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Serial No: MNS-16-053

June 23, 2016

10 CFR 50.55a

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

Subject: Duke Energy Carolinas, LLC (Duke Energy)
McGuire Nuclear Station, Unit 1
Docket No. 50-369
Relief Request 16-MN-002
Alternative to Defect Removal Prior to Performing Repair Activities on Nuclear Service Water System Piping

Pursuant to 10 CFR 50.55a(z)(2), Duke Energy hereby requests U.S. Nuclear Regulatory Commission's approval for an alternative to defect removal prior to performing repair activities on Nuclear Service Water System piping. Enclosure 1 contains details regarding this request.

If you have any questions or require additional information, please contact P.T. Vu of Regulatory Affairs at (980) 875-4302.

Sincerely,

Steven D. Capps

Enclosure

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NRR

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**Enclosure 1**

**Duke Energy Carolinas, LLC**

**McGuire Nuclear Station, Unit 1**

**Relief Request Serial # 16-MN-002**

**Relief Requested in Accordance with 10 CFR 50.55a(z)(2) to use an Alternative to Defect Removal Prior to Performing Repair/Replacement Activities on Nuclear Service Water System Piping**

## 1. ASME Code Component(s) Affected

Nuclear Service Water (RN) System ASME Class 3 components listed below:

1.1. 36 inch and 42 inch diameter buried and underground supply piping from valve 1RN-1 at the Low Level Intake (LLI) at Cowans Ford Dam to the Auxiliary Building, and supply piping from the Auxiliary Building wall to isolation valves 0RN-010AC, 0RN-012AC, and 0RN-301AC in the Auxiliary Building. This piping contains raw water from Lake Norman.

1.2. 30 inch and 36 inch diameter buried and underground supply and return piping from the Standby Nuclear Service Water Pond (SNSWP) to the Auxiliary Building, and supply and return piping from the Auxiliary Building wall to isolation valves 0RN-07A, 0RN-09B, 0RN-0149A, and 0RN-152B in the Auxiliary Building. This piping contains raw water drawn from, and returned to, the SNSWP.

1.3. Design data applicable to the above piping is as follows:

| | |
|---|---|
| Nominal Wall Thickness: | 0.5 inches |
| Design Pressure: | 25 to 35 psig |
| Design Temperature: | 95 to 150 degrees, F |
| Material of Construction: | Carbon Steel |

1.4. The above piping does not have an internal coating system, but the exterior of this piping was coated with coal tar epoxy in accordance with Duke Energy Specification MCS-1152.00-00-0001.

1.5. The above piping is considered to be either buried or underground, as defined below, or is not isolable between the interior of the Auxiliary Building wall and the specified isolation valves. The following definitions are consistent with those developed by the Nuclear Energy Institute (NEI) and shall apply to buried or underground piping identified above.

1. Underground piping is defined as piping that is below grade, not accessible, and outside of buildings.
2. Buried piping is defined as underground piping that is in direct contact with the soil.
3. Underground or buried piping is considered inaccessible if removal of security devices or manways, use of lifting rigs, or performance of excavation, or modification of building structures, armored embedded structures or encasements is required to facilitate access to the piping surfaces.

## 2. Applicable Code Edition and Addenda

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

## 3. Applicable Requirement

3.1. IWA-4400 specifies requirements for welding, brazing, metal removal, fabrication, and installation.

3.2. IWA-4420 specifies requirements for defect removal, evaluation, and examination.

Relief is requested from the requirement of IWA-4400 that defective portions of components be removed prior to performing a repair/replacement activity by welding.

