April 23, 2001

Mr. H. B. Barron
Vice President, McGuire Site
Duke Energy Corporation
12700 Hagers Ferry Road
Huntersville, NC 28078-8985

SUBJECT: CATAWBA NUCLEAR STATION, UNIT 1 AND MCGUIRE NUCLEAR STATION, UNITS 1 AND 2 RE: REQUEST FOR RELIEF NO. 99-GO-03 (TAC NOS. MA8874, MA8853 AND MA8854)

Dear Mr. Barron:

By letter dated May 4, 2000, as supplemented by letter dated July 20, 2000, Duke Energy Corporation requested that the Nuclear Regulatory Commission staff grant relief from certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code (the Code) preservice inspection requirements on certain welds and inner nozzle radii in the replacement steam generators (SG) at Catawba, Unit 1 and McGuire, Units 1 and 2.

The staff has reviewed the information provided in the licensee's letters dated May 4 and July 20, 2000. The staff's evaluation and conclusions are contained in Enclosure 1, and Table 1 in Enclosure 1 contains a summary of the relief requests. Based on the information provided in the relief requests, the staff concludes that for relief requests associated with the Catawba Unit 1 and McGuire Units 1 and 2: (a) SG inlet and outlet nozzle inside radius, (b) SG inlet and outlet nozzle-to-safe-end dissimilar metal welds, (c) SG auxiliary feedwater nozzle-to-safe-end dissimilar metal welds, and (d) the Catawba Unit 1 SG feedwater nozzle inside radius, the examinations provide reasonable assurance of the structural integrity of the nozzles and welds. Based on the impracticality of complying with the Code and the burden on the licensee if those requirements were imposed, relief is granted pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g)(6)(i).

The staff considers this matter resolved and is closing TAC Nos. MA8874, MA8853 and MA8854.

Sincerely,

/RA/
Richard L. Emch Jr., Chief, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-413, 50-369, and 50-370

Enclosure: As stated

cc w/encl: See next page

April 23, 2001

Mr. H. B. Barron
Vice President, McGuire Site
Duke Energy Corporation
12700 Hagers Ferry Road
Huntersville, NC 28078-8985

SUBJECT: CATAWBA NUCLEAR STATION, UNIT 1 AND MCGUIRE NUCLEAR STATION, UNITS 1 AND 2 RE: REQUEST FOR RELIEF NO. 99-GO-03 (TAC NOS. MA8874, MA8853 AND MA8854)

Dear Mr. Barron:

By letter dated May 4, 2000, as supplemented by letter dated July 20, 2000, Duke Energy Corporation requested that the Nuclear Regulatory Commission staff grant relief from certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code (the Code) preservice inspection requirements on certain welds and inner nozzle radii in the replacement steam generators (SG) at Catawba, Unit 1 and McGuire, Units 1 and 2.

The staff has reviewed the information provided in the licensee's letters dated May 4 and July 20, 2000. The staff's evaluation and conclusions are contained in Enclosure 1, and Table 1 in Enclosure 1 contains a summary of the relief requests. Based on the information provided in the relief requests, the staff concludes that for relief requests associated with the Catawba Unit 1 and McGuire Units 1 and 2: (a) SG inlet and outlet nozzle inside radius, (b) SG inlet and outlet nozzle-to-safe-end dissimilar metal welds, (c) SG auxiliary feedwater nozzle-to-safe-end dissimilar metal welds, and (d) the Catawba Unit 1 SG feedwater nozzle inside radius, the examinations provide reasonable assurance of the structural integrity of the nozzles and welds. Based on the impracticality of complying with the Code and the burden on the licensee if those requirements were imposed, relief is granted pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g)(6)(i).

The staff considers this matter resolved and is closing TAC Nos. MA8874, MA8853 and MA8854.

Sincerely,
/RA/

Richard L. Emch Jr., Chief, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-413, 50-369, and 50-370

Enclosure: As stated

cc w/encl: See next page

Distribution:
PUBLIC
PDII-1 R/F
RidsNrrDlpmLpdii1
RidsAcrsAcnwMailCenter
RidsNrrPMRMartin
RidsOgcRp
GHill (6)
JShea, EDO
RidsRgn2MailCenter
CHawes (paper copy)

ADAMS ACCESSION NUMBER: ML011130264 *See Previous Concurrence

OFFICE	PDII-1/PM	PDII-1/PM	PDII-1/LA	EMCB*	PDII-1/SC	OGC*
NAME	RMartin:cn	CPatel	CHawes	TChan	REmch	RHoefling
DATE	4/13/01	4/13/01	4/13/01	3/28/01	4/23/00	4/4/01

OFFICIAL RECORD COPY

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF NO. 99-GO-03

STEAM GENERATOR PRESERVICE INSPECTION REQUIREMENTS

DUKE ENERGY CORPORATION

CATAWBA NUCLEAR STATION, UNIT 1

AND

MCGUIRE NUCLEAR STATION, UNITS 1 AND 2

DOCKET NOS. 50-413, 50-369 AND 50-370

1.0 INTRODUCTION

The inservice inspection (ISI) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1, Class 2, and Class 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i).

