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INDIANA MICHIGAN POWER

June 2, 2003

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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
REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING RELAXATION OF REACTOR PRESSURE VESSEL HEAD PENETRATION INSPECTION REQUIREMENTS IN NUCLEAR REGULATORY COMMISSION ORDER

References:
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

3) Letter from J. E. Pollock, I&M, to U. S. NRC Document Control Desk, "Response to Request for Additional Information Regarding Relaxation of Reactor Pressure Vessel Head Penetration Inspection Requirements in Nuclear Regulatory Commission Order," AEP:NRC:3054-06, dated May 13, 2003

A101

4) Letter from S. A. Greenlee, I&M, to U. S. NRC Document Control Desk, "Proposed Alternatives to the Requirements Of Section XI of the American Society of Mechanical Engineers Code – Request for Additional Information (TAC Nos. MB3551 AND MB3552)," AEP:NRC: 2055, dated April 25, 2002

This letter provides a revised response to a Nuclear Regulatory Commission (NRC) request for additional information (RAI) 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 (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. Reference 3 provided I&M's response to the RAI. The response to the RAI transmitted by Reference 3 has been revised to address the following issues.

The RAI response included the results of a calculation quantifying the time it would take a postulated crack in the lower portion of the nozzle to grow to the J-groove weld. I&M has determined that the growth rate in the axial direction was misapplied in that calculation. As a result, the calculated time period was non-conservative. I&M has had new crack growth calculations performed using a different methodology. The new crack growth calculations were performed using methodology that will be reflected in Westinghouse WCAP-14118, Revision 6. WCAP 14118, Revision 5, was transmitted to the NRC by Reference 4. The RAI response has been revised to include the results of the new calculations.

The RAI response also provided information regarding the minimum length of penetration nozzle below the J-groove weld that would be inspected in accordance with the proposed relaxations. The minimum length was calculated using nominal dimensions given in plant specific fabrication drawings. However, ultrasonic inspections conducted during the current Unit 2 refueling outage indicate that the actual minimum length is less than indicated in Reference 3. The RAI response has been revised to reflect the information obtained from the ultrasonic inspections.

The NRC identified concerns regarding the RAI response in telephone conferences on May 16, May 28, and May 29, 2003. The RAI response has been revised to address the NRC concerns.

The revised alternative proposed by Reference 3 indicated that eddy current and dye penetrant testing conducted pursuant to Sections IV.C(1)(b)(ii) and IV.C(2)(b)(ii) of the order would be required for all wetted, non-threaded surfaces of the RPV head penetration nozzle base material and J-groove weld. It is not practical to perform surface examinations on the small (approximately 0.23 inch high) chamfer face on the inside diameter of the nozzle bottom. The eddy current probe used for examining the inside diameter tends to lose surface contact upon reaching the chamfer, and the sleeves on nozzles with thermal sleeves preclude access for penetrant testing. The RAI response has been revised to clearly exclude the chamfer surface from eddy current and dye penetrant testing requirements. Minor editorial improvements have also been made.

Attachment 1 to this letter provides the revised RAI response. The changed portions of Attachment 1 (except for changes to the letter number) are indicated by revision bars in the right margin. Attachment 2 provides graphs of stress versus distance below the J-groove weld for Unit 2. A single correction has been made to the introductory text, and is indicated by a revision bar in the right margin. Attachment 3 provides crack growth curves for the outer three penetration rows derived from the new crack growth calculation. Since the RAI response transmitted by Reference 3 did not contain a crack growth curve, there are no revision bars in Attachment 3. Attachment 4 documents the revised regulatory commitments made in this letter. Since the commitment in Reference 3 has been entirely superceded, there are no revision bars in Attachment 4.

In Reference 2, I&M stated that the order requirement to perform a leak path assessment when using ultrasonic testing could be met by conducting a bare metal visual examination of the RPV head surface in conjunction with an evaluation of the ultrasonic examination results for evidence of leakage. At the time that Reference 2 was submitted, the vendor selected to perform the examinations had not provided a demonstration of the ability of the ultrasonic testing to perform the leakage assessment. The vendor subsequently provided I&M with technical information regarding mock-up testing that demonstrated the capability to detect leakage into the interference fit zone using ultrasonic testing. This methodology has been employed for all penetrations for which ultrasonic testing was used. Therefore, I&M no longer considers that the leakage assessment need include the results of the bare metal visual examination.

However, I&M intends to continue conducting bare metal visual examinations as required by Sections IV.C(1)(a) and IV.C(2)(a) of the order.

As stated in Reference 3, 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. Revised Response to Request for Additional Information
2. Graphs of Stress Versus Distance Below J-groove Weld for Unit 2
3. Crack Growth Curves
4. Revised 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

J. E. Pollock
Site Vice President

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 2nd DAY OF June, 2003

Julie E Newmiller
Notary Public

My Commission Expires 8-22-2004

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

ATTACHMENT 1 TO AEP:NRC:3054-08

REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

The documents referenced in this attachment are identified on Page 9.

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 requested information for Unit 2. I&M will provide the requested information for Unit 1 by separate correspondence as necessary to support the next Unit 1 under-head inspection required by NRC Order EA-03-009. The inspection is currently scheduled for Spring 2005.

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 approximately equal to the minimum inspectable distance resulting from the external threads on the nozzle. As described in the response to NRC Question 3, with one exception, the minimum inspectable distance resulting from the external threads has been determined to be 0.68 inches, based on best estimates by personnel reviewing ultrasonic inspection results. The one exception is discussed in the response to NRC Question 3.

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 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. 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 steady state and residual stresses in that area, and an analysis of the propagation time for a flaw in that area.

The steady state and residual 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 had calculations performed demonstrating that more than one operating cycle would elapse before a postulated 100 percent through-wall axial flaw in an uninspected area would propagate into the pressure boundary formed by the J-groove weld. As stated in I&M's response to NRC Questions 1 and 3, and NRC Question 1a in Part 2, the minimum distance below the J-groove weld that would be inspected in accordance with the proposed alternatives has been determined to be 0.68 inches (except for penetration 73) based on best estimates by personnel reviewing ultrasonic inspection results. However, I&M has elected to conservatively postulate a flaw with its upper tip located 0.5 inches below the J-groove weld. The crack growth calculations were performed using methodology that will be reflected in Westinghouse WCAP-14118, Revision 6. WCAP 14118, Revision 5, was transmitted to the NRC by Reference 3. The differences between the methodology in Revision 5 and Revision 6 of the WCAP are described below.

The flaw tolerance charts generated in Revision 5 and those in Revision 6 are based on different sets of finite element stress analyses and crack growth models. The flaw tolerance charts in Revision 5 were generated based on a 1992 elastic-plastic finite element analysis using the information and techniques known in the industry at that time. The most significant improvement in the stress analysis is an increase in the density of elements used in the analysis. The element density used for the Revision 6 analysis is twice that used in Revision 5. The elastic-plastic finite element stress analysis methodology itself has also been refined, resulting in a more accurate calculation of the steady state and residual stresses in the vicinity of the penetration nozzle attachment welds. Uphill and downhill stresses below, at, and above the attachment welds were generated and used to develop enhanced flaw tolerance charts for predicting crack growth at these locations in Revision 6. The refinements introduced in the Revision 6 model allow graphing of the stresses as a function of the distance from the weld. Revision 5 did not provide such graphs. These graphs are useful in demonstrating that inspections have covered all the high stress regions of the penetration.

