



JAMES R. MORRIS
Vice President

Catawba Nuclear Station
4800 Concord Rd. / CNO1VP
York, SC 29745-9635

803 831 4251
803 831 3221 fax

October 30, 2007

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Subject: Duke Power Company LLC d/b/a Duke Energy Carolinas,
LLC (Duke)
Catawba Nuclear Station, Unit 2
Docket Number 50-414
Request for Relief Number 07-CN-005
NRC First Revised Order EA-03-009, Relaxation Request
for Inspection of Reactor Pressure Vessel Heads

Reference: Letter from Duke to NRC submitting Request for
Relief Number 06-CN-004, dated December 4, 2006

On February 11, 2003, the NRC issued Order EA-03-009 for interim inspection requirements for reactor pressure vessel (RPV) heads at pressurized water reactor (PWR) facilities. On February 20, 2004, the NRC issued the First Revised Order EA-03-009, which superseded Order EA-03-009. Duke agreed to comply with the revised Order in a letter dated March 9, 2004.

Pursuant to 10 CFR 50.55a(a)(3)(ii), Duke hereby requests relaxation from the requirements for nondestructive examination of five penetration nozzles for which Duke cannot obtain coverage as specified in the Order. In accordance with section IV, paragraph F of the Order, Duke requests relaxation from the requirements specified in section IV, paragraph C.(5)(b)(i) for five RPV head penetrations for which nondestructive testing cannot be performed as required. The requested relaxation meets criterion IV.F.(2) of the revised Order because compliance with the revised Order for the penetrations described in this request would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The details of this request are provided in the attachments.

U.S. Nuclear Regulatory Commission

Page 2

October 30, 2007

Included in the attachments are proprietary and non-proprietary versions of a flaw sizing calculation performed by AREVA NP Inc. This calculation is also applicable to the one penetration nozzle that was the subject of Request for Relief 06-CN-004, which was submitted via the reference letter. Therefore, Duke is submitting this calculation in support of both Request for Relief 07-CN-005 and Request for Relief 06-CN-004.

The proprietary version of the flaw sizing calculation performed by AREVA NP Inc. is supported by an affidavit signed by the owner of this information. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR 2.390.

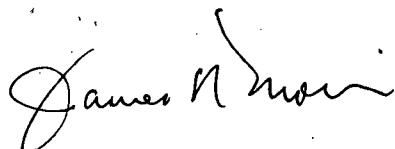
Accordingly, it is respectfully requested that the information that is proprietary be withheld from public disclosure in accordance with 10 CFR 2.390.

Approval of both requests for relief is requested by February 11, 2008. This is the date upon which the inspections required by the Order are due to be completed.

There are no regulatory commitments contained in this letter or its attachments.

If you have any questions or require additional information, please contact L.J. Rudy at (803) 831-3084.

Very truly yours,



James R. Morris

LJR/s

Attachments

U.S. Nuclear Regulatory Commission
Page 3
October 30, 2007

xc (with attachments):

W.D. Travers, Administrator, Region II
U.S. Nuclear Regulatory Commission
Atlanta Federal Center
61 Forsyth St., SW; Suite 23T85
Atlanta, GA 30303-8931

J.F. Stang, Jr., NRC Senior Project Manager
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Mail Stop 8 G9A
Rockville, MD 20852-2738

A.T. Sabisch, NRC Senior Resident Inspector
Catawba Nuclear Station

U.S. Nuclear Regulatory Commission

Page 4

October 30, 2007

xc (with attachments):

R.D. Hart

L.J. Rudy

K.E. Nicholson

W.O. Callaway

D.L. Ward

K.L. Ashe

B.G. Davenport

R.L. Gill, Jr.