**4. Reason for Request**

4.1. McGuire plans to continue to inspect portions of buried and underground Class 3 Nuclear Service Water (RN), including portions of piping identified in this request, in accordance with requirements of the McGuire Buried Piping Integrity Program, during the Unit 1 4th inservice inspection interval. The McGuire Buried Piping Integrity Program was developed for the purpose of maintaining the safe and reliable operation of all buried piping systems within its scope, including portions of the RN System, and was developed in direct response to industry awareness of aging buried pipe issues. Subsequently, NEI and the Buried Piping Integrity Task Force developed and issued NEI 09-14, "Guideline for the Management of Buried Piping Integrity" on February 4, 2010 to facilitate the industry implementation of the Initiative. Duke Energy believes that these examinations will help to confirm the structural and leak-tight integrity of these components, providing additional assurance that the RN system can continue to perform its intended safety function.

4.2. If excessive wall thinning or through-wall leakage resulting from internal or external corrosion is detected during inspections of the piping identified in this request, the defective areas would require repair in accordance with the ASME Code, Section XI, 2007 Edition with the 2008 Addenda, IWA-4000. Prior to performing repair/replacement activities by welding, the defective portions of the component must be removed.

4.3. Because some degradation or through-wall leakage may not be detectable until buried or underground piping is made accessible for examination, Duke Energy believes that it is prudent to have an approved repair methodology in place prior to performing further inspections of buried and underground portions of the RN System piping.

4.4. Because piping between the Auxiliary Building wall and the isolation valves identified in this request cannot be isolated to facilitate removal of defective portions of the piping, Duke Energy believes that use of a hot-tapping machine and installation of a branch connection would be necessary, should degradation or through-wall leakage be detected in these piping segments.

4.5. Duke Energy believes that requiring removal of defective portions of this piping prior to performing repair/replacement activities represents a hardship or unusual difficulty without a compensating increase in the level of quality and safety for reasons identified in this request.

**5. Proposed Alternative and Basis for Use**

5.1. In lieu of the requirement of IWA-4400 to remove the defective portion of the component prior to performing repair/replacement activities by welding, the following alternative is proposed:

5.1.1. This alternative shall not be used for defects caused by external corrosion when suitable repair techniques such as wall thickness restoration by welding can be performed without jeopardizing the integrity of the pressure boundary.

5.1.2. This alternative shall not be used for defects containing cracks or crack-like indications.

5.1.3. Unacceptable wall thickness loss or through-wall leakage caused by localized general or pitting corrosion may be repaired without removing the defective portion of the pipe wall, provided the following conditions are met:

1. The cause of the defective conditions shall be addressed by Duke Energy's Corrective Action Program.

2. The defective area shall be encapsulated on the O.D. of the pipe using pressure retaining parts that comply with the Construction Code and Owner's requirements. The diameter of the encapsulation shall not exceed 10 inches Nominal Pipe Size (NPS), and spacing of adjacent encapsulations, if any, shall comply with Construction Code design limits. Figure 1 illustrates an example of an acceptable encapsulation configuration.

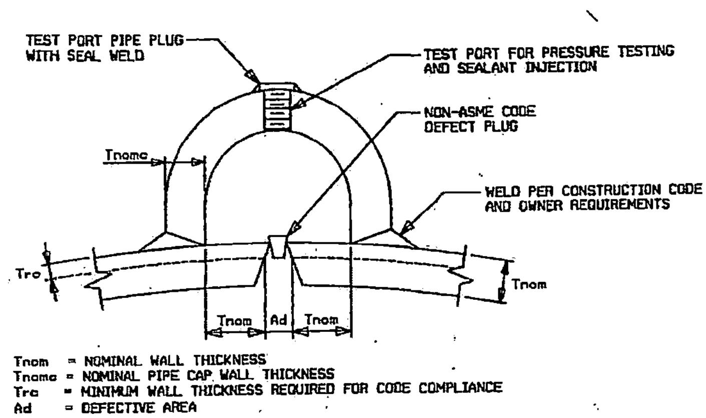


Figure 1

3. For corrosion initiated on the I.D. of the pipe (with or without through-wall leakage), and for corrosion initiated on the O.D. of the pipe that results in through-wall leakage, the repair/replacement activity shall be designed such that the I.D. of the encapsulation is greater than the maximum diameter of the defective area plus twice the nominal thickness of the component. In addition, the nominal thickness of the encapsulation and its connecting weld to the pipe O.D. surface shall be equal to, or greater than, the nominal wall thickness of the pipe.