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) will meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that ISI of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The ISI Code of record for Catawba Nuclear Station, Unit 1 and McGuire Nuclear Station, Units 1 and 2 for their second 10-year interval is the 1989 Edition of the ASME Code. The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein and subject to Commission Approval.

2.0 EVALUATION

RELIEF NO. 99-GO-03

By letters dated May 4 and July 20, 2000, Duke Energy Corporation (the licensee) requested relief from certain preservice inspection requirements for replacement steam generators (SGs) at Catawba Nuclear Station, Unit 1 and McGuire Nuclear Station, Units 1 and 2. The licensee determined that compliance with the volumetric examinations (coverages) required by Code was impractical. Specifically, the licensee determined that the preservice inspection coverages for the following examinations, which could be performed, were less than the coverages required by Code. These examinations for Catawba Unit 1 and McGuire Units 1 and 2 are: (a) SG inlet and outlet nozzle inside radius, (b) SG inlet and outlet nozzle-to-safe-end dissimilar metal welds, (c) SG auxiliary feedwater nozzle-to-safe-end dissimilar metal welds, and (d) the Catawba Unit 1 SG nozzle feedwater nozzle inside radius.

The Catawba Unit 1 replacement SGs have been in service since September 1996, the McGuire Unit 1 replacement SGs since May 1997, and the McGuire Unit 2 replacement SGs since December 1997. The preservice examinations were not performed during manufacturing or prior to installation of the SGs. Instead, the licensee performed onsite preservice examination of the SGs after installation under the provisions of Section XI of the Code. These preservice examinations provided the inspection coverages listed in Table 1 of this safety evaluation.

The staff has evaluated the relief request against the criteria in effect at the time of construction, and later endorsed editions and addenda of the Code, as applicable. The subject replacement SGs were inspected by the licensee to the requirements in the 1989 Edition of Section XI of the Code. The list of affected components is in Table 1.

2.1 Steam Generator Nozzles - Inside Radius - Examination Category B-D, Full Penetration Welds of Nozzles in Vessels[1] Item B3.140 - Steam Generator Nozzle Inside Radius Section

2.1.1 Licensee Evaluation

The Components for Which Relief is Requested:

Class 1 SG inlet and outlet nozzles for Catawba Unit 1 and McGuire Units 1 and 2 as listed in the first six items under Examination Category B-D, B3.140 in Table 1.

Requirement from Which Relief is Requested:

The ASME Code paragraph IWB-2200(a) states that the examination requirements in IWB-2500-1 for Examination Category B-D shall be completed prior to initial plant startup. The Code requires volumetric examination of the SG nozzle inner radius according to Table IWB-2500-1, Examination Category B-D, Item B3.140. The volume to be examined is

[1] Although the title of this Code section refers to welds, it also contains the requirements for examining the inside radius of forged nozzle sections, which is the issue here.

defined in Figure IWB-2500-7 (d). The examination coverage is in Subarticle I-2400 to Appendix I to Section XI, which states that examination coverage shall be conducted in accordance with the applicable requirements of Section V, Article 4, "Ultrasonic Examination Methods for Inservice Inspection."

Licensee's Basis for Requesting Relief and Justification for Granting Relief (as stated)

> Relief is requested from the preservice requirement of examining essentially 100% of the required examination volume for the Inside Radius Sections listed [in Table 1] for Examination Category B-D. This is due to our inability to obtain complete coverage of the required examination volume as shown in ASME Section XI, Figure IWB-2500-7(d).
>
> During the ultrasonic examination of the Steam Generator Primary Inlet and Outlet Nozzle Inside Radius Sections, essentially 100% coverage of the required examination volume could not be obtained. See Note A.
>
> Note A
>
> > The examination coverage on each nozzle was limited during preservice examination to 83.3% of the required examination volume. Limitations were caused by the nozzle OD blend radius which prevents scanning 100% of the examination volume.
> >
> > Ultrasonic examinations of nozzle inside radius sections were conducted in accordance with ASME Section V, Article 4.
>
> The examination volume requirements as defined in ASME Section XI 1989 Edition, Figure IWB-2500-7(d) could not be met, however the amount of coverage obtained for these examinations provides an acceptable level of quality and integrity.
>
> The nozzles of the new steam generators were examined in accordance with ASME Section III, 1986 Edition. This work included ultrasonic examination of the forging using SA-388, "Recommended Practice for The Ultrasonic Examination of Heavy Steel Forgings". Each bottom head, including nozzles, was examined by Magnetic Particle (MP) testing. This MP exam was completed following machining but before cladding. After cladding, each bottom head, including the nozzles, received an ultrasonic examination to determine the clad bond integrity. Finally, the clad surface was inspected by liquid penetrant testing.
>
> Replacement or re-design of any of these Class 1 or Class 2 nozzles is not a viable alternative. For McGuire and Catawba, the design of major replacement components to fit into existing plant structural support and piping system configurations necessitates the loss of some preservice and inservice examination accessibility. To accommodate the existing plant profile, Duke concludes the coverage obtained for these examinations provides reasonable assurance of the structural integrity of the subject welds.

