



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

June 23, 2011

Mr. Regis T. Repko
Vice President
McGuire Nuclear Station
Duke Energy Carolinas, LLC
12700 Hagers Ferry Road
Huntersville, NC 28078

SUBJECT: MCGUIRE NUCLEAR STATION, UNIT 1 (MCGUIRE 1) – RELIEF 10-MN-002,
EXTENSION OF VOLUMETRIC INSPECTION OF STEAM GENERATOR (SG)
PRIMARY MANWAY STUDS FOR ONE OPERATING CYCLE BEYOND THE
THIRD 10-YEAR INSERVICE INSPECTION (ISI) INTERVAL END DATE
(TAC NO. ME4677)

Dear Mr. Repko:

By letter dated August 30, 2010, as supplemented by letter dated March 31, 2011, Duke Energy Carolinas, LLC (the licensee), submitted relief request 10-MN-002, for McGuire 1, related to the use of an alternative to the requirements of the American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code* (ASME Code), Section XI. The licensee proposes to extend the third interval for the SG and outlet primary manway stud volumetric inspections up to the 1EOC22 refueling outage, which is the first refueling outage in the fourth ISI interval. The 1EOC22 refueling outage is currently scheduled for March 2013. The third 10-year ISI interval for McGuire 1 currently ends on November 30, 2011.

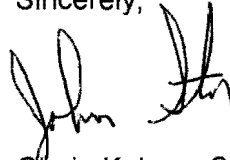
The Nuclear Regulatory Commission (NRC) staff has reviewed the licensee's submittal and, based on the information provided in the licensee's request for relief, the NRC staff has determined that complying with the specified requirement would result in a hardship without a compensating increase in the level of quality or safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in Title 10 of the *Code of Federal Regulations*, Part 50, paragraph 50.55a(a)(3)(ii). Therefore, the NRC staff authorizes the licensee's proposed alternative at McGuire 1, until refueling outage 1EOC22, currently scheduled for March 2013.

R. Repko

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

Sincerely,

A handwritten signature in black ink, appearing to read 'John', followed by a large, stylized flourish or initial.

Gloria Kulesa, Chief
Plant Licensing Branch II-1 *For*
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-369

Enclosure:
Safety Evaluation

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

OF THIRD 10-YEAR INTERVAL INSERVICE INSPECTION

RELIEF NO. 10-MN-002

"EXTENSION OF VOLUMETRIC INSPECTION OF STEAM GENERATOR

PRIMARY MANWAY STUDS FOR ONE OPERATING CYCLE

BEYOND THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL END DATE"

DUKE ENERGY CAROLINAS, LLC

MCGUIRE NUCLEAR STATION, UNIT 1

DOCKET NO. 50-369

1.0 INTRODUCTION

By letter dated August 30, 2010 (Reference 1), as supplemented by letter dated March 31, 2011 (Reference 2), Duke Energy Carolinas, LLC (Duke, the licensee), submitted request for relief 10-MN-002, for the McGuire Nuclear Station, Unit 1 (McGuire 1), related to the use of an alternative to the requirements of the American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code* (ASME Code), Section XI. The licensee proposes to extend the third inservice inspection (ISI) interval for the steam generator (SG) inlet and outlet primary manway stud volumetric inspections up to the 1EOC22 refueling outage (RFO). RFO 1EOC22 is the first RFO in the fourth ISI interval and is currently scheduled for March 2013. The third 10-year ISI interval for McGuire 1 currently ends on November 30, 2011.

2.0 REGULATORY EVALUATION

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, paragraph 50.55a(g)(4) states in part that

... components (including supports) which are classified as ASME Code Class 1, Class 2 and Class 3 must meet the requirements, except design and access provisions and preservice examination requirements, set forth in Section XI of editions of the ASME *Boiler and Pressure Vessel Code* and Addenda that become effective subsequent to editions specified in paragraphs (g)(2) and (g)(3) of this section and that are incorporated by reference in paragraph (b) of this section, to the extent practical within the limitations of design, geometry and materials of construction of the components....

Enclosure

The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year inspection interval and subsequent 10-year inspection 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) twelve months prior to the start of the 120-month inspection interval, subject to the limitations and modifications listed therein.

