March 20, 2003

Mr. G. R. Peterson
Site Vice President
Catawba Nuclear Station
Duke Energy Corporation
4800 Concord Road
York, South Carolina 29745-9635

SUBJECT: CATAWBA NUCLEAR STATION, UNIT 2 RE: REQUEST FOR RELIEF NO. 01-003 (TAC NO. MB3923)

Dear Mr. Peterson:

By letter dated December 20, 2001, as supplemented by letters dated July 29 and November 25, 2002, Duke Energy Corporation requested the Nuclear Regulatory Commission (NRC) staff to grant relief from certain American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code inservice inspection requirements for the Catawba Nuclear Station, Unit 2.

The NRC staff, with technical assistance from Pacific Northwest National Laboratory (PNNL), has reviewed the information provided in the licensee's letters dated December 20, 2001, as supplemented by letters dated July 29 and November 25, 2002. The staff's Safety Evaluation (SE) is enclosed. Attached to the staff's SE is PNNL's Technical Letter Report for Relief Request No. 01-003. The NRC staff has reviewed the PNNL report and agrees with its evaluations and conclusions.

Based on the information provided in the request for relief from the requirements of the ASME Code, Section XI, 1989 Edition, Table IWB-2500, regarding the volumetric examination coverage requirements for examination categories B-D, B-J, C-B, and C-F-1 welds, the staff concludes that the examinations conducted provide reasonable assurance of the structural integrity of the welds. Further, the staff has concluded it is impractical for the licensee to comply with the Code given the burden on the licensee if those requirements were imposed. Therefore, relief is granted pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g)(6)(i), during the second 10-year inservice inspection interval. 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.

The staff considers this matter resolved and is closing out TAC NO. MB3923.

Sincerely,

/***RA***/

John A. Nakoski, Chief, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-414

Enclosure: As stated

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SECOND 10-YEAR INSERVICE INSPECTION INTERVAL

REQUEST FOR RELIEF NO. 01-003

DUKE ENERGY CORPORATION

CATAWBA NUCLEAR STATION, UNIT 2

DOCKET NO. 50-414

## 1.0 INTRODUCTION

The staff of the Nuclear Regulatory Commission (NRC), with technical assistance from Pacific Northwest National Laboratory (PNNL), has reviewed information concerning the inservice inspection (ISI) program Request for Relief number 01-003 that was submitted for the second 10-year interval for the Catawba Nuclear Station, Unit 2, in Duke Power Company's (the licensee's) letter dated December 20, 2001. The licensee revised the request for relief in letters dated July 29, and November 25, 2002. The Evaluation portion of the attached PNNL Technical Letter Report (TLR) includes five sections in order to separately evaluate the various Section XI Code Classes, Examination Categories, and Item Numbers contained in the subject relief.

## 2.0 REGULATORY REQUIREMENTS

The ISI of American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code (Code) and applicable 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). In accordance with 10 CFR 50.55a(a)(3), alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in 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 inservice examination 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 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 applicable edition of Section XI of the ASME Code for the second 10-year interval for Catawba Nuclear Station (Catawba), Unit 2 is the 1989 Edition of the Code.

## 3.0 TECHNICAL EVALUATION

The NRC staff adopts PNNL's evaluations and recommendations for the granting of relief, as contained in the attached TLR. Table 1 of the attached PNNL TLR lists each relief request and the status of approval.

Based on the review of Request for Relief 01-003, the NRC staff finds that for the Catawba Nuclear Station, Unit 2, the Code requirements are impractical. It would be an excessive burden on the licensee to perform the Code required examinations because the subject components would have to be redesigned. The licensee obtained 22.87 percent through 75 percent volumetric coverage for the subject welds and performed 100 percent of the surface examination. The staff has determined that reasonable assurance of the structural integrity of the subject components has been provided based on the examinations that were performed.