2.1.2 Staff Evaluation

The preservice examination verifies construction integrity of the entire nozzle inside radius volume. Preservice examinations may be performed during manufacturing of the SGs as provided in IWB-2200(b)(2) of the Code or after SG installation onsite. According to Code, the licensee is expected to examine the entire nozzle inside radius with either approach or combination of the two approaches. However, the licensee did not perform preservice examination of the nozzle inside radii until after the SGs were installed. The installed SGs provided obstructions to preservice examinations of the nozzle inside radii.

In order to establish construction integrity of the entire nozzle inside radii, the licensee reviewed manufacturing inspection documents. These documents show that the nozzle forgings were examined with ultrasonic testing (UT). The forgings were welded to the vessels, then examined with magnetic particle testing (PT). The inside surfaces of the assemblies were cladded, then examined using UT and PT. The licensee determined that these examinations were acceptable.

The preservice examinations are as stated by the licensee. The examinations were conducted from the outer cylinder portion of the nozzles with prescriptive UT techniques required by the 1989 Edition of the Code. From the cylindrical portion of the nozzle, the techniques could only interrogate 83.3% of the required coverage. The contour formed by blending the outer nozzle surface to the SG restricted the coverage obtainable from the UT examinations required by the Code. The staff concludes that the different nondestructive examinations performed during manufacturing and installation of the SGs and the coverages obtained from preservice examinations provide assurances of an acceptable level of structural integrity of the inside radii.

By definition, preservice examinations of the SG nozzle inside radii must be performed prior to initial startup of the replacement SGs. Therefore, for the existing nozzles that have served in the SGs for several operating cycles, the performance of additional preservice inspections to achieve 100% of Code examination coverage is not possible. To satisfy the examination coverage, the licensee would have to replace the nozzle. Imposition of the Code requirements would result in a significant burden on the licensee.

Conclusion

Based on the above, the staff concludes that the Code requirements are impractical. The several types of examinations performed on the subject SG nozzles in Table 1 of this SE provide reasonable assurance of nozzle radius integrity. Therefore, the staff grants the requested relief for the subject SG nozzle inside radii, pursuant to 10 CFR 50.55a(g)(6)(i), for the Catawba Unit 1, September 1996 SG replacements; McGuire Unit 1, May 1997 SG replacements; and McGuire Unit 2, December 1997 SG replacements. The relief granted 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.

2.2 SG Inlet and Outlet Nozzle-to-Safe-End Dissimilar Metal Welds Examination Category B-F, Pressure Retaining Dissimilar Metal Welds Item B5.70 - Steam Generator (Nozzle-to-Safe-End Butt Welds)

2.2.1 Licensee Evaluation

The Components for Which Relief is Requested:

Class 1 steam generator inlet and outlet nozzle-to-safe-end welds for Catawba Unit 1 and McGuire Units 1 and 2 as listed in the six items under Examination Category B-F, B5.70, in Table 1.

Requirement From Which Relief is Requested

The ASME Code paragraph IWB-2200(a) states that the examination requirements in IWB-2500-1 for Examination Category B-F shall be completed prior to initial plant startup. Preservice examination for pressure retaining welds in all Class 1 components shall be essentially 100%. IWB-2200(c) requires components replaced during the service lifetime of a power unit to be examined according to IWB-2200(a) prior to resumption of service following the replacement. The Code requires volumetric examinations of SG nozzle-to-safe-end dissimilar metal welds according to Table IWB-2500-1, Examination Category B-F, Item B5.70. The weld examination volume is defined in Figure IWB-2500-8(c). The UT technique for interrogating the examination volume is described in Subarticle III-4420 of Appendix III to Section XI of the Code, which states that the volume be examined in two beam path directions. The examinations shall be performed from two sides of the weld, where practicable, or from one side of the weld, as a minimum. The sum of the volume examined from each direction equals the inspection coverage. The Code requires 100% coverage.