The crack growth model used in Revision 6 is based on that recommended in EPRI/MRP-55, Revision 1 (Reference 4). The crack growth model used in Revision 5 was based on the Scott model (Reference 5). Although the crack growth model used in Revision 6 results in a slightly higher crack growth rate than the crack growth model used in Revision 5, the more realistic finite element stresses used in Revision 6 result in a longer calculated time for the crack to reach the bottom of the J-groove weld.

The calculations were performed for the three outer penetration rows (45.8°, 47.0°, and 50.5° in Attachment 2). The results of these calculations are illustrated by the four crack growth curves provided in Attachment 3 to this letter. The first three curves show that it would take more than 2.3 effective full power years for the postulated flaw 0.5 inches below the J-groove weld to propagate to the bottom of the weld. This time period is more than the minimum under-head inspection interval for Unit 2 (one operating cycle) required by NRC Order EA-03-009. For rows other than the three outer rows, the inspectable length exceeds 1 inch, based on best estimates by personnel reviewing ultrasonic inspection results. The 1 inch inspectable length provides a conservative factor of 2 with respect to the crack growth distance assumed in the calculations. The effect of additional inspectable length on crack growth times is illustrated by a comparison of the first and fourth curves in Attachment 3. These curves show that an increase in inspectable length of 0.18 inches results in an increase of approximately 4 effective full power years in the time it would take a flaw in the uninspectable area to reach the J-groove weld for the third outermost row.

The results of the flaw propagation calculations indicate that, even if a flaw were to exist 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) 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.

In telephone conferences on May 16, May 28, and May 29, 2003, the NRC identified concerns regarding the information in the previous revision of this attachment transmitted by Reference 6. The individual concerns are identified below followed by I&M's resolution.

NRC Concern 1

The licensee references a crack growth analysis report. What is the report number, and has this been submitted previously to the NRC? If a crack growth analysis is used that is different than that previously submitted, explain the differences.

Resolution

During the previous Unit 2 penetration nozzle inspection, flaws were evaluated in accordance with Westinghouse WCAP-14118, Revision 5, submitted by Reference 3. Westinghouse is currently revising this WCAP. The crack growth calculations described above were performed using the methodology that will be reflected in WCAP-14118, Revision 6. The significant differences between the methodology in Revision 5 and Revision 6 of the WCAP are described above.

NRC Concern 2

Why is the postulated flaw given a depth of 80 percent of the wall thickness instead of 100 percent of the wall thickness? The former does not appear to be conservative.

Resolution

In the crack growth calculation described in Reference 6, 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 American Society of Mechanical Engineers Boiler and Pressure Vessel Code. However, a flaw depth of 100 percent was assumed in the above described crack growth calculations.

NRC Concern 3

The estimated distance below the weld that is inspectable is stated to be at least 1 inch, minimum. Is this value from generic drawings, plant-specific drawings, or an analysis of the inspection data from the 2002 inspection?

Resolution

The minimum distances between the J-groove weld and the areas that would not be inspected stated in Attachment 1 to Reference 6 were based on plant-specific fabrication drawings. However, ultrasonic inspections conducted during the current Unit 2 refueling outage indicate that the actual minimum length is less than indicated in Reference 6. This revision of Attachment 1 reflects distances that are based on best estimates by personnel reviewing the ultrasonic inspection results.

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

With one exception, the minimum distance from the J-groove weld to the threaded area has been determined to be 0.68 inches based on best estimates by personnel reviewing ultrasonic inspection results. The tolerance on this value is estimated to be plus or minus 10 percent. This minimum distance occurs on the downhill side of one penetration in the third row from the outermost row ("45.8°" in Attachment 2). The "downhill" side of the penetration is the side farthest from the centerline of the RPV head.

The one exception occurs on penetration 73. On penetration 73, the minimum distance from the J-groove weld to the threaded area has been determined to be 0.36 inches based on best estimates by personnel reviewing the ultrasonic inspection results. The tolerance on this value is estimated to be plus or minus 10 percent. Since this distance is less than the 0.5 inch value assumed for the location of a postulated flaw in the crack growth calculations described in the response to NRC Question 2, I&M has performed surface examination of the areas below the 0.36 inch distance on penetration 73. The surface examination consisted of eddy current testing of the inside diameter surface down to the top of the chamfer and penetrant testing the threaded surface of the outside diameter down to the bottom of the threads. These surface examinations extended the inspected area beyond 0.5 inches below the J-groove weld. Penetration 73 is in the next to outermost row. The Attachment 3 curve for the next to outermost row shows that it would take a flaw 0.5 inches below the J-groove weld on penetration 73 more than 2.5 effective full power years to propagate to the weld.

I&M has determined through visual observation that all 78 Unit 2 penetrations affected by the proposed alternative are threaded.

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 Reference 2 and in the response to NRC Question 1a in Part 2, the threaded outer surface results in an undue hardship for both ultrasonic testing and surface inspection of the lowest 0.75 inches of the nozzle. For penetration 73, the hardship is not undue, since the length inspectable by ultrasonic testing alone is not bounded by the crack growth calculations described in the response to Question 2.

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. 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, which is performed from the inside. 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 indicates that the other nozzles affected by the proposed alternative are also threaded. Except for penetration 73, (described in the response to NRC Question 3 in Part 1), the minimum distance from the J-groove weld to the threads for threaded nozzles without funnels has been determined to be 0.68 inches based on best estimates by personnel reviewing ultrasonic inspection results. This minimum distance occurs on the downhill side of one penetration.

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. This estimate is conservatively low as evidenced by the actual dose received during penetrant testing of penetration 73, over 740 person-millirem. Consequently, I&M believes that eddy current or penetrant testing of the threaded surfaces for penetrations other than penetration 73 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, non-chamfer surfaces of the RPV head penetration nozzle base material and J-groove weld. 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, I&M, to U. S. NRC 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