Paragraph 55a(a)(3) of 10 CFR Part 50, states that

Proposed alternatives to the requirements of paragraphs (c), (d), (e), (f), (g), and (h) of this section or portions thereof may be used when authorized by the Director, Office of Nuclear Reactor Regulation, or Director, Office of New Reactors, as appropriate. The applicant shall demonstrate that:

- (i) The proposed alternatives would provide an acceptable level of quality and safety, or
- (ii) Compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The McGuire 1 ASME Code of Record for the third 10-year ISI interval, which began on December 1, 2001, and is scheduled to end on November 30, 2011, is the 1998 Edition through 2000 Addenda of Section XI of the ASME Code. Use of this Code Edition and Addenda, with limitations, was authorized by the Nuclear Regulatory Commission (NRC) staff in a safety evaluation dated November 17, 2004 (Reference 3).

3.0 TECHNICAL EVALUATION

3.1 Affected Systems and Components

The SG inlet and outlet Primary Manway Studs are SA-193, Grade B7 alloy steel, Examination Category B-G-1:

Component	Summary Number	Component ID
SG 1A Primary Inlet Manway Studs	M1.B6.90.0001	1SGA-MW-X2-Y1
SG 1A Primary Outlet Manway Studs	M1.B6.90.0002	1SGA-MW-X2-Y2
SG 1B Primary Inlet Manway Studs	M1.B6.90.0003	1SGB-MW-X1-Y1
SG 1B Primary Outlet Manway Studs	M1.B6.90.0004	1SGB-MW-X2-Y2
SG 1C Primary Inlet Manway Studs	M1.B6.90.0005	1SGC-MW-X2-Y1
SG 1C Primary Outlet Manway Studs	M1.B6.90.0006	1SGC-MW-X2-Y2
SG 1D Primary Inlet Manway Studs	M1.B6.90.0007	1SGD-MW-X1-Y1
SG 1D Primary Outlet Manway Studs	M1.B6.90.0008	1SGD-MW-X2-Y2

3.2 Applicable ASME Code Requirements

ASME Code, Section XI, Table IWB-2500-1, Category B-G-1, Item B6.90, requires a volumetric examination of the SG Inlet and Outlet Primary Manway Studs in accordance with ASME Code, Section XI, Figure IWB 2500-12, once each 10-year ISI interval.

3.3 Basis for Alternative

The McGuire 1 SG tubes were inspected during RFO 1EOC16 (Spring 2004) and were scheduled for inspection during RFO 1EOC18 (spring 2007) and RFO 1EOC20 (spring 2010). However, due to containment sump modification work, the SG tube inspection scheduled in RFO 1EOC18 was performed during RFO 1EOC19 in the fall of 2008, resetting the next SG inspection to RFO 1EOC22, currently scheduled for March 2013. RFO 1EOC21 is the last outage in the McGuire 1 third ISI Interval that ends November 30, 2011. Per ASME Code, Section XI, paragraph IWA 2430, the ISI interval could be extended to November 30, 2012, but the one-year grace time does not encompass the SG inspection in RFO 1EOC22, currently scheduled for March 2013. With the SG inspection scheduled for RFO 1EOC22 and volumetric inspections of the SG primary manway studs required during RFO 1EOC21, the SG manways would have to be removed in consecutive outages.

The licensee states that performing the SG Inlet and Outlet Primary Manway Studs volumetric examinations during the RFO 1EOC21 would require equipment setup and teardown, SG manway and diaphragm removal and reinstallation, stud, nut, and stud hole cleaning and inspection. The dose estimated for this scope of work, based on radiological data obtained from a similar evolution during Eddy Current Testing of the SGs during RFO 1EOC19, is 4.7 man-rem to make the studs available for volumetric inspection. Based on As Low As Reasonably Achievable (ALARA) radiological dose considerations, the licensee is proposing to reschedule the inspection of the SG Inlet and Outlet Primary Manway Studs for the third ISI interval to coincide with the removal of these manway covers for eddy current testing during RFO 1EOC22 in the fourth ISI interval. The licensee states that volumetric inspection of the SG Inlet and Outlet Primary Manway Studs during consecutive outages would result in hardship due to ALARA radiological dose considerations without a compensating increase in the level of quality and safety.

3.4 Proposed Alternative (as stated by licensee)

In Reference 1, the licensee described the proposed alternative thus

In accordance with 10 CFR 50.55a(a)(3)(ii), an alternative is proposed on the basis that compliance with the ASME Code requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. As an alternative to the applicable ASME Code examination requirements the following will be performed:

- 1) A visual inspection of the SG primary manways with insulation removed will be performed during the 1EOC21 refueling outage at ambient pressure and temperature using Maintenance personnel. This inspection will be performed to look for evidence of leakage during the previous cycle.

