July 7, 2008

Mr. J. R. Morris
Site Vice President
Catawba Nuclear Station
Duke Energy Carolinas, LLC
4800 Concord Road
York, SC 29745

SUBJECT: CATAWBA NUCLEAR STATION, UNIT 2, REQUEST FOR RELIEF 07-CN-001, LIMITED WELD EXAMINATIONS DURING END-OF-CYCLE 14 REFUELING OUTAGE (TAC NOS. MD6269 AND MD6270)

Dear Mr. Morris:

By letter dated July 11, 2007, Duke Energy Carolinas LLC, the licensee, submitted a request for relief, Relief Request No. 07-CN-001, from the American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code* (Code), Section XI, 1989 Edition requirement pertaining to limited weld examination coverage at the end of operating cycle 14 during the second 10-year inservice inspection (ISI) interval at Catawba Nuclear Station, Unit 2 (Catawba 2). The second 10-year interval for Catawba 2 started August 19, 1996, and ended August 19, 2006. The licensee already performed the scheduled second 10-year interval ISI on the referenced welds and components resulting in limited volumetric and visual coverages. As a result, the licensee has proposed that no alternate examinations or testing will be performed during the end of operating cycle 14 to compensate for the limited ultrasonic examination coverage.

The enclosed Safety Evaluation contains the U. S. Nuclear Regulatory Commission (NRC) staff's evaluation and conclusions. Based on the information provided in the licensee's request for relief, the NRC staff has determined that it is impractical for the welds identified to be examined to the extent required by the ASME Code at Catawba 2. The NRC staff has also concluded that reasonable assurance of structural integrity is provided by the examinations that were performed by the licensee.

Therefore, relief is granted and requirements are imposed pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(g)(6)(i) for the second 10-year ISI interval at Catawba 2 for referenced welds. Granting relief and imposing requirements are authorized by law and will not endanger life, property, or the common defense and security, and are 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.

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

Sincerely,

***/RA/***

Melanie C. Wong, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-414

Enclosure:
Safety Evaluation

cc w/encl: See next page

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

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Melanie C. Wong, Chief
Plant Licensing Branch II-1
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Enclosure:
Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF NO. 07-CN-001

CATAWBA NUCLEAR STATION, UNIT 2

DUKE ENERGY CAROLINAS, LLC

DOCKET NO. 50-414

## 1.0 INTRODUCTION

By letter dated July 11, 2007, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML072640194), Duke Energy Carolinas, LLC, the licensee, submitted a request for relief, Relief Request No. 07-CN-001, from the American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code* (Code), Section XI, 1989 edition requirement pertaining to limited weld examination coverage at the end of operating cycle 14 during the second 10-year inservice inspection (ISI) interval at Catawba Nuclear Station, Unit 2 (Catawba 2). The second 10-year interval for Catawba 2 started August 19, 1996, and ended August 19, 2006. The licensee already performed the scheduled second 10-year interval ISI on the referenced welds and components resulting in limited volumetric and visual coverages. As a result, the licensee has proposed that no alternate examinations or testing will be performed during the end of operating cycle 14 to compensate for the limited ultrasonic examination coverage.

## 2.0 REGULATORY REQUIREMENTS

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(g) specifies that inservice inspection (ISI) of nuclear power plant components shall be performed in accordance with the requirements of the ASME Code, Section XI, and applicable addenda, except where specific relief has been granted by the U. S. Nuclear Regulatory Commission (NRC) pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 50.55a(g)(6)(i). Section 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if (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. Section 50.55a(g)(5)(iii) states that if the licensee has determined that conformance with certain code requirements is impractical for its facility, the licensee shall notify the NRC and submit, as specified in 10 CFR 50.4, information to support the determinations.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, 3 components (including supports) shall 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 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 of the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable code of record for the second ISI interval for Catawba 2 is the ASME Code, Section XI, 1989 Edition.