## 4.0 CONCLUSIONS

The Catawba, Unit 2, Request for Relief 01-003, seeking relief from certain ASME Code inspection requirements associated with the volumetric examination coverage requirements for examination categories B-D, B-J, C-B and C-F-1 welds has been reviewed by the staff with the assistance of its contractor, PNNL. The TLR provides PNNL's evaluation of these requests for relief. The staff has reviewed the TLR and adopts the evaluation and recommendation for granting the licensee's request for relief. The staff concludes that requiring the licensee to redesign weldments to obtain 100-percent volumetric coverage would result in a significant burden. For each component identified, the staff has determined that compliance with the requirements of the Code is impractical, and grants relief from the specified ASME Code requirement, pursuant to 10 CFR 50.55a(g)(6)(i), during the second 10-year inservice inspection interval. 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 Contributor: T. McLellan, EMCB/DE
M. Anderson, PNNL

Attachment: TLR for Catawba Unit 2, Relief Request 01-003

Date:

TECHNICAL LETTER REPORT
ON THE SECOND 10-YEAR INTERVAL INSERVICE INSPECTION
REQUEST FOR RELIEF NO. 01-003
FOR
DUKE POWER COMPANY
CATAWBA NUCLEAR POWER STATION, UNIT 2
DOCKET NUMBER: 50-414

## 1.0 INTRODUCTION

By letter dated December 20, 2001, the licensee, Duke Power Company, submitted request for relief 01-003, seeking relief from requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components. In response to an NRC Request for Additional Information (RAI), the licensee revised the request in a letter dated July 29, 2002 and provided further clarification in a letter dated November 25, 2002. This request is for the second 10-year inservice inspection (ISI) interval at Catawba Nuclear Power Station, Unit 2 (Catawba 2). The Pacific Northwest National Laboratory (PNNL) has evaluated the subject request for relief in the following section.

## 2.0 EVALUATION

The information provided by Duke Power Company in support of the request for relief from code requirements has been evaluated and the basis for disposition is documented below. The code of record for the Catawba 2 second 10-year interval inservice inspection program, which began on August 19, 1996, is the 1989 Edition of Section XI of the ASME Boiler and Pressure Vessel Code with no addenda. For clarity, the request has been evaluated by Code Examination Category.

### 2.1 Request for Relief 01-003, Examination Category B-D, Item B3.11, Full Penetration Welds of Nozzles In Vessels, Pressurizer Surge Nozzle

Code Requirement: Examination Category B-D, Item B3.11, requires essentially 100% volumetric examination, as defined by Figure IWB-2500-7, of Class 1 full penetration nozzle welds in the pressurizer. “Essentially 100%”, as clarified by ASME Code Case N-460, is greater than 90% coverage of the examination volume, or surface area, as applicable.

Licensee’s Code Relief Request: In accordance with 10CFR50.55a(g)(5)(iii), the licensee requested relief from the 100% volumetric examination coverage requirement for pressurizer surge nozzle-to-vessel Weld 2PZR-W1.

Licensee's Basis for Relief Request (as stated):

During the ultrasonic examination of the pressurizer surge nozzle-to-head Weld 2PZR-WI shown in Attachment 2[1], 100% coverage of the required examination volume could not be obtained. The examination coverage was limited to 42.80%. Limitations are caused by the weld geometry that restricts access to only one side of the weld, and the proximity of heater tubes that restrict the scanning surface. The percentage of coverage reported represents the aggregate coverage obtained from one scan perpendicular to the weld axis and two scans 180° apart parallel to the weld.

Licensee's Proposed Alternative Examination (as stated):

No additional examinations are planned during the current interval for 2PZR-WI. Radiography is not practical because of the geometry of the component, which prevents placement of the film and exposure source. Duke Energy Corporation will continue to use the most effective ultrasonic techniques available to obtain maximum coverage for future examination of this weld.

Evaluation: The Code requires 100% volumetric coverage of pressurizer nozzle-to-lower head Weld 2PZR-W1 (surge nozzle). However, the weld geometry restricts access to only one side of the weld, and the proximity of heater tubes restrict the scanning surface so that 100% of the weld cannot be examined. For the licensee to achieve 100% volumetric coverage, the subject surge nozzle weld would have to be redesigned and modified. This would place a significant burden on the licensee, thus the Code-required 100% volumetric examination is impractical.