Licensee's Basis for Requesting Relief and Justification for Granting Relief (as stated)

> Relief is requested from the preservice requirement of examining essentially 100% of the weld length for the welds listed in [Table 1] for Examination Category B-F. This is due to our inability to obtain complete coverage of the required examination volume in two-beam path directions as stated in ASME Section XI, Appendix III, paragraph III-4420, 1989 Edition.
>
> During the ultrasonic examination of the Steam Generator Primary Inlet and Outlet Nozzle to Safe End Butt Welds, essentially 100% coverage of the required examination volume could not be obtained. See Note B.
>
> Note B
>
> > The subject welds were accessible for preservice examination only from the safe end side resulting in 75% coverage of the required volume for Items B5.70 . . . The most effective ultrasonic technique for the examination of dissimilar metal welds uses refracted longitudinal waves. The longitudinal wave is preferred as the austenitic weld metal and buttering create highly attenuative barriers to shear wave ultrasound. The longitudinal wave is less affected by these difficulties. However, the

> longitudinal wave is affected by mode conversion when it strikes the inside surface of the safe end at any angle other than at a right angle to the surface. . . .
>
> The examination sensitivity is degraded to such an extent that any examination using the second sound path leg is meaningless. Therefore, the two-beam path direction coverage requirement is impractical.

In order to obtain the required two-beam path direction coverage, the nozzles would have to be re-designed to allow scanning from both sides of the weld.

The examination volume requirements as defined in ASME Section XI, 1989 Edition, Figure IWB-2500-8(c), could not be met; however, the amount of coverage obtained for these examinations provides an acceptable level of quality and integrity. . . .

Subsequent to the replacement steam generators being installed, the subject nozzle welds received both radiographic and dye penetrant examinations, the preservice ultrasonic examination to the extent practical, and a hydrostatic test per ASME Section XI requirements. These test[s] were all completed with acceptable results. Successful completion of all these Section III and XI tests ensures the structural integrity of the replaced steam generators.

Replacement or re-design of any of these Class 1 or Class 2 nozzles is not a viable alternative. For McGuire and Catawba, the design of major replacement components to fit into existing plant structural support and piping system configurations necessitates the loss of some preservice and inservice examination accessibility. To accommodate the existing plant profile, Duke concludes the coverage obtained for these examinations provides reasonable assurance of the structural integrity of the subject welds.

2.2.2 Staff Evaluation

The inspection coverage requirements for SG nozzle-to-safe-end dissimilar metal welds are in Table IWB-2500-1, Examination Category B-F, Item B5.70. The welds join carbon steel nozzles to stainless steel safe-ends. Examination from the nozzle side of the welds was restricted by the nozzle configuration and the blending of the nozzle to the vessel. Therefore, the onsite preservice UT examinations could only be conducted from the accessible, stainless steel, safe-end side of the welds. The licensee interrogated the welds for circumferential cracks (in one direction from one side of the weld) and axial cracks (in two directions from both sides of the weld), resulting in a coverage of 75%. These onsite preservice examinations were performed to the maximum extent possible using the prescriptive UT techniques required by the Code. The results of these examinations are the UT baseline (reference) for future ISI.

The preservice inspection (PSI) verifies construction integrity of the entire weld volume. PSI may be performed offsite during manufacturing of the SGs as provided in IWB-2200(b)(2) of the Code or onsite after SG installation. The entire weld volume was accessible for offsite PSI. Instead of performing offsite PSI, the licensee performed limited onsite PSI. The licensee incorrectly reasoned that IWB-2200(b)(2) supported their application of onsite PSI, which

reflects the limited coverage achievable with future ISI. The error with this reasoning is that the integrity of the entire weld is not verified. Verifying weld integrity is the primary purpose of PSI.

To establish construction integrity of the entire weld, the licensee reviewed manufacturing records of inspections performed during fabrication and installation of the SGs. The nozzle-to-safe-end welds were examined for flaws after fabrication with radiographic testing and liquid penetrant testing and were determined by the licensee to be acceptable. Upon completion of installation, these welds received limited onsite UT examination. However, the extent of the manufacturers' and installation inspections and limited preservice examinations that were performed were sufficient to verify the integrity of the welds.

By definition, preservice examinations of the SG nozzle-to-safe-end must be performed prior to initial startup of the replacement SGs. Therefore, for the existing nozzles that have served in the SGs for several operating cycles, the performance of additional preservice inspections to achieve 100% of Code examination coverage is not possible. To satisfy the examination coverage, the licensee would have to replace the nozzle. Imposition of the Code requirements would result in a significant burden on the licensee[2].

Conclusion

Based on the above, the staff concludes that the Code requirements are impractical. The several types of examinations performed on the subject SG nozzle-to-safe-end welds in Table 1 of this SE provide reasonable assurance of weld integrity. Therefore, the staff grants the requested relief for the subject SG nozzle-to-safe-end welds, pursuant to 10 CFR 50.55a(g)(6)(i), for the Catawba Unit 1, September 1996 SG replacements; McGuire Unit 1, May 1997 SG replacements; and McGuire Unit 2, December 1997 SG replacements. The relief granted 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.