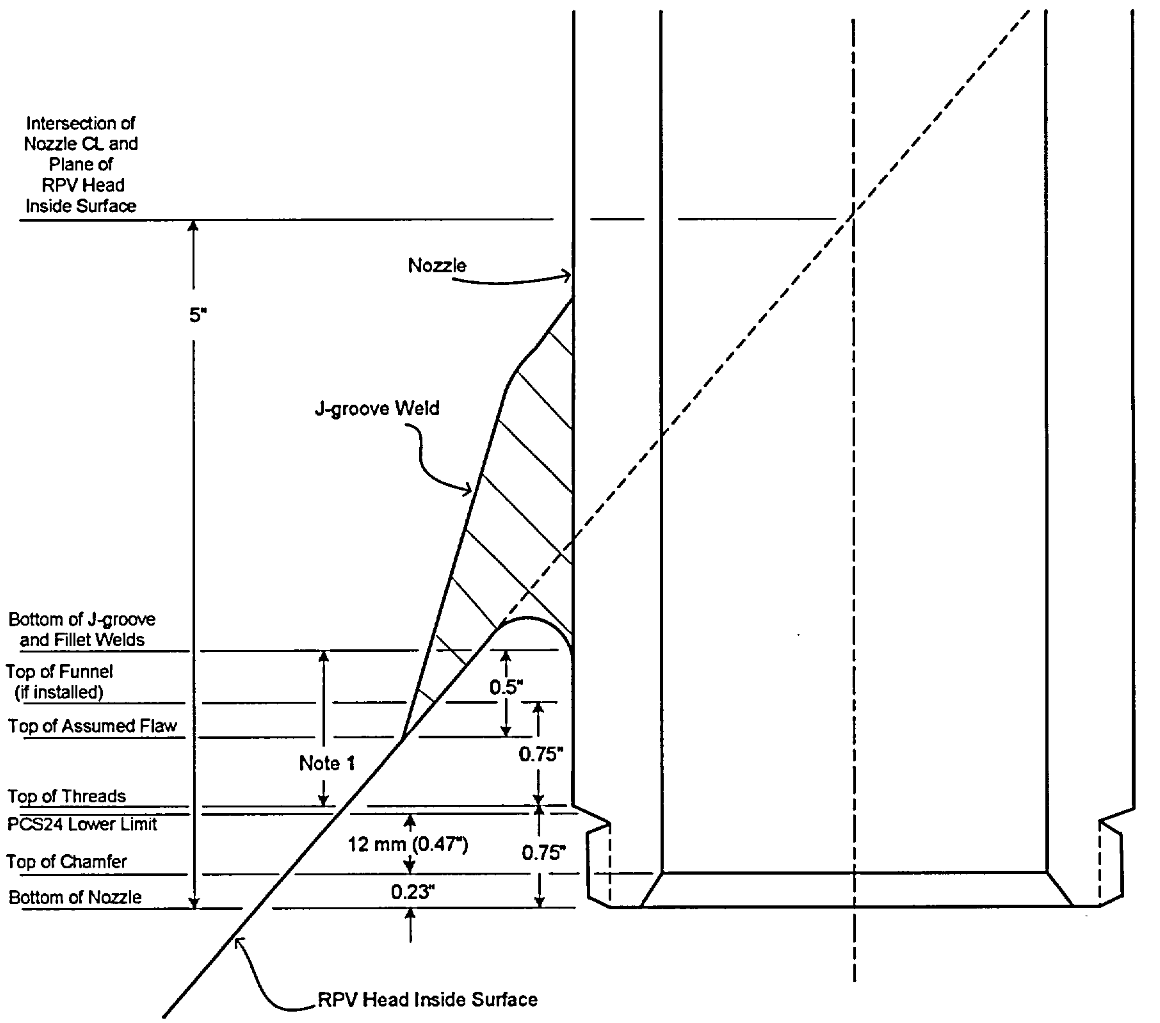
3. Letter from S. A. Greenlee, I&M, to U. S. NRC Document Control Desk, "Proposed Alternatives to the Requirements Of Section XI of the American Society of Mechanical Engineers Code – Request for Additional Information (TAC Nos. MB3551 AND MB3552)," AEP:NRC: 2055, dated April 25, 2002

4. Electric Power Research Institute Document MRP-55, "Materials Reliability Program (MRP) Crack Growth Rates for Evaluating Primary Water Stress Corrosion Cracking (PWSCC) of Thick-Wall Alloy 600 Materials," Revision 1, dated November 2002

5. Paper by P. M. Scott, "An Analysis of Primary Water Stress Corrosion Cracking in PWR Steam Generators," Specialists Meeting on Operating Experience With Steam Generators, Brussels Belgium, September 1991

6. Letter from J. E. Pollock, I&M, to U. S. NRC Document Control Desk, "Response To Request For Additional Information Regarding Relaxation Of Reactor Pressure Vessel Head Penetration Inspection Requirements In Nuclear Regulatory Commission Order," AEP:NRC:3054-06, dated May 13, 2003

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



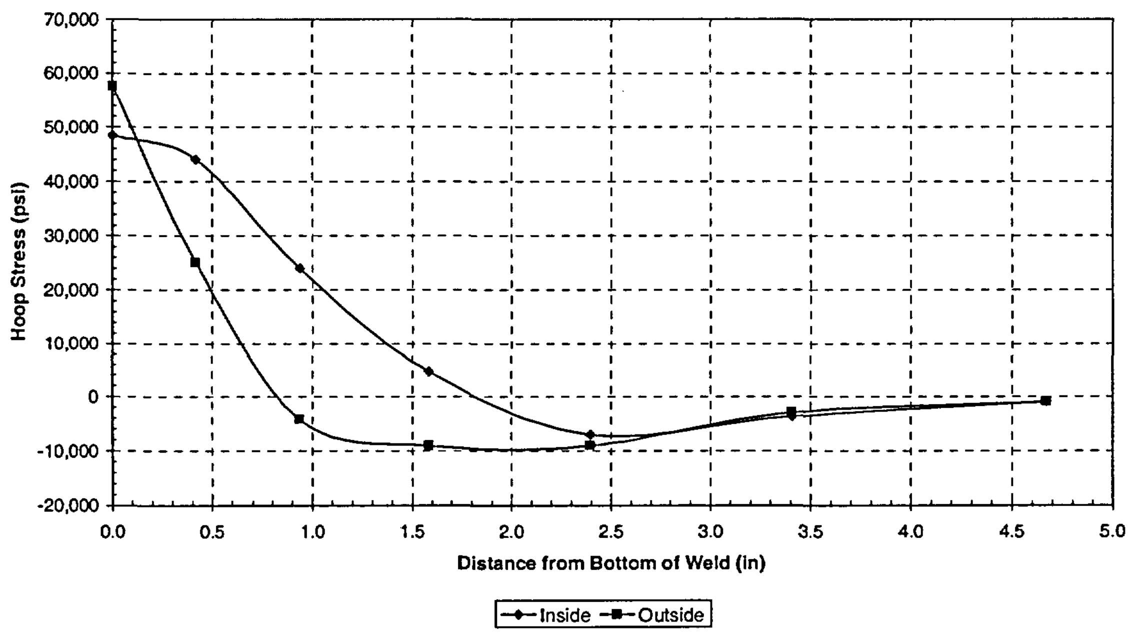
Note 1: The minimum distance from the bottom of the J-groove and fillet welds to the top of the threads (except for penetration 73) is 0.68." - This occurs on the downhill side of one penetration. For penetration 73, the minimum distance the from bottom of the J-groove and fillet welds to the top of the threads is 0.36." The OD of Penetration 73 was dye penetrant tested to the bottom of the nozzle and the OD was eddy current tested to the top of the chamfer. The distances from the bottom of the J-groove and fillet welds to the top of the threads are based on best estimates by personnel reviewing ultrasonic inspection results.

