September 25, 2006

Mr. Dhiaa Jamil
Vice President
Catawba Nuclear Station
Duke Power Company LLC
4800 Concord Road
York, SC 29745

SUBJECT: CATAWBA NUCLEAR STATION, UNIT 1, REQUEST FOR RELIEF 05-CN-004, LIMITED WELD EXAMINATIONS DURING END-OF-CYCLE 15 REFUELING OUTAGE (TAC NOS. MC8337, MC9171, MC9172, MC9173, MC9174, MC9175, MC9176, MC9177, MC9178, and MC9179)

Dear Mr. Jamil:

By letter dated September 8, 2005, as supplemented May 15, 2006, Duke Power Company LLC, the licensee, submitted a request for relief, Relief Request No. 05-CN-004, 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 15 during the second 10-year inservice inspection (ISI) interval at Catawba Nuclear Station, Unit 1 (Catawba 1). The second 10-year interval for Catawba 1 started June 29, 1995 and ended June 29, 2005. 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 15 to compensate for the limited ultrasonic examination coverage.

The enclosed Safety Evaluation (SE) contains the Nuclear Regulatory Commission (NRC) staff's evaluation and conclusions. Table 1 attached to the SE provides a summary of each relief request (items 1 through 10). Based on the information provided in the licensee's request for relief and the supplemental information, 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 1 for items 1 through 10 described in Table 1. It is further concluded that reasonable assurance of structural integrity is provided by the examinations that were performed by the licensee for items 1 through 10.

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 1 for items 1 through 10 of Table 1. Relief for item 7 is granted providing the licensee re-classifies weld 1NC23-01 as ASME Code Category B-J, with the applicable ASME Code Item numbering, in lieu of the ASME Code Category B-F, Item B5.130 designation as currently exist in the Catawba 1 ISI interval program. The licensee may initiate its own augmented examinations beyond the ASME Code sampling requirements if it chooses to examine weld 1NC23-01 or similar welds at a greater frequency in each 10-year ISI interval. 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/

Evangelos C. Marinos, Chief
Plant Licensing Branch II-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-413

Enclosure:
Safety Evaluation

cc w/encl: See next page

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.

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF NO. 05-CN-004

CATAWBA NUCLEAR STATION, UNIT 1

DUKE POWER COMPANY LLC

DOCKET NO. 50-413

1.0 INTRODUCTION

By letter dated September 8, 2005 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML052590564), Duke Power Company LLC, the licensee, submitted Request for Relief 05-CN-004 from the requirements of the American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code* (Code), Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*. In response to a Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI), the licensee provided further information in a letter dated May 15, 2006 (ADAMS Accession No. ML061430259). This request was submitted as part of the inservice inspection (ISI) program for the second 10-year ISI interval at Catawba Nuclear Station, Unit 1 (Catawba 1). The second 10-year ISI interval for Catawba 1 started June 29, 1995, and ended June 29, 2005.

The NRC staff, with technical assistance from its contractor, the Pacific Northwest National Laboratory (PNNL), has reviewed and evaluated the information provided by the licensee. The NRC staff adopts the evaluations and recommendations for granting relief contained in PNNL's Technical Letter report (TLR) for relief requests items 1 through 7 listed in Table 1 attached which have been incorporated into this safety evaluation (SE). A summary of each relief request is contained in the attached table.

2.0 REGULATORY REQUIREMENTS

Inservice inspection (ISI) of the ASME Code Class 1, 2, and 3 components is performed in accordance with Section XI of the ASME Code and applicable addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(g), except where specific relief has been granted by the NRC pursuant to 10 CFR 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.

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 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 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 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 ASME Code of Record for the Catawba 1 second 10-year ISI program, which began on June 29, 1995, and ended June 29, 2005, is the 1989 edition of Section XI of the ASME Code, with no addenda. 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.

3.0 TECHNICAL EVALUATION

The information provided by the licensee in support of the relief requests from ASME Code requirements has been evaluated and the basis for disposition is documented below. For clarity, the request has been evaluated in several parts according to ASME Code Examination Category.

3.1 Request for Relief 05-CN-004 Table 1, Items 1 and 2, ASME Code, Section XI, Examination Category B-A, Items B1.11 and B1.21, Pressure Retaining Welds in Reactor Pressure Vessel

3.1.1 ASME Code Requirement

ASME Code, Section XI, Examination Category B-A, Items B1.11 and B1.21 require essentially 100% volumetric examination, as defined by Figures IWB-2500-1(b) and IWB-2500-3, of the length of Class 1 circumferential shell welds on the reactor pressure vessel (RPV). ASME Code Case-460, Alternative Examination Coverage for Class 1 and Class 2 Welds, as an alternative approved for use by the NRC in Regulatory Guide (RG) 1.147, Revision 14, *Inservice Inspection Code Case Acceptability* (RG 1.147), states that a reduction in examination coverage due in part to geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10%, i.e., greater than 90% examination coverage is obtained.

