



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

November 8, 2013

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

SUBJECT: MCGUIRE NUCLEAR STATION, UNIT 1: PROPOSED RELIEF
REQUEST 12-MN-004 (TAC NOS. MF0508, MF0513, MF0514, AND MF0515)

Dear Mr. Capps:

By letter dated November 29, 2012, as supplemented by letters dated May 7, 2013 (Agencywide Document Access and Management System (ADAMS) Accession No. ML13141A256, August 28, 2013, Accession No. ML13254A203, and E-mail dated July 16, 2013, Accession No. ML13198A436, Duke Energy Carolinas, LLC (the licensee) submitted a request, RR 12-MN-004, to the U.S. Nuclear Regulatory Commission (NRC) for relief from certain requirements of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (Code), Section XI, related to inservice inspection (ISI) of welds. Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(g)(5)(iii), the licensee requested to use the alternative in Relief Request 12-MN-004 for ISI items on the basis that the ASME Code requirement is impractical. These welds were required to be examined in accordance with the ISI Plan for McGuire, Unit 1, third 10-year ISI interval which ended on December 1, 2011. Relief Request 12-MN-004 originally covered ten welds for which the licensee was not able to achieve essentially 100-percent volumetric examination coverage because of materials and geometrical limitations. However, by letter dated August 28, 2013, the licensee withdrew two welds, 1NV1F7908 and 1WL1F3063, from the relief request.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject components, and that complying with the specified ASME Code, Section XI, requirements is impractical. 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), and is in compliance with the ASME Code's requirements. Therefore, the NRC staff grants relief for the subject examinations of the components contained in RR MN-004.

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

S. Capps

- 2 -

If you have any questions, please contact the Project Manager, Jason Paige at 301-415-5888 or via e-mail at jason.paige@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "R. Pascarelli". The signature is fluid and cursive, with a horizontal line extending from the end.

Robert J. Pascarelli, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-369

Enclosure:
Safety Evaluation

cc w/encl: Distribution via ListServ



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NO. 12-MN-004

DUKE ENERGY CAROLINAS, LLC

MCGUIRE NUCLEAR STATION, UNIT 1

DOCKET NO. 50-369

1.0 INTRODUCTION

By letter dated November 29, 2012, as supplemented by letters dated May 7, 2013 (Agencywide Document Access and Management System (ADAMS) Accession No. ML13141A256, August 28, 2013, Accession No. ML13254A203, and E-mail dated July 16, 2013, Accession No. ML13198A436, Duke Energy Carolinas, LLC (the licensee) submitted a request, relief request (RR) 12-MN-004, to the U.S. Nuclear Regulatory Commission (NRC) for relief from certain requirements of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (Code), Section XI, related to inservice inspection (ISI) of welds. Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(g)(5)(iii), the licensee requested to use the alternative in Relief Request 12-MN-004 for ISI items on the basis that the ASME Code requirement is impractical. These welds were required to be examined in accordance with the ISI Plan for McGuire Unit 1, third 10-year ISI interval which ended on December 1, 2011. Relief Request 12-MN-004 originally covered ten welds for which the licensee was not able to achieve essentially 100-percent volumetric examination coverage because of materials and geometrical limitations. However, by letter dated August 28, 2013, the licensee withdrew two welds, 1NV1F7908 and 1WL1F3063, from the relief request. This safety evaluation covers eight welds, 1NC1F-1493, 1NC1F-1613, 1NC1F-1615, 1NI231-1, 1NVP888-1, 1NV1FW53-27, 1RCHP-IN, and 1RPV6-446B.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) "must meet the requirements, except design and access provisions and preservice examination requirements, set forth in Section XI of editions and addenda of the ASME [Boiler and Pressure Vessel] B&PV Code ... to the extent practical within the limitations of design, geometry, and materials of construction of the components."

Enclosure

The regulation at 10 CFR 50.55a(g)(5)(iii), 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), 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 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."

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 The Licensee's Relief Request

The applicable Code Edition and Addenda for the third ISI interval is the ASME Code, Section XI, 1998 Edition through the 2000 Addenda. Although the ASME Code requires 100% examination coverage for all subject seven welds as discussed below, the McGuire ISI Plan has used NRC-approved ASME Code Case N-460, which permits greater than 90% coverage of the required examination volume in lieu of the 100% coverage. As discussed below, none of the subject welds have satisfied greater than 90% volumetric coverage.

The licensee ultrasonically examined welds 1NC1F-1493, 1NC1F-1613, 1NC1F-1615, 1NVP888-1, 1NV1FW53-27, 1NI231-1, and 1RPV6-446B using procedures, equipment and personnel qualified in accordance with the 1998 Edition with the 2000 Addenda of the ASME Section XI, Appendix VIII. The licensee manually scanned these welds with conventional methods in accordance with 10 CFR 50.55a(b)(2)(xv)(A)(1) (and ASME Section V, Article 4 for weld 1RPV6-446B), which requires scanning welds in two axial and two circumferential directions. The licensee scanned the welds to the extent possible to meet these requirements.

The licensee examined weld 1RCHP-IN using radiographic testing (RT) as part of preservice inspection in accordance with the ASME Code, Sections III and XI.