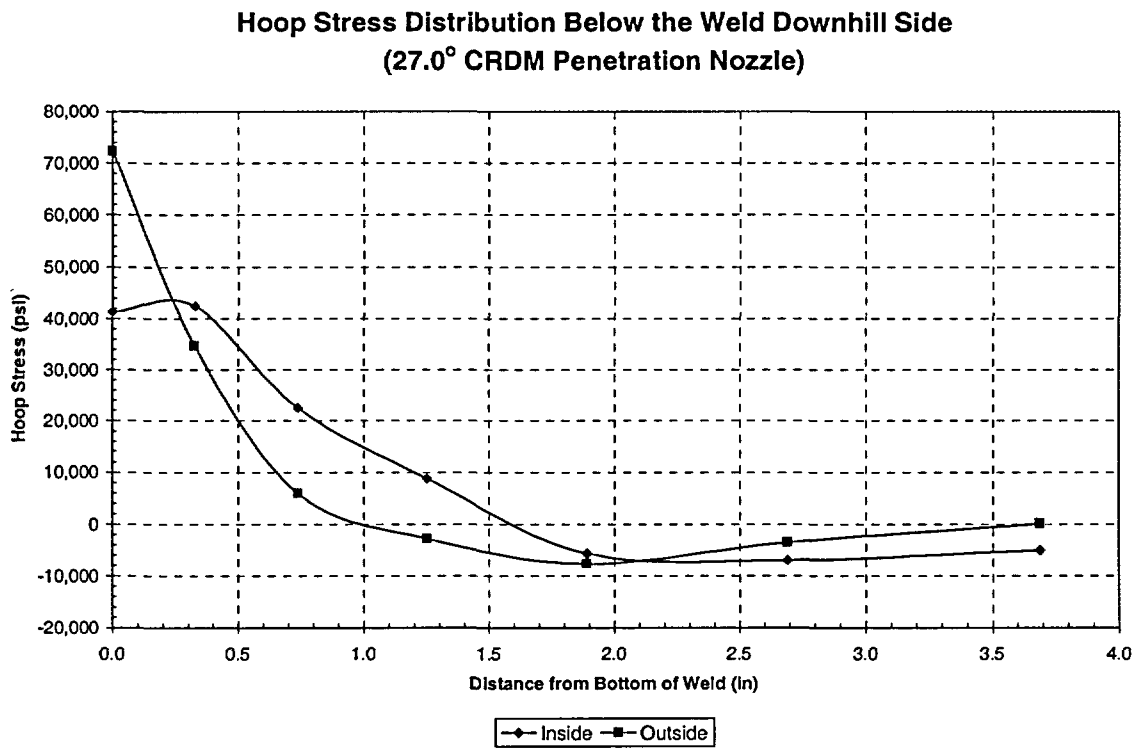
ATTACHMENT 2 TO AEP:NRC:3054-08

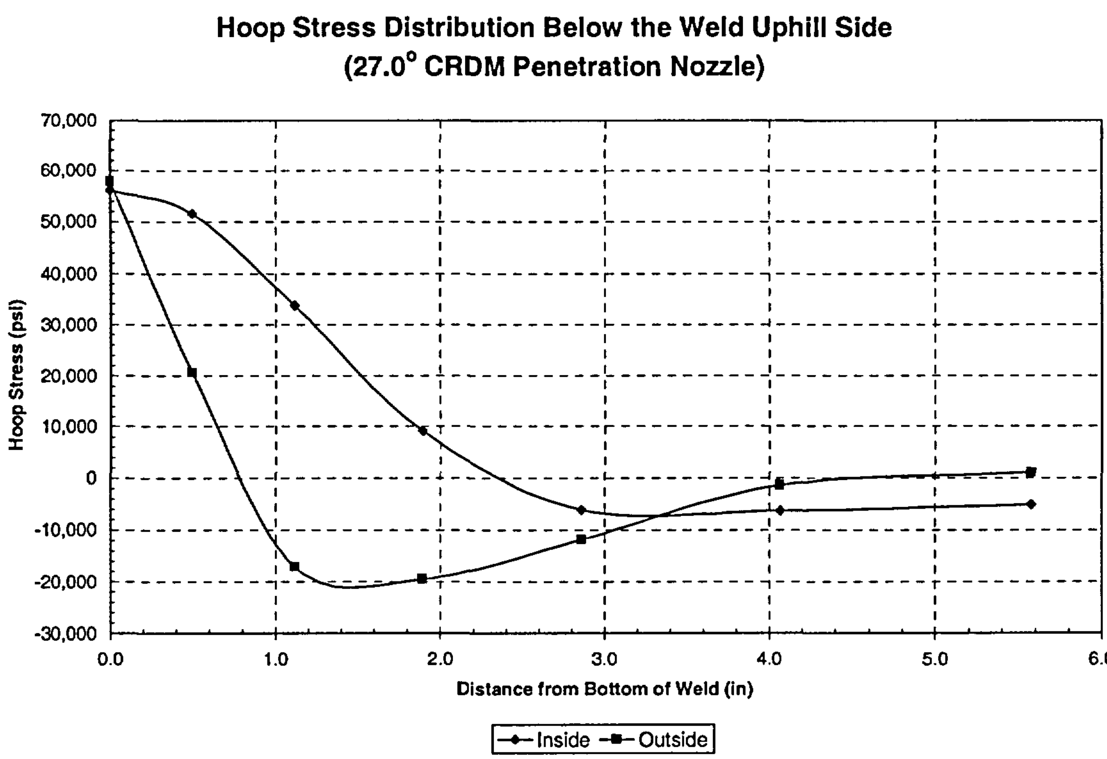
GRAPHS OF STRESS VERSUS DISTANCE BELOW J-GROOVE WELD

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-groove weld, including 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.

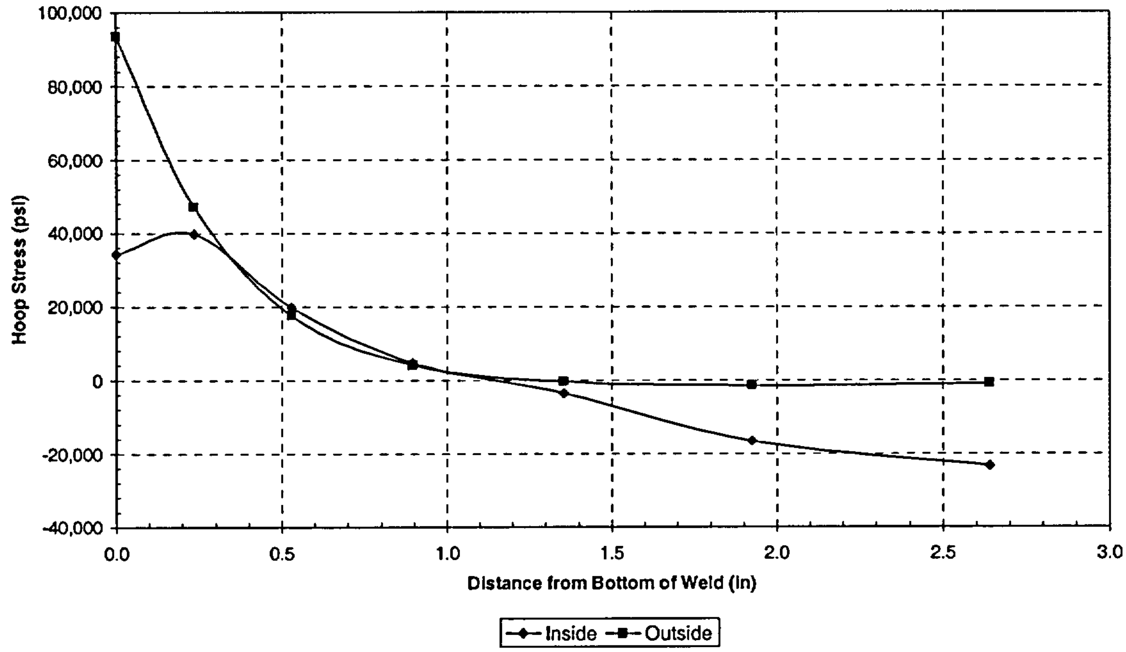
Hoop Stress Distribution Below the Weld Downhill and Uphill Side (0° CRDM Penetration Nozzle)



