection 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 or subsequent 120-month inspection interval for which relief is sought."

The regulation at 10 CFR 50.55a(g)(6)(i), “Impractical IST requirements: Granting of relief,” states that “The Commission will evaluate determinations under paragraph (g)(5) of this section that code requirements are impractical. The Commission may grant such relief and may impose such alternative requirements as it determines are authorized by law, and will not endanger life or property or the common defense and security, and are 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."

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 NRC staff to grant the relief requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1 ASME Code Component(s) Affected

The affected ASME Code Class 1 welds are identified in Table 1 of the relief request. Five welds are associated with the reactor pressure vessel shell and one weld is associated with pressurizer shell. The affected welds are classified as Examination Categories B-A and B-D with Item numbers B1.11, B1.12, and B3.110 as shown in Table IWB-2500-1 of the ASME Code, Section XI.

3.2 Applicable Code Edition and Addenda

The code of record for the McGuire Nuclear Station (MNS), Unit 1, Fourth Inservice Inspection Interval is the ASME Code, Section XI, 2007 Edition through the 2008 Addenda. The licensee stated that it examined the subject welds in accordance with the requirements of ASME, Section XI, Appendix VIII, “Performance Demonstration for Ultrasonic Examination Systems,” as amended and mandated by 10 CFR 50.55a. The licensee further stated that in the case of limited examinations, it made efforts to obtain additional examination coverage.

3.3 Applicable Code Requirements

ASME Code, Section XI, Examination Category B-A

Examination Category B-A, Item Number B1.11, per Table IWB-2500-1 of the ASME Code, Section XI, requires a volumetric examination of all circumferential shell welds of the reactor pressure vessel (RPV), as shown in Figure IWB-2500-1 of the ASME Code, Section XI.

Examination Category B-A, Item number B1.12, per Table IWB-2500-1, requires a volumetric examination of all RPV longitudinal shell welds as shown in Figure IWB-2500-2.

ASME Code, Section XI Examination Category B-D

Examination Category B-D, Item Number B3.110, per Table IWB-2500-1, requires a volumetric examination of all pressurizer nozzle-to-vessel welds as shown in Figure IWB-2500-7(b).

ASME Code, Section XI Examination Method IWA-2200(c)

In accordance with ASME Section XI, IWA-2200(c), all nondestructive examinations (NDE) of the required examination surface or volume shall be conducted to the maximum extent practical. When performing VT-1 visual, surface, radiographic, or ultrasonic examination on a component with defined surface or volume, essentially 100 percent of the required surface or volume shall be examined. Essentially 100 percent coverage is achieved when the applicable examination coverage is greater than 90 percent. However, in no case shall the examination be terminated when greater than 90 percent coverage is achieved if additional coverage of the required examination surface or volume is practical.

3.4 Impracticality of Compliance and Burden Caused by Compliance

Pursuant to 10 CFR 50.55a(g)(5)(iii), the licensee requested relief on the basis that conformance with the above ASME Section XI Code requirements is impractical as conformance would require extensive structural modifications to the component or surrounding structure. Section 10 CFR 50.55a recognizes the limitations to Inservice Inspection of components in accordance with the ASME Code, Section XI, that are imposed due to early plants' design and construction. The licensee stated that a design modification would be required to obtain ASME Code required essentially 100 percent coverage. The licensee contended that it is impractical for MNS Unit 1 to satisfy the ASME Code, Section XI, requirements to perform a volumetric examination of the components listed in Table 1 of the relief request due to the physical component configuration, single sided access, and interference from permanent plant equipment. Table 1 of the relief request provides a summary of the examination limitations for each component for which relief is requested, the outage the component was examined, the coverage percentage obtained for each component, and other pertinent design information. Enclosure 2 provides NDE data and coverage plots that detail the examination limitations.

3.5 Proposed Alternative

In lieu of examination coverage of essentially 100 percent in accordance with the ASME Code, Section XI, the licensee proposed the achieved examination coverage as shown in Table 1 of the relief request.

3.6 Basis for Use

To increase the examination coverage to essentially 100 percent, radiography testing (RT) could be used to examine the subject welds. However, the licensee stated that RT is not a desired option because RT is limited in its ability to detect service-induced flaws. The licensee also considered other manual or automated ultrasonic testing (UT) techniques in addition to the UT technique that was used at MNS, Unit 1, such as conventional or phased array. The licensee further stated that other UT techniques would not increase coverage due to limitation created by the component configuration.