R.L. Doss

D.E. Whitaker

Document Control File 801.01

RGC Date File

ELL-EC050

NCMPA-1

NCEMC

PMPA

SREC

Attachment 1

Relief Request 07-CN-005

Prepared by: W. O. Cullaway

Date: 10-25-07

Reviewed by: Rachel Doss

Date: 10-25-07

Reviewed by: J. D. Day
(Cross Disciplinary)

Date: 10/29/07

Approved by: D. L. Ward

Date: 10-29-07

10 CFR 50.55a Relief Request 07-CN-005

Proposed Alternative in Accordance with 10 CFR 50.55a(a)(3)(ii)

Hardship or Unusual Difficulty without a Compensating Increase
in the Level of Quality and Safety

Pursuant to 10 CFR 50.55a(a)(3)(ii), Duke requests relaxation from NRC Order EA-03-009. Information is being submitted in support of this determination that compliance with the specified requirements of this Order results in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

I. Component(s) Affected:

Affected Unit: Catawba Nuclear Station Unit 2
Component number: CN 2 NC Rx Head
Description: RPV Head Penetration Thermocouple
Nozzles
ASME Code Class: 1

(no fabrication drawing included)

II. Applicable Requirement:

NRC Order EA-03-009, Revision 1, "Issuance of First Revised NRC Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," Section IV, Paragraph C.(5)(b)(i).

NRC Order EA-03-009, Revision 1, Section IV, Paragraph C.(5)(b)(i) requires that:

"Ultrasonic testing of the RPV head penetration nozzle volume (i.e., nozzle base material) from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 2 inches below the lowest point at the toe of the J-groove weld on a horizontal plane perpendicular to the nozzle axis (or the bottom of the nozzle if less than 2 inches [see Figure IV-1]); OR from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 1.0-inch below the lowest point at the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) and

including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater (see Figure IV-2)..."

III. Applicable Code Requirements:

Not applicable.

IV. Reason for Request:

The Catawba Unit 2 RPV head includes five thermocouple head penetrations that are used during operation for core temperature measurement. Each of these head penetrations includes a thermocouple column welded via a J-groove weld to the internal surface of the RPV head. Below each J-groove weld, a housing guide is threaded to the bottom of the column to facilitate head replacement after refueling operations. See Figure 1.

The configurations of the five thermocouple head penetrations (#74, #75, #76, #77 and #78) for Catawba Unit 2 do not allow a complete volumetric examination as required by the Order. The limited projected nozzle length below the internal surface of the RPV head and the tapered tip of the thermocouple column restrict the examination of the entire volume defined by the Order for these thermocouple locations as one inch below the lowest point at the toe of the J-groove weld.

For thermocouple head penetrations #74 through #78, the examination of inspection volumes with boundaries as defined in Table 1 below has been performed.

Table 1.

T/C	Distance ²	Required Coverage ¹	Achieved Coverage ¹
74	0.35"	1.00"	0.93"
75	0.35"	1.00"	0.87"
76	0.35"	1.00"	0.70"
77	0.35"	1.00"	0.90"
78	0.35"	1.00"	0.87"

¹ distance of lower bound plane below the lowest point at the toe of the J-groove weld

² distance from the lowest point at the toe of the J-groove weld to the point where surface tensile stresses diminish below 20 ksi.

Compliance with the requirements of NRC Order EA-03-009 would result in hardship without a compensating increase in the level of quality and safety.

