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INDIANA MICHIGAN POWER

May 13, 2003

AEP:NRC:3054-06
10 CFR 2.202

Docket Nos: 50-315
50-316

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O-P1-17
Washington, DC 20555-0001

Donald C. Cook Nuclear Plant Unit 1 and Unit 2
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING RELAXATION OF REACTOR PRESSURE VESSEL HEAD PENETRATION INSPECTION REQUIREMENTS IN NUCLEAR REGULATORY COMMISSION ORDER

Reference: 1) U. S. Nuclear Regulatory Commission (NRC) Order EA-03-009, "Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," dated February 11, 2003

2) Letter from J. E. Pollock, Indiana Michigan Power Company (I&M), to U.S. NRC Document Control Desk, "Donald C. Cook Nuclear Plant Unit 1 and Unit 2, Request for Relaxation from Nuclear Regulatory Commission Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," AEP:NRC:3054-04, dated March 26, 2003

This letter provides I&M's response to an NRC request for additional information regarding the proposed relaxation of two reactor vessel head penetration inspection requirements contained in an NRC order.

NRC Order EA-03-009 (Reference 1) established interim inspection requirements for reactor pressure vessel head penetrations at pressurized water reactors. In Reference 2, I&M requested relaxation from two requirements in the order. The requirements from which relaxation was requested involve nondestructive examination (ultrasonic, eddy current, and dye penetrant testing)

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of penetration nozzles below the J-groove weld. The NRC requested additional information regarding the requested relaxations in a telephone conference conducted on April 28, 2003. Attachment 1 to this letter provides the information request by the NRC, except that the response to one question is applicable only to Unit 2. The response to that question includes a commitment to provide the requested information for Unit 1 in a subsequent letter. Attachment 2 provides graphs of stress versus distance below the J-groove weld for Unit 2. Attachment 3 identifies the regulatory commitment made in this letter.

I&M requests that the proposed relaxations be approved for Unit 2 independently of the approval for Unit 1.

Should you have any questions, please contact Mr. Brian A. McIntyre, Manager of Regulatory Affairs, at (269) 697-5806.

Sincerely,

J. E. Pollock
Site Vice President

JW/rdw

Attachments:

1. Response to Request for Additional Information
2. Stress Versus Distance Below J-groove Weld for Unit 2
3. Regulatory Commitments

c: Director, Office of Nuclear Reactor Regulation
H. K. Chernoff, NRC Washington DC
K. D. Curry, Ft. Wayne AEP, w/o attachments
J. E. Dyer, NRC Region III
J. T. King, MPSC, w/o attachments
MDEQ - DW & RPD, w/o attachments
NRC Resident Inspector
J. F. Stang, Jr., NRC Washington DC

AFFIRMATION

I, Joseph E. Pollock, being duly sworn, state that I am Vice President of Indiana Michigan Power Company (I&M), that I am authorized to sign and file this request with the Nuclear Regulatory Commission on behalf of I&M, and that the statements made and the matters set forth herein pertaining to I&M are true and correct to the best of my knowledge, information, and belief.

Indiana Michigan Power Company

J. E. Pollock
Site Vice President

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 13th DAY OF May, 2003

Julie E. Newmiller
Notary Public

JULIE E. NEWMILLER
Notary Public, Berrien County, MI
My Commission Expires Aug 22, 2004

My Commission Expires 8-22-2004

bc: A. C. Bakken III, w/o attachments
G. F. Borlodan/C. R. Lane/K. R. Worthington
M. J. Finissi, w/o attachments
D. J. Garner
J. B. Giessner
D. W. Jenkins, w/o attachments
J. A. Kobyra, w/o attachments
B. A. McIntyre, w/o attachments
J. E. Newmiller
J. E. Pollock, w/o attachments
D. J. Poupard
T. R. Satyan-Sharma
M. K. Scarpello, w/o attachments
C. L. Vanderniet
T. K. Woods

ATTACHMENT 1 TO AEP:NRC:3054-06

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

The documents referenced in this attachment are identified on Page 7.

Nuclear Regulatory Commission (NRC) Order EA-03-009 (Reference 1) established interim inspection requirements for reactor pressure vessel (RPV) head penetrations at pressurized water reactors. In Reference 2, Indiana Michigan Power Company (I&M) requested relaxation from two requirements in the order. The requirements from which relaxation was requested involve nondestructive examination (ultrasonic, eddy current, and dye penetrant testing) of penetration nozzles below the J-groove weld. The NRC requested additional information regarding the requested relaxations in a telephone conference conducted on April 28, 2003. This attachment provides the information requested by the NRC, except that the response to one question is applicable only to Unit 2. The response to that question includes a commitment to provide the requested information for Unit 1 in a subsequent letter.

The information in this attachment is presented in two parts. Part 1 addresses the NRC questions that apply to the proposed alternative to ultrasonic testing requirements specified in the order. Part 2 addresses the NRC questions that apply to the proposed alternative to eddy current and dye penetrant testing requirements specified in the order. In the responses discussing distances below the J-groove weld, the J-groove weld is assumed to include the associated fillet weld as shown on the attached sketch.

Part 1
Questions Pertaining to Proposed Alternative No. 1 to NRC Order EA-03-009: Alternative to Requirement to Perform Ultrasonic Testing to Bottom of Nozzles

NRC Introduction

The licensee requested relief from performing ultrasonic testing of each RPV head penetration nozzle (i.e., nozzle base material) from 2 inches above the J-groove weld to the bottom of the nozzle.

NRC Question 1

The licensee stated that a small portion of base material will not be scanned on the bottom of the nozzle because the lower transducer and the upper transducer of the probe need to be in contact with the nozzle material. The distance from the bottom of the nozzle upward that cannot be scanned is 12 mm. Please identify the minimum distance from the J-groove weld to the location on the nozzle that cannot be scanned.

