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

May 1, 2017

Mr. Steven D. Capps
Vice President
McGuire Nuclear Station
Duke Energy Carolinas, LLC
12700 Hagers Ferry Road
Huntersville, NC 28078-8985

SUBJECT: MCGUIRE NUCLEAR STATION, UNIT 2 - RELIEF REQUEST 17-MN-001, ALTERNATIVE FOR REPAIR OF CLASS 1 PIPING (CAC NO. MF9344)

Dear Mr. Capps:

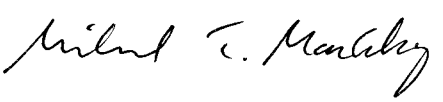
By letter dated March 2, 2017, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17061A505), as supplemented by letter dated March 13, 2017 (ADAMS Accession No. ML17080A152, not publically available), Duke Energy Carolinas, LLC (Duke Energy, the licensee) submitted Relief Request (RR) 17-MN-001 for relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, IWA-4420, at McGuire Nuclear Station (MNS), Unit 2. Specifically, 17-MN-001 provides an alternative for the temporary repair of a degraded boron injection line to the reactor coolant system cold leg piping.

The U.S. Nuclear Regulatory Commission (NRC) staff has concluded that the proposed alternative provides reasonable assurance of structural integrity of the subject piping and that complying with the specified ASME Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC staff authorizes the use of RR 17-MN-001 until next MNS, Unit 2 refueling outage which is scheduled for spring 2017.

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

If you have any questions, please contact the Project Manager, Michael Mahoney at 301-415-3867 or via e-mail at Michael.Mahoney@nrc.gov.

Sincerely,



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

Docket No. 50-370

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 17-MN-001

ALTERNATE REPAIR OF BORON INJECTION LINE TO COLD LEG

MCGUIRE NUCLEAR STATION, UNIT 2

DUKE ENERGY CAROLINAS, LLC.

DOCKET NO. 50-370

1.0 INTRODUCTION

By letter dated March 2, 2017 (Agencywide Documents and Access Management System (ADAMS) Accession No. ML17061A505) with supplement dated March 13, 2017 (ADAMS Accession Nos. ML17080A152, not publically available, contains proprietary information), Duke Energy Carolinas, LLC (Duke Energy, the licensee) requested relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, IWA-4420, at McGuire Nuclear Station (MNS), Unit 2.

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(2), the licensee requested to use Relief Request (RR) 17-MN-001 for the temporary repair of a degraded boron injection line to the reactor coolant system cold leg piping on the basis that compliance with the specified ASME requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

On March 3, 2017 (ADAMS Accession No. ML17065A045), the U.S. Nuclear Regulatory Commission (NRC) staff verbally authorized the use of RR 17-MN-001 for MNS, Unit 2 until next MNS, Unit 2 refueling outage which is scheduled to begin in spring 2017. The NRC staff determined that the proposed relief request is technically justified and provides reasonable assurance of the structural integrity of the affected piping. This safety evaluation documents the technical basis of the NRC's verbal authorization.

2.0 REGULATORY EVALUATION

Section 50.55a(g)(4) of 10 CFR states, in part, that ASME Code Class 1, 2, and 3, components (including supports) shall 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 (ISI) of Nuclear Power Plant Components." Section 50.55a(z) of 10 CFR states, in part, that alternatives to the requirements of 10 CFR 50.55a(g) may be used, when authorized by the NRC, if the licensee demonstrates (1) the proposed alternatives would provide an acceptable level of quality and safety or (2) compliance with the specified

requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Based on the above, and subject to the following technical evaluation, the NRC staff concludes that regulatory authority exists for the licensee to request and the NRC staff to authorize the alternative proposed by the licensee.

3.0 TECHNICAL EVALUATION

3.1 ASME Code Components Affected

The affected component is ASME Class 1, nominal pipe size (NPS) 1.5 inches, Schedule 160, 5D bend boron injection piping connected to 2D reactor coolant system (RCS) cold leg piping. The piping material is stainless steel SA-376, TP304.