Weld #1NC1F-1493

Weld #1NC1F-1493 is an ASME Class 1 pipe-to-welding boss butt weld and is covered under Summary Number M1.R1.11.0002, ISI Examination. It is part of the reactor coolant system (NC). The boss is made of forged stainless steel; the pipe and weld are made of stainless steel.

The nominal pipe size (NPS) is 1.5 inch and pipe wall thickness is 0.281 inches.

This weld is part of the risk-informed ISI (RI-ISI) program. The applicable ISI requirement is based on Westinghouse topical report, WCAP-14572, Revision 1-NP-A, Supplement 2, Table 4.1-1, Examination Category R-A, Item Number R1.11, which requires 100% coverage of examination volume C-D-E-F in Figure IWB-2500-8(c). By letter dated June 12, 2002 (ADAMS Accession No. ML021480421), the NRC authorized the RI-ISI program as an acceptable alternative to the ISI requirements of the ASME Code, Section XI for ASME Code Class 1 piping welds, Examination Categories B-F and B-J, and ASME Code Class 2 piping welds, Examination Category C-F-1 and C-F-2, for the third ISI interval.

The licensee achieved an aggregate coverage of 37.5% of the required volume using 45-degree shear and longitudinal waves and 60-degree shear waves. The licensee did not identify recordable indications during this examination.

In addition, the licensee performed best effort supplemental scanning using 70-degree shear waves to interrogate the lower 1/3 welding boss, far side of the weld, from the pipe side. However, the supplemental scanning is not qualified to be calculated into the above claimed coverage. The supplemental shear was only to interrogate the axial direction per procedure. The licensee selected the 70-degree shear wave to supplement the 60-degree shear waves as the component is less than 0.500 inches in thickness.

The licensee stated that the impracticality was caused by the taper configuration that did not allow meaningful interrogation from the welding boss. Therefore, the licensee could not obtain coverage by scanning from the welding boss side. The licensee explained that in order to scan all of the required volume for this weld, the welding boss would have to be redesigned and replaced, which is impractical. The licensee stated that RT is not a desired option because RT is limited in the ability to detect service induced flaws, and has not been qualified through performance demonstration. The licensee stated that use of other qualified manual or automated UT techniques, whether conventional or phased array, would not increase coverage due to the limitation created by the weld configuration.

The licensee explained that the High Safety Significant (HSS) piping segment as part of the RI-ISI program that contains this weld has only one 1.5-inch butt weld that can be selected for examination. The licensee noted that there are no other butt welds in this segment to be examined.

The licensee performs the system leakage test each refueling outage in accordance with Table IWB-2500-1, Examination Category B-P which requires a VT-2 visual examination to detect evidence of leakage. The system leakage test and VT-2 examination provide assurance of pressure boundary integrity. In addition, reactor building normal sump monitoring and other leakage detection systems provide assurance that in the event that leakage did occur through this weld, it would be detected and proper action taken.

Weld #1NC1F-1613

Weld #1NC1F-1613 is an ASME Class 1 pipe-to-welding boss butt weld and is covered under Summary Number M1.R1.11.0004, ISI Examination. It is part of the reactor coolant system

(NC). The boss is made of forged stainless steel; the pipe and weld are made of stainless steel. The NPS is 1.5 inch and pipe wall thickness is 0.281 inches.

This weld is part of the NRC-approved RI-ISI program as discussed above. The applicable ISI requirement is based on WCAP-14572, Revision 1-NP-A, Supplement 2, Table 4.1-1, Examination Category R-A, Item Number R1.11, which requires 100% coverage of examination volume C-D-E-F in Figure IWB-2500-8(c).

The licensee achieved an aggregate coverage of 37.5% of the required volume using 45-degree shear and longitudinal waves and 60-degree shear waves. The licensee did not identify any recordable indications during this examination.

The licensee performed best effort supplemental scanning using 70-degree shear waves to interrogate the lower 1/3 welding boss, far side of the weld, from the pipe side. However, the supplemental scanning is not qualified to be calculated into the above claimed coverage. The supplemental shear was only used to interrogate in the axial direction per procedures. The licensee selected the 70-degree shear wave to supplement the 60-degree shear waves as the component is less than 0.500 inches in thickness.

The licensee explained that the impracticality was caused by the taper configuration that did not allow meaningful interrogation from the welding boss. Therefore, coverage could not be obtained by scanning from the welding boss side. The licensee stated that in order to scan all of the required volume for this weld, the welding boss would have to be redesigned and replaced, which is impractical. The licensee explained that RT is not a desired option because RT is limited in ability to detect service induced flaws, and has not been qualified through performance demonstration. The licensee stated that use of other qualified manual or automated UT techniques, whether conventional or phased array, would not increase coverage due to the limitation created by the weld configuration.

The licensee explained that the HSS piping segment that contains this weld has only one 1.5-inch butt weld that can be selected for examination. The licensee noted that there are no other butt welds in this segment that can be examined.