[2] After the licensee completed the preservice examinations, the NRC issued a rule affecting UT requirements for ISI (64 *FR* 51370, September 22, 1999) which included provisions for dissimilar metal pipe welds. The rule requires that a performance-based UT examination be used after November 22, 2002, instead of the prescriptive UT technique that was used by the licensee for preservice examinations. The rule allows licensees to perform UT examinations from one side of the weld and receive full credit for two sided examinations. The change in UT examinations will cause the results of future UT examinations to be different from those original Code-required UT baselines, essentially creating a revised performance-based UT baseline for each weld. The creation of a performance-based UT baseline will diminish the need for the original baseline and diminish the significance of the licensee not completing the original Code-required baseline.

2.3 SG Auxiliary Feedwater Nozzle-to-Safe-End Dissimilar Metal Welds Examination Category C-F-1, Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping Item C5.11 - Auxiliary Feedwater (Piping Circumferential Welds)

2.3.1 Licensee Evaluation

The Components for Which Relief is Requested:

Class 2 steam generator auxiliary feedwater nozzles for Catawba Unit 1 and McGuire Units 1 and 2 as listed in the last three items under Examination Category C-F-1, C5.11, in Table 1.

Requirement From Which Relief is Requested

The ASME Code paragraph IWC-2200(a) states that the examination requirements in IWC-2500-1 for Examination Category C-F-1 shall be completed prior to initial plant startup. The Code requires volumetric examinations of the SG auxiliary feedwater nozzle-to-safe-end circumferential welds according to Table IWC-2500-1, Examination Category C-F-1, Item C5.11. The licensee's weld examination volume is defined in Figure IWC-2500-7(a). The UT examination coverage is described in Subarticle III-4420 of Appendix III to Section XI of the Code, which states that coverage be examined in two beam path directions. The examination shall be performed from two sides of the weld, where practicable, or from one side of the weld, as a minimum. The sum of the volume examined from each direction equals the inspection coverage. The Code requires 100% coverage.

Licensee's Basis for Requesting Relief and Justification for Granting Relief (as stated)

> Relief is requested from the preservice requirement of examining essentially 100% of the weld length for the welds listed in [Table 1] for Examination Category C-F-1. This is due to our inability to obtain complete coverage of the required examination volume in two-beam path directions as stated in ASME Section XI, Appendix III, paragraph III-4420, 1989 Edition.
>
> During the ultrasonic examination of the Steam Generator Auxiliary Feedwater Circumferential Welds, essentially 100% coverage of the required examination volume could not be obtained. See Note B.
>
> Note B
>
> > The subject welds were accessible for preservice examination only from the safe end side resulting in 50% coverage of the required volume for Items C5.11 . . . The most effective ultrasonic technique for the examination of dissimilar metal welds uses refracted longitudinal waves. The longitudinal wave is preferred as the austenitic weld metal and buttering create highly attenuative barriers to shear wave ultrasound. The longitudinal wave is less affected by these difficulties. However, the longitudinal wave is affected by mode conversion when it strikes the inside surface of the safe end at any angle other than at a right angle to the surface. . . .

> The examination sensitivity is degraded to such an extent that any examination using the second sound path leg is meaningless. Therefore, the two-beam path direction coverage requirement is impractical.
>
> In order to obtain the required two-beam path direction coverage, the nozzles would have to be re-designed to allow scanning from both sides of the weld.
>
> The examination volume requirements as defined in ASME Section XI, 1989 Edition, Figure IWB-2500-7(a), could not be met; however, the amount of coverage obtained for these examinations provides an acceptable level of quality and integrity. . . .
>
> Subsequent to the replacement steam generators being installed, the subject nozzle welds received both radiographic and dye penetrant examinations, the preservice ultrasonic examination to the extent practical, and a hydrostatic test per ASME Section XI requirements. These test(s) were all completed with acceptable results. Successful completion of all these Section III and XI tests ensures the structural integrity of the replaced steam generators.
>
> Replacement or re-design of any of these Class 2 nozzles is not a viable alternative. For McGuire and Catawba, the design of major replacement components to fit into existing plant structural support and piping system configurations necessitates the loss of some preservice and inservice examination accessibility. To accommodate the existing plant profile, Duke concludes the coverage obtained for these examinations provides reasonable assurance of the structural integrity of the subject welds.

2.3.2 Staff Evaluation

The inspection coverage requirements for SG auxiliary feedwater nozzle-to-safe-end dissimilar metal welds are in Table IWC-2500-1, Examination Category C-F-1, Item C5.11. The welds join carbon steel nozzles to stainless steel safe-ends. Examination from the nozzle side of the welds was restricted by the nozzle configuration and the blending of the nozzle to the vessel. Therefore, the on-site preservice UT examinations could only be conducted from the accessible, stainless steel, safe-end side of the welds. The licensee interrogated the welds for circumferential cracks (in one direction from one side of the weld) and axial cracks (in two directions from one side of the weld), resulting in a coverage of 50%. These onsite preservice examinations were performed to the maximum extent possible using the prescriptive UT techniques required by the Code. The results of these examinations are the UT baseline (reference) for future ISI.