3.1.2 Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100% of the ASME Code-required inspection volume(s) shown in Figures IWAB-2500-1(b) or IWB-2500-3, as applicable, for the following RPV shell welds:

ASME Item	Component I.D.	Description	Coverage
B1.11	1RPV-W03	RPV lower shell to mid shell	73%
B1.21	1RPV-W01	Lower head to lower shell	87%

3.1.3 Licensee's Basis for Relief Request (As Stated)

During the ultrasonic examination of weld ID [inside diameter] [identification] number 1RPV-W03, Reactor Vessel Shell to Lower Head Circumferential Weld, 100% coverage of the required examination volume could not be obtained. Scanning limitations were caused by the proximity of the bottom mounted instrument tubes, which prevented scanning 100% of the weld length from four orthogonal directions. The procedure, qualified through the Performance Demonstration Initiative (PDI), requires scanning in four orthogonal directions using 45 single element shear waves, 45 single element refracted longitudinal waves (RL), and 45 dual element RL waves.

During the ultrasonic examination of weld ID [identification] number 1RPV-W01, Reactor Vessel Lower Head to Bottom Head Circumferential Weld, 100% coverage of the required examination volume could not be obtained. Scanning limitations were caused by the core support lugs, which prevented scanning 100% of the weld length from four orthogonal directions. The procedure, qualified through the Performance Demonstration Initiative requires scanning in four orthogonal directions using 45 single element shear waves, 45 single element [RL], and 45 dual element RL waves.

The percent of coverage reported represents the aggregate coverage from all scans performed on the welds. In order to scan all of the required surfaces for the inspection of the shell to lower head circumferential weld and the lower head to bottom head circumferential weld, the interferences would have to be moved to allow scanning the full length of the welds, which is impractical. These examinations were performed using personnel, procedures and equipment qualified in accordance with ASME Code Section XI, Appendix VIII, 1995 Edition through the 1996 Addenda as administered through the Performance Demonstration Initiative (PDI).

3.1.4 Licensee's Proposed Alternative Examination (As Stated)

The scheduled 10-year code examination was performed on the referenced welds and resulted in the noted limited coverage of the required ultrasonic volume. No alternate examinations or testing are planned for the welds during the current inspection interval which ended on 6/29/05 [June 29, 2005].

3.1.5Evaluation

The ASME Code requires essentially 100% volumetric examination of the length of Class 1 pressure retaining circumferential RPV welds. However, 100% volumetric coverage for the subject welds cannot be obtained due to interferences caused by adjacent RPV core support lugs and bottom mounted instrumentation tubes. For the licensee to achieve the required volumetric coverage, these RPV internal components would have to be redesigned and modified. This would place a burden on the licensee, to the extent that the ASME Code-required 100% volumetric examinations are impractical.

As shown on the sketches and technical descriptions provided by the licensee, volumetric coverage levels obtained were approximately 73% for weld 1RPV-W03 and 87% for weld

1RPV-W01. The locations and proximity of core stabilizing support lugs and bottom mounted instrumentation tubes restricts access for ultrasonic scans on the subject welds. For both subject welds, the accessible ultrasonic examination volumes were found to be free of service-induced flaws. The procedures used to examine the welds were qualified to ASME Code Section XI, Appendix VIII, as required by 10 CFR 50.55a(g)(6)(ii)(C)(1).

The licensee has shown that it is impractical to meet the ASME Code-required 100% volumetric examination coverage for the subject welds due to the design and proximity of other RPV internal components. Based on the limited examinations performed, along with the full examination of ASME Code-required volumes in other RPV pressure-retaining welds, it is concluded that if significant service-induced degradation were occurring in the subject welds, there is reasonable assurance that evidence of it would be detected by the examinations that were performed.

3.2 Request for Relief 05-CN-004 Table 1 Items 3, 4, 5, and 6, ASME Code, Section XI, Examination Category B-D, Item B3.110, Nozzle-to-Vessel Welds in the Pressurizer

3.2.1 ASME Code Requirement

ASME Code, Section XI, Examination Category B-D, Item B3.110 requires 100% volumetric examination, as defined in Figure IWB-2500-7(a), of pressurizer nozzle-to-shell welds during each inspection interval. The requirement for examining adjacent base metal extends a distance of one-half the vessel shell wall thickness from the widest part of the weld, on each side of the weld. ASME Code Case N–460, *Alternative Examination Coverage for Class 1 and Class 2 Welds*, as an alternative approved for use in Regulatory Guide (RG) 1.147, Revision 14, *Inservice Inspection Code Case Acceptability* (RG 1.147). The Code Case states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10%, i.e., greater than 90% examination coverage is obtained.

3.2.2 Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100% of the ASME Code-required inspection volume(s) shown in Figures IWB-2500-7(b) for pressurizer nozzle-to-shell welds 1PZR-W1, 1PZR-W4A, 1PZR-W4B and 1PZR-W4C.

