June 17, 2003

Mr. A. Christopher Bakken III, Senior Vice President
and Chief Nuclear Officer
Indiana Michigan Power Company
Nuclear Generation Group
500 Circle Drive
Buchanan, MI 49107

SUBJECT: DONALD C. COOK NUCLEAR PLANT UNIT NO. 2 - RELAXATION OF THE REQUIREMENTS OF ORDER (EA-03-009) REGARDING REACTOR PRESSURE VESSEL HEAD INSPECTIONS (TAC NOS. MB8205 AND MB8206)

Dear Mr. Bakken:

The U.S. Nuclear Regulatory Commission (NRC) has approved, upon good cause shown and subject to the conditions specified below, Indiana Michigan Power Company's (the licensee's) request for relaxation of the specific requirements of Order EA-03-009 for Donald C. Cook (D. C. Cook), Unit 2. The Order requires inspections of the reactor pressure vessel (RPV) and associated penetration nozzles at pressurized-water reactors. This relaxation is in response to licensee's letter dated March 26, 2003, as supplemented and revised by letters dated May 13, June 2, and June 12, 2003. The licensee's letter dated March 26, 2003, had requested relaxation for both D. C. Cook Units 1 and 2. The licensee's June 2, 2003, letter requested that the NRC issue the relaxations from the Order for Unit 2 only, because the additional information requested by the NRC staff for Unit 1 had not been developed. The NRC staff will separately review the Unit 1 relaxations when the licensee has provided sufficient information to the NRC staff.

Pursuant to the procedure specified in Section IV, Paragraph F of the Order, the licensee requested two relaxations from the requirements specified in Section IV, Paragraphs C.(1)(b)(i) and C.(1)(b)(ii) to perform the ultrasonic testing (UT) and eddy current testing (ET) which cannot be completed as specified in the Order. These requirements direct licensees of plants in the highly susceptible category to either ultrasonically test each RPV head penetration nozzle from 2 inches above the J-groove weld to the bottom of the nozzle; or, eddy current test or dye penetrant test the wetted surface of each J-groove weld and RPV head penetration nozzle base material to at least 2 inches above the J-groove weld. This relaxation allows the licensee to perform UT and ET examinations from 2 inches above the J-grove weld to the lowest elevation that can be practically inspected on each nozzle.

The relaxations from the Order were discussed with the licensee in a telephone conference call on April 28, 2003. During the conference call, the NRC staff requested additional information. The licensee provided additional information by letter dated May 13, 2003. Additional telephone conference calls were held with the NRC staff on May 16, May 28, and May 29, 2003. During the phone calls, the NRC staff requested additional information. By letter dated June 2, 2003, the licensee provided the additional information.

The NRC staff has reviewed and evaluated the information provided in support of the licensee's requests for relaxation and found that the licensee has demonstrated good cause for the requested relaxations. The licensee has demonstrated that compliance with the Order would result in hardship without a compensating increase in the level of quality and safety. Therefore, pursuant to Section IV. F of the Order and Title 10 of the *Code of Federal Regulations*, Section 50.55a(a)(3), the NRC staff approves for one operating cycle, commencing with start from the spring 2003 (U2C14) refueling outage, the licensee's requests for relaxation and authorizes the proposed alternatives to items IV.C.(1)(b)(i) and C.(1)(b)(ii) with respect to UT and ET testing which cannot be completed as specified in the Order, subject to the following condition:

> If the NRC staff finds that the crack growth formula in industry report MRP-55 is unacceptable, the licensee shall revise its analysis that justifies relaxation of the Order within 30 days after the NRC informs the licensee of an NRC-approved crack growth formula. If the licensee's revised analysis shows that the crack growth acceptance criteria are exceeded prior to the end of the current operating cycle, this relaxation is rescinded and the licensee shall, within 72 hours, submit to the NRC written justification for continued operation. If the revised analysis shows that the crack growth acceptance criteria are exceeded during the subsequent operating cycle, the licensee shall, within 30 days, submit the revised analysis for NRC review. If the revised analysis shows that the crack growth acceptance criteria are not exceeded during either the current operating cycle or the subsequent operating cycle, the licensee shall, within 30 days, submit a letter to the NRC confirming that its analysis has been revised. Any future crack growth analyses performed for this and future cycles for RPV head penetrations must be based on an acceptable crack growth rate formula.