The licensee performs the system leakage test each refueling outage in accordance with Table IWB-2500-1, Examination Category B-P, which requires a VT-2 visual examination to detect evidence of leakage. The system leakage test and VT-2 examination provide assurance of pressure boundary integrity. In addition, reactor building normal sump monitoring and other leakage detection systems provide assurance that in the event that leakage did occur through this weld, it would be detected and proper action taken.

Weld #1NC1F-1615

Weld #1NC1F-1615 is an ASME Class 1 pipe-to-welding boss butt weld and is covered under Summary Number M1.R1.11.0003, ISI Examination. It is part of the reactor coolant system (NC). The boss is made of forged stainless steel; the pipe and weld are made of stainless steel. The NPS is 1.5 inch and the pipe wall thickness is 0.281 inches.

This weld is part of the NRC-approved RI-ISI program. The applicable ISI requirement is based on WCAP-14572, Revision 1-NP-A, Supplement 2, Table 4.1-1, Examination Category R-A, Item Number R1.11, which requires 100% coverage of examination volume C-D-E-F in Figure IWB-2500-8(c).

The licensee achieved an aggregate coverage of 37.5% of the required volume using 45-degree shear and longitudinal waves and 60-degree shear waves. The licensee did not identify any recordable indications during this examination.

The licensee performed best effort supplemental scanning using 70-degree shear waves to interrogate the lower 1/3 welding boss, far side of the weld, from the pipe side. The supplemental scanning is not qualified to be calculated into the above claimed coverage. The supplemental shear was only used to interrogate the axial direction per procedures. The licensee selected the 70-degree shear wave to supplement the 60-degree shear waves as the weld is less than 0.500 inches in thickness.

The licensee stated that the impracticality was caused by the taper configuration that did not allow meaningful interrogation from the welding boss. Therefore, coverage could not be obtained by scanning from the welding boss side. The licensee explained that in order to scan all of the required volume for this weld, the welding boss would have to be redesigned and replaced, which is impractical. The licensee further explained that RT is not a desired option because RT is limited in the ability to detect service induced flaws, and has not been qualified through performance demonstration. The licensee stated that use of other qualified manual or automated UT techniques, whether conventional or phased array, would not increase coverage due to the limitation created by the weld configuration.

The licensee explained that the HSS piping segment as part of the RI-ISI program that contains this weld has only one 1.5-inch butt weld that can be selected for examination. There are no other butt welds in this segment to be examined.

The licensee performs the system leakage test each refueling outage in accordance with Table IWB-2500-1, Examination Category B-P which requires a VT-2 visual examination to detect evidence of leakage. The system leakage test and VT-2 examination provide assurance of pressure boundary integrity. In addition, reactor building normal sump monitoring and other leakage detection systems provide assurance that in the event that leakage did occur through this weld, it would be detected and proper action taken.

Weld #1NVP888-1

Weld #1NVP888-1 is an ASME Class 2, reducer-to-pipe butt weld and is covered under Summary Number M1.R1.16.0025, Inservice Inspection. It is part of the chemical and volume control system (NV). The reducer, pipe and weld are all made of stainless steel. The NPS is 2.0 inch and pipe thickness is 0.344 inches.

This weld is part of the NRC-approved RI-ISI program. The applicable ISI requirement is based on WCAP-14572, Revision 1-NP-A, Supplement 2, Table 4.1-1, Examination Category R-A, Item Number R1.16, which requires 100% coverage of examination volume C-D-E-F in Figure IWB-2500-8(c).

The licensee achieved an aggregate coverage of 37.5% of the required volume using 45-degree shear and longitudinal waves and 70-degree shear waves. The licensee did not identify recordable indications during this examination.

The licensee also performed best effort supplemental scanning using 70-degree shear waves to interrogate the lower 1/3 reducer, far side of the weld, from the pipe side. However, the supplemental scanning is not qualified to be calculated into the above claimed coverage. The supplemental shear was only used to interrogate the axial direction per procedures. The licensee used the 70-degree shear wave to supplement the coverage as the weld is less than 0.500 inches in thickness.

The licensee explained that the impracticality was caused by the socket weld attaching a component which completely covered the pipe surface that prevented scanning from the pipe side of the weld. According to the licensee, in order to scan all of the required volume for this weld, the socket weld and component would have to be redesigned or removed, which is impractical. The licensee stated that RT is not a desired option because RT is limited in the ability to detect service induced flaws, and has not been qualified through performance demonstration. The licensee stated that use of other qualified manual or automated UT techniques, whether conventional or phased array, would not increase coverage due to the limitation created by the weld configuration.

The licensee clarified that the HSS piping segment that contains this weld has only two 2-inch butt welds that can be selected for examination. One weld is the subject of this relief request. The other butt weld in this segment has also been examined without limited coverage and found acceptable.

The licensee performs the system leakage test each inspection period in accordance with Table IWC-2500-1, Examination Category C-H, which requires a VT-2 visual examination to detect evidence of leakage. The system leakage test and VT-2 examination provide assurance of pressure boundary integrity. In addition, the licensee's visual observations during operator rounds provide assurance that in the event leakage did occur through this weld, it would be detected and proper action taken.