4. Ultrasonic examination shall be performed to characterize the defect and to confirm that the defect does not contain cracks or crack-like indications. Ultrasonic thickness examinations shall also be performed on all pipe exterior surfaces within an area whose diameter is at least twice that of the encapsulation to confirm the absence of any additional flaws that could adversely affect the design of the modification or integrity of the piping.

5. The encapsulation shall be designed to address continued corrosion of the pipe wall, as follows:

   a. For external general corrosion of the pipe wall that does not result in a through-wall defect, continued corrosion through the thickness of the pipe wall and laterally will be arrested by installing sealant into the encapsulation following pressure testing. This will inhibit continued external corrosion of the pipe wall, as well as protect the interior of the encapsulation from future corrosion. Application of protective coatings on the exterior surfaces of the pipe wall and the encapsulation will inhibit future corrosion of these surfaces.

b. For internal general corrosion of the pipe wall that does not result in through-wall leakage, the design of the encapsulation shall use 2 mils/year for the through-wall and lateral rate of corrosion at the defective area. This corrosion rate is supported by information documented in 5.2.6 of this request.

c. For internal pitting corrosion of the pipe wall, the design of the encapsulation shall use 4 mils/year for the lateral rate of corrosion at the defective area. This corrosion rate is supported by information documented in 5.2.6 of this request.

d. For external corrosion of the pipe wall at locations where localized pitting has resulted in through-wall leakage, external corrosion in the through-wall direction will be arrested by installation of sealant into the encapsulation. In the lateral direction, the design of the encapsulation shall use a corrosion rate of 4 mils/year because Duke Energy believes that the corrosion rate would be no greater than that anticipated for through-wall defects resulting from internal pitting corrosion, as discussed above.

6. When the proposed alternative is used to repair a defective area resulting from external corrosion, all external surfaces of the piping within 5 feet on each side of the repair area shall be visually examined to confirm the absence of similar conditions requiring repair.

7. When the proposed alternative is used to repair a defective area resulting from internal corrosion, all external surfaces of the piping within 5 feet on each side of the repair area shall be examined ultrasonically using 6 inch grids. These examinations provide reasonable assurance that the structural integrity of the piping has not been challenged.

8. Weld surfaces shall be dry, allowing welds to be made in accordance with qualified welding procedures. In the event that temporary plugs are not capable of stopping leakage, additional actions shall be taken to ensure that the weld surfaces are dry. Such actions may include, but are not limited to, installation of a metal plug over the defective area using a seal weld. This plug and its seal weld would be completely encapsulated and would not be relied upon for the leak-tight or structural integrity of the modification.

9. Duke Energy Welding and Metallurgical engineers reviewed the materials and their associated specification grades and determined that they have low hardenability. Duke Energy plans to use stringer beads to deposit the weld in the branch connection groove and reinforcing fillet. Because the stringer bead technique is expected to produce tempering in the Heat Affected Zone (HAZ), use of a temper bead technique was determined to be unnecessary to achieve an acceptable microstructure.

10. After a minimum period of 48 hours from completion of welding, a surface examination (i.e., magnetic particle, liquid penetrant) shall be performed on the weld connecting the encapsulation to the pipe.
11. The encapsulation shall be pressure tested in accordance with IWA-4540 upon completion of the repair/replacement activity to confirm the leak-tight integrity of the encapsulation and its connecting welds to the pipe wall.
12. Following pressure testing, sealant shall be installed into the encapsulation to inhibit corrosion, the pressure test fitting in the encapsulation shall be seal-welded, and protective coatings shall be restored on exterior surfaces of the pipe and the encapsulation in the vicinity of the repair area.
13. The following examinations shall be performed at least once during each Inservice Inspection Period for the duration of the design life of the repair to confirm the absence of leakage from piping locations where encapsulations have been installed. Leakage, if detected, shall be addressed through the McGuire Corrective Action Program:
    a. A visual examination of ground surfaces above buried piping in the vicinity of each encapsulation
    b. A visual examination of underground piping in the vicinity of each encapsulation
    c. A visual examination of each encapsulation installed on piping within the Auxiliary Building
14. Encapsulation of a defective area shall be used only once at each discrete location requiring correction by repair/replacement activity.