The PSI verifies construction integrity of the entire weld volume. PSI may be performed offsite during manufacturing of the SGs as provided in IWC-2200(b)(2) of the Code or onsite after SG installation. The entire weld volume was accessible for offsite PSI. Instead of performing offsite PSI, the licensee performed limited onsite PSI. The licensee incorrectly reasoned that IWC-2200(b)(2) supported their application of onsite PSI, which reflects the limited coverage achievable with future ISI. The error with this reasoning is that the integrity of the entire weld is not verified. Verifying weld integrity is the primary purpose of PSI.

To establish construction integrity of the entire weld, the licensee reviewed manufacturing records of inspections performed during fabrication and installation of the SGs. The nozzle-to-safe-end welds were examined for flaws after fabrication with radiographic testing and liquid penetrant testing and were determined by the licensee to be acceptable. Upon completion of installation, these welds received limited onsite UT examination. However, the extent of the manufacturers' and installation inspections and limited preservice examinations that were performed were sufficient to verify the integrity of the welds.

By definition, preservice examinations of the SG auxiliary feedwater nozzle-to-safe-end must be performed prior to initial startup of the replacement SGs. Therefore, for the existing nozzles that have served in the SGs for several operating cycles, the performance of additional preservice inspections to achieve 100% of Code examination coverage is not possible. To satisfy the examination coverage, the licensee would have to replace the nozzles. Imposition of the Code requirements would result in a significant burden on the licensee[3].

Conclusion

Based on the above, the staff concludes that the Code requirements are impractical. The several types of examinations performed on the subject SG auxiliary feedwater nozzle-to-safe-end welds in Table 1 of this SE provide reasonable assurance of weld integrity. Therefore, the staff grants the requested relief for the subject SG auxiliary feedwater nozzle-to-safe-end welds, pursuant to 10 CFR 50.55a(g)(6)(i), for the Catawba Unit 1, September 1996 SG replacements; McGuire Unit 1, May 1997 SG replacements; and McGuire Unit 2, December 1997 SG replacements. The relief granted 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.

2.4 SG Feedwater Nozzle Inside Radii Examination Category C-B, Pressure Retaining Nozzle Welds in Vessels Item C2.22 - Feedwater (Nozzle Inside Radius Section)

2.4.1 Licensee Evaluation

The Components for Which Relief is Requested

Class 2 steam generator main feedwater nozzle inside radius section for Catawba Unit 1 as listed in the single item under Examination Category C-B, C2.22, in Table 1.

Requirement from Which Relief is Requested

The ASME Code paragraph IWC-2200(a) states that the examination requirements in IWC-2500-1 for Examination Category C-B shall be completed prior to initial plant startup. The Code requires volumetric examinations of the SG feedwater nozzle inner radii according to Table IWC-2500-1, Examination Category C-B, Item C2.22. The volume to be examined is defined in Figure IWC-2500-4(a). The examination coverage is in Subarticle I-2400 to

[3] The comment in footnote 2 for section 2.2, regarding the NRC rule affecting UT requirements for ISI is also applicable to the discussion in section 2.3.

Appendix I to Section XI which states that examination coverage shall be conducted in accordance with the applicable requirements of Article 4, "Ultrasonic Examination Methods for Inservice Inspection."

Licensee's Basis for Requesting Relief and Justification for Granting Relief (as stated)

> Relief is requested from the preservice requirement of examining essentially 100% of the required examination volume for the Inside Radius Sections listed in [Table 1] for Examination Category C-B. This is due to our inability to obtain complete coverage of the required examination volume as shown in ASME Section XI, Figure IWC-2500-4(a).
>
> During the preservice ultrasonic examination of the Steam Generator Feedwater Nozzle Inside Radius Sections, essentially 100% coverage of the required examination volume could not be obtained.
>
> The examination coverage for each nozzle was limited to 8.4% of the required volume. The nozzle taper adjacent to the vessel wall prevented scanning from the vessel wall. Duke Energy Corporation investigated the use of computer modeling and mock-ups to increase the coverage. The nozzles inside radius sections were examined during an inservice inspection in subsequent outages (EOC-10 and EOC-11). One hundred percent coverage was achieved and no indications were found.
>
> The examination volume requirements as defined in ASME Section XI 1989 Edition, Figure IWC-2500-4(a), could not be met; however, the amount of subsequent inservice inspection coverage (100%) obtained for these examinations provides an acceptable level of quality and integrity.

2.4.2 Staff Evaluation

The preservice examination verified construction integrity of the entire nozzle inside radius volume. Preservice examinations may be performed during manufacturing of the SGs as provided in IWC-2200(b)(2) of the Code or after SG installation onsite. According to Code, the licensee is expected to examine the nozzle inside radius with either approach or combination of the two approaches. However, the licensee did not perform preservice examination of the nozzle inside radii until after the SGs were installed. The installed SGs provided obstructions to preservice examinations of the nozzle inside radii.