Weld #1NV1FW53-27

Weld #1NV1FW53-27 is an ASME Class 2, valve 1-NV-0035A-to-pipe butt weld, and is covered under Summary Number M1.R1.16.0031, ISI Examination. It is part of the chemical and volume control system (NV). The pipe and weld are made of stainless steel; the valve is made of cast stainless steel. The NPS is 2.0 inch and pipe thickness is 0.436 inches.

This weld is part of the NRC-approved RI-ISI program. The applicable ISI requirement is based on WCAP-14572, Rev. 1-NP-A, Supplement 2, Table 4.1-1, Examination Category R-A, Item Number R1.16, which requires 100% coverage of examination volume C-D-E-F in Figure IWB-2500-8(c).

The licensee achieved an aggregate coverage of 37.5% of required volume using 45-degree shear and longitudinal waves and 60-degree shear waves. The licensee did not identify any recordable indications during this examination.

The licensee performed best effort supplemental scanning using 70-degree shear waves to interrogate the lower 1/3 valve, far side of the weld, from the pipe side. However, the supplemental scanning is not qualified to be calculated into the above claimed coverage. The supplemental shear was only used to interrogate the axial direction per the procedure. The licensee selected the 70-degree shear wave to supplement the 60-degree shear waves as the component is less than 0.500 inches in thickness.

The licensee stated that the impracticality was caused by the cast stainless steel valve material which cannot be effectively interrogated by ultrasound. The licensee further stated that currently no examination techniques have been qualified to examine cast stainless steel through the ASME Code, Section XI, Appendix VIII. Therefore, coverage could not be obtained by scanning from the valve side. The licensee explained that in order to scan all of the required volume for this weld, the valve would have to be redesigned and replaced, which is impractical. The licensee explained that RT is not a desired option because RT is limited in the ability to detect service induced flaws, and has not been qualified through performance demonstration. The licensee stated that use of other qualified manual or automated UT techniques, whether conventional or phased array, would not increase coverage due to the limitation created by the weld configuration.

The licensee explained that this HSS piping segment contains three 2-inch butt welds, with two being selected for examination. The first is the subject of this request. The second has been examined without limited coverage and found acceptable. The third weld has the same configuration as the weld in this request and would have the same limited coverage.

The licensee performed the system leakage test each inspection period in accordance with Table IWC-2500-1, Examination Category C-H, which requires a VT-2 visual examination to detect evidence of leakage. The system leakage test and VT-2 examination provide assurance of pressure boundary integrity. In addition, the licensee stated that reactor building normal sump monitoring and other leakage detection systems provide assurance that, in the event that leakage did occur through this weld, it would be detected and proper action taken.

Weld #1NI231-1

Weld #1NI231-1 is an ASME Class 2 pipe-to-reducer butt weld and is covered under Summary Number M1.R1.16.0009, ISI Examination. It is part of the safety injection system (NI). The pipe, reducer and weld are made of stainless steel. The NPS is 1.5 inch and pipe thickness is 0.281 inches.

This weld is part of the NRC-approved RI-ISI program. The applicable ISI requirement is based on WCAP-14572, Revision 1-NP-A, Supplement 2, Table 4.1-1, Examination Category R-A, Item Number R1.16, which requires 100% coverage of examination volume C-D-E-F in Figure IWB-2500-8(c).

The licensee achieved an aggregate coverage of 67.7% of the required volume using 45-degree shear and longitudinal waves and 60-degree shear waves. The licensee did not identify any recordable indications during this examination.

The licensee performed best effort supplemental scanning using 70-degree shear waves to interrogate the lower 1/3 reducer, far side of the weld, from the pipe side. However, the supplemental scanning is not qualified to be calculated into the above claimed coverage. The supplemental shear was only used to interrogate the axial direction per procedures. The licensee selected 70-degree shear wave to supplement the 60-degree shear waves as the component is less than 0.500 inch in thickness.

The licensee explained that the impracticality was caused by the configuration of the reducer causing lift off of the UT transducer. Therefore, the licensee could not obtain the full coverage by scanning from the reducer side. The licensee stated that in order to scan all of the required volume for this weld, the reducer would have to be redesigned and replaced, which is impractical. The licensee stated that RT is not a desired option because RT is limited in the ability to detect service induced flaws, and has not been qualified through performance demonstration. The licensee stated that use of other qualified manual or automated UT techniques, whether conventional or phased array, would not increase coverage due to the limitation created by the weld configuration.

The licensee explained that the HSS piping segment that contains this weld has only two 1.5-inch butt welds that can be selected for examination. One weld is the subject of this relief request. The other butt weld in this segment has also been examined without limited coverage and found acceptable.

The licensee performs the system leakage test each inspection period in accordance with Table IWC-2500-1, Examination Category C-H, which requires a VT-2 visual examination to detect evidence of leakage. The system leakage test and VT-2 examination provide assurance of pressure boundary integrity. According to the licensee, reactor building normal sump monitoring and other leakage detection systems provide assurance that, in the event that leakage did occur through this weld, it would be detected and proper action taken.