The licensee stated that MNS, Unit 1, has performed the ASME Code, Section XI, required examinations to the maximum extent practical as shown in Table 1 of the relief request. The licensee stated that in most examinations, examination was limited due to the location of reactor core stop lugs below the welds and the RPV outlet nozzle boss. The licensee contended that due to the design of the reactor vessel and location of the core stop lugs and outlet nozzle boss causing these limitations, alternative examination techniques are currently unavailable to increase coverage. As for the pressurizer weld, the licensee stated that the examination limitation was caused by the pressurizer heater wells that limit the available scanning area and nozzle geometry to single sided access.

The licensee stated that it performs the VT-2 visual examinations associated with the Class 1 leakage test each refueling outage. The licensee contended that the volume of coverage obtained during the UT examinations along with ongoing leakage tests every refueling outage provide adequate assurance that any flaw(s) that might have propagated through the subject welds are identified and dispositioned through the corrective action program.

3.7 Duration of Proposed Alternative

The proposed relief request is applicable for the fourth ISI intervals which started on December 1, 2011, and ended on November 30, 2021.

3.8 NRC Staff Evaluation

The NRC staff reviewed the examined weld locations and configurations, coverage drawings and calculations, and examination results based on provisions of the 2007 edition through the 2008 addenda of the ASME Code, Section XI. As such, the NRC staff evaluated the following topics as discussed below in the areas of NDE methods, examination coverage, examination results, defense-in-depth measures, and impracticality and burden of compliance.

NDE Methods

The NRC staff verified that the five reactor vessel welds and one pressurizer weld are required to be examined volumetrically in accordance with the ASME Code, Section XI, IWB-2500. The NRC staff determined that the licensee performed the examination of the subject welds in accordance with the requirements of ASME, Section XI, Appendix VIII, as amended and mandated by 10 CFR 50.55a. The NRC staff noted that the licensee used the examination procedures of the Performance Demonstration Initiative program to satisfy the provisions of the ASME Code, Section XI, Appendix VIII. The NRC staff also noted that the licensee used automated phased array UT method to examine the subject welds, which is an up-to-date examination technique.

Section 6.0 of the relief request states that:

> Based on the volumetric coverage obtained, along with the completed ASME Code required surface examination and System Pressure Tests, it is reasonable to conclude that if significant service induced degradation were occurring, it would have been evident by the examinations and testing that were performed.

Given that Table IWB 2500-1 of the 2007 Edition through 2008 Addenda of the ASME Code, Section XI, requires only ultrasonic examination, not surface examination, to be performed for the subject welds. The NRC staff finds that a surface examination in addition to the ultrasonic examination provides additional coverage than required by the ASME Code; therefore, the NRC staff does not object to the licensee performing a surface examination.

In the licensee's supplement letter dated February 28, 2023, the licensee clarified that no surface examinations were performed on the subject welds. The NRC staff noted that the licensee did perform the ultrasonic examination of the subject welds. Therefore, the NRC staff verified that the licensee has complied with the examination method requirements of the ASME Code, Section XI, Table IWB-2500-1.

Examination Coverage

As shown in Table 1 of the relief request, the NRC staff determined that the licensee has followed the appropriate weld Figures IWB-2500-2 and IWB-2500-7(b) of the ASME Code, Section XI, to examine the subject welds. The NRC staff further determined that the licensee followed the corresponding Code-Required Volume as shown in Figures IWB-2500-2 and IWB-2500-7(b). Therefore, the NRC staff determined that the licensee has satisfied the provisions of the ASME Code, Section XI, in terms of examining Code-required weld volumes.

The NRC staff determined that as shown in the sketches in Enclosure 2, the subject welds were examined to the extent practical. The licensee obtained volumetric coverage ranging from approximately 51.5 percent to 85.1 percent of the required volume. The NRC staff noted that because of limited access, the licensee had only taken partial credit for the ASME Code-required inspection volumes on the subject welds.

Table 1 of the relief request shows that the examination coverage achieved for the lower shell to bottom head circumferential weld 1RPV10-442 and the upper shell at 180° longitudinal weld 1RPV1-442B were 59.6 percent and 51.5 percent of the required volume, respectively. The NRC staff recognizes that this low examination coverage was caused by the interference of the in-core instrumentation nozzles. In the staff's request for additional information (RAI), the NRC staff questioned whether the licensee performed additional best effort examinations beyond the ASME Code requirements. In the licensee's February 28, 2023, dated supplement, the licensee stated that a visual VT-3 examination was performed of the reactor vessel interior per the requirements of ASME Code, Section XI Code, Examination Category B-N-1, Item Number B13.10. The licensee reported that it did not identify any rejectable indications. Considering the limitations and impracticality and burden of compliance, the NRC staff determined that the coverage obtained for each of the subject welds is acceptable.