3.2 Applicable Code Edition and Addenda

ASME Code, Section XI, 2007 Edition with the 2008 Addenda.

3.3 Applicable Code Requirements

The ASME Code, Section XI, IWA-4420 requires, in part, that defects be removed or mitigated in accordance with the requirements of IWA-4421(a), (b), or (c). The licensee requested relief from the defect removal requirements of IWA-4420 to allow installation of a weld overlay to repair the subject piping.

3.4 Reason for Request

On February 23, 2017, the licensee detected an unisolable pressure boundary leak in the boron injection line to 2D RCS cold leg piping during plant operation, requiring a unit shutdown to perform a repair/replacement activity. The flawed area of piping is located approximately 5.75 inches from the pipe to nozzle weld 2NC2FW45-5, on the intrados of the 5D elbow bend. The flaw was located approximately 45 degrees between the bottom and side of the piping circumference at a skew angle of approximately 45 degrees to the piping axis.

The licensee observed the flaw open to the outside surface of the pipe approximately 0.6 inches of length. The flaw was ultrasonically sized with a combined surface and subsurface length of approximately 1.3 inches. The licensee characterized the flaw as an off-axis axial flaw. Adjacent to the surface-breaking flaw, the licensee also detected two additional low amplitude indications at approximately 0.1 to 0.15 inches below the leaking flaw and another indication of significant amplitude was observed, approximately 0.25 inches above the leaking flaw, with a length of approximately 0.25 inches. The licensee detected a total of four off-axis flaws, including the leaking flaw.

To repair the flaws, the licensee proposed to perform a temporary weld overlay repair using ASME Code, Section XI, Appendix Q, as modified in this request. Compliance with the requirement of the ASME Code, Section XI, IWA-4420, to remove the defect and perform an ASME Code repair in accordance with IWA-4000 will require draining of the RCS loops below the level necessary for operability of the RHR system. This requires the reactor to be defueled. The licensee notes that performing an ASME Code repair to comply with the requirement of

IWA-4420 would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

3.5 Proposed Alternative and Basis for Use

In lieu of performing a repair or replacement to remove the defect in accordance with the ASME Code, Section XI, IWA-4200 and IWA-4420, the licensee proposed to use the ASME Code, Section XI, Non-mandatory Appendix Q for the temporary repair of the subject piping with exceptions and modifications. All other applicable requirements of the ASME Code, Section XI, 2007 Edition with the 2008 Addenda, IWA-4000 will be met. The discussion below is organized to the same subsections as in Appendix Q.

Scope, Q-1000

In lieu of paragraph Q-1000 of the ASME Code, Section XI, Appendix Q, the licensee proposed to install a weld overlay on pipe base material of the boron injection line instead of on a weld.

Prerequisites, Q-2000

In accordance with paragraph Q-2000(a), the licensee will use low carbon stainless steel weld metal to install a weld overlay covering 360 degrees around the circumference of the degraded area of the subject pipe.

Paragraph Q-2000(b) requires that prior to deposition of the weld overlay, the surface to be repaired shall be examined by the liquid penetrant method. Indications greater than 1/16 inch shall be removed, reduced in size, or corrected in accordance with the following requirements, prior to application of weld reinforcement. One or more layers of weld metal shall be applied to seal unacceptable indications in the area to be repaired with or without excavation. The thickness of these layers shall not be used in meeting weld reinforcement design thickness requirements. Peening the unacceptable indication prior to welding is permitted.

To satisfy Paragraph Q-2000(b), the licensee has performed ultrasonic testing (UT) and penetrant testing on the leaking flaw and its vicinity. The licensee reported that subsequent UT of the pipe after the leak occurred did not find flaws in the 5D bent pipe and nozzle area other than the three flaws that were detected. In addition, the licensee conducted penetrant testing on the 5D pipe bend prior to overlay installation and did not detect flaws other than those four flaws. The licensee stated that they will install a seal weld on the leaking flaw prior to installing the weld overlay.