Weld #1RCHP-IN

Weld #1RCHP-IN is an ASME Class 2, pipe flange-to-pump housing weld, and is covered under Summary Numbers M1.R1.11.2123 and M1.R1.16.0047, Preservice Inspection Examination. It is part of the chemical and volume control system (NV). The pump casing is made of forged stainless steel; the weld and pipe flange are made of stainless steel. The NPS is 4.0 inch and pipe thickness is 0.237 inches.

This weld is part of the NRC-approved RI-ISI program. The applicable ISI requirement is based on WCAP-14572, Rev.1-NP-A, Supplement 2, Table 4.1-1, Examination Category R-A, Item Number R1.11, Item Number R1.16, which requires 100% coverage of examination volume C-D-E-F in Figure IWB-2500-8(c).

The applicable requirement for preservice inspection (PSI) is based on the ASME Code, Section XI, IWC-2500, Table IWC-2500-1, Examination Category C-F-1, Item Number C5.21, requires 100% coverage of examination volume C-D-E-F in Figure IWC-2500-7(a).

On September 30, 2011, the licensee performed the initial ISI of this weld using RT and detected unacceptable fabrication defects based on the ASME Code, Section XI. The initial ISI examination obtained 77% coverage. The licensee replaced the defective weld with a new weld.

On February 17, 2012, the licensee performed a PSI of the new weld using RT based on the ASME Code Sections III and XI. The new weld was radiographed using a single wall exposure, single wall technique. The required examination volume includes the weld and 0.25 inches of base metal on both sides of the weld. One side of the weld is the pump housing and the other side is a 4-inch flange. The thickness of the pump housing does not allow RT to capture radiographic image of 0.250 inches of base metal on the pump side of the examined area. The PSI examination obtained 73% coverage.

The licensee stated that PSI RT recorded one indication, a 0.042-inch tungsten inclusion which was accepted in accordance with the acceptance standards of the ASME Code, Section III, 1989 Edition through the 2004 Addenda and ASME Code Section XI, 1998 Edition Through 2000 Addenda.

In the August 28, 2013 letter, the licensee explained that it has not performed additional examinations beyond the examinations performed for construction acceptance and the PSI for this weld on February 17, 2012, during the third ISI interval. The weld is currently not scheduled for examination during the 4th ISI interval. The licensee stated that the weld is being evaluated for examination in accordance with the criteria of ASME Code Case N-716 because for the 4th ISI interval, ASME Code Case N-716 is being incorporated as its risk-informed ISI examination method.

The licensee explained that in order to radiograph all of the required ISI and PSI volumes for this weld, the pipe flange to pump housing would have to be redesigned, which is impractical.

The licensee does not plan to perform alternative examinations for the weld during the current inspection interval. The licensee explained that UT is not a desired option for this weld because UT is limited in the ability to scan from the pipe flange surface and provides no scanning from the pump housing due to the weld location to the pump. The licensee explained that use of other qualified manual or automated UT techniques, whether conventional or phased array, would not increase coverage due to the limitation created by the weld configuration. The licensee further stated that no substitution alternative for this weld is available which would provide better coverage.

The licensee performs the system leakage test each refueling outage in accordance with Table IWC-2500-1, Examination Category C-H, which requires a VT-2 visual examination to detect evidence of leakage. The system leakage test and VT-2 examination provide assurance of pressure boundary integrity. In addition, the licensee's visual observations performed during operator rounds provide assurance that in the event leakage did occur through this weld, it would be detected and proper action taken.

Weld #1RPV6-446B

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code-required volumetric examination McGuire Unit 1 Head Ring to Head Cap, Weld # 1RPV6-446B, Summary Number M1.B1.21.0001 of the Reactor Coolant System (NC).

In its E-mail dated July 16, 2013, the licensee stated that Section 10.4 of the relief request references ASME [Code] Section V, Article 4, which is not accurate. The examination was performed to [ASME Code, Section XI] Appendix VIII qualified procedure PDI-UT-6, which is accurately identified in Section 10.5 of the relief request. Review of the UT data confirmed that the equipment selection and method of calibration met the examination requirements stated within the procedure.

This weld was examined using procedures, equipment and personnel qualified in accordance with ASME Code, Section XI, Appendix VIII. This component was scanned to the extent possible to meet these requirements. The aggregate coverage reported in Attachment "B" of the relief request UT coverage data report is described and calculated from the following:

- 60° longitudinal waves for axial scans (S1, S2) obtained 89.2% coverage.
- 60° longitudinal waves for circ. scans (CW, CCW) obtained 52.4% coverage.
- The aggregate coverage was calculated to be $(89.2\% + 52.4\%)/2 = 70.8\%$.

The impracticality was caused by the Surface 1 head cap taper configuration which did not allow complete scanning in the axial and circumferential direction. Also, three lifting lugs limited scanning in each required scanning direction. In order to scan all of the required volume for this weld, the head cap taper and three lifting lugs would have to be redesigned and replaced, which is impractical.