Response to NRC Question 1

As shown in the sketch provided at the end of this attachment, the distance from the bottom of the nozzle upward that cannot be scanned due to the PCS24 probe transducer arrangement has been calculated to be 12 millimeters (0.47 inches) plus the height of the chamfer (0.23 inches). The minimum distance downward from the J-groove weld to the location on the nozzle that cannot be ultrasonically scanned due to the PCS24 probe transducer arrangement has been calculated to be 1.1 inches. Due to the curvature of the RPV head, this minimum distance only occurs at one point on the downhill side of the outermost penetrations (six penetrations on Unit 1 and five penetrations on Unit 2).

NRC Question 2

Provide additional technical justification (i.e., operating stress levels, crack growth analysis, etc.) that supports the licensee's statement that the small area that cannot be scanned is insignificant to the phenomena of concern.

Response to NRC Question 2

The following response applies only to Unit 2. I&M will provide a response to NRC Question 2 for Unit 1 by separate correspondence as necessary to support the next Unit 1 under-head inspection required by NRC Order EA-03-009, currently scheduled for Spring 2005. The following response applies to the proposed alternatives to both surface examination (eddy current and penetrant testing) and ultrasonic testing requirements in the order.

As described in NRC Order EA-03-009, the phenomena of concern are reactor coolant system leakage through an RPV head penetration nozzle J-groove weld or through the nozzle base metal above the J-groove weld caused by primary water stress corrosion cracking (PWSCC). These phenomena can result in corrosion of the low-alloy steel RPV head resulting in a loss of coolant accident, including ejection of the nozzle. I&M's conclusion that the small area that would not be inspected (by ultrasonic, eddy current, or penetrant testing) is not significant to the phenomena of concern is supported by the low operating stresses in that area, and an analysis of the propagation time for a flaw in that area.

The operating stresses in that area are shown in Attachment 2 to this letter, which provides graphs of hoop stress versus distance below the J-groove weld for various nozzles from the center of the Unit 2 RPV head to the outermost row. As shown in these graphs, the stresses in the area of the nozzle that would not be inspected are low relative to the yield stress of the nozzle material (41,000 to 63,000 pounds per square inch).

Additionally, I&M has performed a calculation demonstrating that more than two operating cycles would elapse before a postulated axial flaw in the area that would not be inspected would propagate into the pressure boundary formed by the J-groove weld. The calculation was performed using the methodology outlined by the NRC in Reference 3, and the American

Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. The flaw was postulated to be 80 percent through the nozzle wall, since this is the maximum value given in Table A-3320-2 in Appendix A to Section XI of the ASME Code. As stated in I&M's response to NRC Questions 1 and 3, and NRC Question 1a in Part 2 below, the minimum distance below the J-groove weld that would be inspected in accordance with the proposed alternatives has been calculated to be approximately 1 inch. However, the flaw was conservatively postulated to be 0.5 inches below the J-groove weld in the flaw propagation calculation. The calculation determined that the time it would take for a flaw to propagate from that location to the bottom of J-groove weld would be at least 4.7 years. This time period is more than twice the minimum under-head inspection interval for Unit 2 (one operating cycle) required by NRC Order EA-03-009.

The results of the flaw propagation calculation indicate that, even if a flaw were to occur in an uninspected portion of the nozzle, there would be adequate opportunity for detection prior to the flaw reaching the reactor coolant system pressure boundary. These results, and the stress levels shown in Attachment 2, demonstrate that the proposed alternatives (modified as described in the responses to NRC Question 6 and NRC Question 2a in Part 2 below) provide reasonable assurance of the structural integrity of the Unit 2 RPV head penetration nozzles and J-groove welds. Therefore, the proposed alternatives, combined with the other provisions of the NRC order, provide adequate protection against the phenomena of concern. Accordingly, I&M considers that the proposed alternatives provide an acceptable level of quality and safety.

NRC Question 3

The licensee stated that at least five nozzles are threaded approximately 0.75 inches at the bottom of the nozzle. Provide the distance from the bottom of the weld to the threaded area that cannot be examined by UT. Additionally, please provide a more exact count of the nozzles that would be affected.

Response to NRC Question 3

The minimum distance from the J-groove weld to the threaded area has been calculated to be 1.05 inches. Due to the curvature of the RPV head, this minimum distance only occurs at one point on the downhill side of the outermost penetrations (labeled 50.5° in Attachment 2, six penetrations on Unit 1, five penetrations on Unit 2). The minimum distance from the J-groove weld to the threaded area for all other points on these penetrations, and for all points on the other 73 penetrations, exceeds this value. As indicated in the response to NRC Question 1 above, the minimum distance from the J-groove weld to the location on the nozzle that cannot be ultrasonically scanned due to the PCS24 probe transducer arrangement has been calculated to be 1.1 inches. Since this value is approximately equal to the 1.05 inch minimum distance to the threaded area, the minimum distance from the J-groove weld to the location on the nozzle that cannot be ultrasonically inspected due to both causes will be considered to be approximately 1 inch.

I&M has determined through visual observation that all 78 Unit 2 penetrations affected by the proposed alternative are threaded. Six penetrations on Unit 1 are known to be threaded because they have a thermocouple guide funnel installed on the threads. Fabrication drawings indicate that all of the 73 other Unit 1 nozzles affected by the proposed alternative are also threaded, even though they do not have guide funnels installed.

NRC Question 4

Since the order allows either UT or a surface examination, what would be the implications of performing surface examination of the nozzle areas with limited UT coverage to provide 100% coverage of all the nozzles, consistent with the requirements of the order?