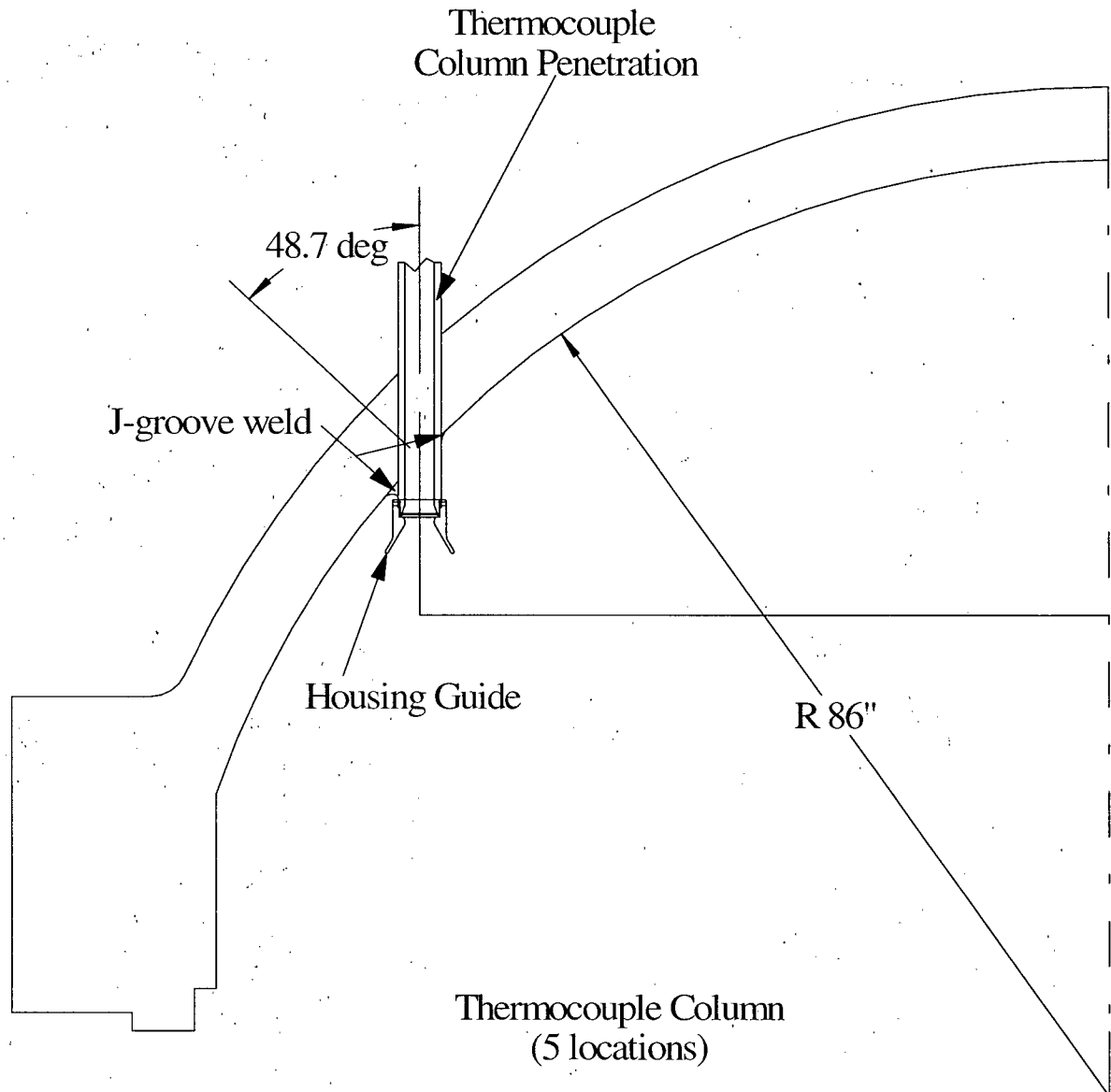


Figure 1: Catawba Unit 2, illustrating location of thermocouple column penetration relative to RV head.

V. Background:

A structural evaluation (Reference 2) of each control rod drive mechanism head penetration was performed as part of the non-visual RPV head inspection. The purpose of the evaluation was to develop residual and normal operating stresses in the hoop and axial directions along the vertical length of the penetration. These stresses were then used to qualify a reduced inspection region that is

necessary in some cases because of examination limits associated with particular geometrical features of the penetrations. This reduction in inspection volume is allowed by the Order for all regions greater than 1 inch below the downhill side of the toe of the J-groove weld as long as all surface tensile stresses are less than 20 ksi. The 3-D finite element analysis of the structural evaluation establishes the stress profile of the penetration nozzles. Based on the stress profile for the five affected thermocouple penetrations, the required inspection zone was established as 1 inch below the lowest point of the J-groove weld. (See Table 1.) The actual inspection scope was then compared with the required inspection zone to satisfy the examination requirements of the Order. For thermocouple penetrations #74 through #78, the required inspection coverage could not be achieved. For all other head penetrations the Order required inspection volumes were achieved.