The details of the NRC staff's review are contained in the enclosed safety evaluation. If you have any questions concerning this approval, please contact Mr. John Stang at (301) 415-1345.

Sincerely,

/RA by LRaghavan for/

William H. Ruland, Director
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-316

Enclosure: Safety Evaluation

cc w/encl: See next page

The NRC staff has reviewed and evaluated the information provided in support of the licensee's requests for relaxation and found that the licensee has demonstrated good cause for the requested relaxations. The licensee has demonstrated that compliance with the Order would result in hardship without a compensating increase in the level of quality and safety. Therefore, pursuant to Section IV. F of the Order and Title 10 of the *Code of Federal Regulations*, Section 50.55a(a)(3), the NRC staff approves for one operating cycle, commencing with start from the spring 2003 (U2C14) refueling outage, the licensee's requests for relaxation and authorizes the proposed alternatives to items IV.C.(1)(b)(i) and C.(1)(b)(ii) with respect to UT and ET testing which cannot be completed as specified in the Order, subject to the following condition:

> If the NRC staff finds that the crack growth formula in industry report MRP-55 is unacceptable, the licensee shall revise its analysis that justifies relaxation of the Order within 30 days after the NRC informs the licensee of an NRC-approved crack growth formula. If the licensee's revised analysis shows that the crack growth acceptance criteria are exceeded prior to the end of the current operating cycle, this relaxation is rescinded and the licensee shall, within 72 hours, submit to the NRC written justification for continued operation. If the revised analysis shows that the crack growth acceptance criteria are exceeded during the subsequent operating cycle, the licensee shall, within 30 days, submit the revised analysis for NRC review. If the revised analysis shows that the crack growth acceptance criteria are not exceeded during either the current operating cycle or the subsequent operating cycle, the licensee shall, within 30 days, submit a letter to the NRC confirming that its analysis has been revised. Any future crack growth analyses performed for this and future cycles for RPV head penetrations must be based on an acceptable crack growth rate formula.

The details of the NRC staff's review are contained in the enclosed safety evaluation. If you have any questions concerning this approval, please contact Mr. John Stang at (301) 415-1345.

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ORDER (EA-03-009) RELAXATION REQUEST, EXAMINATION COVERAGE

FOR REACTOR PRESSURE VESSEL HEAD PENETRATION NOZZLES

DONALD C. COOK NUCLEAR PLANT, UNIT 2

INDIANA MICHIGAN POWER COMPANY

DOCKET NO. 50-316

1.0 INTRODUCTION

Order EA-03-009, issued on February 11, 2003, requires specific examinations of the reactor pressure vessel (RPV) head and vessel head penetration (VHP) nozzles of all pressurized-water reactor plants. Section IV, Paragraph F, of the Order states that requests for relaxation of the Order associated with specific penetration nozzles will be evaluated by the Nuclear Regulatory Commission (NRC) staff using the procedure for evaluating proposed alternatives to the American Society of Mechanical Engineers Code in accordance with 10 CFR 50.55a(a)(3). Section IV, Paragraph F, of the Order states that a request for relaxation regarding inspection of specific nozzles shall address the following criteria: (1) the proposed alternative(s) for inspection of specific nozzles will provide an acceptable level of quality and safety, or (2) compliance with this Order for specific nozzles would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

For D. C. Cook Unit 2, and similar plants determined to have a high susceptibility to primary water stress corrosion cracking (PWSCC) in accordance with Section IV, Paragraphs A and B, of the Order, the following inspections are required to be performed every refueling outage in accordance with Section IV, Paragraph C.(1) of the Order:

a. Bare metal visual examination of 100 percent of the RPV head surface (including 360° around each RPV head penetration nozzle), AND

b. Either:

   i. Ultrasonic testing (UT) of each RPV head penetration nozzle (i.e., nozzle base material) from two (2) inches above the J-groove weld to the bottom of the nozzle and an assessment to determine if leakage has occurred into the interference fit zone, OR

   ii. Eddy current testing or dye penetrant testing of the wetted surface of each J-groove weld and RPV head penetration nozzle base material to at least two (2) inches above the J-groove weld.