The information provided by the licensee in support of the request has been evaluated by the NRC staff and the bases for disposition are documented below.

## 3.0 TECHNICAL EVALUATION

### 3.1 Licensee's Evaluation

#### 3.1.1 Components for Which Relief is Requested

Relief Request 07-CN-001:

- Weld ID Number 2ND-37A, Residual Heat Removal System, Valve Body-to-Bonnet Weld, and

- Weld ID Number 2ND24-16, Residual Heat Removal System, Pipe to Flange Weld.

Relief Request 07-CN-001 requests relief from the requirements listed below:

| Examination Category | Item No. | Component | Examination Requirement |
|---|---|---|---|
| B-M-1 | B12.40 | 2ND-37A | Essentially 100% volumetric examination of specified weld examination volume. |
| C-F-1 | C5.11 | 2ND24-16 | Essentially 100% volumetric examination of specified weld examination volume. |

#### 3.1.2 Impracticality/Burden Caused by Code Compliance

During the ultrasonic examination of weld ID Number 2ND-37A, 100% coverage of the required examination volume could not be obtained due to valve body and bonnet geometry. Ultrasonic examination resulted in 70.825-percent coverage of the required examination volume; this percentage of coverage reported represents the aggregate coverage from all scans performed on the weld and adjacent base material.

ASME Code, Section XI, Appendix III, III-4420 requires coverage of the examination volume in two beam path directions and Appendix III, III-4430 requires scanning the weld crown and base material in two directions. These requirements could not be met because the proximity of the machined radius on the valve bonnet prevented scanning on the bonnet side of the weld.

The 45-degree scan parallel to the weld covered 75.30 percent in two beam directions. The combination of 45-degree and 60-degree shear and refracted longitudinal wave scans perpendicular to the weld covered 37.10 percent from the valve bonnet side and 95.60 percent from the valve body side. All scans were performed using a one half V-path technique. There

were no recordable indications found during the inspection of this weld.

Two beam path direction coverage is normally obtained using one half V-path shear waves from both sides of the weld or, alternatively, full V-path shear waves from one side of the weld. The weld joint geometry prevented scanning from both sides of the weld in two beam path directions and a full V-path examination from one side is prevented because of the stainless steel weld metal properties which cause excessive attenuation with shear waves. Substituting full V-path refracted longitudinal waves for shear waves is not possible because of the mode conversion that occurs at the inside surface when using refracted longitudinal waves.

During the ultrasonic examination of weld ID Number 2ND24-16, 100-percent coverage of the required examination volume could not be obtained due to the taper on the flange side of the weld not providing enough scanning area from that side of the weld. Ultrasonic examination resulted in 62.50 percent coverage of the required examination volume; this percentage of coverage reported represents the aggregate coverage from all scans performed on the weld and adjacent base material. The 45-degree shear wave circumferential scans, both clockwise and counter-clockwise, covered 100 percent of the weld and base metal. The 60-degree shear wave scan from the pipe side perpendicular to the weld covered 50 percent of the weld and base material.

A supplemental scan using a 70-degree shear wave search unit covered 50 percent of the examination volume on the flange side from one direction perpendicular to the weld but is not included in the coverage calculations because 10 CFR 50.55a(b)(2)(xv)(A)(1) mandates scanning from four directions two axially and two circumferentially for welds of dissimilar metal. There were no recordable indications found during the inspection of this weld.

For both welds, in order to achieve more coverage, the welds would have to be redesigned to allow scanning from both sides of the weld.

The examinations were performed using personnel qualified in accordance with ASME Code, Section XI, Appendix VII, 1989 Edition. The ultrasonic procedures used complied with the requirements of ASME Code, Section XI, Appendix III, 1989 Edition.

3.1.3 Proposed Alternative Examinations or Testing

The scheduled 10-year code examinations were performed on the referenced welds and resulted in the noted limited-coverage of the required ultrasonic volume. No alternate examinations or testing were planned for the welds during the inspection interval which ended on August 19, 2006.