Paragraph Q-2000(c) requires that if correction of indications in paragraph Q-2000(b) is required, the area where the weld reinforcement is to be deposited, including any local repairs or initial weld overlay layers, shall be examined by the liquid penetrant method. The area shall contain no indications greater than 1/16 inches prior to the application of the structural layers of the weld overlay. The licensee stated that they will apply a seal weld on the leaking flaw and perform penetrant testing of the affected area of the pipe before installing the weld overlay.

The licensee did not take exception to paragraph Q-2000(d) which requires that the weld overlay will consist of at least two weld layers having as-deposited delta ferrite content of at least 7.5 ferrite number (FN). The first layer of weld metal with delta ferrite content of at least 7.5 FN shall constitute the first layer of the weld reinforcement that may be credited toward the required thickness. Alternatively, first layers of at least five FN are acceptable, provided the

carbon content of the deposited weld metal is determined by chemical analysis to be less than 0.02 percent.

The licensee did not take exception to paragraph Q-2000(e) which prohibits the use of the submerged arc welding method for weld overlays.

Design Considerations, Q-3000

Paragraphs Q-3000(a) requires that flaw characterization and evaluation requirements be based on the as-found flaw. However, the size of the as-found flaws shall be projected to the end of design life of the overlay. Crack-growth, including stress corrosion cracking and fatigue crack-growth, shall be evaluated using the ASME Code, Section XI, IWB-3640.

To characterize the flaws per paragraph Q-3000(a), the licensee performed UT of the subject piping using conventional angle beam with a 38-degree search unit, which produces an approximately 60-degree impingement angle, for the circumferential scan direction and a 45-degree search unit for the axial scan direction. The licensee also used 60- and 70-degree search units for axial scans. The licensee interrogated the full circumference of the piping base material in four scanning directions, from the pipe-to-nozzle weld down to the first upstream pipe coupling, which encompassed the entire 5D elbow bend. The licensee also examined one inch bands of base material of the upstream socket welds 2NC2FW45-6 and 2NC2FW45-7.

The licensee stated that detected cracking is likely being influenced by residual stress from forming the 5D bend, applied torsional stress, or both. Torsional stress at the nozzle area and 5D bend is suspected because of pipe interaction with a pipe rupture restraint installed near the bottom of the vertical piping segment just upstream from (below) the 5D bend. The licensee determined that the piping was misaligned with the adjacent rupture restraint, and contact between the pipe and the rupture restraint is suspected due to the anticipated thermal movement of the pipe. This would generate torsion stresses at the upper nozzle/pipe area and is suspected of being a contributor to the cause of the flaws. The licensee stated that they will modify the restraint to provide adequate clearances between the pipe and the pipe restraint prior to returning the unit to service.

The licensee stated that axial cracking near the intrados (in the "cheeks") of a pipe bend is a common location for inside diameter-initiated axial cracks due to the residual stress patterns formed in cold-formed pipe bends. The straightness of the cracking implies a fatigue mechanism, which could be caused by either thermal and/or mechanical fatigue. The 5D bend was fabricated by a vendor using piping material supplied by the licensee and was installed during the MNS, Unit 2014 refueling outage.

The licensee considered thermal fatigue as a contributor to the degradation because of the flaw being in the susceptible area based on the Electrical Power Research Institute (EPRI) topical report, MRP-146, "Thermal Fatigue in Normally Stagnant Non-Isolable RCS Branch Lines". However, the flaw orientations are atypical of thermal fatigue cracks observed previously at McGuire. The licensee will collect vibration data to confirm whether mechanical fatigue due to vibration has contributed to, or caused pipe cracking. However, previously collected vibration data does not support mechanical fatigue as the likely cause. The licensee stated that they are actively working to determine the root cause of this event, but a final, conclusive cause cannot be determined until the 5D bend containing the flaws is removed and metallurgical analysis is completed during the spring 2017 MNS, Unit 2 refueling outage.