As shown on the sketches and technical descriptions provided by the licensee, approximately 43% coverage of the required examination volume was obtained. The pressurizer heater tubes penetrate the vessel and are located periodically around the surge nozzle. These limit access to ultrasonic scans from the vessel side of the nozzle weld. In addition, the radius of curvature of the nozzle outside surface prevents scanning from the opposite side of this weld. However, the licensee is able to complete a substantial volume of the pressurizer nozzle weld by scanning between the locations of these heater tubes. Based on the absence of flaws detected in pressurizer surge nozzle welds within the industry, it is assumed that service-induced degradation will not occur preferentially in the weld area not being inspected (adjacent to heater tube penetrations) during these limited examinations. While the licensee cannot meet the Code-required 100% volumetric examination coverage, the limited examination completed should detect any general patterns of degradation that may occur in the areas examined, providing reasonable assurance of the continued structural integrity of this weld. Therefore, pursuant to 10CFR50.55a(g)(6)(i), it is recommended that relief be granted.

[1]The licensee's drawings and examination data shown in the Attachment 2 are not included in this report.

2.2 Request for Relief 01-003, Examination Category B-J, Item B9.31, Pressure Retaining Welds in Piping; Branch Pipe Connection

Code Requirement: Examination Category B-J, Item B9.31 requires essentially 100% volumetric and surface examination of the weld length, as defined by Figure IWB-2500-11, of Class 1 full penetration piping welds. "Essentially 100%", as clarified by ASME Code Case N-460, is greater than 90% coverage of the examination volume, or surface area, as applicable. In Paragraph III-4420, the Code further states that examinations be performed using a sufficiently long beam path to provide coverage of the required examination volume in two-beam path directions, and that the examination be performed from two sides of the weld, where practicable, or from one side of the weld, as a minimum.

Licensee's Code Relief Request: In accordance with 10CFR50.55a(g)(5)(iii), the licensee requested relief from the Code requirement to examine branch piping Weld 2NC13-WN9 using two beam paths, and to complete 100% coverage of the examination volume shown in Figure IWB-2500-11.

Licensee's Basis for Relief Request (as stated):

During the ultrasonic examination of this branch pipe connection weld, 2NC13-WN9 shown in Attachment 3[2], greater than 90% of the required examination volume as allowed by Code Case N-460 could not be achieved. The examination coverage was limited to 22.87% of the required examination volume. This is an austenitic stainless steel branch connection weld where access is limited to the main run pipe side of the weld. The main run of pipe is cast stainless steel. The percentage of coverage reported represents the aggregate coverage obtained from one scan parallel to the pipe axis and two scans 180° apart in the circumferential direction on each weld. Although 22.87% is the coverage claimed for this examination, 100% of the examination volume was covered with a 45° angle from one direction perpendicular to the weld axis.

This is an austenitic stainless steel branch connection weld where access is limited to the main run pipe side of the weld. The main pipe run is cast stainless steel. The weld design prevented any scan from the branch connection side. In order to achieve coverage in the two beam directions, and to cover greater then 90% of the examination volume the weld would have to be re-designed to allow scanning from both sides.

Duke Energy Corporation does not claim credit for coverage of the far side of austenitic welds. The characteristics of austenitic weld metal attenuate and distort the sound beam when shear waves pass through the weld. Refracted longitudinal waves provide better penetration. Duke Energy Corporation uses refracted longitudinal waves to examine cast austenitic welds.

On November 21, 2002, a telephone call was held between Duke Energy Corporation and the NRC regarding the subject request for relief. Specifically, the NRC requested information regarding the coverage obtained in the surface examinations for the subject

[2]The licensee's drawings and examination data shown in the Attachment 3 are not included in this report.

welds. Duke Energy Corporation subsequently indicated in an electronic mail that for the subject welds, all of the examinations received 100% surface examination coverage, except for weld [Code] Item number B3.11, which does not require a surface examination by ASME Section XI. This letter [the licensee's November 25, 2002, supplement] confirms and dockets the surface examination coverage of the subject welds.

Licensee's Proposed Alternative Examination (as stated):

No additional examinations are planned during the current interval for 2NC13-WN9. Radiography is not practical because of the geometry of the component, which prevents placement of the film and exposure source. Duke Energy Corporation will continue to use the most effective ultrasonic techniques available to obtain maximum coverage for future examination of this weld.