The preservice examinations, as stated by the licensee, were conducted from the outer cylinder portion of the nozzle using prescriptive UT techniques that are required by the 1989 Edition of the Code. From the cylindrical portion of the nozzles, the preservice UT techniques could only interrogate 8.4% of the required coverages after installation. The contours formed by blending the outer nozzle surfaces to the SGs restricted the coverages obtainable from Code-required UT examinations.

In order to establish construction integrity of the entire nozzle inside radii, the licensee reviewed manufacturing inspection documents. These documents show that the nozzle forgings were examined with UT. The forgings were welded to the vessels, then examined with magnetic PT.

The inside surfaces of the assemblies were cladded, then examined using UT and PT. The licensee determined that these examinations were acceptable.

After startup, the licensee contacted the Electric Power Research Institute - Nondestructive Center for assistance in performing computer modeling and for developing a new scan plan for the feedwater nozzle inner radius. The licensee procured a calibration block designed to duplicate the feedwater nozzle geometry. Using the new scan plan during refueling outages at the end-of-cycle 10 (EOC-10) and EOC-11, the licensee was able to achieve 100% coverage of the feedwater nozzle inside radii. The staff finds that the several types of preservice nondestructive examinations performed during manufacturing and installation of the SGs and the coverage obtained from supplementary examinations during EOC-10 and EOC-11 provide adequate assurance of the structural integrity of the nozzle inside radii.

By definition, preservice examinations of SG feedwater nozzle inside radii must be performed prior to startup. Therefore, for the existing nozzles that have served in the SGs for several operating cycles, the performance of additional preservice inspections to achieve 100% of Code examination coverage is not possible. To satisfy the examination coverage, the licensee would have to replace the nozzles. Imposition of the Code requirements would result in a significant burden on the licensee.

Staff Summary

Based on the above, the staff concludes that the Code requirements are impractical. The examinations performed on the subject SG feedwater nozzle inside radii in Table 1 of this SE provide reasonable assurance of radii integrity. Therefore, the staff grants the requested relief for the subject SG feedwater nozzle inside radius, pursuant to 10 CFR 50.55a(g)(6)(i), for the Catawba Unit 1, September 1996 SG replacements. The relief granted 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 coudl result if the requirements were imposed on the facility.

3.0 CONCLUSION

The Catawba Unit 1 and McGuire Units 1 and 2 Request for Relief 99-GO-03, seeking relief from certain ASME Code pre-service inspection requirements associated with the: (a) SG inlet and outlet nozzle inside radius, (b) SG inlet and outlet nozzle-to-safe-end dissimilar metal welds, (c) SG auxiliary feedwater nozzle-to-safe-end dissimilar metal welds, and (d) the Catawba Unit 1 request for relief for the SG nozzle feedwater nozzle inside radius have been reviewed by the staff. A summary of Request for Relief No. 99-GO-03 and affected components is presented in Table 1. The staff grants relief from each ASME Code requirement pursuant to 10 CFR 50.55a(g)(6)(i). 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 giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

Principal Contributors: D. Naujock
R. Martin

Date: April 23, 2001

Table 1. Component identification, inspection requirements, inspection interference, and percent of volume inspected (coverage)

PLANT	IDENTIFICATION NUMBER	EXAMINATION CATEGORIES, CODE ITEMS	DESCRIPTION	PERCENT COVERAGE	LIMITATION
McGuire	INLET:1SGA, 1SGB, 1SGC, and 1SGD	B-D, B3.140	SG, Nozzle Inside Radius	83.3	Nozzle OD blend rad
McGuire	OUTLET: 1SGA, 1SGB, 1SGC, and 1SGD	B-D, B3.140	SG, Nozzle Inside Radius	83.3	Nozzle OD blend rad
Catawba	INLET: 1SGA, 1SGB, 1SGC, and 1SGD	B-D, B3.140	SG, Nozzle Inside Radius	83.3	Nozzle OD blend rad
Catawba	OUTLET: 1SGA, 1SGB, 1SGC, and 1SGD	B-D, B3.140	SG, Nozzle Inside Radius	83.3	Nozzle OD blend rad
McGuire	INLET: 2SGA, 2SGB, 2SGC, and 2SGD	B-D, B3.140	SG, Nozzle Inside Radius	83.3	Nozzle OD blend rad
McGuire	OUTLET: 2SGA, 2SGB, 2SGC, and 2SGD	B-D, B3.140	SG, Nozzle Inside Radius	83.3	Nozzle OD blend rad
McGuire	INLET-SE: 1SGA, 1SGB, 1SGC, and 1SGD	B-F, B5.70	Nozzle-to-Safe End Weld	75.0	Nozzle configuration Accessible only from
McGuire	OUTLET-SE: 1SGA, 1SGB, 1SGC, and 1SGD	B-F, B5.70	Nozzle-to-Safe End Weld	75.0	Nozzle configuration Accessible only from
Catawba	INLET-SE: 1SGA, 1SGB, 1SGC, and 1SGD	B-F, B5.70	Nozzle-to-Safe End Weld	75.0	Nozzle configuration Accessible only from
Catawba	OUTLET-SE: 1SGA, 1SGB, 1SGC, and 1SGD	B-F, B5.70	Nozzle-to-Safe End Weld	75.0	Nozzle configuration Accessible only from
McGuire	INLET-SE: 2SGA, 2SGB, 2SGC, and 2SGD	B-F, B5.70	Nozzle-to-Safe End Weld	75.0	Nozzle configuration Accessible only from
McGuire	OUTLET-SE: 2SGA, 2SGB, 2SGC, and 2SGD	B-F, B5.70	Nozzle-to-Safe End Weld	75.0	Nozzle configuration Accessible only from
Catawba	W258: 1SGA, 1SGB, 1SGC, and 1SGD	C-B, C2.22	Feedwater Nozzle Inside Radius Section	8.4	Nozzle taper adjacen
Catawba	W261: 1SGA, 1SGB, 1SGC, and 1SGD	C-F-1, C5.11	Aux. Feedwater Nozzle-to-Safe End Weld	50.0	Nozzle configuration Accessible only from
McGuire	W261: 1SGA, 1SGB, 1SGC, and 1SGD	C-F-1, C5.11	Aux. Feedwater Nozzle-to-Safe End Weld	50.0	Nozzle configuration Accessible only from
McGuire	W261: 2SGA, 2SGB, 2SGC, and 2SGD	C-F-1, C5.11	Aux, Feedwater Nozzle-to-Safe End Weld	50.0	Nozzle configuration Accessible only from