5.2. The basis for the proposed alternative is as follows:

5.2.1. For repair of excessive wall thinning caused by external corrosion (without through-wall leakage), restoration of the required component wall thickness could be performed by weld overlay on the exterior of the pipe in accordance with applicable ASME Code requirements. However, the integrity of the pressure boundary could be jeopardized by welding directly on these areas during system operation.

5.2.2. The RN System Low Level Intake supply piping is a single header that is shared between Units 1 and 2, and is difficult to isolate, depressurize, and drain to allow the removal of a defect prior to performing a repair/replacement activity. As a shared line between both units, it is the normal water source for all Nuclear Service Water, and butterfly isolation valve 1RN001 at the low level intake cannot be tested to determine whether it is sufficiently leak-tight to allow the pipe to be isolated and dewatered without entering Technical Specification 3.7.7, Condition A. The first isolation valves after this piping enters the Auxiliary Building are 0RN-10AC, 0RN-012AC, and 0RN-301AC. As such, Duke Energy believes that the use of a hot-tapping machine would be necessary to install a line stop to completely dewater the pipe to perform the defect removal, or to perform the defect removal and repair during system operation.

If a line stop is used to isolate this piping, the RN System would have to operate solely from the Standby Nuclear Service Water Pond (SNSWP) while the Low

Level Intake supply piping is isolated. Because the "A" train of both units aligns to the Low Level Intake on an Engineered Safety Features actuation, repairs would have to be completed within the Technical Specification 3.7.7, Condition A Allowed Outage Time of 72 hours. Duke Energy believes that it would be difficult to complete such a repair within this timeframe.

If a hot-tapping machine is used to perform the defect removal and repair during system operation, there would be risks to system operation, as described in 5.2.4.

5.2.3. The RN System 30 inch and 36 inch diameter supply and return piping cannot be isolated between the SNSWP and valves 0RN-07A, 0RN-07B, 0RN-0149A, and 0RN-152B in the Auxiliary Building. Therefore, isolation of this piping to permit depressurization and draining for repairs can only be accomplished by installing temporary blind flanges on the underwater intake and discharge piping at the SNSWP, or by use of a hot-tapping machine to install a line stop to completely dewater the pipe to perform the defect removal. Alternatively, a hot-tapping machine could be used to perform the defect removal and repair during system operation.

If a line stop is used, or if a blind flange is installed at the SNSWP, one train of the RN System would be isolated, and Duke Energy believes that it would be difficult to complete the required repairs and return the affected train to service within the Technical Specification 3.7.7, Condition A Allowed Outage Time of 72 hours.

If a hot-tapping machine is used to perform the defect removal and repair during system operation, there would be risks to system operation, as described in 5.2.4.

5.2.4. Using a hot-tapping machine to perform defect removal and repair is not desirable for the following reasons:

1. Hot-tapping the RN pipe could result in metal shavings or the removed, defective portion of the pipe wall dislodging, entering the system, and becoming debris that could hinder system operation and make it difficult to retrieve the loose material.
2. Typically, the installation of a branch connection using a hot-tapping machine results in a mechanical joint being installed on the new branch connection after the hot-tap is completed. Installation of a mechanical joint in a buried application is not desirable because it introduces a new path for potential system leakage.