- 2) A visual examination (VT-2) of the SG manway area with the insulation removed will be performed during the 1EOC21 refueling outage at nominal operating temperature and pressure. This examination will be conducted in accordance with ASME Code Section XI, Table IWB-2500-1 Examination Category B-P, Item B15.30 during 1EOC21.
- 3) The Third Interval inspection for volumetric examination of the SG Inlet and Outlet Primary Manway studs will be extended to the 1EOC22 refueling outage. A volumetric examination of the SG Inlet and Outlet Primary Manway Studs in accordance with Figure IWB-2500-12 per ASME Code Section XI, Table IWB-2500-1, Category B-G-1, Item B6.90 will be performed during 1EOC22.

4.0 TECHNICAL EVALUATION

ASME Code, Section XI, Table IWB-2500-1, requires volumetric examination of the SG primary manway studs once each 10-year ISI interval. The licensee's proposed alternative would delay the volumetric examination of the manway studs for the third 10-year ISI interval until the first RFO of the fourth 10-year ISI interval, 1EOC22, to coincide with the scheduled SG inspection.

The licensee has evaluated the radiation exposure which would result from volumetric inspection of the studs and has estimated that equipment setup and teardown, SG manway and diaphragm removal and reinstallation, stud, nut, and stud hole cleaning and inspection would result in a 4.7 man-rem dose just to make the studs available for volumetric inspection. The licensee's estimate is based on radiological data obtained from Eddy Current Testing of the SGs during RFO 1EOC19. The licensee would once again be required to perform the manway removal and reinstallation activities during RFO 1EOC22 to accommodate the performance of SG inspection activities, resulting in an additional 4.7 man-rem of radiation exposure. The NRC staff finds the radiological dose estimate reasonable, and finds that performing the activities for stud examination and SG inspection in consecutive outages present a hardship as the result of additional radiological dose that would be acquired.

The licensee proposes to perform a visual inspection of the SG primary manways during RFO 1EOC21 with the SG at ambient temperature and pressure and insulation removed to look for evidence of leakage during the previous cycle. In addition, a VT-2 examination of the SG manway area with the SG at nominal operating temperature and pressure and insulation removed to find leakage, in accordance with pressure boundary examination, ASME Code, Section XI, Table IWB-2500-1, Category B-P, Item B15.30, will be performed during RFO 1EOC21. The volumetric inspection of the SG Inlet and Outlet Primary Manway studs for the third ISI interval, in accordance with Figure IWB 2500-12 per ASME Code Section XI, Table IWB-2500-1, Category B-G-1, Item B6.90, will be performed during RFO 1EOC22, currently scheduled for March 2013.

The NRC staff has considered the likely causes of failure of the manway studs, cyclic fatigue and corrosion. In response to the NRC staff's request for additional information (RAI) (Reference 2), the licensee stated that

The SG primary manway studs have a design fatigue cumulative usage factor (CUF) of 0.913, which is based on 200 postulated transients due to heatup/cooldown and stud preload. The [McGuire] Unit 1 steam generators were replaced in 1997 and the manway studs on these steam generators are estimated to have experienced fewer than 20 heatup/cooldown cycles....

While the licensee does not document the actual CUF for the manway studs, the NRC staff concludes that the limited number of heatup/cooldown cycles compared to the 200 transients used for the design CUF ensures that sufficient margin exists so that the fatigue lifetime is not challenged before the next scheduled volumetric examination during RFO 1EOC22.

The other potential degradation mechanism is stud corrosion resulting from contact with primary water leakage. In Reference 1, the licensee states that

A search of the [Babcock and Wilcox International (BWI)] Operating Experience database revealed no issues with BWI replacement SG primary manway studs.

The McGuire 1 studs have been visually inspected during RFO 1EOC19 with no issues noted, and there have been no indications of leakage from the McGuire 1 SG primary manways since the SG replacement in 1997.

In addition, the licensee's proposed alternative includes a visual inspection of the SG primary manways with insulation removed during RFO 1EOC21 at ambient pressure and temperature to look for evidence of leakage during the previous cycle. In addition, a visual examination for leakage (VT-2) of the SG manway area at nominal operating temperature and pressure with the insulation removed will be performed during RFO 1EOC21. The NRC staff finds that the combination of industry operating experience, along with visual examinations to detect prior primary coolant leakage, and a VT-2 examination at operating temperature and pressure to detect presently occurring leakage, provide reasonable assurance that the studs have not been exposed to the corrosive influence of primary coolant which could compromise their structural integrity.