Footnote 3 of the Order provides specific criteria for examination of repaired VHP nozzles.

By letter dated March 26, 2003, as supplemented May 13, June 2, and June 12, 2003, Indiana Michigan Power Company (I&M, the licensee) requested relaxation to implement alternatives to the requirements of Section IV, Paragraphs C.(1)(b)(i) and C.(1)(b)(ii), for the D. C. Cook Units 1 and 2 VHP nozzles. The June 2, 2003, letter requested that the NRC issue the relaxations from the Order for Unit 2 only, because the additional information requested by the NRC staff for Unit 1 had not been developed. The NRC staff will separately review the Unit 1 relaxations from the Order when the licensee has provided sufficient information to support its request to the NRC staff.

2.0 ORDER EA-03-009 RELAXATION REQUEST FOR PROPOSED ALTERNATIVE INSPECTION FOR RPV HEAD NOZZLES

2.1 Order Requirements for which Relaxation is Requested

Section IV.C.(1)(b) of Order EA-03-009 requires, in part, that the following inspections be performed during every refueling outage for high susceptibility plants similar to D. C. Cook Unit 2:

Either:

(i) Ultrasonic testing of each RPV head penetration nozzle (i.e., nozzle base material) from two (2) inches above the J-groove weld to the bottom of the nozzle and an assessment to determine if leakage has occurred into the interference fit zone, OR

(ii) Eddy current testing or dye penetrant testing of the wetted surface of each J-groove weld and RPV head penetration nozzle base material to at least two (2) inches above the J-groove weld.

The licensee has requested relief from Section IV.C.(1)(b)(i) and Section IV.C.(1)(b)(ii) of the Order as follows:

1. Not to perform ultrasonic testing of the RPV head penetration nozzles to the bottom of the nozzle.

2. Not to perform non-destructive examination of the entire wetted surface of each RPV head penetration nozzle base material.

2.2 Licensee's Proposed Alternative

The licensee's proposed alternative examinations are as follows:

Request 1

In lieu of requiring ultrasonic testing of each RPV head penetration nozzle to the bottom of the nozzle, the licensee proposes to perform ultrasonic testing pursuant to Section IV.C.(1)(b)(i) of NRC Order EA-03-009, but only 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.

Request 2

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, the licensee proposes to perform eddy current or dye penetrant testing pursuant to Section IV.C.(1)(b)(ii) of NRC Order EA-03-009, but only 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.

2.3 Licensee's Basis for Relaxation

The licensee's submittal dated March 26, 2003, indicates that the proposed alternatives are submitted under Criterion (1) of Section IV, Paragraph F, of the Order: (1) the proposed alternative(s) for inspection of specific nozzles will provide an acceptable level of quality and safety.

Request 1

The licensee has requested relaxation from performing ultrasonic testing in accordance with Section IV.C.(1)(b)(i) of NRC Order EA-03-009 due to the configuration of the ultrasonic transducers in the probes used to examine the RPV head penetration nozzles, and a chamfer located in the bottom of the nozzles. The licensee stated that these probes (Model PCS24) have separate transducers, approximately 0.95 inches apart, for sending and receiving the ultrasonic signal. The licensee cites that the PCS24 probe was used for ultrasonic testing of Unit 2 on previous outages. The licensee stated that the lower transducer will not contact the inside wall of the nozzle unless the upper transducer is inserted greater than (approximately) 0.95 inches into the nozzle. Since the scanning process requires both transducers to be in contact with the surface, the licensee stated the probe cannot scan a small portion of the lower end of the nozzle. Based on the geometry involved in the transducer location and the nozzle configuration, the licensee estimates that the portion of the nozzle that cannot be scanned is the portion extending from the bottom of the nozzle upward for a distance slightly greater than 0.47 inches plus the height of the chamfer (0.23 inches), totaling 0.70 inches. The licensee further determined that the minimum distance downward from the J-groove weld to the location on the nozzle that cannot be scanned is 0.68 inches in all but one case, as described below. The licensee stated that this value is based on best estimates by personnel reviewing the ultrasonic inspection results. The licensee stated that utilizing an additional probe for the sole purpose of scanning the small portion of the nozzle below the J-groove weld (the portion that

cannot be scanned with the PCS24 probe) would result in a hardship due to increased testing time and expense and would not provide information that is "significant to the area of concern," which the licensee describes as those areas of the nozzle at and above the J-groove weld.