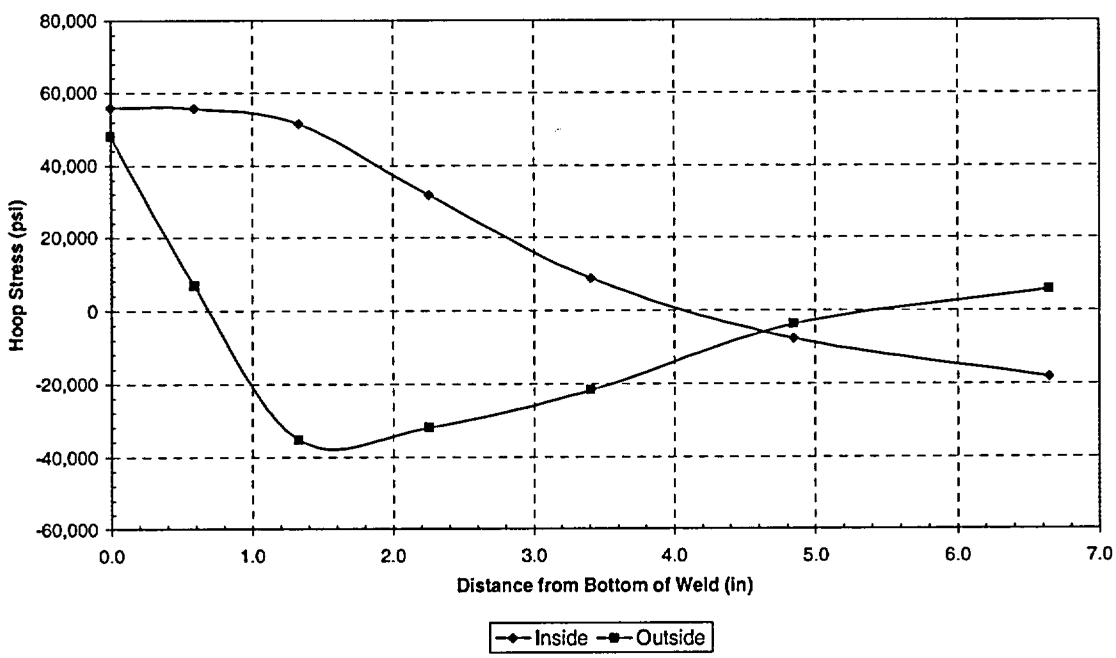

Hoop Stress Distribution Below the Weld Downhill Side
(27.0° CRDM Penetration Nozzle)
Hoop Stress (psi)
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
-10,000
-20,000
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Distance from Bottom of Weld (in)
Inside
Outside

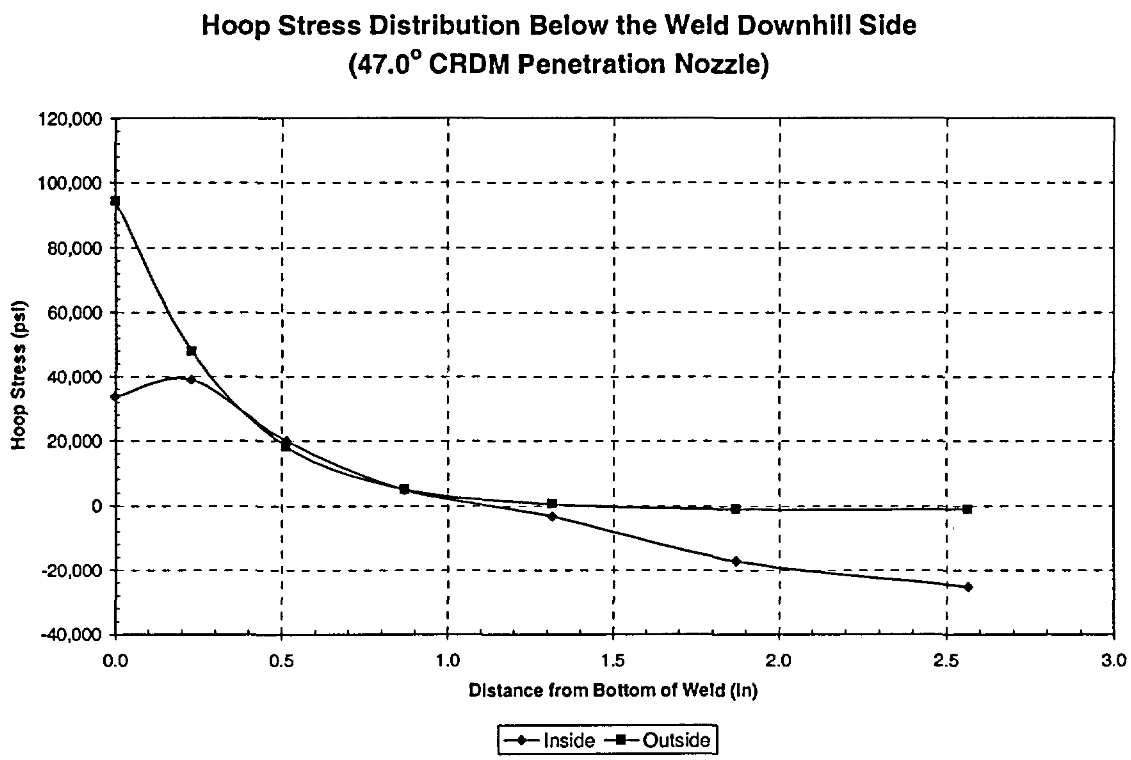

Hoop Stress Distribution Below the Weld Uphill Side
(27.0° CRDM Penetration Nozzle)
Hoop Stress (psi)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
-10,000
-20,000
-30,000
0.0
1.0
2.0
3.0
4.0
5.0
6.0
Distance from Bottom of Weld (in)
Inside
Outside

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

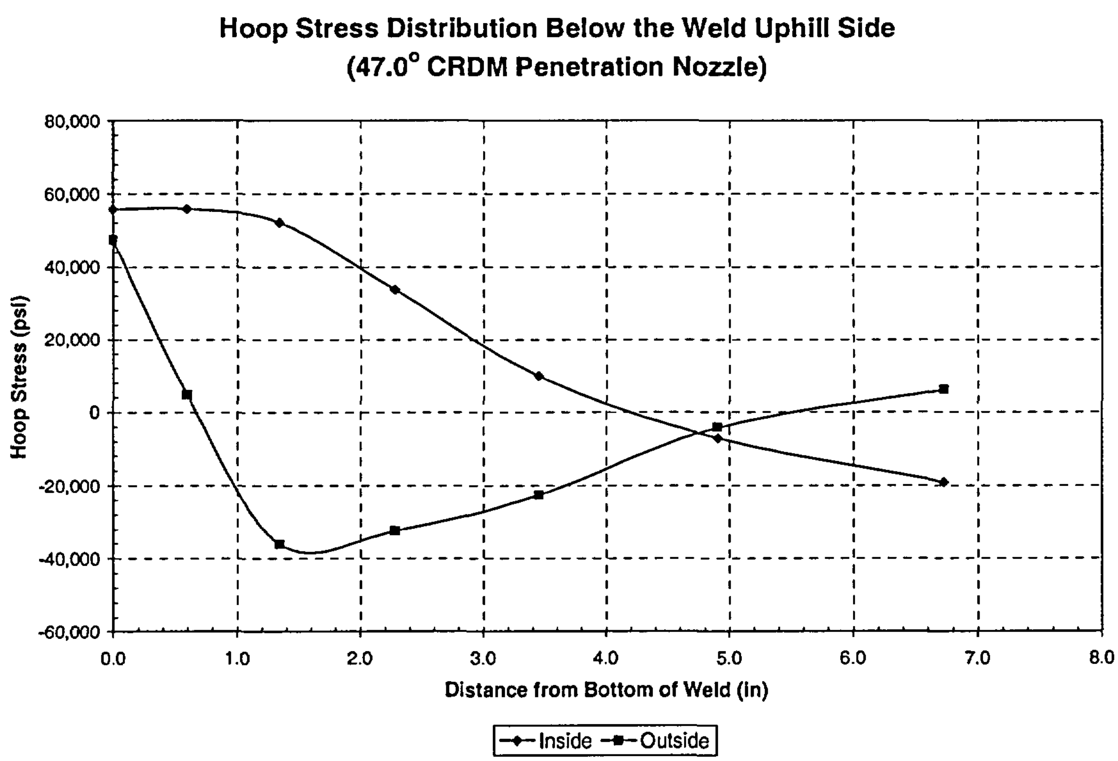


Hoop Stress Distribution Below the Weld Uphill Side
(45.8° CRDM Penetration Nozzle)