Degradation of the studs during continued operation could result if there is leakage of the gasket. The licensee proposes that future leakage during plant operation can be monitored by (1) the daily "Reactor Coolant System Leak Rate Test" performed by control room operators; (2) containment airborne radiation monitors; (3) containment temperature, pressure and humidity monitoring; and, (4) containment sump level monitoring. In response to the NRC staff's RAI, the licensee states that

Although leakage would not be expected upon failure of one SG primary manway stud, leakage (if it were to occur) at a rate of 1 gpm [gallons per minute] or greater would be detected by performing Surveillance Test "Reactor Coolant Leakage Calculation." Leakage at a rate of 1 gpm or greater would also be detected by containment airborne radiation monitors and containment sump level monitoring. Leakage from the Reactor Coolant System that results in a 1 gpm or greater input to the Ventilation Unit Drain Tank would be detected by the tank's level instrumentation.

The NRC staff finds that the available systems to detect potential gasket leakage are adequate to ensure that leakage can be detected and actions taken prior to significant stud degradation occurring during the additional cycle of operation.

The NRC staff finds that performing the activities for stud examination and SG inspection in consecutive outages presents a hardship as a result of the additional radiological dose that would be acquired. The NRC staff also finds that the limited number of heatup/cooldown cycles, industry experience with BWI replacement studs, two visual examinations, along with monitoring for leaks during plant operation, will provide reasonable assurance of structural integrity of the studs until the volumetric examination can be performed in RFO 1EOC22, currently scheduled for March 2013. Therefore, the NRC staff concludes that requiring a volumetric examination of the McGuire 1 SG inlet and outlet primary manway studs during RFO 1EOC21 would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. The NRC staff notes that a similar proposed alternative for deferring SG manway stud inspection until the next refueling outage has been authorized for the Donald C. Cook Nuclear Plant, Unit 1 (Reference 4).

The volumetric examination of the SG primary manway studs to be performed in RFO 1EOC22 will satisfy the ASME Code, Section XI, requirement for the third 10-year ISI interval at McGuire 1. As such, this examination cannot be credited toward the McGuire 1 fourth 10-year ISI interval examination requirement.

5.0 CONCLUSION

As set forth above, the NRC staff finds that complying with the specified ASME Code requirement to volumetrically examine the SG manway studs prior to the end of the third ISI inspection interval would result in a hardship without a compensating increase in the level of quality or safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(ii). Therefore, the NRC staff authorizes the licensee's proposed alternative at McGuire 1 until RFO 1EOC22, which is currently scheduled for March 2013.

All other requirements for which relief was not specifically requested and authorized remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

6.0 REFERENCES

1. Letter from Regis T. Repko, Duke, to Document Control Desk (DCD), NRC, "Duke Energy Carolinas, LLC (Duke Energy) McGuire Nuclear Station, Unit 1, Docket No. 50-369, Relief Request Serial # 10-MN-002, Volumetric Inspection of Steam Generator Primary Manway Studs," dated August 30, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML102510185).
2. Letter from Regis T. Repko, Duke, to DCD, NRC, "Duke Energy Carolinas, LLC (Duke Energy) McGuire Nuclear Station, Unit 1, Docket No. 50-369, Relief Request Serial #1 0-MN-002, Response to Request for Additional Information," dated March 31, 2011 (ADAMS Accession No. ML111020358).

3. Letter from Mary Jane Ross-Lee, NRC, to G. R. Peterson, Duke, "McGuire Nuclear Station, Unit 1 - Request For Relief For Use of a Later Edition of the ASME Section XI Code for the Remainder of the Third 10-Year Inspection Interval RR-03-001 (TAC MC2767)," dated November 17, 2004 (ADAMS Accession No. ML043060231).
4. Letter from Robert J. Pascarelli, NRC, to Joseph N. Jensen, Indiana Michigan Power Company, "Donald C. Cook Nuclear Plant, Unit 1 - Evaluation of Relief Request (ISIR-32) (TAC NO. ME2304)," dated February 26, 2010 (ADAMS Accession No. ML100539516).

Principal Contributor: J. Wallace, NRR

Date: June 23, 2011

R. Repko

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

Sincerely,

/RA/ by JStang Acting for

Gloria Kulesa, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-369

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