3.1.4 Justification for Granting Relief

The base materials for all of these welds are austenitic-based materials which (a) have high-corrosion resistance with low contribution of corrosion products to the coolant, (b) have good mechanical properties and (c) are highly weldable. Very few service-induced problems with stainless steel in pressurized-water reactor (PWR) primary system applications have been observed in operating plants. There has been limited susceptibility to stress corrosion cracking (SCC) due to chloride contamination and cracking in stagnant borated systems. Chemistry limits on chlorides, fluorides and sulfides and dissolved oxygen are controlled by selected licensee

commitments (SLC) and other administrative procedures at Catawba 2 to ensure that any favorable conditions for SCC are precluded. Additionally, controls on welding filler material consistent with Regulatory Guide 1.31, "Control of Ferrite Content in Stainless Steel Weld Metal Revision 3," also have served to limit the susceptibility of these welds to SCC. No other known degradation mechanisms are applicable to this material at this particular location within the system.

The 2ND-37A body-to-bonnet weld is located inside the Unit 2 containment. The valve is a secondary boundary isolation valve which remains closed during normal operation to isolate the low pressure residual heat removal system from the high pressure reactor coolant system (i.e., reactor coolant pressure isolation valves). The valve is opened during plant startup and shutdown to provide core cooling. The subject weld is between the SA 182 F316 valve body and the SA 182 F316 bonnet neck.

The piping and valve body are normally covered by metal reflective insulation. During each refueling outage, multiple walkdowns of the containment area are performed to determine the presence of external leakage via evidence of active leakage or boron deposit buildups around the valve and mirror insulation. These walkdowns include a boric acid walkdown while the primary system remains at temperature and pressure. Other walkdowns performed during the outage are system engineer walkdowns, operation walkdowns at 350 pounds per square inch (psi), 1000 psi and normal operation pressure, and the ASME Code, Section XI, IWA-5000 system leakage test.

In addition, any leakage at the body-to-bonnet weld 2ND-37A would be detected by various other leakage detection systems available to the operator. These systems include:

- Containment atmosphere particulate radioactivity (EMF 38) monitor which would detect airborne radiological activity;

- Containment ventilation unit condensate drain tank level monitor which collects and measures as unidentified leakage the moisture removed from the containment atmosphere;

- Containment floor and equipment sump level monitors where identified accumulated water on the containment floor would be monitored and evaluated as sump level changes;

- A reactor coolant system water inventory balance is performed on a regular basis (i.e., at least once every 3 days). The normal operating practice is to perform this computer based program on a daily frequency and/or whenever the operators suspect any abnormal changes to other leakage detection systems. The Technical Specifications require system leakage from "unidentified" sources to be maintained below 1 gallon per minute (gpm); however, plant operation procedure PT/1(2)/A/4150/001D, (Reactor Coolant System Leakage Calculation) establishes an administrative limit of 0.15 gpm above which the source of leakage will be investigated. Leakage as a result of a leak in the body-to-bonnet weld 2ND-37A would show up as unidentified leakage and subject to the 0.15 gpm administrative limit; and other leakage detection systems available to the operator include (1) Volume Control Tank (VCT) level changes, (2) VCT make-up frequencies, and (3) Cold Leg Accumulator level changes.

The 2ND24-16 pipe to flange weld is between 12" XS wall piping and a 12", 600 pound (lb), raised face flange. It is located downstream of the residual heat removal heat exchanger 2A on ASME Class 2 piping with a design temperature of 400 degrees Fahrenheit and design pressure of 615 psia. This piping is located in the Catawba 2 mechanical penetration room of the auxiliary building and is not normally pressurized during reactor operation. The weld maintains the pressure boundary as part of the emergency core cooling system (ECCS) flow path under accident conditions. The subject weld is between the SA 312 TP304 piping and a SA182 F304 flange.