Response to NRC Question 4

Based on the telephone conference with the NRC conducted on April 18, 2003, I&M understands that the order allows combining ultrasonic testing and surface examination (eddy current and penetrant testing) to achieve full coverage of a given nozzle. However, as described in the responses to NRC Question 3 above and NRC Question 1a in Part 2 below, a threaded outer surface would result in an undue hardship for both ultrasonic testing and surface inspection of the lowest 0.75 inches of the nozzle.

NRC Question 5

The licensee is requested to provide a sketch of the nozzle with the necessary dimensioning to clarify the areas covered by the request.

Response to NRC Question 5

A sketch has been provided at the end of this attachment.

NRC Question 6

The licensee stated that performing a UT examination to the bottom of the nozzle in accordance with Order EA-03-009 would not provide relevant information to the phenomena of concern, since some of the nozzles in the center area of the head extend approximately 5 inches below the J-groove weld. The licensee is requested to provide technical justification that supports why this portion of the nozzle does not need to be inspected, and why 2 inches below the J-groove weld would be sufficient for testing. In particular, address the quality and safety aspects of not inspecting beyond 2 inches below the weld.

Response to NRC Question 6

The alternative proposed in Reference 2 included a provision which would have eliminated requirements to ultrasonically scan areas greater than 2 inches below the J-groove weld. This provision was requested to preclude scanning unnecessary portions of the nozzles in the center area of the RPV head, since the nozzles in this area extend well below the J-groove weld. Although this provision can be justified, I&M has conservatively elected to eliminate the provision. Accordingly, the proposed alternative is revised to be:

> In lieu of requiring that ultrasonic testing of each RPV head penetration nozzle extend to the bottom of the nozzle, I&M proposes that the ultrasonic testing conducted pursuant to Sections IV.C(1)(b)(i) and IV.C(2)(b)(i) of NRC Order EA-03-009 be required to extend to the lowest elevation that can be practically inspected with a PCS24 probe. The requirement that ultrasonic testing extend to 2 inches above the J-groove weld would be unaffected. The proposed alternative would not apply to the RPV level indication nozzle.

Part 2
Questions Pertaining To Proposed Alternative No. 2 to NRC Order EA-03-009: Alternative to Requirement to Perform Eddy Current or Dye Penetrant Testing of All Wetted Surfaces of Nozzle Base Material

NRC Introduction

The licensee requested relief from performing eddy current or dye penetrant testing based on two considerations:

Consideration 1: The outside surface of at least five nozzles is threaded for approximately 0.75 inches at the bottom end of the nozzle. These nozzles have a guide funnel installed on the threads and they are either drilled and pinned or stitch welded to securely fix it in position.

NRC Question 1a

Provide the distance from the bottom of the weld to the point where ET/PT cannot be performed.

Response to NRC Question 1a

The nozzles that have guide funnels installed are the outermost nozzles. As shown in the sketch provided with this attachment, the guide funnels extend approximately 0.75 inches above the threads. Consequently, the minimum distance from the J-groove weld to the location on the nozzle that cannot be examined by eddy current testing or dye penetrant testing on nozzles that have funnels installed is less that the distance assumed in the crack growth calculation described

in the response to NRC Question 2 in Part 1 above. Although the portion of the funnel extending 0.75 inches above the threads precludes eddy current testing and dye penetrant testing, it does not preclude ultrasonic inspection. Therefore this area of the nozzles having guide funnels would be inspected ultrasonically.

Although none of the other nozzles have funnels, visual observation of Unit 2, and fabrication drawings for Unit 1 indicate that the other nozzles affected by the proposed alternative are also threaded. The minimum distance from the J-groove weld to the threads for threaded nozzles without funnels has been calculated to be 1.4 inches. Due to the curvature of the RPV head this minimum distance would only occur at one point on the downhill side of the eight next-to-outermost penetrations (labeled 47° in Attachment 2). The minimum distance from the J-groove weld to the threads for all other points on these eight penetrations, and for all points on the other 65 penetrations without funnels, would exceed this value.

The vendor performing nozzle inspections for CNP does not have an eddy current probe capable of examining threaded surfaces. I&M estimates that penetrant testing these surfaces would involve approximately 400 person-millirem per nozzle. Consequently, I&M believes that eddy current or penetrant testing of threaded surfaces would result in undue hardship.

NRC Question 1b

Describe the implications of removing the funnels and performing the surface examinations on the threaded surface that currently cannot be examined.

Response to NRC Question 1b

After the funnels were torqued during installation, they were pinned to the nozzle or were stitch welded, forming a permanent attachment. The vendor's procedure for removal of a funnel, if needed for a repair, would destroy the funnel, and a new funnel would have to be installed. These operations would involve added time, monetary expenditure, and personnel radiation exposure. Additionally, eddy current or penetrant testing of the threads exposed by removal of the funnel would result in undue hardship as described in the response to NRC Question 1a.

NRC Introduction

Consideration 2: The second consideration is the elimination of the requirements to perform eddy current or dye penetrant testing on portions of the nozzle that are not significant to the phenomena of concern. The licensee states that some of the nozzles extend 5 inches below the J-groove weld.

NRC Question 2a

The licensee needs to provide technical justification to support the statement that the area 5 inches below the J-groove weld is not a significant portion of the nozzle and a surface examination would not be relevant. In particular, address the quality and safety aspects of not inspecting beyond 2 inches below the weld.

Response to NRC Question 2a

This response addresses both NRC Question 2a and NRC Question 2b. The alternative previously proposed in Reference 2 included a provision which would have eliminated requirements to eddy current or penetrant test areas greater than 2 inches below the J-groove weld. This provision was requested to preclude inspecting unnecessary portions of the nozzles in the center area of the RPV head, since the nozzles in this area extend well below the J-groove weld. Although I&M considers this provision to be justified, it has conservatively elected to eliminate the provision. Accordingly, the proposed alternative is revised to be:

> In lieu of requiring that all wetted surfaces of the J-groove weld and RPV head penetration nozzle base material be subjected to eddy current or dye penetrant testing, I&M proposes that the eddy current or dye penetrant testing conducted pursuant to Sections IV.C(1)(b)(ii) and IV.C(2)(b)(ii) of NRC Order EA-03-009 be required for all wetted, non-threaded surfaces of the J-groove weld and RPV head penetration nozzle base material. The requirement that eddy current or dye penetrant testing extend to 2 inches above the J-groove weld would be unaffected. The proposed alternative would not apply to the RPV level indication nozzle.