3.2.3 Licensee's Basis for Relief Request (As Stated)

> During the ultrasonic examination of weld ID number 1PZR-W1, 100% coverage of the required examination volume could not be obtained. Scanning limitations were caused by the nozzle geometry that restricts scanning from the nozzle side. The percent coverage reported represents the aggregate coverage of all scans performed. The examination volume was scanned using 35 and 45 shear waves, and straight beam longitudinal waves in accordance with ASME Code Section V, Article 4, T-441.3.2.1.
>
> The 35 beam covered 88.5% of the examination volume perpendicular to the weld from the vessel head side and 62.5% of the examination volume

perpendicular to the weld from the nozzle side. Scans parallel to the weld with the 35 beam covered 79.3% of the examination volume in two opposite directions.

The 45 beam covered 81.2% of the examination volume perpendicular to the weld from the vessel head side and 59.7% of the examination volume perpendicular to the weld from the nozzle side. Scans parallel to the weld with the 45 beam covered 79.3% of the examination volume in two opposite directions.

The straight beam covered 79.3% of the examination volume. In order to achieve more coverage, the nozzle would have to be re-designed to allow scanning in four orthogonal directions. This examination was performed with procedures prepared in accordance with ASME Code Section V, Article 4 using personnel qualified in accordance with ASME Code Section XI, IWA-2300, including Appendix VII, 1995 Edition through the 1996 Addenda.

During the ultrasonic examination of weld ID numbers 1PZR-W4A, 1PZR-W4B and 1PZR-W4C, 100% coverage of the required examination volume could not be obtained. Scanning limitations were caused by the nozzle geometry that restricts scanning from the nozzle side. The percent coverage reported represents the aggregate coverage of all scans performed. The examination volume was scanned using 45 and 60 shear waves, and straight beam longitudinal waves in accordance with ASME Code Section V, Article 4, T-441.3.2.1.

The 45 beam covered 92.0% of the examination volume perpendicular to the weld from the vessel head side and 66.7% of the examination volume perpendicular to the weld from the nozzle side. Scans parallel to the weld with the 45 beam covered 79.6% of the examination volume in two opposite directions. The 60 beam covered 94.2% of the examination volume perpendicular to the weld from the vessel head side and 60.5% of the examination volume perpendicular to the weld from the nozzle side. Scans parallel to the weld with the 60 beam covered 79.6% of the examination volume in two opposite directions. The straight beam covered 79.6% of the examination volume. In order to achieve more coverage, the nozzle would have to be re-designed to allow scanning in four orthogonal directions.

3.2.4 Licensee's Proposed Alternative Examination (As Stated)

The scheduled 10-year [ASME] Code examination was performed on the referenced welds and resulted in the noted limited coverage of the required ultrasonic volume. No alternate examinations or testing are planned for the welds during the current inspection interval which ended on 6/29/05.

3.2.5 Evaluation

The ASME Code, Section XI, Examiation Category B-D, Item B3.110 requires 100% volumetric examination of Class 1 full penetration nozzle to vessel welds. However, volumetric examination to the extent required by the ASME Code for pressurizer nozzle to shell welds 1PZR-W1, 1PZR-W4A, 1PZR-W4B and 1PZR-W4C cannot be performed due to the nozzles'

outside geometry, which limits ultrasonic scanning. For the licensee to achieve the ASME Code-required volumetric coverage, the nozzles would need to be redesigned and modified. This would place a burden on the licensee, to the extent that the ASME Code-required volumetric examinations are impractical.

As shown on the sketches and technical descriptions provided by the licensee, approximately 77 to 79% coverage of the required examination volumes were obtained for welds 1PZR-W1, 1PZR-W4A, 1PZR-W4B and 1PZR-W4C. These nozzles were examined from the outside surface of the component. The surface geometry of the nozzle blend area (the transition region from nozzle-to-pressurizer shell), has a concave shape that causes ultrasonic beam re-direction and loss of coupling in this region. Therefore, these welds must be examined from the shell and nozzle sides, up to, but not across, the transition region. The accessible volumetric coverage from the shell and nozzle sides includes most of the inner portion of the weld and base materials, where one would expect service induced degradation to occur, using 45 and 60 degree shear wave methods. No service-related flaws were detected in any of the pressurizer welds included in this request.

It is impractical for the licensee to obtain 100% of the ASME Code-required volumetric coverage. The licensee examined 77% to 79% of the weld volume. Based on the coverage obtained there is reasonable assurance that significant service induced degradation would be detected in the subject welds.

3.3 Request for Relief 05-CN-004, Table 1, Item 7, ASME Code, Section XI, Examination Category B-F, Item B5.10, Reactor Vessel Outlet Nozzle-to-Safe End Weld

3.3.1 ASME Code Requirement

ASME Code, Section XI, Examination Category B-F, Item B5.10 requires volumetric and surface examination, as defined by Figure IWB-2500-8(c), of Class 1 nozzle-to-safe end dissimilar metal welds. ASME Code Case N-460, *Alternative Examination Coverage for Class 1 and Class 2 Welds*, as an alternative approved for use by the NRC in Regulatory Guide (RG) 1.147, Revision 14, *Inservice Inspection Code Case Acceptability* (RG 1.147), states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10%, i.e., greater than 90% examination coverage is obtained.