In addition, Duke has complied with the requirements for determining if leakage has occurred into the annulus between the RPV head penetration nozzle and the RPV head. This determination was made by ultrasonic leak path detection and bare metal visual examination at the top of the RPV head surface that includes inspection 360° around the head penetration nozzles. No pressure boundary leakage at the head penetrations was identified.

VI. Proposed Relaxation:

Duke proposes to define the lower boundary of the inspection volume for RPV head penetration thermocouple nozzles #74 through #78 as: to the top of the tapered region as identified in Table 2 below.

Table 2

<u>T/C</u>	<u>Lower Bound Inspection Plane</u> ¹
74	0.93"
75	0.87"
76	0.70"
77	0.90"
78	0.87"

¹ refers to the location of the lower bound inspection plane expressed as the distance of the thermocouple tapered id chamfer region from the lowest point at the toe of the J-groove weld

VII. Justification for Granting of Relaxation:

As discussed previously, the requirement specified in NRC Order EA-03-009, that the RPV head penetration nozzle base material be ultrasonically tested 1.0 inch below the lowest point at the toe of the J-groove weld and including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level of 20 ksi tension and greater, results in a significant hardship without a compensating increase in the level of quality and safety.

The design of the RPV head penetration thermocouple nozzles includes a tapered section at the bottom of the nozzles. At thermocouple nozzles #74 through #78, the dimensional configuration (see Figure 2) is such that the distance from the lowest point at the toe of the J-groove weld to the top of the tapered region is less than the 1-inch lower boundary limit specified in section IV.C.(5)(b)(i) of the First Revised Order. Since UT results are not fully qualified in the tapered region, Duke requests that the lower boundary of the UT inspection for thermocouple nozzles be redefined to extend only to the top of the tapered region. The basis for this request is:

- a) A fracture mechanics evaluation (included) considering postulated axial and circumferential flaws indicates that any undetectable flaw in a region of the nozzle without coverage would not grow to a critical size prior to the next required volumetric examination (7 years). Table 21 of the evaluation indicates that any axial flaw length less than 1.499" would not grow into the bottom of the J-

groove weld over the inspection interval. Table 18 of the evaluation indicates that any circumferential flaw length less than 3.535" would not grow beyond the acceptance limit of 75% of the circumference over the inspection interval. The largest postulated axial or circumferential flaw in the undetectable region of each penetration is clearly less than the allowable flaw size determined from the fracture mechanics evaluation.

- b) The reduction in examination volume as a result of the coverage limitation is extremely small. Although not credited in the fracture mechanics evaluation, a significant portion of the wall thickness in the uninspectable volume has been examined using the rotating inspection head of the AREVA ultrasonic system. No recordable indications were identified in this uncredited partial examination volume below the lower bound plane established by the vertex of the id taper.
- c) The Catawba Unit 2 RPV is classified/ranked as a low-susceptibility plant with a current EDY of 3.4 years.
- d) The 73 other CRDM head penetrations were fully examined in accordance with the Order with no evidence of primary water stress corrosion cracking (PWSCC).
- e) A manual examination of this inspection volume would require entry into a very high radiation zone with dose rates of approximately 3 rem/hour. Furthermore, removal of the housing guide and attachment welds would be necessary to allow access for a manual scan. An entry in this radiation field for this task would involve a very large radiation exposure without a significant benefit.
- f) A remote, automated examination of this minuscule inspection volume would require the specialized design of robotic tooling and equipment. This would present a technical hardship, coupled with the fact that there would be limited commercial use for this type of remote examination equipment.

Based on the above reasons, the limited inspection volume for penetrations #74 through #78 does not affect the integrity of the reactor coolant system pressure boundary. Furthermore, without the proposed relaxation, a technical and radiological hardship would be incurred with no measurable benefit.