This piping and flange are normally covered by calcium silicate insulation. Leakage during normal operation would be seen as active leakage due to ambient temperature conditions and readily identified on the 543 foot floor elevation below. The room is accessible during normal operation and is within the scope of the weekly operation walkdowns. Periodic system engineer walkdowns are also performed that include leakage identification on the residual heat removal (RHR) system.

In addition to walkdowns, an operational leak rate test (PT/2/A/4202/002) for the RHR system is performed with the system pressurized on an annual basis. An ASME Code, Section XI, IWA-5000 system leakage test is also performed every ISI period. Either of these tests would identify leakage at this particular weld. These walkdowns and leakage tests provide a high level of confidence that any leakage would be promptly identified at this welded joint in the auxiliary building mechanical penetration room.

3.2 NRC Staff's Evaluation

By letter dated July 11, 2007, Duke Energy Carolinas, LLC, requested pursuant to 10 CFR 50.55a(g)(5)(iii) approval of Relief Request 07-CN-001 which involved limited weld examination coverage at Catawba 2. Specifically, during the ultrasonic examination conducted for the third period of the second 10-year inservice inspection interval (Request for Relief 07 CN 001), 100-percent coverage of the required examination volume could not be obtained for welds 2ND-37A, and 2ND24-16 because of weld configuration and the geometry of associated components.

NRC Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability – ASME Section XI, Division 1" endorses ASME Code Case N-460, "Alternative Examination Coverage for Class 1 and Class 2 Welds." Code Case N-460 defines weld examination coverage greater than 90% to meet the essentially 100% requirement specified in ASME Code, Section XI. The applicable code of record for the second ISI interval for Catawba 2 is the ASME Code, Section XI, 1989 Edition.

The NRC staff's review of the data submitted for the subject welds regarding the inspection volumes found that 100-percent coverage of the required examination volume could not be obtained due to the geometry of the welds and associated components. The coverage limitations and inspection results for each component are listed in the following table:

| Component ID | Exam Category/Item No.<br>Figure No.<br>Aggregate Coverage Obtained | Coverage Limitation | Recordable Indications (Yes/No) |
|---|---|---|---|
| 2ND-37A | B-M-1/B12.40<br>IWB-2500-1<br>70.825-percent coverage | Proximity of machined radius on valve bonnet prevented scanning on the bonnet side of the weld. | No |
| 2ND24-16 | C-F-1/C5.11<br>IWC-2500-1<br>62.50-percent coverage | Taper on the flange side of the weld does not provide enough scanning area from that side. | No |

The licensee also stated that in order to achieve more coverage, in each case, the welds and the associated components would have to be redesigned to allow more scanning area. The staff finds that this alternative would be impractical and would impose undue burden on the licensee.

Based on our review of the information provided, the NRC staff finds that the licensee's proposed alternative provides reasonable assurance of structural integrity for the subject welds. This conclusion is based on the fact that the subject welds have been examined to the extent practical using 45-degree and 60-degree shear waves and 60-degree refracted longitudinal waves achieving an aggregate coverage of 37.50 percent to 78.70 percent with no recordable indications found during the inspections. Therefore, the NRC staff finds that any significant degradation, if present, should have been detected.

## 3.0 CONCLUSIONS

Based on the above reviews, the NRC staff concludes that due to the geometry of the welds and associated components, the Code-required examinations are impractical to perform to the extent required by the Code. Furthermore, the examinations performed by the licensee provide reasonable assurance of continued structural integrity of the subject components. Therefore, request for Relief 07-CN-001 is granted pursuant to 10 CFR 50.55a(g)(6)(i) for the second 10-year ISI interval. This grant of relief is authorized by law and will not endanger life or property or common defense and security, and is otherwise in the public interest, giving due consideration to the burden upon the licensee and facility that could result if the requirements were imposed on the facility.

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

Principal Contributor: C. Nove

Date: July 7, 2008