Evaluation: The Code requires 100% volumetric coverage of Category B-J pressure retaining welds in piping using two beam path directions. The subject piping branch connection weld (ID number 2NC13-WN9) is part of the reactor coolant pressure boundary and is located inside containment. The outside surface geometry of this pipe branch connection restricts access to only the main pipe side of the weld, which is fabricated of cast stainless steel. Scan access is not available from the pipe branch side of the weld. The licensee uses dual element refracted longitudinal wave transducers, which are known to provide superior penetration in austenitic materials than shear wave transducers. However, these transmit-receive transducers are optimally focused on the component inside surface using a one-half-vee metal path. To achieve the Code-required second axial direction, the transducer would have to be capable of focusing at the full-vee metal path. Using the transducer beyond the one-half-vee focal range would not provide adequate sensitivity. For the licensee to achieve 100% volumetric coverage of this weld from two beam directions would require that the weld be completely redesigned and modified. This would place a significant burden on the licensee; therefore, the Code-required 100% volumetric examination from two beam directions is impractical.

As shown on the sketches provided by the licensee, an aggregate coverage of approximately 23% of the required examination volume was obtained. This includes 100% of the required examination volume coverage with a 45°angle longitudinal wave technique, applied in one direction oriented perpendicular to the weld axis from the main pipe run side of the weld. The design of the pipe branch connection does not permit scanning from the forged pipe branch side of the weld. Recent round-robin trials for ultrasonic examination of cast stainless steel, especially in thick-walled (>2-inch) components, show that many of these configurations may not be reliably inspected with current technology. However, longitudinal wave techniques were shown in these trials to provide the better detection results in highly attenuative cast material. No known degradation mechanisms or industry failures have been experienced for these austenitic pipe-to-branch connections in PWRs. Further, the licensee performed 100% of the Code-required surface examination on this weld. While the licensee cannot meet the

Code-required 100% volumetric examination requirement from two beam path directions, the longitudinal wave and surface examinations examination performed should detect any structurally significant patterns of degradation that may occur, providing reasonable assurance of the continued integrity of Weld 2NC13-WN9. Therefore, pursuant to 10CFR50.55a(g)(6)(i), it is recommended that relief be granted.

2.3 Request for Relief 01-003, Examination Category C-B, Item C2.21, Pressure Retaining Welds in Vessels, Nozzle-to-Shell Welds, Steam Generator Auxiliary Feedwater Nozzle

Code Requirement: Examination Category C-B, Item C2.21, requires essentially 100% volumetric and surface examination, as defined in Figure IWC-2500-4(a), of Class 2 nozzle-to-vessel welds. "Essentially 100%", as clarified by ASME Code Case N-460, is greater than 90% coverage of the examination volume, or surface area, as applicable. Further, ASME Section V, Article 4, Paragraph T424.1 states that the volume be examined by moving the search unit over the examination surface so as to scan the entire examination volume.

Licensee's Code Relief Request: In accordance with 10CFR 50.55a(g)(5)(iii), the licensee requested relief from the Code requirement to examine 100% of the weld volume required by Figure IWC-2500-4(a) for Steam Generator 2B, auxiliary feedwater system nozzle-to-shell Weld 2SGB-06A-18.

Licensee's Basis for Relief Request (as stated):

During the ultrasonic examination of Steam Generator 2B Auxiliary Feedwater Nozzle-to-Shell Weld 2SGB-06A-18, Item Number C02.021.001, greater than 90% coverage of the required examination volume could not be obtained. The examination coverage was limited to 75.00% of the required examination volume. This is a ferritic nozzle to shell weld where access is limited to the vessel shell side only. The weld would have to be re-designed to allow scanning from both sides in order to achieve greater than 90% coverage. The percentage of coverage reported represents the aggregate coverage obtained, from one scan perpendicular to the weld axis and two scans 180° apart parallel to the weld as shown in Attachment 4[3].

On November 21, 2002, a telephone call was held between Duke Energy Corporation and the NRC regarding the subject request for relief. Specifically, the NRC requested information regarding the coverage obtained in the surface examinations for the subject welds. Duke Energy Corporation subsequently indicated in an electronic mail that for the subject welds, all of the examinations received 100% surface examination coverage, except for weld [Code] Item number B3.11, which does not require a surface examination by ASME Section XI. This letter [the licensee's November 25, 2002, supplement] confirms and dockets the surface examination coverage of the subject welds.