3.3.2 Licensee's ASME Code Relief Request

In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100% of the ASME Code-required inspection volume shown in Figure IWB-2500-8 for RPV nozzle-to-vessel Weld 1RPV-W18-SE and safe end-to-pipe Weld 1NC23-01.

3.3.3 Licensee's Basis for Relief Request (As Stated)

> During the ultrasonic examination of weld ID [identification] numbers 1RPV-W18-SE and 1NC23-01 100% coverage of the required examination volume could not be obtained. Limitations were due to the ID configuration which consists of counter-bore and root protrusion. Ultrasonic detection scans for the DM [dissimilar metal] welds were examined from the ID surface using 70 degree L

> wave transducers applied four-directionally. This exam interrogated the inner 1/3 thickness volume. Eddy Current examination was also employed to examine inner surfaces of the dissimilar metal welds and the adjacent examination volumes where ID geometry presented a limitation to the detection of axial flaws as defined in the [performance demonstration qualification summary] PDQS for the qualified [ASME Code, Section XI,] Appendix VIII techniques.
>
> The percent of coverage reported represents the aggregate coverage from all scans performed on the welds. In order to scan all of the required surfaces, the counter bore and root protrusions would have to be removed, which is impractical. These examinations were performed using personnel, procedures and equipment qualified in accordance with ASME Code Section XI, Appendix VIII, 1995 edition through the 1996 addenda as administered through the (PDI).

3.3.4 Licensee's Proposed Alternative Examination (As Stated)

> The scheduled 10-year code examination was performed on the referenced welds and resulted in the noted limited coverage of the required ultrasonic volume. No alternate examinations or testing are planned for the welds during the current inspection interval which ended on 6/29/05.

3.3.5 Evaluation

There are two issues associated with the licensee's request 1) the classification of an ASME Code Category B-J weld as Category B-F, and 2) limited volumetric coverage for two welds. These will be addressed separately below.

3.3.5.1 Incorrect ASME Code Category Classification

The licensee classified weld 1NC23-01 as a dissimilar metal (DM) weld under ASME Code Category B-F, Item B5.13. However, in response to the request for additional information, the licensee confirmed that weld 1NC23-01 is actually a wrought stainless steel safe-end to cast stainless steel piping weld. The correct ASME Code designation for this weld is Category B-J, Item B9.11.

The licensee stated the following in its letter dated May 15, 2006, as justification for classifying weld 1NC23-01 as a Category B-F DM weld:

> Note that there are two (2) welds within close proximity to each other at this and similar Reactor Vessel Loop locations. There is a [B-J] weld of wrought stainless steel safe-end to cast stainless weld and a [B-F] carbon steel vessel nozzle to wrought stainless steel safe-end.
>
> During the Catawba [1] first Interval ISI plan development process, the decision was made to take a conservative approach in evaluating the configuration of the Reactor Vessel Nozzle SS [stainless steel] Safe End-to-Centrifugally Cast SS [stainless steel] Piping Welds as dissimilar metal [nozzle] welds. This same conservative approach was applied to the 2nd Interval during ISI Plan development. Consequently, the licensee included these welds in Examination

> Category B-F, Pressure-Retaining Dissimilar Metal Welds as part of Item Number B5.130, Dissimilar Metal Piping Butt Welds NPS 4 or Larger, which required a surface and a volumetric examination once per interval per ASME Code Section XI, 1989 Code, no addenda. Had the licensee chosen to consider this configuration to be similar metal, these welds would have been included in the total population of Examination Category B-J, Pressure-Retaining Welds In Piping, which only requires a 25% sample of the total number of circumferential butt welds.

The more conservative approach taken by the licensee required Catawba 1 to perform automated ultrasonic and liquid penetrant examinations on all eight (8) of the Reactor Vessel Nozzle Safe End to Pipe welds during the 2nd Interval as opposed to only examining a 25% sample.

The NRC staff finds that when the ASME Code classification is applied correctly, ASME Code Category B-F designates DM welds in Class 1 vessel nozzles and piping. DM welds are listed as a) carbon- or low-alloy steels to high-alloy steels, b) carbon- or low-alloy steels to high-nickel alloys, or c) high-alloy steels to high-nickel steels. The safe-end to piping weld 1NC23-01 joins wrought stainless steel to cast stainless steel; therefore, this is not by definition a DM weld.

The licensee believes that, by classifying the weld as Category B-F, the weld is ensured to be examined every interval, since this ASME Code Category requires 100% of DM welds to be examined each 10-year interval. Further, the licensee states that, if categorized correctly (as a B-J piping weld), this weld would fall into the total population of B-J welds, of which the ASME Code only requires a 25% sampling each interval. However, ASME Code, Section XI contains only the minimum requirements that must be performed, and does not limit licensees wishing to examine more items, or examine items more frequently. ASME Code, Section XI categories are established by consensus to provide a basis for developing initial rules such as component population sampling, inspection methods and frequencies, inspection volumes or surface areas, and subsequent requirements, e.g., flaw acceptability limits, repair criteria, etc., to ensure consistent implementation of ISI programs. To miscategorize components for any reason, even with conservative intentions, is misleading and could potentially result in misapplication of hierarchal requirements.