The licensee has performed the crack-growth and weld overlay sizing calculations and has demonstrated that the proposed weld overlay will encapsulate any potential crack-growth until the next MNS, Unit 2 refueling outage in spring 2017.

Paragraphs Q-3000(a)(1), (a)(2), and (a)(3) are applicable to circumferential flaws. As stated above, the four detected flaws are off-axis axial flaws. Therefore, Q-3000(a)(1), (a)(2), and (a)(3) are not applicable.

Paragraphs Q-3000(a)(4) requires that for axial flaws 1.5 inches or longer, or for five or more axial flaws of any length, the flaws shall be assumed to be 100 percent through the original pipe wall thickness for the entire axial length of the flaw for the entire circumference of the pipe. The licensee did not take exception to Q-3000(a)(4) and has performed a flaw evaluation assuming the axial flaws are 100 percent through-wall.

Paragraph Q-3000(a)(5) requires that for weldments with four or fewer axial flaws, each shorter than 1.5 inches, and no circumferential flaws, the weld reinforcement shall satisfy the requirements of Q-2000(d). No additional structural reinforcement is required. The axial length of the overlay shall cover the weldment and the heat affected zones, and shall extend at least 0.5 inches beyond the ends of the observed flaws.

In lieu of the requirement of paragraph Q-3000(a)(5), the licensee stated that the axial length of the overlay will cover the flaws and extend at least 0.5 inches beyond the ends of the observed flaws in the pipe base material. The licensee noted that there is no weld or heat affected zone in the degraded area of the subject pipe, so the requirement of paragraph Q-3000(a)(5) related to the weldment and heat affected zones is not applicable.

Paragraph Q-3000(b)(1) requires, in part, that the axial length and end-slope of the weld overlay shall cover the weldment and the heat affected zones on each side of the weldment. In addition, the weld overlay shall provide for load redistribution from the pipe into the weld overlay and back into the pipe without violating applicable stress limits for primary local and bending stresses and secondary and peak stresses, as required by the Construction Code. In lieu of the requirement of paragraph Q-3000(b)(1) that the axial length and end-slope of the weld overlay shall cover the weldment and heat affected zones on each side of the weldment, the proposed alternative requires that the axial length and end slope of the weld overlay cover the flaws identified in the pipe base material. The licensee stated that there is no weld or heat affected zone in the degraded area of the subject pipe; therefore, the requirement of Q-3000(b)(1) related to the weldment and heat affected zones is not applicable.

The licensee did not take exception to Paragraph Q-3000(b)(2) which requires that unless specifically analyzed in accordance with Q-3000(b)(1), the end transition slope of the overlay shall not exceed 45 degrees. Paragraph Q-3000(b)(2) recommends a slope of not more than 1:3.

The licensee did not take except to Paragraph Q-3000(b)(3) which requires that the overlay design thickness of items meeting Q-3000(a)(2), (3), or (4) be based on the measured diameter, using the thickness of the weld overlay as restricted by Q-2000(d). The wall thickness at the weld overlay, any planar flaws in the weld overlay, and the effects of any discontinuity (e.g., another weld overlay or reinforcement for a branch connection) within a distance of $2.5\sqrt{Rt}$ from the toes of the weld overlay, shall be evaluated and shall meet the requirements of the ASME Code, Section XI, IWB-3640.

The licensee did not take except to Paragraph Q-3000(b)(4) which requires that the effects of any changes in applied loads, as a result of weld shrinkage, on existing flaws previously accepted by analytical evaluation be evaluated in accordance with the ASME Code, Section XI, IWB-3640.

Examination and Inspection, Q-4000

Examination, Q-4100

The licensee did not take exception to Paragraph Q-4100(a) which requires that the weld overlay have a surface finish of 250 micro-inches (6.3 micrometers) root-mean-square (RMS) or better and a flatness sufficient to allow for adequate examination in accordance with procedures qualified in accordance with the ASME Code, Section XI, Appendix VIII. The weld overlay shall be examined to verify acceptable configuration.