[3]The licensee's drawings and examination data shown in the Attachment 4 are not included in this report.

Licensee's Proposed Alternative Examination (as stated):

No additional examinations are planned during the current interval for 2SGB-06A-18. Radiography is not an acceptable alternative because of access restrictions for source and film placement. Duke Energy Corporation will continue to use the most effective ultrasonic techniques available to obtain maximum coverage for future examination of this weld.

Evaluation: The Code requires 100% volumetric and surface examination coverage of Steam Generator 2B auxiliary feedwater nozzle-to-shell Weld 2SGB-06A-18. However, the component outside surface geometry restricts access for volumetric examination to only the vessel side of the weld. The subject weld would have to be redesigned and modified for the licensee to achieve 100% volumetric coverage. This would place a significant burden on the licensee; therefore, the Code-required 100% volumetric examination is impractical.

The licensee is able to obtain a substantial (approximately 75%) amount of the required volumetric coverage and 100% of the required surface coverage. In addition, the base metal and weldment are ferritic materials (carbon steel) which are known to exhibit favorable ultrasonic transmission qualities due to their small, isotropic grain structures. During previous round robin tests, as reported in NUREG/CR-5068, "Piping Inspection Round Robin," it has been demonstrated that ultrasonic examinations of ferritic material from a single side provide high probabilities of detection (usually 90% or greater) for both near- and far-side cracks in blind inspection trials. For these reasons, the licensee may perform a thorough examination of the Code-required volume from one side of the weld, therefore, the examinations being performed provide reasonable assurance of the continued structural integrity of this weld. Based on the impracticality of achieving the Code-required volumetric coverage requirements and the extent of examinations performed on this weld, it is recommended that relief be granted pursuant to 10CFR50.55a(g)(6)(i).

2.4 Request for Relief 01-003, Examination Category C-B, Item C2.21, Pressure Retaining Welds in Vessels, Nozzle-to-Shell and Nozzle-to-Head Welds, Containment Spray Heat Exchanger Nozzles

Code Requirement: Examination Category C-B, Item No. C2.21, requires essentially 100% volumetric and surface examination, as defined in Figure IWC-2500-4(a), of Class 2 nozzle-to-vessel welds. "Essentially 100%", as clarified by ASME Code Case N-460, is greater than 90% coverage of the examination volume, or surface area, as applicable. Furthermore, Paragraph III-4420 states that the examination shall be performed from two sides of the weld where practicable, or from one side of the weld as a minimum.

Licensee's Code Relief Request: In accordance with 10CFR50.55a(g)(5)(iii), the licensee requested relief from the Code requirements to perform an ultrasonic examination using two sound beam path directions and to obtain 100% coverage of the required examination volumes for inlet/outlet nozzle-to-vessel welds 2BNSHX-3-N1 and 2BNSHX-3-N2 on the containment spray heat exchanger.

Licensee's Basis for Relief Request (as stated):

During the ultrasonic examination of the Containment Spray Heat Exchanger Inlet and Outlet Nozzle to Channel Welds 2BNSHX-3-Nl and 2BNSHX-3-N2 shown in Attachments 5 and 6[4], respectively, greater than 90% coverage of the required examination volume could not be obtained. The examination coverage for both welds was limited to 49.03%. The percentage of coverage reported represents the aggregate coverage obtained from one scan parallel to the nozzle axis and two scans, 180° apart in the circumferential direction on the weld. Although 49.03% is the claimed coverage of this examination, 100% of the inside surface within the examination volume was covered with a 70° angle from one direction perpendicular to the weld axis.

Austenitic weld metal characteristics and single-sided access caused by the component geometry prevents two-beam path direction coverage of the examination volume. Obtaining coverage greater than 90% of the weld volume as defined in Code Case N-460 is not possible. In order to achieve two beam path direction coverage, the welds would have to be redesigned to allow scanning from both sides.

Duke Energy Corporation uses refracted longitudinal waves, which provide superior penetration to examine austenitic welds. The refracted longitudinal wave transducers have a simulated focus effect that produces high sensitivity at a specific sound path distance. However, the sound beam diverges beyond this focal point and sensitivity decreases by a factor of two at twice the focal sound path distance. The transducers used in this examination have focal distances from 3/4 T to T, where T is the nominal thickness of the nozzle. As a result, there is not enough sensitivity to calibrate the ultrasonic system for extended sound path distances beyond the pipe inside surface.