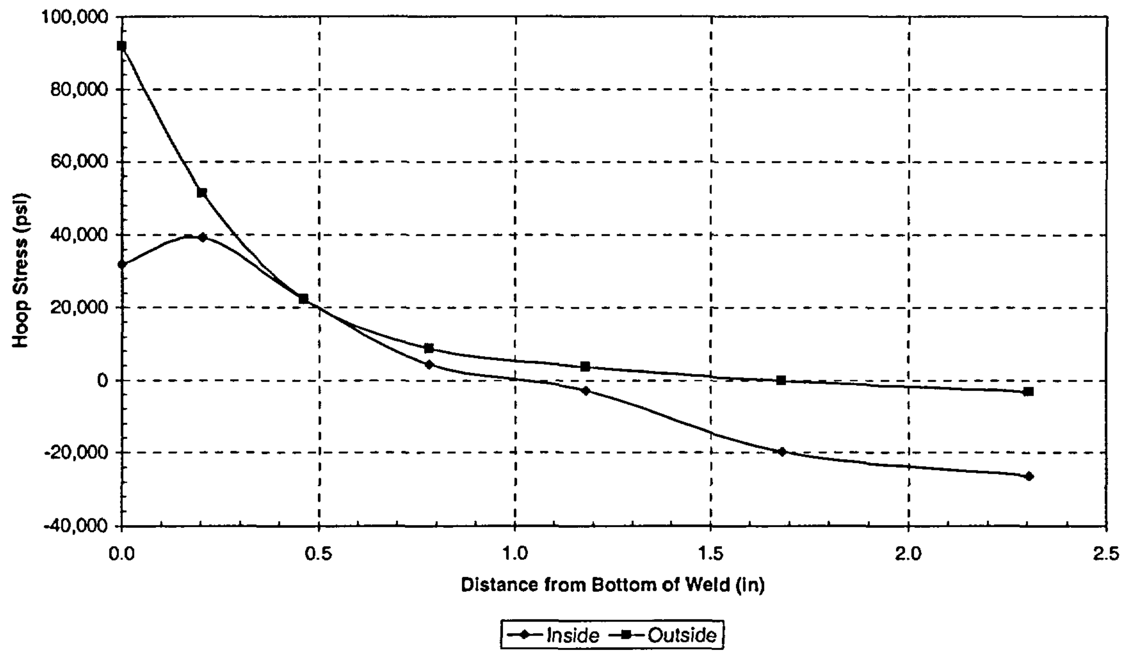


Hoop Stress Distribution Below the Weld Downhill Side
(47.0° CRDM Penetration Nozzle)
120,000
100,000
80,000
60,000
40,000
20,000
0
-20,000
-40,000
Hoop Stress (psi)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Distance from Bottom of Weld (in)
Inside
Outside

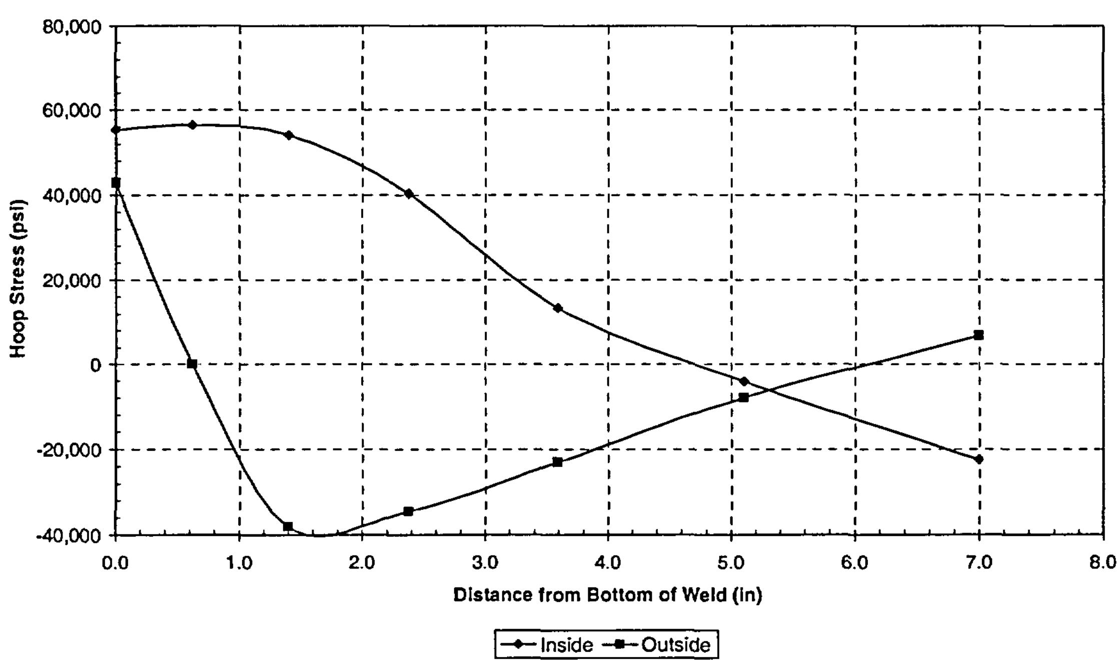


Hoop Stress Distribution Below the Weld Uphill Side
(47.0° CRDM Penetration Nozzle)
80,000
60,000
40,000
20,000
0
-20,000
-40,000
-60,000
Hoop Stress (psi)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
Distance from Bottom of Weld (in)
Inside
Outside