NRC Question 2b

The licensee needs to provide technical justification to support the statement that providing a surface examination 2 inches below the J-groove weld is sufficient.

Response to NRC Question 2b

As described in the response to NRC Question 2a, I&M has revised the proposed alternative to eliminate the provision that would have excluded areas greater than 2 inches below the J-groove weld from surface examination requirements.

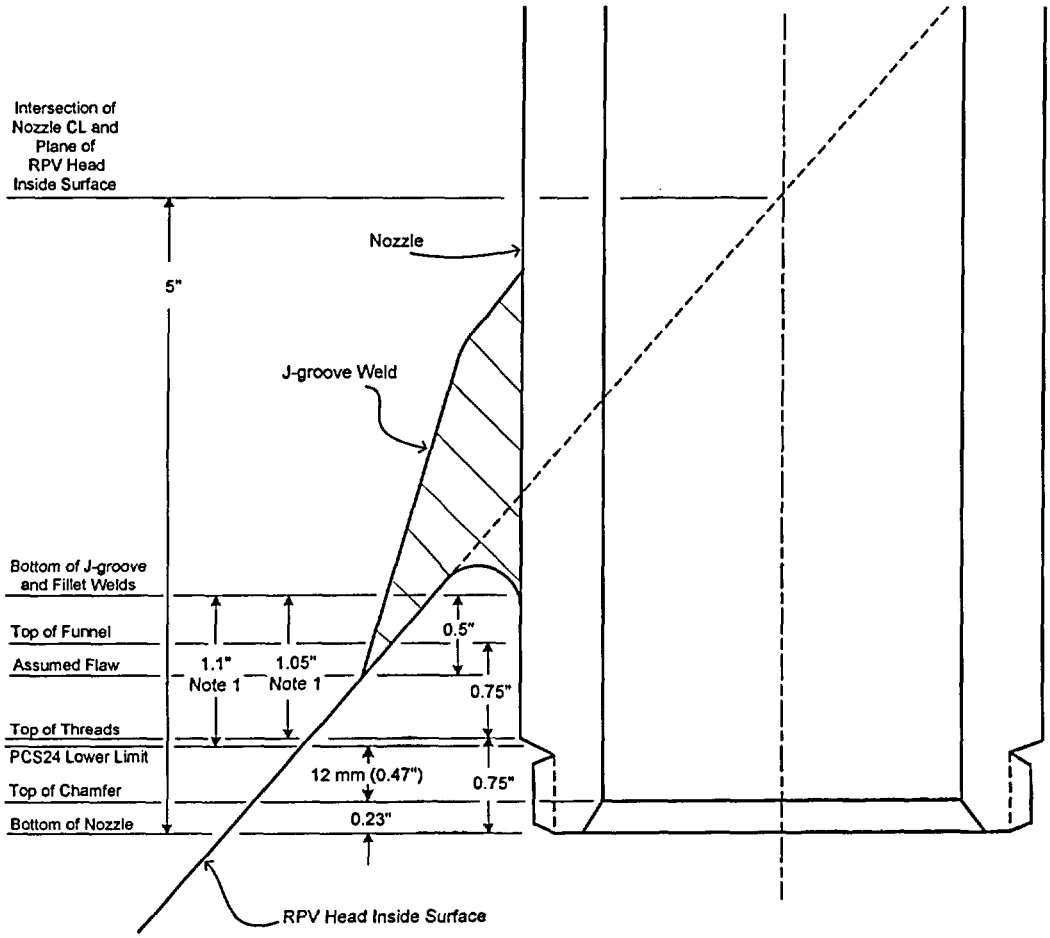
References

1. Nuclear Regulatory Commission Order EA-03-009, "Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," dated February 11, 2003

2. Letter from J. E. Pollock, Indiana Michigan Power Company, to U.S. Nuclear Regulatory Commission, Document Control Desk, "Donald. C Cook Nuclear Plant Unit 1 and Unit 2, Requests for Relaxation from Nuclear Regulatory Commission Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," AEP:NRC: 3054-04, dated March 26, 2003

3. Letter from R. Barrett, NRC, to A. Marion, Nuclear Energy Institute, "Flaw Evaluation Guidelines," dated April 11, 2003

Sketch of D.C. Cook Unit 1 and Unit 2 Reactor Vessel Head Penetration (Not to Scale)