ASME Code, Section XI, Table IWB-2500, Item B1.21 requires "Accessible Length of all welds (Note 2)," which includes essentially 100% of the weld length. The entire length of the weld was scanned, with the exception of inaccessible length being covered by the three permanent lifting lugs. The three lugs cover a total of 24 inches of the weld. The total length of the weld is 456 inches. The actual length of the weld scanned was $432/456(100) = 94.7\%$ of the total length of the weld. If the lugs were removed, the coverage obtained would be at 73.8%, as the true limiting factor for this weld is the taper configuration. Therefore, the weld was scanned to the extent possible, and the requirements of Note 2 have been met.

The McGuire ISI plan allows the use of Code Case N-460, which requires greater than 90% volumetric coverage. The achieved coverage did not meet the acceptance criteria of this Code Case. This relief request is specific to examination volume coverage limitations only. All other Code requirements were satisfied.

No indications were recorded during this examination. The reject box is marked for internal tracking purposes of the coverage limitation only.

Ultrasonic examination of the weld for Summary Number M1.61.21.0001 (ISI) was conducted using personnel, equipment, and procedures qualified in accordance with ASME [Code] Section XI, 1998 Edition with the 2000 Addenda.

The system leakage test performed each refueling outage in accordance with [ASME Code, Section XI] Table IWB-2500-1; Examination Category B-P requires a VT-2 visual examination to detect evidence of leakage. This test and VT-2 examination provide additional assurance of pressure boundary integrity.

In addition to the above [ASME] Code required examinations (volumetric and pressure test), visual observations performed during operator rounds provide additional assurance that in the event leakage did occur through this weld, it would be detected and proper action taken.

Duke Energy has examined Weld ID 1RPV6-446B (Summary Number M1.B1.21.0001) to the maximum extent possible utilizing approved examination techniques and equipment. Based on the acceptable results for the coverage completed by the volumetric examination, the pressure testing (VT-2) examinations required by Section XI and the leakage monitoring, it is the licensee's position that the combination of examinations provide a reasonable assurance of quality and safety.

The NRC staff in its request for additional information (RAI) dated April 8, 2013 (ADAMS Accession Number ML13098A229), asked the licensee to provide clarification of the component in which the licensee is seeking relief and state if the licensee met the ASME Code examination requirements including the surface examination, if required.

The licensee provided the additional information in its letter dated May 7, 2013, as stated below:

Duke is not seeking relief for the weld commonly known as the "RPV Head-to-Flange Weld." The Reactor Pressure Vessel Closure Head Ring to Head Cap Weld is identified correctly as shown in Relief Request Serial No.12-MN-Q04. This weld is correctly categorized as part of [ASME Code] Examination Category B-A, Pressure Retaining Welds in Reactor Vessel, [ASME Code] Item No. B1.21, Head Circumferential Welds, Figure No. IWB-2500-3. This category requires a volumetric examination only. Therefore, the examination method requirement for Examination Category B-A/Item No. B1.21 has been met for Summary Number M1.81.21.0001/Weld ID 1RPV-446B. Relief is requested because greater than 90 percent coverage was not obtained as described below.

[ASME Code, Section XI,] Table IWB-2500, Item B1.21 requires "Accessible Length of all welds (Note 2)", which includes essentially 100% of the weld length. The entire length of the weld was scanned, with the exception of inaccessible length being covered by the three permanent lifting lugs. The three lugs cover a total of 24 inches of the weld. The total length of the weld is 456 inches. The actual length of the weld scanned was $432/456(100) = 94.7$ [percent] of the total length of the weld. If the lugs were removed, the coverage obtained would be at 73.8 [percent], as the true limiting factor for this weld is the taper configuration. Therefore, the weld was scanned to the extent possible, and the requirements of Note 2 have been met.

3.2 NRC Staff Evaluation

3.2.1 Welds 1NC1F-1493, 1NC1F-1613, 1NC1F-1615, 1NVP888-1, 1NV1FW53-27, 1NI231-1, and 1RCHP-IN

The NRC staff verifies the percentages of examination coverage and impracticality for the licensee to achieve greater than 90% coverage, applicable Code requirements for ISI, and potential degradation mechanisms of the welds. The NRC staff determines how the structural integrity of these welds can be ensured, given that the licensee could not achieve 90% examination coverage for all subject welds.

The NRC noted that welds 1NC1F-1493, 1NC1F-1615, 1NC1F-1613, 1NVP888-1, and 1NV1FW53-27 achieved a coverage of 37.5% of required volume. Weld 1NI231-1 achieved a 67.7% coverage and weld 1RCHP-IN achieved a 73% coverage. The reason for the limited 37.5% coverage was that the licensee can only perform the ultrasonic examination from one side of these welds because the other side of the welds has obstructions. The licensee was able to achieve a higher coverage of 67.7% for weld 1NI231-1 because the licensee was able to examine the weld from both sides, although one side of the weld has a slope. The licensee examined weld 1RCHP-IN using radiographic testing. The coverage limitation on 1RCHP-IN was caused by the pipe flange-to-pump inlet configuration that would not permit the placement of radiographic film.