5.2.5. Installation of sealant material within the encapsulation will provide protection against possible continued corrosion that could otherwise occur within the encapsulation. Restoration of protective coatings on the exterior of the encapsulation and exposed exterior surfaces of the piping will provide protection against external corrosion of these areas.

5.2.6. Duke Energy has performed exterior inspections on portions of the buried 36 inch and 42 inch RN system piping and has found the pipe to be in good condition with no leaks or mechanical repairs being required. In addition, divers have performed interior visual examinations on approximately 1200 feet of pipe, and localized ultrasonic thickness (UT) measurements on the SNSWP piping. Only a small section of the LLI piping has been inspected by divers due to interferences with valve 1RN001.

Duke Energy also has over 220 locations on the RN system where corrosion data has been collected. UT data acquired since 1992 shows that the RN piping is experiencing an average general corrosion rate of 2 mils/year and an average pitting corrosion rate of 4 mils/year due to internal corrosion.

5.2.7. The encapsulation is designed to provide a margin against lateral growth of the defect due to internal corrosion of the pipe wall by requiring that the I.D. of the encapsulation be considerably larger than the defective area. Based on an average pitting corrosion rate of 4 mils/year, Duke Energy believes that continued internal corrosion of the pipe wall will not challenge the structural integrity of the encapsulation for the remaining plant life. For this reason, periodic re-inspection of the defective areas within the encapsulations is not necessary. Due to the relatively low system operating pressure, Duke Energy believes that any future leakage from an encapsulation would occur before structural integrity is challenged. The proposed visual examinations are judged sufficient to detect this leakage before structural integrity of the modification or the piping in the vicinity of the modification is challenged.

5.3. For the reasons stated above, Duke Energy believes that compliance with the requirements of the ASME Code, Section XI, IWA-4400 to remove defective portions of RN System piping identified in this request prior to performing a repair/replacement activity by welding would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

## 6. Duration of Proposed Alternative

6.1. The proposed alternative to the requirements of the ASME Code, Section XI, IWA-4000 is requested for the remainder of the McGuire Unit 1, 4th Inservice Inspection Interval, currently scheduled to end on 11/30/2021.

6.2. Use of any encapsulation installed in accordance with this request is requested for the duration of the design life of the encapsulation.

## 7. References

7.1. Letter from B. H. Hamilton, Duke Energy, to NRC, dated May 4, 2009, "Relief Request Serial #09-MN-002," (Agencywide Documents Access and Management System (ADAMS), Accession No. ML092170658)

7.2. Letter from R. T. Repko, Duke Energy, to NRC, dated February 1, 2010, "Relief Request Serial #09-MN-002, Rev 0 Response to Request for Additional Information," (ADAMS, Accession No. ML100480974)

7.3. Letter from R. T. Repko, Duke Energy, to NRC, dated September 28, 2010, "Relief Request Serial #09-MN-002, Response to Requests for Additional Information," (ADAMS, Accession No. ML102790167)

7.4. Letter from R. T. Repko, Duke Energy, to NRC, dated December 14, 2010, "Relief Request Serial #09-MN-002, Revision 1, Response to Request for Additional Information," (ADAMS, Accession No. ML103560592)

7.5. Letter from Gloria Kulesa, NRC to R. T. Repko, Duke Energy dated March 28, 2011, "McGuire Nuclear Station, Unit 1 - Relief 09-MN-002, Revision 1, For a Proposed Alternative to Delay the Update to the Code of Record for the Fourth 10-Year Inservice Inspection (ISI) Interval (TAC NO. ME4870)", (ADAMS, Accession No. ML110800426)

7.6. Letter from S. D. Capps, Duke Energy to NRC, dated November 9, 2015, "Relief Request Serial No. 15-MN-002", (ADAMS, Accession No. ML15322A157)

7.7. Letter from S. D. Capps, Duke Energy to NRC, dated May 17, 2016, "Withdrawal of Relief Request Serial No. 15-MN-002", (ADAMS, Accession No. ML16146A542)