The licensee did not take exception to Paragraph Q-4100(b) which requires that the weld overlay and the adjacent base material for at least 0.5 inches from each side of the weld be examined using the liquid penetrant method. The weld overlay shall satisfy the surface examination acceptance criteria for welds of the Construction Code or ASME Code, Section III, NB-5300. The adjacent base metal shall satisfy the surface examination acceptance criteria for base material of NB-2500.

Paragraph Q-4100(c) requires, in part, that the examination volume in Figure Q-4100-1 be ultrasonically examined to assure adequate fusion (i.e., adequate bond) with the base metal and to detect welding flaws such as interbead lack of fusion, inclusions, or cracks. Planar flaws in Class 1 piping shall meet the preservice examination standards of the ASME Code, Section XI, Table IWB-3514-1. The licensee stated that it will follow the requirement of paragraph Q-4100(c) except that in lieu of the weld shown in Figure Q-4100-1, the overlay will be installed over as-found flaws in the pipe base material. The licensee noted that this exception does not change the examination volume that it will perform on the overlaid pipe as specified in Figure Q-4100-1.

The licensee did not take exception to paragraph Q-4100(d) which requires that after completion of all welding activities, affected restraints, supports, and snubbers shall be VT-3 visually examined to verify that design tolerances are met.

Preservice Inspection, Q-4200

Paragraph Q-4200(a) requires that the examination volume in Fig. Q-4300-1 be ultrasonically examined. The angle beam shall be directed perpendicular and parallel to the pipe axis, with scanning performed in four directions to locate and size cracks that have propagated into the upper 25-percent of the pipe base material or into the overlay.

The licensee stated that preservice ultrasonic examination will be performed in accordance with Q-4200, using the ASME Code, Section XI, Appendix VIII qualified procedure, personnel, and equipment. The licensee further stated that the examination will be performed using UT procedure EPRIWOL-PA-1, "Nondestructive Evaluation: Procedure for Manual Phased Array Ultrasonic Testing of Weld Overlays," which is qualified to accurately detect and size discontinuities within the specified examination volume from the outside diameter overlay surface. Additionally, the diameter and thickness of weld overlay being examined is within the qualification Ranges of Applicability as described in EPRIWOL-PA-1. The licensee noted that

although EPRIWOL-PA-1 is intended for use in examining overlays of similar and dissimilar metal welds (and adjacent base material), the technical requirements and qualification conditions are specified and are applicable to the underlying pipe base material. According to the licensee, EPRIWOL-PA-1 meets the intent of the ASME Code, Section XI, Appendix VIII for the proposed examinations.

The licensee stated that in lieu of the preservice examination volume A-B-C-D shown in Figure Q-4300-1 as specified by paragraph Q-4200(a), the proposed examination volume will extend a minimum of 0.5 inches beyond both ends of the flaws to be overlaid. The depth of the proposed examination volume will extend from the outer diameter surface of the weld overlay to points C and D, located at a depth of t/4 (where t is the thickness of the pipe), as shown in Figure Q-4300-1. The licensee stated that there is no weld in the affected area of the subject pipe requiring weld overlay, so the examination volume shown in Figure Q-4300-1 extending 0.5 inches from the toe of the weld is not applicable.

The licensee did not take exception to Paragraph Q-4200(b) which requires that for Class 1 piping, the preservice examination acceptance standards of Table IWB-3514-1 be satisfied for the weld overlay. Cracks in the outer 25-percent of the pipe base metal shall meet the design analysis requirements of Q-3000.

Inservice Inspection, Q-4300

The inservice inspection requirements of paragraph Q-4300 are not applicable to the proposed alternative because the licensee will remove the overlaid pipe during the MNS, Unit 2 spring 2017 refueling outage.