On November 21, 2002, a telephone call was held between Duke Energy Corporation and the NRC regarding the subject request for relief. Specifically, the NRC requested information regarding the coverage obtained in the surface examinations for the subject welds. Duke Energy Corporation subsequently indicated in an electronic mail that for the subject welds, all of the examinations received 100% surface examination coverage, except for weld [Code] Item number B3.11, which does not require a surface examination by ASME Section XI. This letter [the licensee's November 25, 2002, supplement] confirms and dockets the surface examination coverage of the subject welds.

Licensee's Proposed Alternative Examination (as stated):

No additional examinations are planned during the current interval for weld Numbers 2BNSHX-3-Nl and 2BNSHX-3-N2. Radiography is not an acceptable alternative because of access restrictions for source and film placement. Duke Energy Corporation will continue to use the most effective ultrasonic techniques available to obtain maximum coverage for future examination of these welds.

[4]The licensee's drawings and examination data shown in the Attachments 5 and 6 are not included in this report.

Evaluation: The Code requires that Class 2, Examination Category C-B pressure retaining welds in vessels be examined ultrasonically using two sound beam path directions that cover 100% of the examination volume as shown in figure IWC-2500-4(a). However, the outside surface geometry of the inlet and outlet nozzle-to-channel head welds on the containment spray heat exchanger, 2BNSHX-3-N1 and 2BNSHX-3-N2, restricts scanning access to only one side of these austenitic welds. The subject 12-inch diameter inlet and outlet nozzles would have to be redesigned and modified for the licensee to achieve 100% volumetric coverage. This would place a significant burden on the licensee; therefore, the Code-required 100% volumetric examination is impractical.

During the ultrasonic examination of the containment spray heat exchanger inlet and outlet nozzle-to-channel head Welds 2BNSHX-3-Nl and 2BNSHX-3-N2, greater than 90% coverage of the required examination volume could not be obtained. The examination coverage for both welds was limited to approximately 49%. The percentage of coverage reported represents the aggregate coverage obtained from one scan oriented perpendicular to the nozzle weld on the channel head side and two scans, 180° apart (clockwise and counterclockwise) in the circumferential direction on the weld. Although 49% is the claimed coverage of this examination, 100% of the inside surface within the examination volume was covered with a 70° angle longitudinal beam from one direction perpendicular to the weld axis. Longitudinal wave techniques are shown to provide better detection results than shear waves in austenitic material of this configuration. Additionally, 100% of the Code-required surface examination was completed. Further, no known degradation mechanisms or industry failures have been shown for these nozzle-to-channel head connections. It is expected that most service-induced degradation would originate from the inner surface of this component, and the volumetric examination performed by the licensee should have detected any significant patterns of this degradation that may occur. Therefore, the examinations performed by the licensee provide reasonable assurance of the continued structural integrity of these nozzle welds.

Based on the impracticality of achieving the Code-required volumetric coverage requirements, and the extent of examinations performed on these welds, it is recommended that relief be granted pursuant to 10CFR50.55a(g)(6)(i).

2.5 Request for Relief 01-003, Examination Category C-F-1, Item C5.21, Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping, Circumferential Weld

Code Requirement: Examination Category C-F-1, Item No. C5.21, requires essentially 100% volumetric and surface examination, as defined in Figure IWC-2500-7(a), for Class 2 austenitic pressure retaining welds in piping. “Essentially 100%”, as clarified by ASME Code Case N-460, is greater than 90% coverage of the examination volume, or surface area, as applicable.

Licensee’s Code relief Request: In accordance with 10CFR50.55a(g)(5)(iii), the licensee requested relief from the requirement to examine 100% of the volume shown in Figure IWC-2500-7(a) for piping Weld 2NV20-5.

Licensee's Basis for Relief (as stated):

During the ultrasonic examination of this pipe to valve weld, 2NV20-5 shown in Attachment 7[5], greater than 90% of the required examination volume as allowed by Code Case N-460 could not be achieved. The examination coverage was limited to 61.09% of the required examination volume. This is an austenitic stainless steel pipe-to-valve weld where access is limited to the pipe side of the weld only. The percentage of coverage reported represents the aggregate coverage obtained from one scan parallel to the pipe axis and two scans 180° apart in the circumferential direction on each weld. The weld design prevented any axial scan from the valve side. In order to achieve more coverage the weld would have to be re-designed to allow scanning from both sides.