In its August 28, 2013, letter the licensee clarified that for the axial and circumferential scans, it performed a single-sided examination for welds 1NC1F-1493, 1NC1F-1613, 1NC1F-1615, 1NVP888-1, and 1NV1FW53-27. For the axial and circumferential scans, it performed a double-sided examination for weld 1NI231-1. The NRC staff examined the licensee's UT coverage sketches and confirmed that the licensee's axial and circumferential scans for welds 1NC1F-1493, 1NC1F-1613, 1NC1F-1615, 1NVP888-1, and 1NV1FW53-27 can only be performed from one side of the weld as a result of configuration. Even with the double sided examination, weld 1NI231-1 could only receive coverage of 67.7% of the required volume. Also, from the examination sketches, the NRC staff confirms that impracticality exists for these seven welds based on the weld configuration including the piping components and difficulty in examining cast stainless steel material. The NRC staff noted that even if the licensee use different ultrasonic angle beams to examine the weld volume or a different location or position for the radiographic testing film, the percentage of coverage would not be increased. The NRC staff recognizes that it is impractical to redesign or replace the affected component to achieve greater than 90% coverage.

The NRC staff notes that the licensee did not find any recordable indications in the subject welds except a 0.042-inch tungsten inclusion in weld 1RCHP-IN which was accepted by the standards of the ASME Code Section III and XI. The fact that the licensee has not identified any rejectable indications in the subject welds provides a reasonable assurance of their structural integrity.

The NRC staff noted that the licensee examined welds 1NI231-1, 1NVP888-1, 1NV1FW53-27, and 1RCHP-IN in accordance with Figure IWB-2500-8(c) which is applicable to examining ASME Class 1 piping with a NPS of 4 inches and greater. These four welds are ASME Class 2 components and their NPS is equal to or less than 4 inches. The NRC staff questioned that

based on Table IWC-2500-1, Examination Category C-F-1 of the ASME Code, Section XI, and these four welds should be examined in accordance with Figure IWC-2500-7(a), not Figure IWB-2500-8(c). In the August 28, 2013, letter the licensee explained that for these four welds, the applicable ISI requirement is based on WCAP-14572, Rev.1-NP-A, Supplement 2, Table 4.1-1, Figure IWB-2500-8(c), Note 2. Note 2 of Table 4.1-1 states that "Includes examination locations and Class 1 weld examination requirement figures that typically apply to Class 1, 2, and 3 and Non-Code Class welds identified in accordance with risk-informed selection process described in WCAP-14572, Rev.1-NP-A." That is, the licensee used Figure IWB-2500-8(c) in lieu of Figure IWC-2500-7(a) in examining these four welds because the risk-informed ISI selection requires such use. The NRC staff finds that the licensee provided reasonable technical basis for using Figure IWB-2500-8(c) in lieu of Figure IWB-2500-7(a) and therefore, it is acceptable.

Because the licensee was not able to achieve greater than 90% examination coverage, flaws may exist in the un-examined weld volume. Eventually, a flaw may develop through wall and radioactive coolant may leak. In this scenario, the NRC staff's concern is how the licensee monitors the structural integrity of these welds.

The licensee stated that reactor building normal sump monitoring and other leakage detection systems provide assurance that, leakage through these welds, if occurred, would be detected early and proper action be taken. The NRC staff asked the licensee to clarify the other leakage detection systems and how the applicable reactor coolant system (RCS) leakage detection systems satisfy NRC Regulatory Guide (RG) 1.45, Revision 1, "Reactor Coolant Pressure Boundary Leakage Detection Systems." The NRC staff also asked about the minimum leak rate that can be detected by the RCS leakage detection systems, any technical specification (TS) limits and administrative limits on the leakage, and how soon the operator will be notified when leakage is detected.

By letter dated August 28, 2013, the licensee stated that besides the reactor building normal sump monitoring, other leakage detection systems and instruments include the core flood and equipment sump level monitor, incore instrument sump level alarm, containment atmosphere particulate radioactivity monitor, and containment ventilation unit condensate drain tank level monitor. The licensee noted that these instruments are required to be operable per TS 3.4.15, "RCS Leakage Detection Instrumentation."

RG 1.45, Revision 1, states that leakage detection systems should be able to respond to a one gallon per minute (gpm) leak, or its equivalent, in one hour or less. The licensee explained that the containment atmosphere particulate radioactivity monitor at McGuire meets the 1 gpm per hour capability. The licensee stated that in addition, the core flood and equipment sump level monitor is capable of detecting a 1 gpm leak in approximately one hour as documented in Updated Final Safety Analysis Report (UFSAR) Table 5-30. The incore sump alarm will detect a 1 gpm input within 4 hours of leakage reaching the sump as documented in UFSAR Table 5-55.

The licensee stated that once any alarm or indication of leakage is received from the RCS leakage detection instrumentation, control room operators evaluate all available system parameters to assess RCS pressure boundary integrity. The expected alarm indication includes core flood and equipment sump level monitor, incore instrument sump level monitor,

containment atmosphere particulate radioactivity monitor, and containment ventilation unit condensate drain tank level monitor.

In addition, volume control tank (VCT) level change also can detect RCS leakage into containment even though the VCT level change is not required in accordance with TS 3.4.15 and cannot be taken credit for the limiting condition for operation.