As previously stated, the licensee may elect to examine all safe end-to-pipe welds associated with RPV nozzles during each interval, as an augmentation to the minimum criteria listed in ASME Code. The NRC staff determined that in order to grant relief the correct designation of ASME Code Category B-J, Item B9.11, must be applied to weld 1NC23-01.

3.3.5.2 Limited Volumetric Coverage

The ASME Code requires 100% volumetric examination of Class 1 nozzle-to-safe end DM welds. However, for RPV outlet nozzle-to-safe end weld 1RPV-W18-SE and safe end-to-piping weld 1NC23-01, 100% of the required inspection volumes could not be achieved due to the inside diameter configuration of the welds which have counterbore and root protrusion. Achieving 100% of the ASME Code-required examination coverage would require redesigning and modifying these welds and would be impractical.

Drawings and descriptions included in the licensee's submittal clearly show that examinations of the subject welds have been performed to the extent practical, with the licensee obtaining approximately 82% coverage for each of these welds. The examinations were performed with an automated device from the inside diameter of the RPV nozzle and include 100% of the weld volume by scanning perpendicular to the welds from either side. These examinations would normally have detected any service-induced flaws oriented circumferentially along the weld direction.

However, portions of the weld root and piping counterbore prevent adequate coupling of ultrasonic search units when scanning in the circumferential direction as required by the ASME Code (which targets detection of flaws oriented axially in the weld or heat-affected zone). In order to compensate for limited ultrasonic circumferential scans, the licensee also performed a supplemental eddy current examination that should have detected any surface-breaking flaws oriented in the axial direction. These welds were examined using procedures and personnel qualified through the industry's PDI program. Based on the volumetric coverages obtained and the supplemental eddy current examinations conducted on these welds, it is reasonable to conclude that significant patterns of degradation, should they exist, would have been detected.

3.4 Request for Relief 05-CN-004, Table 1, Item 8 Weld ID Number 1NC286-1, Reactor Coolant (NC) System upper head injection (UHI) Adapter to Pipe Cap

3.4.1 ASME Code Requirement

ASME Code, Section XI, 1989 edition, in examination Category B-J, Item Number B9.11, Figure Number IWB-2500-8 of the ASME Code, Section XI requires examination of essentially 100% of the specified weld examination volume.

3.4.2 Licensee's ASME Code Relief Request

The licensee sought relief from the examination requirements of ASME Code, Section XI because the ASME Code, Section XI, 100% required examination coverage could not be achieved for weld 1NC286-1. NRC Regulatory Guide 1.147, " Inservice Inspection Code Case Accessibility - 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.

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

> During the ultrasonic examination of Weld ID Number 1NC286-1, 100% coverage of the required examination volume could not be obtained. Single sided access caused by the proximity of the pipe cap prevented scanning from the cap side of the weld. The percent coverage reported represents the aggregate coverage of all scans performed. The examination volume was scanned using 45^0 and 60^0 shear waves.

The 45^0 beam covered 50% of the required volume in two opposite circumferential directions. The 60^0 beam covered 50% of the required volume in one axial direction from the pipe side of

the weld. Because of the requirements of 10 CFR50.55a(b)(2)(xv)(A)(2), coverage of the far side of the weld was not claimed.

In order to achieve more coverage, the weld would have to be re-designed to allow scanning from four orthogonal directions. This examination was performed using personnel, procedures and equipment qualified in accordance with ASME Section XI, Appendix VIII, Supplement 2, 1995 edition through the 1996 addenda as administered through the Performance Demonstration Initiative (PDI).

3.4.4 Licensee's Proposed Alternative Examination (as stated)

The scheduled 10-year code examination was performed on the referenced welds and resulted in the noted limited coverage of the required ultrasonic volume. No alternate examinations or testing are planned for the welds during the current inspection interval which ended on 06/29/05.

3.4.5.1 Justification (as stated)

The reactor pressure vessel upper head originally had four connections for the UHI system. Three of the four UHI penetrations are capped off. The other one serves as the alternate reactor vessel head vent penetration. Weld 1NC286-1 is located at the pipe cap on a capped-off UHI nozzle at Catawba 1. To meet the requirements of NRC Order EA-03-009, Catawba has established periodic inspection of the reactor vessel head area. This includes visual inspections performed each refueling outage to identify boric acid leaks for pressure-retaining components above the reactor vessel head. Any boric acid leakage from capped-off UHI nozzles would be identified during this inspection.

Plant Technical Specifications dictate that a reactor coolant system water inventory balance be 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. Plant Technical Specification requires system leakage from "unidentified" sources be maintained below 1 gpm; however, plant operation procedure (PT/1(2)/A/4150/001D, NC 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 failed weld discussed in this section would show up as unidentified leakage and subject to the 0.15 gpm administrative limit. The water inventory balance provides repeatable results less than the 0.15 gpm administrative limit; however, an evaluation of sensitivity below this leak rate level has not been performed. Other leakage detection systems available to the operator per plant technical specifications are:

•Containment Atmosphere Particulate Radioactivity (EMF 38) Monitoring System which would detect airborne radiological activity, and

•Containment Ventilation Unit Condensate Drain Tank Level Monitoring which collects and measures as unidentified leakage the moisture removed from the containment atmosphere.