McGuire Nuclear Station
Catawba Nuclear Station

cc:
Ms. Lisa F. Vaughn
Legal Department (PBO5E)
Duke Energy Corporation
422 South Church Street
Charlotte, North Carolina 28201-1006

County Manager of Mecklenburg County
720 East Fourth Street
Charlotte, North Carolina 28202

Mr. Michael T. Cash
Regulatory Compliance Manager
Duke Energy Corporation
McGuire Nuclear Site
12700 Hagers Ferry Road
Huntersville, North Carolina 28078

Anne Cottingham, Esquire
Winston and Strawn
1400 L Street, NW.
Washington, DC 20005

Senior Resident Inspector
c/o U. S. Nuclear Regulatory
Commission
12700 Hagers Ferry Road
Huntersville, North Carolina 28078

Mr. Peter R. Harden, IV
VP-Customer Relations and Sales
Westinghouse Electric Company
5929 Carnegie Blvd.
Suite 500
Charlotte, North Carolina 28209

Dr. John M. Barry
Mecklenburg County
Department of Environmental
Protection
700 N. Tryon Street
Charlotte, North Carolina 28202

Mr. Richard M. Fry, Director
Division of Radiation Protection
North Carolina Department of
Environment, Health, and
Natural Resources
3825 Barrett Drive
Raleigh, North Carolina 27609-7721

Ms. Karen E. Long
Assistant Attorney General
North Carolina Department of
Justice
P. O. Box 629
Raleigh, North Carolina 27602

Mr. C. Jeffrey Thomas
Manager - Nuclear Regulatory
Licensing
Duke Energy Corporation
526 South Church Street
Charlotte, North Carolina 28201-1006

Elaine Wathen
Lead REP Planner
Division of Emergency Management
116 West Jones Street
Raleigh, North Carolina 27603-1335

Mr. T. Richard Puryear
Owners Group (NCEMC)
Duke Energy Corporation
4800 Concord Road
York, South Carolina 29745

McGuire Nuclear Station
Catawba Nuclear Station

cc:
Mr. Gary Gilbert
Regulatory Compliance Manager
Duke Energy Corporation
4800 Concord Road
York, South Carolina 29745

North Carolina Municipal Power
Agency Number 1
1427 Meadowwood Boulevard
P. O. Box 29513
Raleigh, North Carolina 27626-0513

County Manager of York County
York County Courthouse
York, South Carolina 29745

Piedmont Municipal Power Agency
121 Village Drive
Greer, South Carolina 29651

Saluda River Electric
P. O. Box 929
Laurens, South Carolina 29360

Virgil R. Autry, Director
Division of Radioactive Waste Management
Bureau of Solid and Hazardous Waste
Department of Health and Environmental
Control
2600 Bull Street
Columbia, South Carolina 29201

North Carolina Electric Membership
Corporation
P. O. Box 27306
Raleigh, North Carolina 27611

Senior Resident Inspector
4830 Concord Road
York, South Carolina 29745

Mr. G. R. Peterson
Site Vice President
Catawba Nuclear Station
Duke Energy Corporation
4800 Concord Road
York, South Carolina 29745

Mr. H. B. Barron
Vice President, McGuire Site
Duke Energy Corporation
12700 Hagers Ferry Road
Huntersville, North Carolina 28078