The licensee stated that the area not covered by the ultrasonic examination has been evaluated and determined to be a low stress zone and a non-pressure boundary portion of the nozzle. The licensee submitted graphs of hoop stress vs. distance below the J-groove weld for various nozzles from the center of the Unit 2 RPV head to the outermost row of nozzles. Based on the graphs provided, the licensee concluded that the stresses in the area of the nozzle that would not be ultrasonically inspected are low relative to the yield strength of the nozzle material.

The licensee also provided crack-growth calculations to quantify the time it would take a postulated crack in the uninspected portion of the nozzle to grow to the J-groove weld. The crack-growth model used in the analysis is based on that recommended in EPRI/MRP-55, "Materials Reliability Program Crack-growth Rates for Evaluating Primary Water Stress Corrosion Cracking (PWSCC) of Thick Wall Alloy 600 Material (MRP) Revision 1." The licensee performed the calculations on the three outer penetration rows of nozzles (45.8°, 47.0°, and 50.5°). The postulated flaw was a 100 percent through wall flaw 0.5 inches below the J-groove weld. The licensee stated that the results of the calculations for the outer three rows concluded it would take 2.3 effective full power years for the postulated flaw to propagate to the bottom of the weld. This time period is greater than one operating cycle for Unit 2. Following one operating cycle the penetration would then be reinspected as required by NRC Order EA-03-009. For all other nozzles, the region of the nozzle which cannot be inspected by the PCS24 probe is more than 1 inch below the J-groove weld, based on best estimates by licensee personnel reviewing the ultrasonic inspection results. The licensee noted that the 1 inch distance below the weld provides a conservative factor of 2 with respect to the distance assumed in the calculations. The licensee also provided a curve which showed the effect of additional distance below the weld on crack-growth time for a postulated crack to grow to the weld. The licensee stated that the curves show that an increase in distance of 0.18 inches (to a total of 0.68 inches below the weld) results in an increase of approximately four effective full power years in the time it would take a postulated flaw in the uninspected area to reach the J-groove weld, for the third outermost row of nozzles.

The licensee also stated that through visual observation during the inspection, all 78 penetrations in Unit 2 are threaded for approximately 0.75 inches from the bottom of the nozzle on the outer diameter surface. The licensee stated that all nozzles, with the exception of one, (penetration number 73) have a minimum distance from the J-groove weld to the threaded area of 0.68 inches. The licensee stated that this minimum distance was determined from best estimates by personnel reviewing the ultrasonic inspection results. This minimum distance occurs on the downhill side of one penetration in the third row from the outermost row (i.e., 45.8°). For clarity, the downhill side of the penetration is the side farthest from the centerline of the RPV head. Therefore, the licensee concludes that all nozzles, with the exception of one, have been inspected such that no flaws in the uninspected portion of the nozzle can propagate to a level adjacent to the J-groove weld within two or more operating cycles of the plant.

The licensee stated that one nozzle (penetration number 73), had a minimum distance from the J-groove weld to the threaded area of approximately 0.36 inches. The licensee stated that since this distance is less than the 0.5 inch value assumed for the postulated flaw in the crack-growth calculations described previously, an eddy current examination was performed on the

inside diameter surface down to the top of the chamfer, and penetrant testing was performed on the threaded surface of the outside diameter down to the bottom of the threads. The licensee stated that these surface examinations extended the inspected area beyond 0.5 inches below the J-groove weld to a location such that the uninspected area is at least 0.88 inches below the weld. Penetration 73 is in the next to the outermost row, and the crack growth curves for the outermost row submitted by the licensee show 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.

Based upon the above information and the results of the flaw propagation calculations, the licensee concludes that if a flaw were to exist in an uninspected portion of the nozzle, there would be adequate opportunity for detection at subsequent inspections prior to the flaw reaching the reactor coolant system pressure boundary. Further, the licensee concluded that the proposed alternative provides an acceptable level of quality and safety.