The licensee noted that another requirement to restrict the potential leakage is TS 3.4.13, "RCS Operational Leakage," which limits pressure boundary leakage to 1 gpm for unidentified leakage and 10 gpm for identified leakage.

The licensee noted that welds 1NC1F-1493, 1NC1F-1613, 1NC1F-1615, 1NI231-1, and 1NV1FW53-27 are located inside the containment; therefore, the RCS leakage detection systems will be used to monitor their potential leakage as the RCS leakage detection systems are located in the containment and the operator cannot perform their rounds inside the containment during normal plant operation.

The licensee stated that for welds 1NVP888-1 and 1RCHP-IN that are located in the auxiliary building, leakage from these two welds would be detected via operator rounds because the operator makes rounds in the auxiliary building during normal operation. The licensee stated that operators are not required by procedure to specifically examine welds 1NVP888-1 and 1RCHP-IN during rounds. Operators are required to look for leakage in their general area during walkdowns. The locations of these two welds are such that the area would be inspected during each operator round. Weld 1NVP888-1 is located in an open area at elevation 733 feet and weld 1RCHP-IN is in the chemical and volume control system pump room. The licensee stated that operators perform and document rounds once per shift.

The NRC staff finds that as part of defense-in-depth measures, the RCS leakage detection systems have sufficient capability to detect and notify the operator of potential leakage from welds 1NC1F-1493, 1NC1F-1613, 1NC1F-1615, 1NI231-1, and 1NV1FW53-27. The NRC staff finds that operator rounds once every shift provides sufficient monitoring to detect the potential leakage from welds 1NVP888-1 and 1RCHP-IN.

As stated above, the licensee performs the system leakage test during each refueling outage for the Class 1 welds and each inspection period for the Class 2 welds and performs associated VT-2 visual examination to monitor their structural integrity. The NRC staff notes that all seven welds are made of stainless steel which has sufficient fracture toughness to resist catastrophic pipe failure.

In summary, the NRC staff determines that although the licensee was not able to achieve greater than 90% examination coverage, the licensee has demonstrated that its monitoring of potential leakage, periodic system leakage tests and associated VT-2 visual examination will provide a reasonable assurance the structural integrity of the subject welds. The NRC staff finds that the licensee has adequately demonstrated the impracticality of achieving greater than 90% of examination coverage.

3.2.2 Weld 1RPV6-446B

The ASME Code requires ASME Code, Section XI, Table IWB-2500-1, Examination Category B-A, Item Number B1.21, Figure IWB-2500-3, Examination Volume A-B-C-D essentially 100 percent volume coverage of the accessible weld length. The RPV McGuire, Unit 1 Head Ring to Head Cap, Weld # 1RPV-446B weld was scanned to the extent possible, and the requirements of Note 2 of ASME Code, Section XI, Table IWB-2500-1, Category B-A were met. However, the design configuration of the subject weld limited examination of the weld volume due to the head cap taper configuration that did not allow complete scanning of the weld volume in the axial and circumferential direction. In addition, three lifting lugs limited scanning in each required scanning direction. In order to effectively increase the examination coverage of the weld volume, the RPV head and adjacent components would require design modifications or replacement. Therefore, examining essentially 100% of the ASME Code-required volume is considered impractical.

The subject weld was examined using procedures, equipment and personnel qualified in accordance with ASME Code, Section XI, Appendix VIII. This component was scanned to the extent possible to meet these requirements. The aggregate coverage reported in Attachment "B" of the relief request UT coverage data report is described and calculated from the following that requires the scanning of the subject weld in two axial and two circumferential directions. The aggregate coverage that was obtained for 60 degree longitudinal waves for axial scans was 89.2 percent. For the 60 degree longitudinal waves for circular scans (Clock Wise, Counter Clock Wise) 52.4 percent was obtained, coverage. The licensee obtained an aggregate coverage of 70.8 percent. During these examinations the licensee found no indications.

As an alternative, the licensee considered RT; however, it concluded that RT was not a desired option because RT is limited in the ability to detect service induced flaws, and has not been qualified through performance demonstration.

Based on the volumetric coverage obtained it is reasonable to conclude that if significant service-induced degradation had occurred, evidence of it would have been detected by the examinations that were performed. Furthermore, the staff determined that the examinations performed and system leakage tests performed each refueling outage provide reasonable assurance of structural integrity and leak tightness of the subject components.

4.0 CONCLUSION

As set forth above, the staff has determined that granting relief 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 given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. Furthermore, the staff concluded that the examinations performed to the extent practical provide reasonable assurance of structural integrity of the subject components. 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 relief for the subject examinations of the components contained in RR 12-MN-004.

The NRC staff notes that RR 12-MN-004 is not applicable to welds 1NV1F7908 and 1WL1F3063 because the licensee has withdrawn these two welds from the relief request.

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

Principal Contributors: J. Tsao, NRR
T. McClellan, NRR

Date: November 8, 2013

S. Capps

- 2 -

If you have any questions, please contact the Project Manager, Jason Paige at 301-415-5888 or via e-mail at jason.paige@nrc.gov.

Sincerely,
/RA/

Robert J. Pascarelli, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-369

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