Additional Examinations, Q-4310

Paragraph Q-4310 requires additional examinations if inservice examinations detect an unacceptable indication or crack-growth in the weld overlay. The requirements of paragraph Q-4310 are not applicable because the licensee will not perform any inservice inspections and will remove the weld overlay during the MNS, Unit 2 spring 2017 refueling outage.

Pressure Testing, Q-4400

The licensee did not take exception to Paragraph Q-4400 which requires that pressure testing be conducted in accordance with the ASME Code, Section XI, IWA-4540.

3.6 Duration of Proposed Alternative

The licensee requested to use the proposed alternative during the fourth inservice inspection interval, which began on July 15, 2014, and is currently scheduled to end on December 14, 2024. The licensee requested the proposed alternative to be effective until the MNS, Unit 2 spring 2017 refueling outage, during which the licensee will remove the affected pipe and weld overlay and perform a permanent repair or replacement in accordance with the ASME Code, Section XI, IWA-4000.

4.0 NRC Staff Evaluation

The NRC staff evaluated the proposed alternative in the topics of scope, prerequisites, design considerations, examinations, and pressure testing in accordance with Appendix Q of the ASME Code, Section XI, 2007 edition.

Scope, Q-1000

Paragraph Q-1000 specifies that Appendix Q is applicable for the installation of a stainless steel weld overlay on an existing stainless steel weld. The NRC staff concludes that Appendix Q does not specifically prohibit installing a weld overlay on pipe base metal. The licensee proposed to install a stainless steel weld overlay on the subject pipe which is fabricated with stainless steel. Therefore, in terms of stresses, materials properties, and crack-growth, the NRC staff does not find adverse impact on the structural integrity of the subject pipe if the proposed weld overlay is installed on pipe base metal for a short duration (a maximum of 60 days).

The NRC staff concludes that for those Appendix Q requirements that are not applicable to the pipe base metal application, the licensee has taken appropriate exceptions and provided alternative modifications. Therefore, the NRC staff concludes that the licensee's proposed alternative satisfies the intent of paragraph Q-1000.

Prerequisites, Q-2000

The NRC staff concludes that the licensee did not take exception to and will follow the requirement of Q-2000(a) to use low carbon stainless steel weld metal to fabricate the weld overlay.

The NRC staff concludes that the proposed alternative satisfies Q-2000(b) because the licensee has inspected the degraded area of the subject pipe with penetrant testing prior to the weld overlay installation and that the licensee will install a seal weld at the leaking flaw prior to installing the weld overlay.

The NRC staff concludes that the licensee did not take exception to paragraph Q-2000(c) and will perform a penetrant test after the seal weld is installed and prior to the weld overlay installation.

The NRC staff notes that the licensee did not take exception to Q-2000(d) and (e).

Based on above, the NRC staff concludes that the proposed alternative satisfies the prerequisite requirements of paragraph Q-2000.

Design Considerations, Q-3000

The NRC staff concludes that the proposed alternative is acceptable and has satisfied the flaw characterization requirements of Q-3000(a) because: (a) the licensee has performed UT of the degraded area and has reported the flaw length and depth, (b) the licensee has evaluated the potential cause of the flaws, (c) the licensee has appropriately calculated crack-growth and the design of the weld overlay is based on the final crack size, and (d) the licensee has demonstrated that the final flaw size will not exceed the length and thickness of the weld overlay for the design life of the repair.

The NRC staff notes that Paragraphs Q-3000(a)(1), (a)(2), and (a)(3) are related to circumferential flaws. The four flaws in the subject pipe are axial flaws; therefore, paragraphs Q-3000(a)(1), (a)(2), and (a)(3) are not applicable.