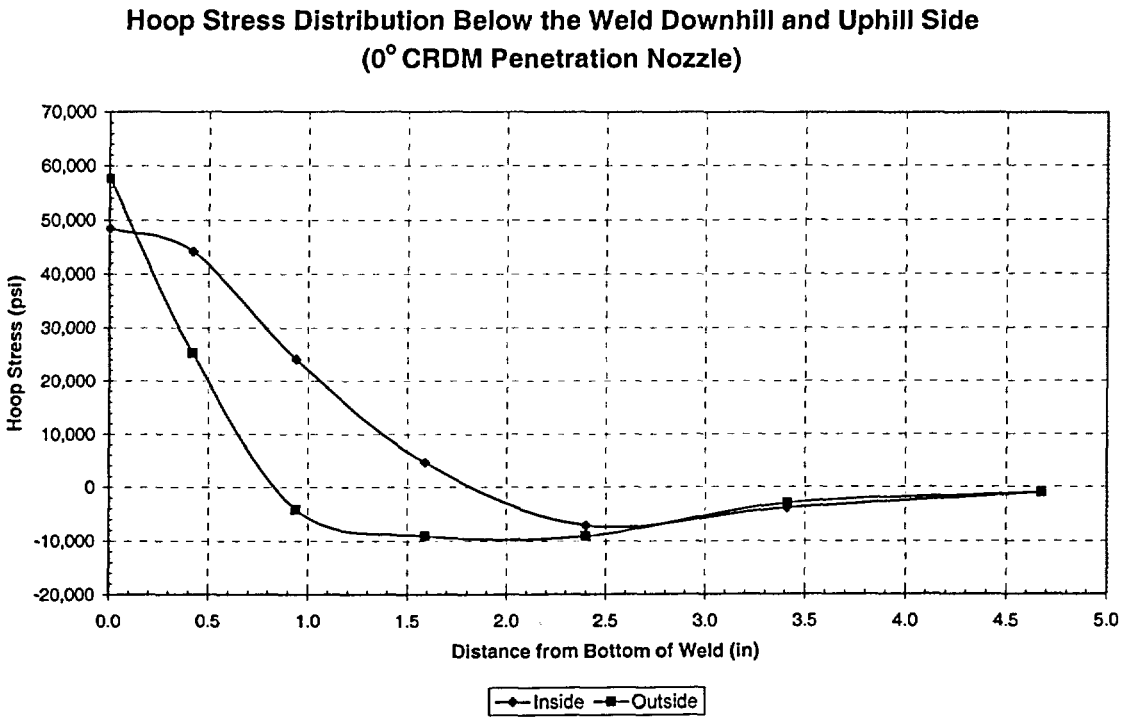


Note 1: Values referencing this note are minimum values, applicable to the downhill side of the outermost penetration.