The above leakage detection methods are dependent upon the Lower Containment Ventilation System, which provides for forced circulation of cooling air across the reactor vessel and for subsequent air return to lower containment. This provides the motive force for transporting moisture and radioactivity from any through-wall leak in the reactor vessel to the above described leakage detection monitors.

3.4.5.2 Evaluation

The licensee indicated that during the ultrasonic examination of Weld ID Number 1NC286-1, 100% coverage of the required examination volume could not be obtained. Single sided access caused by the proximity of the pipe cap prevented scanning from the cap side of the weld. As a result 50%-coverage was obtained using 45^0 scans in two opposite circumferential directions and 50% of the required volume was obtained using 60^0 scans in one axial direction from the pipe side of the weld. The examination was performed using personnel, procedures and equipment qualified in accordance with ASME Code, Section XI, Appendix VIII, 1995 edition through the 1996 addenda as administered through the PDI.

The licensee also indicated that in order to achieve more coverage, the weld would have to be re-designed to allow scanning from four orthogonal directions. Imposition of this requirement would result in undue hardship on the licensee. Further, the licensee has performed the Code-required examinations to the extent practical and has achieved coverages of 50% using 45^0 scans in two opposite circumferential directions and 50% of the required volume was obtained using the 60^0 scan in one axial direction from the pipe side of the weld. Therefore, any existing patterns of significant degradation should have been detected by the examinations that were completed and thus a reasonable assurance of structural integrity has been provided.

The NRC staff finds that the licensee's proposed alternative provides reasonable assurance of structural integrity for the subject weld. This conclusion is based on the fact that the subject weld has been examined to the extent practical and 50% of the required volume was examined using 45^0 scans in two opposite circumferential directions and 50% of the required volume was examined in one axial direction from the pipe side of the weld using the 60^0 scan. Therefore, significant degradation, if present, should have been detected.

3.5 Request for Relief 05-CN-004 Table 1 Item 9, Weld ID Number 1ND-37A Valve 1ND-37A Valve Body-to-Bonnet Weld

3.5.1 ASME Code Requirement

ASME Code, Section XI, 1989 edition category B-M-1, Item Number B12.40, Figure Number IWB-2500-17, requires volumetric examination of essentially 100% of the specified weld examination volume.

3.5.2 Licensee’s ASME Code Relief Request

The licensee sought relief from the examination requirements of ASME Code, Section XI because the ASME Code, Section XI required 100% examination coverage could not be achieved for weld 1ND37-A. 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.

3.5.3 Licensee’s Basis for Relief Request (as stated)

During the ultrasonic examination of weld ID Number 1ND-37A, 100% coverage of the required examination volume could not be obtained. Single sided access caused by the valve body and bonnet geometry prevented scanning from two opposing circumferential and axial directions. The percent coverage reported represents the aggregate coverage of all scans performed. The examination volume was scanned using 45^0 and 60^0 shear waves.”

The 45^0 beam covered 72.8% of the required volume in two opposite circumferential directions. A combination of 45^0 and 60^0 beams covered 65.81% of the required volume perpendicular to the weld. In order to achieve more coverage, the weld would have to be re-designed to allow scanning from four orthogonal directions. This examination was performed using personnel, qualified in accordance with ASME Section XI, ASME Section XI, IWA-2300, and Appendix VIII, 1995 edition through the 1996 addenda.

3.5.4 Licensee’s Proposed Alternative Examination (as stated)

The scheduled 10-year code examination was performed on the referenced weld and resulted in the noted limited coverage of the required ultrasonic volume. No alternate examinations or testing are planned for the weld during the current inspection interval which ended on 06/29/05.

3.5.5.1 Justification (as stated)

The 1ND37A body-to-bonnet (1ND-37A) and 1ND2A body-to-pipe (1ND39-12) welds are located within the reactor building. These valves are the second boundary isolation which remains normally closed to isolate the low pressure residual heat removal system from the high pressure reactor coolant system (i.e., reactor coolant pressure isolation valves). These valves are opened to provide core cooling during plant shutdown. This piping and these welds are normally covered by mirror insulation. During each refueling outage while the primary system remains at temperature and pressure (Mode 3), all accessible areas within containment are inspected for any evidence of boric acid leaks. During this walkdown, any leakage from these welds would be recognized by a boron deposit buildup around the piping and mirror insulation.