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

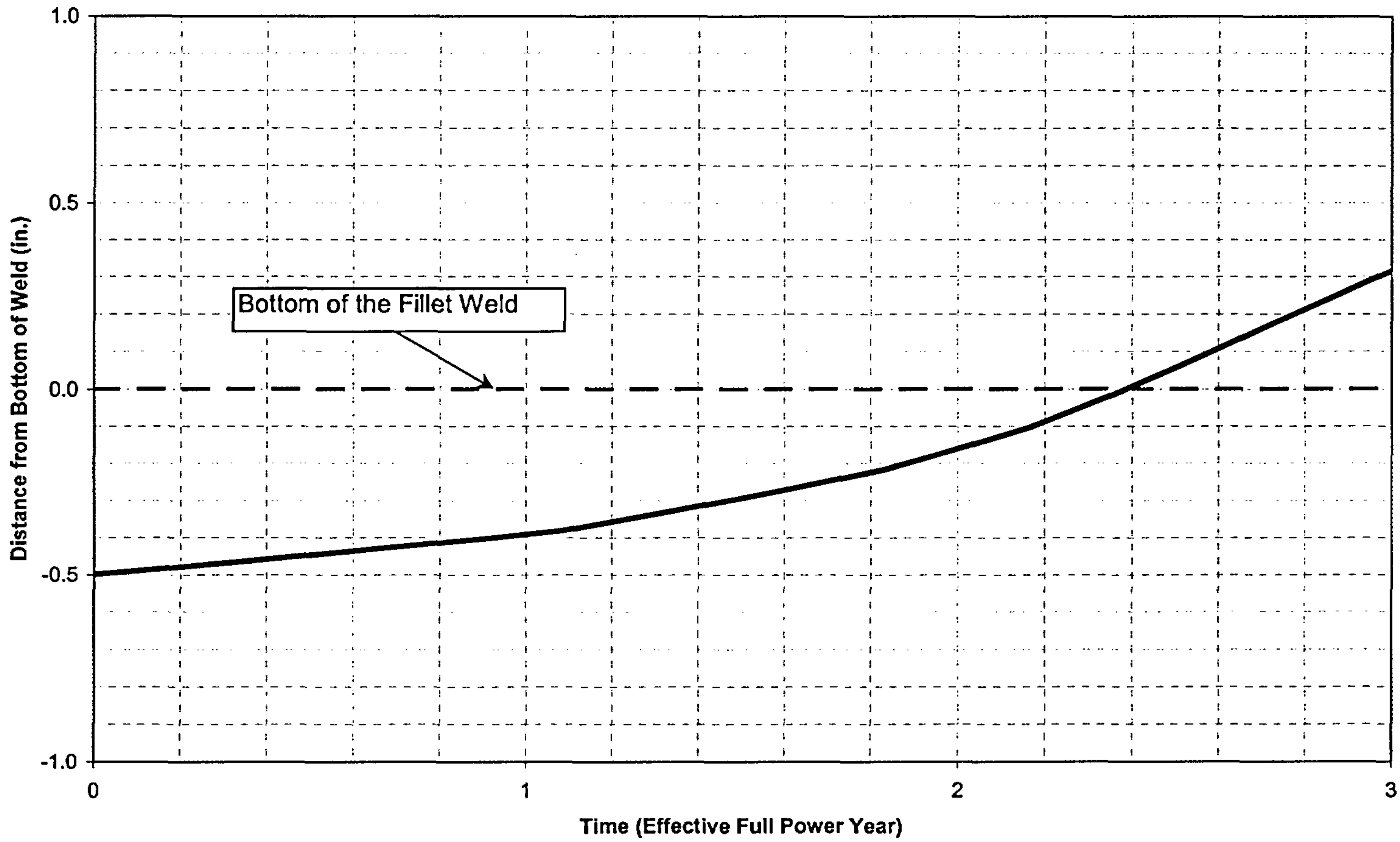


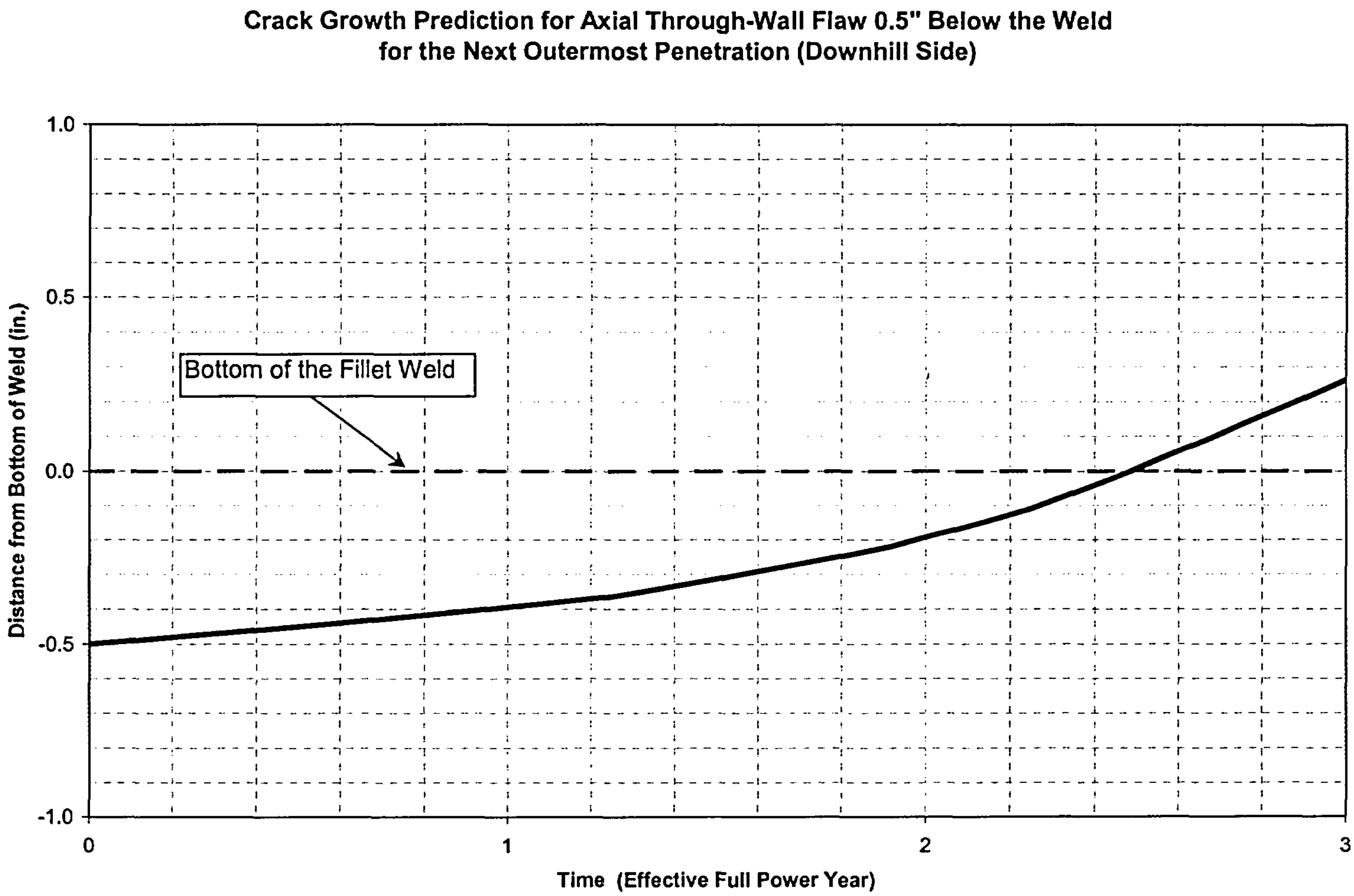
Hoop Stress Distribution Below the Weld Uphill Side (50.5° CRDM Penetration Nozzle)