Request 2

The licensee also requested relaxation from performing eddy current and/or dye penetrant testing in accordance with Section IV.C.(1)(b)(ii) of NRC Order EA-03-009 due to the configuration of the RPV head penetration nozzles. The licensee stated that all of the RPV head penetration nozzles are threaded for approximately 0.75 inches from the bottom end of the nozzle on the outside diameter surface. The outside surfaces of five nozzles have a guide funnel installed on the threads. The licensee stated that the funnels are either drilled and pinned, or stitch welded to securely fix them in position. The licensee added that these surfaces must be considered wetted since there is no seal to prevent reactor coolant from reaching the mating threaded surfaces on the nozzle and funnel. The licensee concluded that the guide funnels extend approximately 0.75 inches above the threads, and therefore, 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 is less than the distance assumed in the crack-growth calculation previously described. The licensee stated that although the portion of the funnel extending 0.75 inches above the threads precludes eddy current testing and dye penetrant testing of the outer diameter surface, it does not preclude ultrasonic testing, and therefore the area of the nozzles having guide funnels will be ultrasonically inspected from the inside diameter surface of the nozzles. The licensee also assessed the implications of removing the funnels and performing the surface examinations on the threaded surfaces of the nozzles. The licensee concluded that the funnels would be destroyed once they were removed and a new funnel would have to be installed. These operations as stated by the licensee would involve hardship due to added outage time, monetary expenditure, and personnel radiation exposure.

The licensee stated that eddy current testing was performed on nine nozzles (penetration numbers 1 to 9) located on the inner-most rows of the RPV head. These nozzles had centering tabs with thermal sleeves installed which prevented UT inspections because of the configuration of the UT transducers. Eddy current testing was performed from 2 inches above the J-groove weld down to the top of the chamfer. The licensee stated that the distance from the J-groove weld to the top of the chamfer was greater than the 0.5 inch value assumed for the postulated flaw in the crack-growth calculations described previously. The licensee concluded

that the area not covered by the ET examination (i.e., threaded area) is a low stress zone and a non-pressure boundary portion of the nozzle. This was supported by the graphs of hoop stress vs. distance below the J-groove welds.

From visual observation of Unit 2, the licensee indicated that all nozzles without funnels do have external threads. The licensee stated that the minimum distance from the J-groove weld to the examined area on the threaded nozzles without funnels is a minimum of 0.68 inches. The licensee stated that the minimum distance was based on best estimates by personnel reviewing the ultrasonic inspection results and this minimum distance occurs on the downhill side of one penetration in the third row from the outermost row. Although the threads are exposed, the licensee stated that the vendor performing the nozzle inspections does not have an eddy current probe capable of examining threaded surfaces. The licensee estimated that penetrant testing these surfaces would involve approximately 400 person-millirem per nozzle. The licensee considered the estimate low because the actual dose received during penetrant testing of penetration 73 was over 740 person-millirem. Therefore, based on the information above, the licensee believes that attempting to perform eddy current or penetrant testing of the threaded surfaces would result in undue hardship.

2.4 EVALUATION

The NRC staff's review of this request was based on criterion (2) of paragraph F of Section IV of the Order which states:

> *Compliance with this Order for specific nozzles would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.*

Request 1

The proposed alternative UT examination would be performed on the 69 penetrations not examined using eddy current as described in Request 2, and would inspect from 2 inches above the J-groove weld to the lowest elevation that can be practically inspected with the PCS24 probe. The distance from the bottom of the nozzle upward that cannot be scanned was calculated by the licensee to be 0.47 inches plus the height of the chamfer (0.23 inches) or 0.70 inches. The licensee determined that with one exception, the minimum distance from the J-groove weld to the threaded area was 0.68 inches based on best estimates by personnel reviewing the ultrasonic inspection results. This minimum distance occurs on the downhill side of one penetration in the third row from the outermost row (i.e., 45.8°). The staff reviewed the hoop stress in this area and found it to be reasonably low: approximately 17 ksi.