Paragraph Q-3000(a)(5) requires, in part, that the axial length of the overlay shall cover the weldment and the heat affected zones, and shall extend at least 0.5 inches beyond the ends of the observed flaws. In lieu of this requirement, the proposed alternative requires that the axial length of the overlay will cover the flaws and extend at least 0.5 inches beyond the ends of the observed flaws in pipe base metal. The licensee noted that there is no weld or heat affected zone in the proposed repair, so the requirement related to the weldment and heat affected zones is not applicable. The NRC staff finds that the licensee's exception is acceptable because the proposed alternative repairs pipe base metal, is not an existing weld. The NRC staff notes that based on the licensee's design drawing, the weld overlay length will extend much more than 0.5 inches beyond ends of the four flaws; therefore, the NRC staff concludes that the licensee's proposed modification is acceptable and satisfies the intent of paragraph Q-3000(a)(5).

Paragraph Q-3000(b)(1) requires, in part, that axial length and end-slope of the weld overlay shall cover the weldment and the heat affected zones on each side of the weldment. In lieu of the requirement, the proposed alternative requires that the axial length and end-slope of the weld overlay cover the flaws identified in the pipe base material. The licensee stated that there is no weld or heat affected zone in the repaired area, the requirement of Q-3000(b)(1) related to the weldment and heat affected zones is not applicable. The NRC staff concludes that the proposed exception is acceptable because the proposed repair is applicable to pipe base metal, not to an existing weld. The NRC staff concludes that the proposed weld overlay is acceptable and will cover the existing four flaws. The NRC staff concludes that the licensee's proposed alternative is acceptable and satisfies the intent of paragraph Q-3000(b)(1).

Examination and Inspection, Q-4000

Examination, Q-4100

The NRC staff finds acceptable that the licensee did not take exception to Q-4100(a).

Paragraph Q-4100(b) requires, in part, that the weld overlay and the adjacent base material for at least 0.5 inches from each side of the weld shall be examined using the liquid penetrant method. The licensee should have taken, but did not take, an exception to this requirement because Paragraph Q-4100(b) is related to the examination of an overlaid weld, not of an overlaid pipe as specified in the proposed alternative. The NRC staff does not find adverse impact to the structural integrity of the proposed overlaid pipe simply because Paragraph Q4100(b) requires an examination of an overlaid weld whereas the proposed alternative specifies an examination of overlaid pipe. The key requirement is whether the licensee will or will not perform the liquid penetrant examination of the overlaid pipe. The NRC staff concludes that since the licensee did not request an exception to the liquid penetrant examination, the licensee will perform the liquid penetration examination of the overlaid pipe. Therefore, the NRC staff concludes that the proposed alterative satisfies the intent of paragraph Q-4100(b).

The licensee stated that it will follow the requirement of paragraph Q-4100(c) except that in lieu of the weld shown in Figure Q-4100-1, the weld overlay will be installed over as-found flaws in the pipe base material. The licensee noted that this exception does not change the examination volume specified in Figure Q-4100-1. The NRC staff concludes that, although the licensee

takes exception to paragraph Q-4100(c) with regard to Figure Q-4100-1, the licensee will not change the examination volume specified in Figure Q-4100-1. Therefore, the NRC staff concludes that the proposed alterative satisfies the intent of paragraph Q-4100(c).

The NRC staff finds acceptable that the licensee did not take exception to paragraph Q-4100(d).

Preservice Inspection, Q-4200

Paragraph Q-4200(a) requires, in part, that the examination volume in Fig. Q-4300-1 be ultrasonically examined as part of preservice inspection. Figure Q-4300-1 requires the ultrasonic examination of a specific volume of a repaired weld. The licensee took the exception to the examination volume in Figure Q-4300-1 because the proposed weld overlay is applied to pipe base metal, not an existing weld. As such, the examination volume A-B-C-D shown in Figure Q-4300-1 extending 0.5 inches from the toe of the weld is not applicable. In lieu of the required examination volume shown in Figure Q-4300-1, the licensee proposed an examination volume that will extend a minimum of 0.5 inches beyond both ends of the four flaws to be overlaid. The NRC staff concludes that the licensee proposed modification to the examination volume for the overlaid pipe is acceptable and is equivalent to the examination volume specified in Figure Q-4300-1 because the licensee will examine the weld overlay to include a minimum of 0.5 inches beyond both ends of the flaws.