Examination Results

Table 1 of the relief request states that indications have been detected in four RPV welds, 1RPV1-442B, 1RPV3-442A, 1RPV3-442B, and 1RPV3-442C. The NRC staff noted that the indications detected in the subject welds are acceptable in accordance with the acceptance standards of IWB-3000 of the ASME Code, Section XI. In the staff's RAI. the NRC staff questioned whether these welds will be inspected in the future to monitor the potential growth of the indications. In the licensee's supplemental letter dated February 28, 2023, the licensee stated that the four welds are scheduled to be examined in the current fifth ISI interval per the requirements of Table IWB-2500-1, Examination Category B-A, Item Number B1.12, of the ASME Code, Section XI. The NRC staff verified that the licensee will inspect these four welds in the current fifth ISI interval in accordance with the requirements of the ASME Code, Section XI to monitor the condition of the indications. Therefore, The NRC staff finds that the licensee has complied with the ASME Code, Section XI, and is acceptable.

Defense-in-Depth Measures

The NRC staff noted that as stated in Section 6 of the relief request, the licensee performs a system leakage test and associated VT-2 visual examination during plant startup in accordance with the ASME Code, Section XI, IWA-5000. The NRC staff further noted that MNS, Unit 1, has reactor coolant system (RCS) leakage detection systems to monitor potential leakage from subject welds. The leakage detection instruments are used to quantify leakage from the RCS and are controlled by the plant Technical Specifications. The plant's Technical Specifications Section 3.4.13 has leakage limits as specified by the limiting condition for operation. If RCS leakage is detected, the licensee is required to perform corrective actions. Therefore, the NRC staff determined that the licensee has sufficient defense-in-depth measures to monitor structural integrity of the subject welds.

Impracticality and Burden of Compliance

As shown in the weld configurations and UT examination coverage maps in Enclosure 2, the NRC staff verified that the licensee could not achieve essentially 100 percent examination coverage for the subject welds because of various obstructions at the weld locations. Therefore, the NRC staff recognizes that to achieve essentially 100 percent examination coverage, the licensee would have to modify the welds or remove the obstructions which would be a burden to the licensee.

Summary

The NRC staff determined that if significant service-induced degradation were occurring, there is reasonable assurance that evidence of degradation would be detected by the examination coverages achieved based on the examination coverage obtained for the subject welds.

The NRC staff verified that the licensee performed the volumetric examination for the subject welds to the maximum extent practical. The NRC staff noted that obtaining the ASME Code-required examination volume for the subject welds is impractical because of the obstructions and that the modifications necessary to obtain the required coverage would impose a burden upon the licensee.

The NRC staff finds that there is reasonable assurance that the structural integrity of the subject welds has been maintained because (1) evidence of safety significant service-induced

degradation in subject welds, if it were to occur, would be detected in the examination coverages achieved, and (2) the licensee performed the required pressure testing including visual examination for evidence of leakage in accordance with the ASME Code, Section XI, IWA-5000.

4.0 CONCLUSION

As set forth above, the NRC staff has determined that it is impractical to satisfy the ASME Code required greater than 90 percent examination coverage for the subject welds due to material and component configuration. The NRC staff finds that imposition of the ASME Code requirements would result in an excessive burden to the licensee. The NRC staff has determined that granting the relief request 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.

Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(g)(6)(i). Therefore, the NRC staff grants the use of Relief Request RA-22-0024 for the duration of the fourth 10-year ISI interval at MNS, Unit 1. The fourth 10-year ISI interval began on December 1, 2011, and ended on November 30, 2021.

All other ASME Code, Section XI requirements for which relief has not been specifically requested and approved in this relief request remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributors: Eric Palmer, NRR
John Tsao, NRR

Date: June 20, 2023

SUBJECT: WILLIAM B. MCGUIRE NUCLEAR STATION, UNIT 1 – RELIEF REQUEST IMPRACTICAL REACTOR SYSTEM WELDS (EPID L-2020-LLR-0065) DATED JUNE 20, 2023

DISTRIBUTION:
PUBLIC
LPL2-1 R/F
RidsAcrs_MailCTR Resource
RidsNrrDorlLpl2-1 Resource
RidsNrrLAKGoldstein Resource
RidsNrrPMMcGuire Resource
RidsRgn2MailCenter Resource
RidsNrrDnrlNvib Resource
JTsao, NRR
EPalmer, NRR

ADAMS Accession No.: ML23159A271

OFFICE	DORL/LPL2-1/PM	DORL/LPL2-1/LA	DNRL/NVIB/BC
NAME	JKlos	KGoldstein (KEntz for)	ABuford
DATE	6/8/2023	6/9/2023	4/7/2023
OFFICE	DORL/LPL2-1/(A)BC	DORL/LPL2-1/PM	
NAME	MMarkley (EMiller for)	JKlos	
DATE	6/14/2023	6/20/2023	

OFFICIAL RECORD COPY