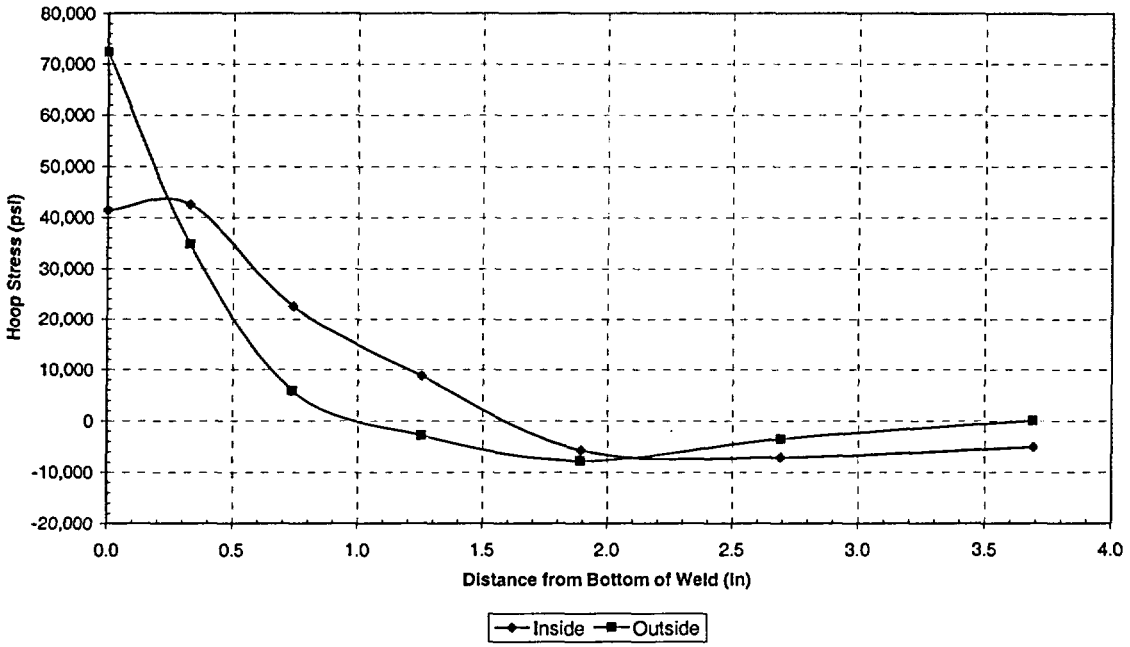
ATTACHMENT 2 TO AEP:NRC:3054-06

GRAPHS OF STRESS VERSUS DISTANCE BELOW J-GROOVE WELD

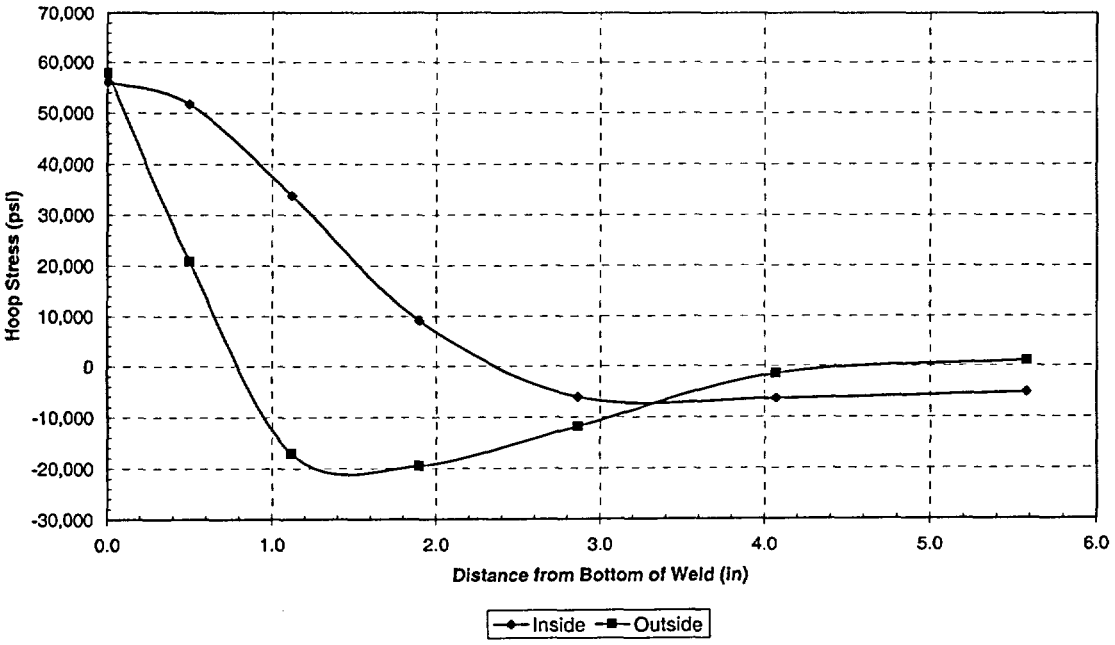
This attachment provides graphs of hoop stresses in reactor pressure vessel head control rod drive mechanism (CRDM) penetration nozzles as a function of distance below the J-grove weld, excluding the associated fillet weld, for Donald C. Cook Nuclear Plant Unit 2. The terms "downhill" and "uphill" side refer, respectively, to the side of the penetration farthest and nearest to the centerline of the reactor pressure vessel head. The degree (°) designation refers to the angular displacement of the nozzle from the centerline of the reactor pressure vessel head, with the "0° CRDM Penetration Nozzle" being the nozzle located in the center of the head.



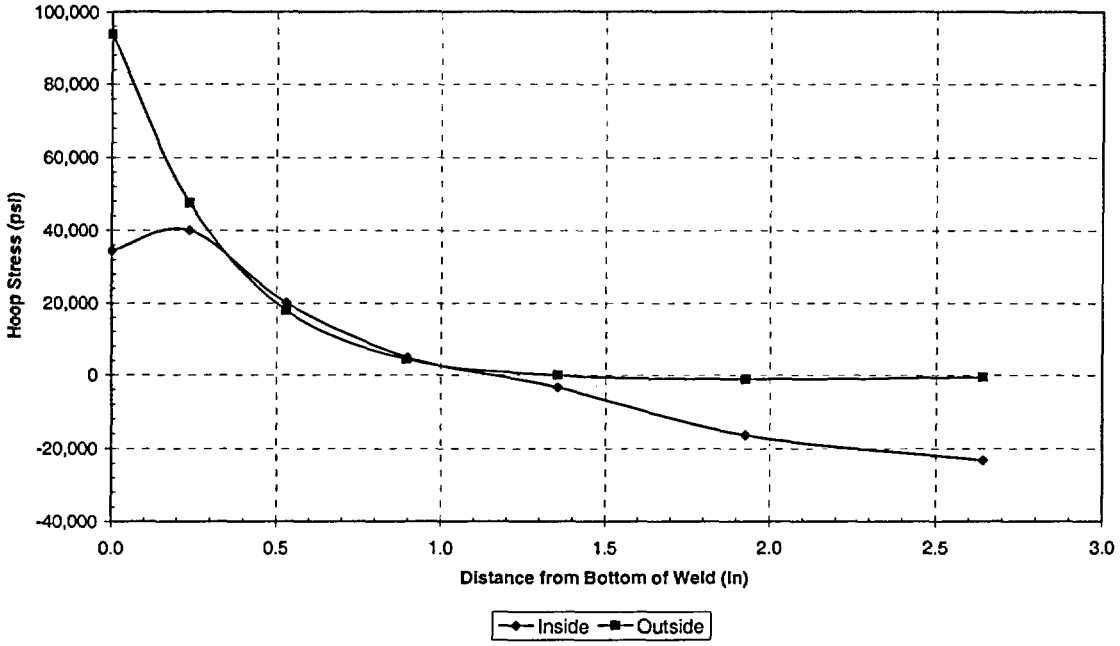
Hoop Stress Distribution Below the Weld Downhill Side
(27.0° CRDM Penetration Nozzle)



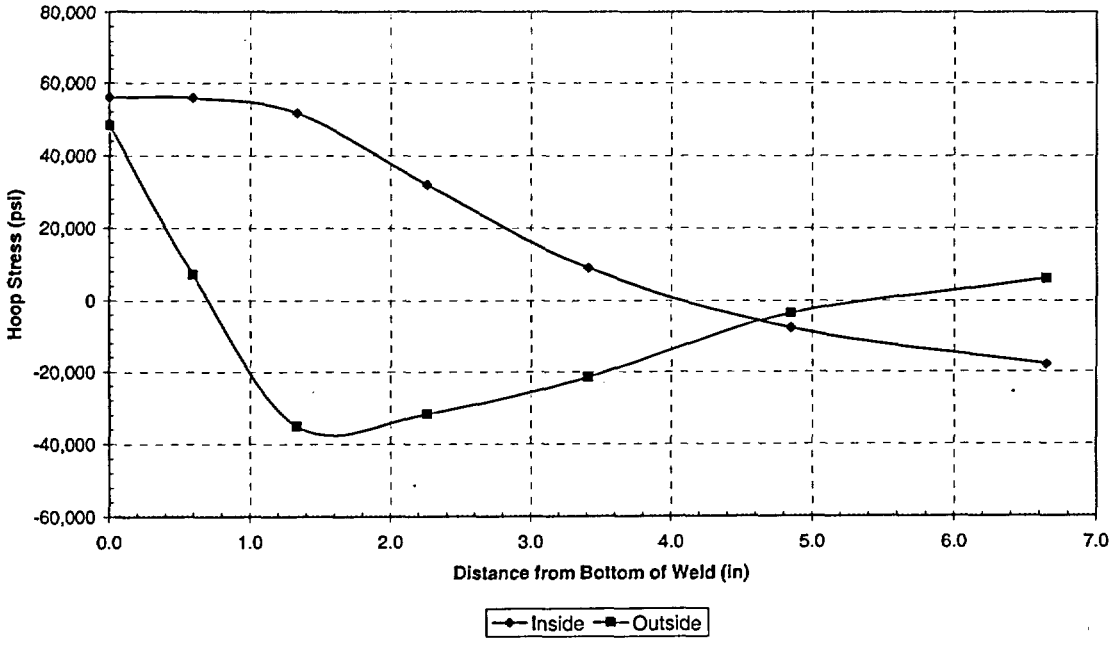
Hoop Stress Distribution Below the Weld Uphill Side
(27.0° CRDM Penetration Nozzle)