The NRC staff concludes that the licensee's use of procedure EPRIWOL-PA-1, which is qualified through the industry performance demonstration initiative program, is acceptable. The NRC has approved the performance demonstration initiative program which provides UT procedures to meet the requirements of the ASME Code, Section XI, Appendix VIII. The licensee stated that EPRIWOL-PA-1 is specifically developed to examine flaws in overlaid welds; however, EPRIWOL-PA-1 is applicable for the UT of overlaid pipe base metal. The NRC staff finds acceptable that EPRIWOL-PA-1 procedure will be used to examine the overlaid pipe because EPRIWOL-PA-1 should not diminish the inherent capability and reliability of UT technique when it is used to examine pipe base metal in lieu of a weld. Therefore, the NRC staff concludes that the proposed alterative satisfies the intent of paragraph Q-4200(a).

The NRC staff finds acceptable that the licensee does not take exception to and will follow paragraph Q-4200(b) which requires that the acceptance standards of the ASME Code, Section XI, Table IWB-3514-1 be satisfied for the weld overlay and that cracks in the outer 25-percent of the pipe base metal shall meet the design analysis requirements of paragraph Q-3000.

Inservice Inspection, Q-4300

The NRC staff concludes that the inservice inspection requirements of Section Q-4300 do not apply to the proposed alternative because the overlaid pipe will be removed during the MNS, Unit 2 spring 2017 refueling outage and inservice inspections are not needed.

Additional Examinations, Q-4310

The NRC staff concludes that the additional examination requirements of paragraph Q-4310 do not apply to the proposed alternative because the overlaid pipe will be removed during the MNS, Unit 2 spring 2017 refueling outage and additional examinations are not needed.

Pressure Testing, Q-4400

Paragraph Q-4400 requires a pressure test of repaired pipes in accordance with the ASME Code, Section XI, IWA-4540. Article IWA-4540 requires that unless exempted by IWA-4540(b), repair/replacement activities performed by welding or brazing on a pressure-retaining boundary shall include a hydrostatic or system leakage test in accordance with IWA-5000, prior to, or as part of, returning to service. The NRC staff concludes that the exemption of IWA-4540(b) is not applicable to the proposed weld overlay repair because the welding activity penetrates the pressure boundary; therefore, the proposed alternative cannot be exempted from a pressure test. The NRC staff finds acceptable that the licensee does not take exception to paragraph Q-4400 and that the licensee will perform a pressure test. Therefore, the NRC staff concludes that the proposed alternative satisfies paragraph Q-4400.

Hardship Justification

The NRC staff finds that to perform an ASME Code repair, the licensee will require to drain the RCS loops below the level necessary for operability of the RHR system. This requires the reactor to be defueled which imposes an unnecessary and additional transients on the safety equipment and components. The NRC concludes that, considering that the proposed temporary repair will provide reasonable assurance of the structural integrity of the subject pipe, requiring the licensee to perform the ASME Code repair would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety.

5.0 CONCLUSION

The NRC staff concludes that the proposed RR 17-MN-001 provides reasonable assurance of structural integrity and leak tightness of the subject boron injection piping. The NRC staff also concludes that, complying with the ASME Code requirement would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC authorizes the proposed alternative in RR 17-MN-001 for the MNS, Unit 2 until the next refueling outage which is scheduled for spring 2017.

All other requirements of ASME Code, Section XI, for which relief was not specifically requested and authorized by the NRC staff remain applicable, including the third party review by the Authorized Nuclear In-service Inspector.

Principal Contributor: John Tsao

Date: May 1, 2017.

SUBJECT: MCGUIRE NUCLEAR STATION, UNIT 2 - RELIEF REQUEST 17-MN-001, ALTERNATIVE FOR REPAIR OF CLASS 1 PIPING (CAC NO. MF9344) DATED: MAY 1, 2017.

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