In addition, any leakage at welds 1ND-37A or 1ND39-12 would be detected via other leakage detection systems available to the operator. These systems identified with plant technical specifications include:

•Containment Atmosphere Particulate Radioactivity (UMF 38) Monitoring System which would detect airborne radiological activity;

•Containment Ventilation Unit Condensate Drain Tank Level Monitoring Subsystem which collects and measures as unidentified leakage the moisture removed from the containment atmosphere;

•Containment Floor and Equipment Sump Level and Flow Monitoring Subsystem where unidentified accumulated water on the containment floor would be monitored and evaluated as sump level changes; and

The above leakage detection methods are dependent upon the Lower Containment Ventilation System, which provides for forced circulation of cooling air across the reactor vessel and for subsequent air return to the lower containment. This provides the motive force for transporting moisture and radioactivity from any through-wall leak in the reactor vessel to the above described leakage detection monitors.

3.5.5.2 Evaluation

The licensee indicated that during the ultrasonic examination of weld 1ND37-A, 100% coverage of the required examination volume could not be obtained because single sided access caused by the valve body and bonnet geometry prevented scanning from two opposing circumferential and axial directions. The examination volume was scanned using 45^0 and 60^0 shear waves. The 45^0 beam covered 72.8% of the required volume in two opposite circumferential directions. A combination of 45^0 and 60^0 beams covered 65.81% of the required volume perpendicular to the weld. The examination was performed using personnel, procedures and equipment qualified in accordance with ASME Code, Section XI, Appendix VIII, 1995 edition through the 1996 addenda as administered through the Performance Demonstration Initiative (PDI).

The licensee also indicated that in order to achieve more coverage, the weld would have to be re-designed to allow scanning from four orthogonal directions. Imposition of this requirement would result in undue hardship on the licensee. Further, the licensee has performed the Code-required examinations to the extent practical and has achieved coverages of 72.8% using 45^0 shear waves scan in two opposite circumferential directions and 65.81% using combination of 45^0 and 60^0 scans perpendicular to the weld. Therefore, any existing patterns of degradation should have been detected by the examinations that were completed, and thus reasonable assurance of structural integrity has been provided.

The NRC staff finds that the licensee's proposed alternative provides reasonable assurance of structural integrity for the subject weld. This conclusion is based on the fact that the subject weld has been examined to the extend practical using 45^0 and 60^0 shear waves. The 45^0 beam covered 72.8% of the required volume in two opposite circumferential directions. A combination of 45^0 and 60^0 beams covered 65.81% of the required volume perpendicular to the weld. Therefore, any significant degradation, if present, should have been detected.

3.6 Request for Relief 05-CN-004, Table 1, Item 10 Valve 1ND2A-to-Pipe Circumferential Weld (1ND39-12)

3.6.1 ASME Code Requirement

ASME Code, Section XI, 1989 edition, in examination category C-F-1, Item Number C5.11, Figure Number IWB-2500-7 requires examination of essentially 100% of the specified weld examination volume.

3.6.2 Licensee's ASME Code Relief Request

The licensee sought relief from the examination requirements of ASME Code, Section XI because the ASME Code, Section XI required 100% examination coverage could not be achieved for weld 1ND39-12. 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.

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

> During the ultrasonic examination of Weld ID No. 1ND39-12, 100% coverage of the required examination volume could not be obtained. Single sided access caused by the valve configuration prevented scanning from the valve side of the weld. The percent coverage reported represents the aggregate coverage of all scans performed. The examination volume was scanned using $45^0$and 60^0 shear waves.
>
> The 45^0 beam covered 100% of the required volume in two opposite circumferential directions. The 60^0 beam covered 52.9% of the required volume in one axial direction from the pipe side of the weld, and 51.4% from the valve side. A supplemental 60^0 longitudinal wave best effort scan covered 100% of the inside surface within the required volume in one axial direction from the pipe side of the weld but was not included in the coverage calculation because of the requirements of 10 CFR50.55a(b)(2)(xv)(A)(2).
>
> In order to achieve more coverage, the weld would have to be re-designed to allow scanning from four orthogonal directions. This examination was performed using personnel, procedures and equipment qualified in accordance with ASME Section XI, Appendix VIII, 1995 edition through the 1996 addenda as administered through the Performance Demonstration Initiative (PDI).

3.6.4 Licensee's Proposed Alternative Examination (as stated)

The scheduled 10-year code examination was performed on the referenced welds and resulted in the noted limited coverage of the required ultrasonic volume. No alternate examinations or testing are planned for the welds during the current inspection interval which ended on 6/29/05.

3.6.5 Justification (as stated)

The 1ND37A Body-to-Bonnet (1ND-37A) and 1ND2A Body-to-Pipe (1ND39-12) welds are located within the reactor building. These valves are second boundary isolation which remains normally closed to isolate the low pressure residual heat removal system from the high pressure reactor coolant system (i.e., Reactor Coolant Pressure Isolation Valves). These valves are opened to provide core cooling during plant shutdown. This piping and these welds are normally covered by mirror insulation. During each refueling outage while the primary system remains at temperature and pressure (Mode 3), all accessible areas within containment are inspected for any evidence of boric acid leaks. During this walkdown, any leakage from these welds would be recognized by a boron deposit build-up around the piping and mirror insulation.