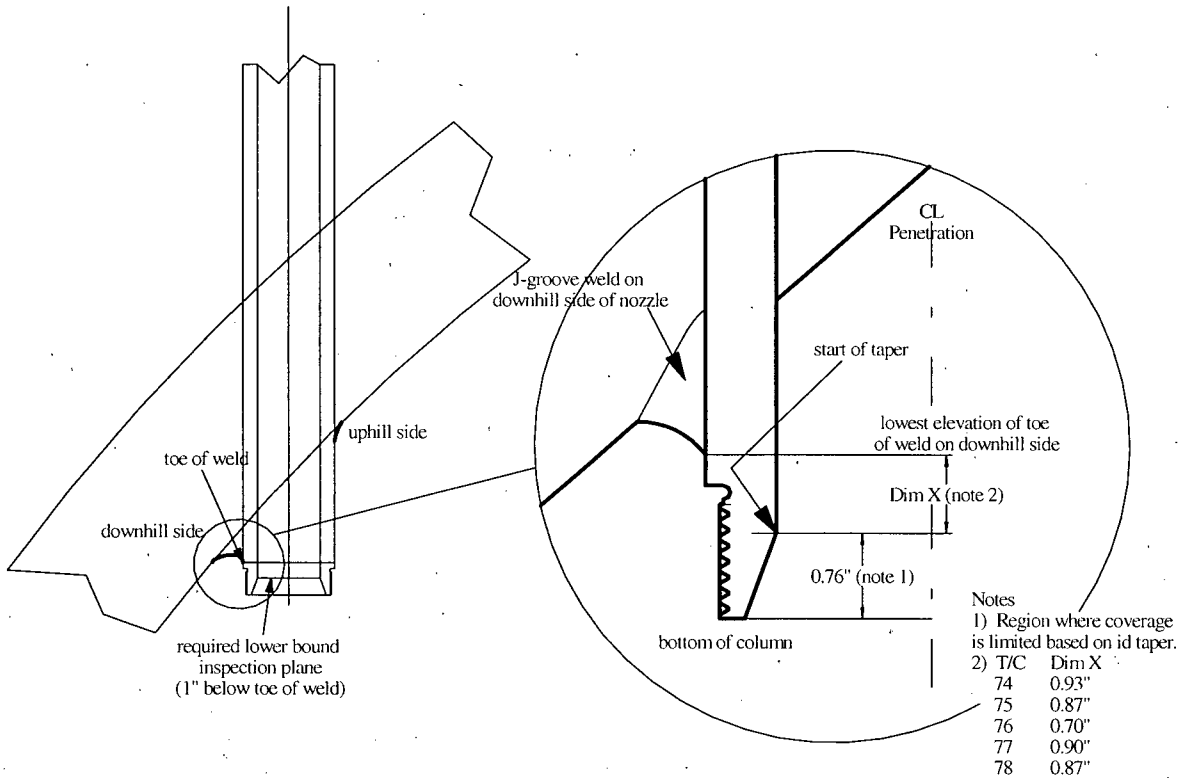


Figure 2: An illustration of the coverage limitations on RPV head penetration thermocouple nozzles. For clarity, the Thermocouple Housing Guide is not shown.

VIII. Duration of Proposed Relaxation:

This relief is requested for the duration of NRC Order EA-03-009.

An expedited NRC staff approval is requested by February 11, 2008, which is the date upon which the inspections required by the Order are due to be completed.

IX. Precedents:

This proposed relaxation is similar to relaxation requests submitted by other plants, including Indian Point Units 2 and 3, Seabrook Unit 1, Diablo Canyon Unit 2, Wolf Creek, Palisades, and Millstone Unit 3.

X. References:

1. NRC letter dated February 20, 2004: R. Borchardt to Holders of Licenses for Operating Pressurized Water Reactors, "Issuance of First Revised Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors" (ADAMS Accession Number ML040220181).
2. Dominion Engineering, Inc. Calculation No. C-3023-00-02, "Catawba Unit 2 Upper Head CRDM Nozzle Welding Residual Stress Analysis".
3. AREVA NP Inc. Calculation Nos. 32-9063178-000 (Proprietary) and 32-9063181-000 (Non-Proprietary), "Catawba Unit 1 and 2 Thermocouple Head Penetration Nozzle Hypothetical Flaw Evaluations".
4. Title 10 of the Code of Federal Regulations, Part 50, Section 55a, Codes and Standards (i.e., 10 CFR 50.55a).