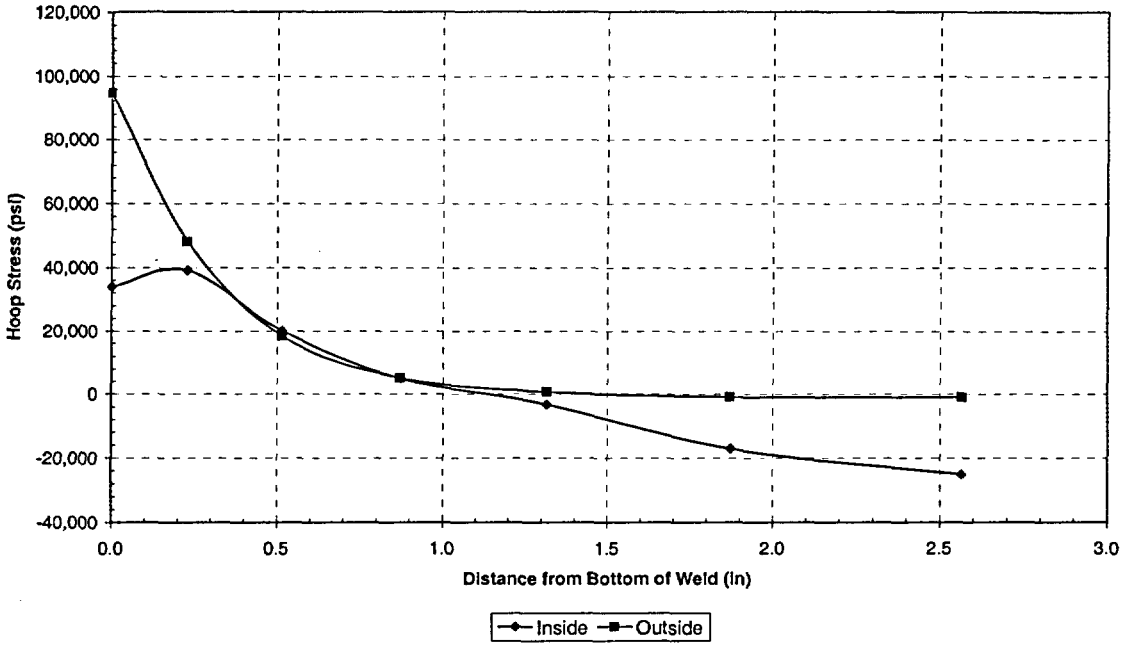
Hoop Stress Distribution Below the Weld Downhill Side
(45.8° CRDM Penetration Nozzle)



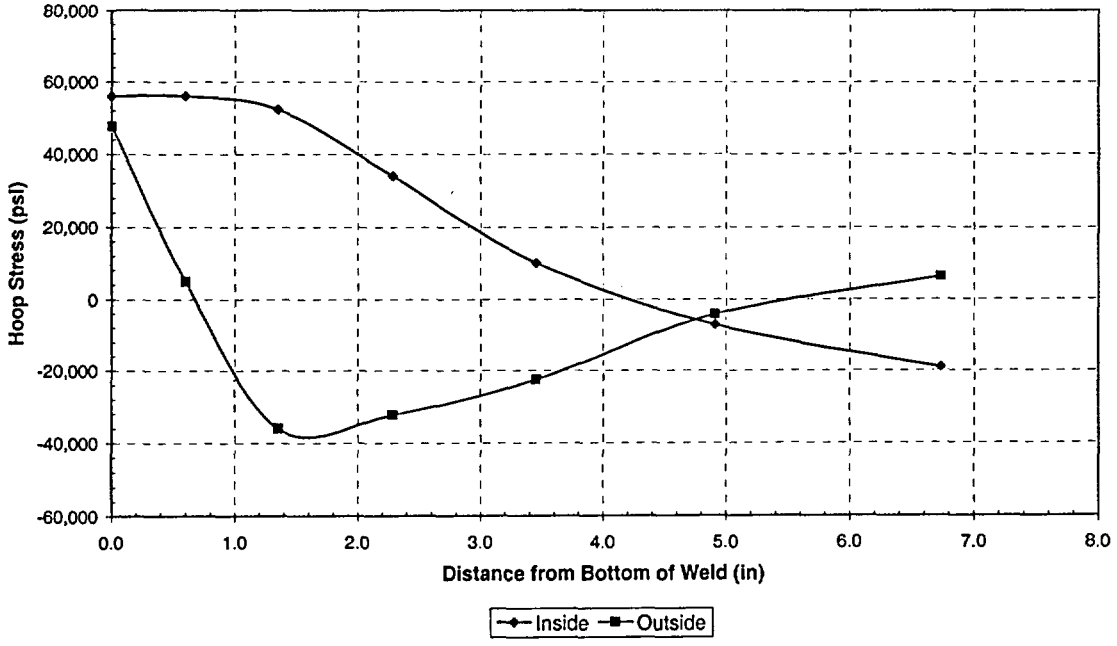
Hoop Stress Distribution Below the Weld Uphill Side
(45.8° CRDM Penetration Nozzle)