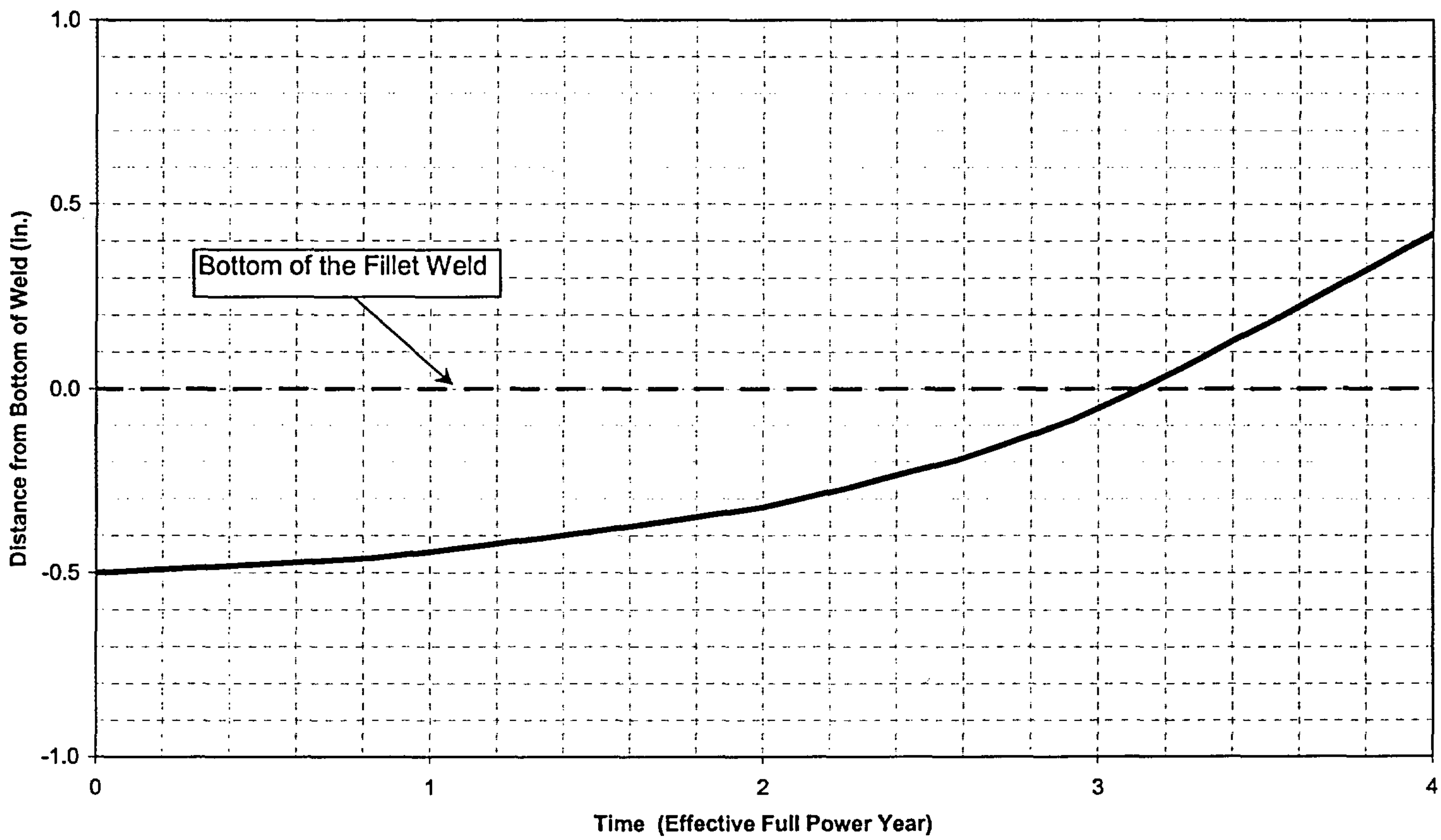
ATTACHMENT 3 TO AEP:NRC:3054-08
CRACK GROWTH CURVES

Crack Growth Prediction for Axial Through-Wall Flaw 0.5" Below the Weld for the Third Outermost Penetration (Downhill Side)

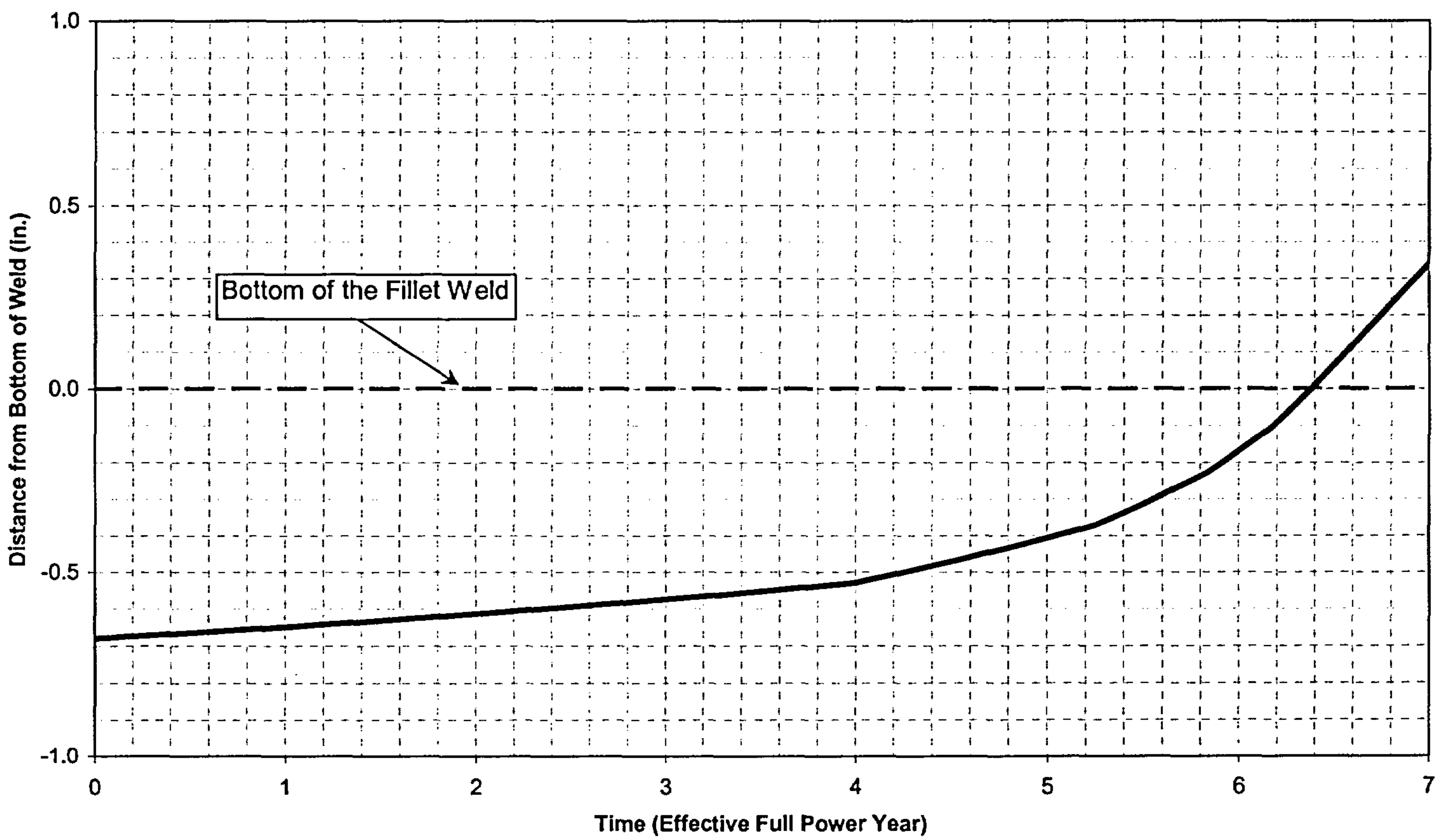



Crack Growth Prediction for Axial Through-Wall Flaw 0.5" Below the Weld
for the Next Outermost Penetration (Downhill Side)
Bottom of the Fillet Weld
Distance from Bottom of Weld (in.)
Time (Effective Full Power Year)
1.0
0.5
0.0
-0.5
-1.0
0
1
2
3

Crack Growth Prediction for Axial Through-Wall Flaw 0.5" Below the Weld for the Outermost Penetration (Downhill Side)



Crack Growth Prediction for Axial Through-Wall Flaw 0.68" Below the Weld for the Third Outermost Penetration (Downhill Side)



ATTACHMENT 4 TO AEP:NRC:3054-08

REVISED REGULATORY COMMITMENT

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. This commitment supercedes the commitment made in the letter from J. E. Pollock, I&M, to the NRC Document Control Desk, AEP:NRC:3054-06, dated May 13, 2003

Commitment	Date
I&M will provide a response to the NRC request for additional information for Unit 1.	As necessary to support the next Unit 1 under-head inspection required by NRC Order EA-03-009. The inspection is currently scheduled for Spring 2005.