Duke Energy Corporation does not claim credit for coverage of the far side of austenitic welds. The characteristics of austenitic weld metal attenuate and distort the sound beam when shear waves pass through the weld. Refracted longitudinal waves provide better penetration. Duke Energy Corporation uses a combination of shear waves and longitudinal waves to examine single-sided austenitic welds.

The procedures, personnel, and equipment have been qualified through the Performance Demonstration Initiative (PDI). However, although longitudinal wave search units were used in the qualification and cracks were detected through the weld metal, PDI does not provide a qualification for single-sided examinations of austenitic welds.

On November 21, 2002, a telephone call was held between Duke Energy Corporation and the NRC regarding the subject request for relief. Specifically, the NRC requested information regarding the coverage obtained in the surface examinations for the subject welds. Duke Energy Corporation subsequently indicated in an electronic mail that for the subject welds, all of the examinations received 100% surface examination coverage, except for weld [Code] Item number B3.11, which does not require a surface examination by ASME Section XI. This letter [the licensee's November 25, 2002, supplement] confirms and dockets the surface examination coverage of the subject welds.

Licensee's Proposed Alternative Examination (as stated):

No additional examinations are planned during the current interval for ID Number 2NV20-5. Because of the valve configuration, radiography would not provide any additional coverage. Duke Energy Corporation will use the most effective ultrasonic techniques available to obtain maximum coverage for future examination of this weld.

Evaluation: This piping weld is located on the seal return line from the reactor coolant pumps and this same line provides mini-flow protection for the high head safety injection pumps. The portion of the seal return line containing this weld is located in the auxiliary building and as such, is accessible for visual inspections during normal power

[5]The licensee's drawings and examination data shown in the Attachment 7 are not included in this report.

operations and unit refueling outages. The Code requires 100% volumetric and surface coverage of the weld as described in Figure IWC-2500-7(a). However, the outside surface geometry and limited surface area on the valve side of this pipe-to-valve weld restricts ultrasonic access to only the pipe side of the weld. The subject pipe-to-valve weld would have to be replaced with a modified design for the licensee to achieve 100% volumetric coverage. This would place a significant burden on the licensee; therefore, the Code required 100% volumetric examination is impractical.

The licensee used inspection procedures, personnel, and equipment that have been qualified under the auspices of the industry's Performance Demonstration Initiative (PDI) for austenitic piping. The entire examination volume, as defined in Figure IWC-2500-7(a), could not be completed. However, the amount of coverage obtained (approximately 61%) for this examination, along with the enhanced ultrasonic qualification measures imposed under PDI, and the 100% surface examination that was completed, should enable the licensee to detect any general patterns of degradation that may occur in the inspected regions, providing reasonable assurance of the continued structural integrity of this weld. Therefore, pursuant to 10CFR50.55a(g)(6)(i), it is recommended that relief be granted.

## 3.0 CONCLUSIONS

The PNNL staff has reviewed the licensee's submittal and concludes that the Code examination coverage requirements are impractical for the subject welds listed in Request for Relief No. 01-003. Further, reasonable assurance of the structural integrity of the subject components has been provided by the examinations that were performed. Therefore, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i) for the second interval at Catawba 2.

Catawba Nuclear Station

cc:

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

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

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

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

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

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

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

NCEM REP Program Manager
4713 Mail Service Center
Raleigh, NC 27699-4713

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

Senior Resident Inspector
U.S. Nuclear Regulatory Commission
4830 Concord Road
York, South Carolina 29745

Virgil R. Autry, Director
Division of Radioactive Waste Management
Bureau of Land and Waste Management
Department of Health and Environmental
Control
2600 Bull Street
Columbia, South Carolina 29201-1708

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

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

Mr. Peter R. Harden, IV
VP-Customer Relations and Sales
Westinghouse Electric Company
6000 Fairview Road
12th Floor
Charlotte, North Carolina 28210

Catawba Nuclear Station

cc:

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

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