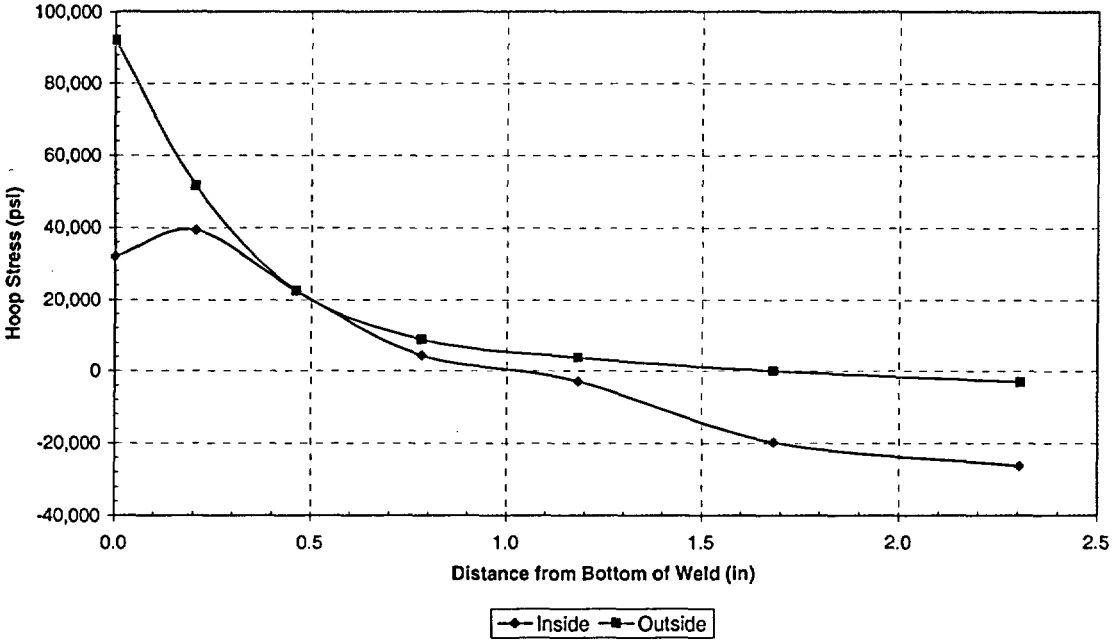
Hoop Stress Distribution Below the Weld Downhill Side
(47.0° CRDM Penetration Nozzle)



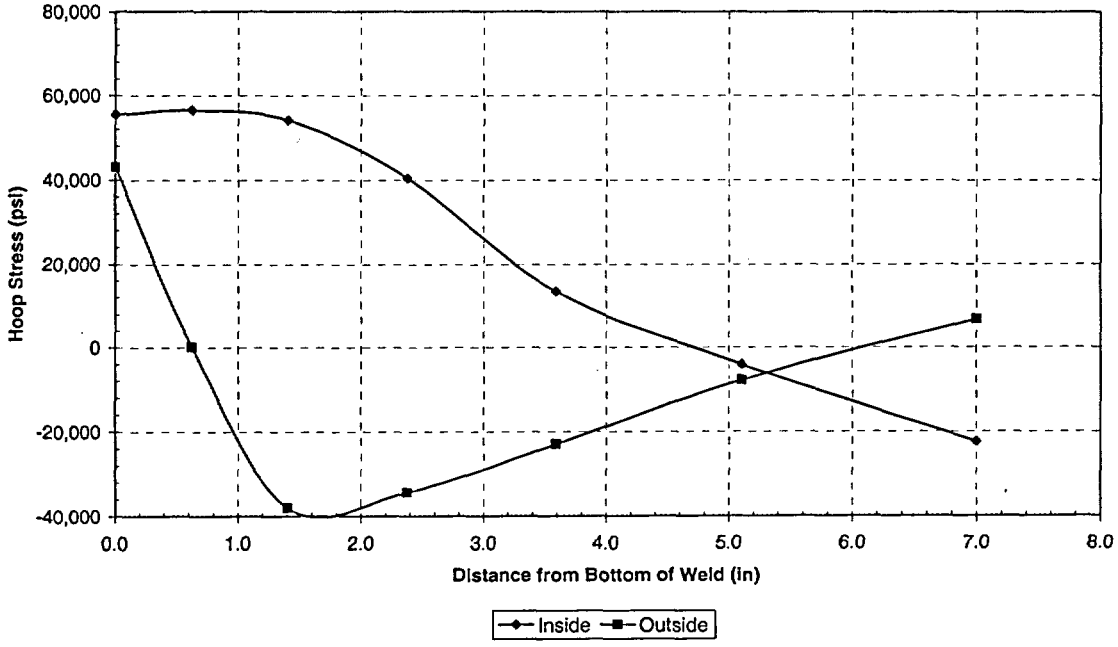
Hoop Stress Distribution Below the Weld Uphill Side
(47.0° CRDM Penetration Nozzle)



Hoop Stress Distribution Below the Weld Downhill Side
(50.5° CRDM Penetration Nozzle)



Hoop Stress Distribution Below the Weld Uphill Side
(50.5° CRDM Penetration Nozzle)



ATTACHMENT 3 TO AEP:NRC:3054-06

REGULATORY COMMITMENTS

The following table identifies those actions committed to by Indiana Michigan Power Company (I&M) in this document. Any other actions discussed in this submittal represent intended or planned actions by I&M. They are described to the Nuclear Regulatory Commission (NRC) for the NRC's information and are not regulatory commitments.

Commitment	Date
I&M will provide a response to NRC Question 2 in Part 1 for Unit 1.	As necessary to support the next Unit 1 under-head inspection required by NRC Order EA-03-009, currently scheduled for Spring 2005.