In addition, any leakage at welds IND-37A or IND39-12 would be detected via other leakage detection systems available to the operator. These systems identified with plant technical specifications include:

•Containment Atmosphere Particulate Radioactivity (EMF 38) Monitoring System which would detect airborne radiological activity;

•Containment Ventilation Unit Condensate Drain Tank Level Monitoring Subsystem which collects and measures as unidentified leakage the moisture removed from the containment atmosphere;

•Containment Floor and Equipment Sump Level and Flow Monitoring Subsystem where unidentified accumulated water on the containment floor would be monitored and evaluated as sump level changes; and

•Containment Atmosphere Particulate Radioactivity (EMF 38) Monitoring System which would detect airborne radiological activity.

The above leakage detection methods are dependent upon the Lower Containment Ventilation System, which provides for forced circulation of cooling air across the reactor vessel and for subsequent air return to lower containment. This provides the motive force for transporting moisture and radioactivity from any through-wall leak in the reactor vessel to the above described leakage detection monitors.

3.6.6 Evaluation

The staff finds that the licensee's proposed alternative provides reasonable assurance of structural integrity for the subject weld. This is based on the fact that the subject

weld (1ND-37A) has been examined to the extent practical. The resulting volume coverage of the subject weld was 52.9% using the 45 degree scan from the pipe side of the weld, and 51.4% coverage using 60 degree scan from the valve side of the weld. Therefore, any pattern of significant degradation, if present, would have been detected.

4.0 CONCLUSIONS

The staff concludes that ASME Code examination coverage requirements are impractical for the subject welds listed in Table 1, items 1 through 10. Further, based on the coverages obtained, if significant service-induced degradation were occurring, there is reasonable assurance that evidence of it would be detected by the examinations that were performed. Furthermore, the examinations performed provide reasonable assurance of structural integrity of the subject welds. Therefore, relief is granted for items 1 through 10 listed in Table 1 pursuant to 10 CFR 50.55a(g)(6)(i), for the second 10-year ISI interval at Catawba 1.
For Request for Relief 05-CN-004 item 7, relief for weld 1NC23-01 is granted pursuant to 10 CFR 50.55a(g)(6)(i) providing the licensee re-classifies weld 1NC23-01 as ASME Code Category B-J, with the applicable ASME Code Item numbering, in lieu of the ASME Code Category B-F, Item B5.130 designation as it currently exists in the Catawba, Unit 1, ISI interval program. The licensee may initiate its own augmented examinations beyond the ASME Code sampling requirements if it chooses to examine weld 1NC23-01 or similar welds at a greater frequency in each 10-year ISI interval.

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

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Date: September 25, 2006

Attachment: Summary of Relief Requests

Attachment

CATAWBA NUCLEAR STATION, UNIT 1
Second 10-Year ISI Interval

TABLE 1

SUMMARY OF RELIEF REQUESTS

Relief Request Number	TLR RR Sec.	System or Component	Exam. Category	Item No.	Volume or Area to be Examined	Required Method	Licensee Prop Alternativ
05-CN-004 Item 1	3.1	RPV Shell and Head Welds	B-A	B1.11	100% of full penetration head-to-shell and shell-to-shell welds	Volumetric	Use achieved 87 and 77% volume coverages, respectively
05-CN-004 Item 2	3.1	RPV Shell and Head Welds	B-A	B1.11	100% of full penetration head-to-shell and shell-to-shell welds	Volumetric	Use achieved 87 and 77% volume coverages, respectively
05-CN-004 Item 3	3.2	PZR Nozzle Welds	B-D	B3.110	100% of full penetration nozzle-to-shell welds	Volumetric	Use achieved 77 volumetric cover
05-CN-004 Item 4	3.2	PZR Nozzle Welds	B-D	B3.110	100% of full penetration nozzle-to-shell welds	Volumetric	Use achieved 77 volumetric cover
05-CN-004 Item 5	3.2	PZR Nozzle Welds	B-D	B3.110	100% of full penetration nozzle-to-shell welds	Volumetric	Use achieved 77 volumetric cover
05-CN-004 Item 6	3.2	PZR Nozzle Welds	B-D	B3.110	100% of full penetration nozzle-to-shell welds	Volumetric	Use achieved 77 volumetric cover
05-CN-004 Item 7	3.3	RPV Nozzle-to-Pipe and Safe End-to-Pipe Welds	B-F	B5.10	100% of nozzle-to-pipe DM welds and piping DM welds	Volumetric and Surface	Use achieved 82 volumetric cover and supplement surface ET scan
05-CN-004 Item 8	None	UHI Adapter to Pipe Cap	B-J	B9.11	100% of UHI Adapter-to-Pipe Cap Weld	Volumetric	Use achieved 37 volumetric cover
05-CN-004 Item 9	None	Valve 1ND-37A Valve Body-to-Bonnet Weld	B-M-1	B12.4	100% of Valve Body-to-Bonnet Weld	Volumetric	Use achieved 69 volumetric cover
05-CN-001 Item 10	None	Valve 1ND2A-to-Pipe Circumferential Weld	C-F-1	C05.11	100% of Valve-to-Pipe Weld	Volumetric	Use achieved 76 volumetric cover