The licensee's request is appropriately supported by crack-growth calculations to quantify the time it would take a postulated crack in the uninspected portion of the nozzle to grow to the J-groove weld. The crack-growth model used is based on that recommended in EPRI/MRP-55, "Materials Reliability Program Crack-growth Rates for Evaluating Primary Water Stress Corrosion Cracking (PWSCC) of Thick Wall Alloy 600 Material (MRP) Revision 1." The licensee performed the calculations for the three outer penetration rows (45.8°, 47.0°, and 50.5°). The postulated flaw was a 100 percent through wall flaw 0.5 inches below the J-groove weld. The results of the calculations for the outer three rows indicated that it would take 2.3 effective full power years for the postulated flaw to propagate to the bottom of the weld. For the minimum actual inspection coverage of 0.68 inches below the weld, the licensee's calculations

indicate that the operating time is more than 6 years. 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 all other rows, the uninspected portion is a minimum of 1 inch from the J-groove weld, based on best estimates by licensee personnel reviewing the ultrasonic inspection results. Therefore, the licensee's calculations for postulated cracks in the uninspected portions of the nozzles indicate considerable operating time before such a postulated crack could progress to an elevation adjacent to the J-groove weld.

The aforementioned crack-growth analysis used the approach described in Footnote 1 of the Order as the criteria to set the necessary height of the surface examination. Therefore, the coverage addressed by this request provides reasonable assurance of structural integrity of the component. However, this analysis incorporates a crack-growth formula, different from that described in Footnote 1 of the Order, as provided in the Electric Power Research Institute Report "Material Reliability Program (MRP) Crack-growth Rates for Evaluating Primary Water Stress Corrosion Cracking (PWSCC) of Thick Wall Alloy 600 Material (MRP-55), Revision 1." The NRC staff has completed a preliminary review of the crack-growth formula, but has not yet made a final assessment regarding the acceptability of the report. If the NRC staff finds that the crack-growth formula in industry report MRP-55 is unacceptable, the licensee shall revise its analysis which justifies relaxation of the Order within 30 days after the NRC informs the licensee of an NRC-approved crack-growth formula. If the licensee's revised analysis shows that the crack-growth acceptance criteria are exceeded prior to the end of the current operating cycle, this relaxation is rescinded and the licensee shall, within 72 hours, submit to the NRC written justification for continued operation. If the revised analysis shows that the crack-growth acceptance criteria are exceeded during the subsequent operating cycle, the licensee shall, within 30 days, submit the revised analysis for NRC review. If the revised analysis shows that the crack-growth acceptance criteria are not exceeded during either the current operating cycle or the subsequent operating cycle, the licensee shall, within 30 days, submit a letter to the NRC confirming that its analysis has been revised. Any future crack-growth analyses performed for this and future cycles for RPV head penetrations, must be based on an acceptable crack-growth rate formula. By letter dated June 12, 2003, the licensee supplemented its request to include this condition.

Utilizing an additional probe for the sole purpose of scanning the small portion of the nozzle that cannot be scanned with the PCS24 probe would result in a hardship due to increased testing that would be required. The additional testing time will result in additional exposure time for the technicians performing the testing and higher radiation exposure. The additional testing will not provide significant additional information about areas of the nozzle at and above the J-groove weld. Thus, the staff finds that there is hardship involved with regard to performing the complete inspection in accordance with Order EA-03-009. Based on the crack growth analyses on the areas to be examined, the licensee's proposed alternative examination is sufficient to and the areas to be examined, provide reasonable assurance of structural integrity of the component.

Based upon the above information and the staff's evaluation of the licensee's information, this relaxation request is considered to be acceptable because the licensee has demonstrated that compliance with the Order would result in hardship without a compensating increase in the level of quality and safety.

Request 2

In the proposed alternative, eddy current examination and dye penetrant examination would be performed on all wetted, non-threaded surfaces of the J-groove weld and RPV head penetration nozzle base material. The requirement identified in the Order EA-03-009 that the eddy current or dye penetrant examination extend 2 inches above the J-groove weld would not be affected. The proposed alternative would also not apply to the RPV level indication nozzle.

The licensee stated that eddy current testing was performed on 9 nozzles (penetration numbers 1 to 9) located on the inner-most rows of the RPV head. These nozzles had centering tabs with thermal sleeves installed which prevented UT inspections because of the configuration of the UT transducers. Eddy current testing was performed from 2 inches above the J-groove weld down to the top of the chamfer. The licensee concluded that the distance from the J-groove weld to the top of the chamfer was greater than the 0.5 inch value assumed for the postulated flaw in the crack growth calculations. Therefore, the licensee concluded that the area not covered by the ET examination (i.e., threaded area) is a low stress zone and a non-pressure boundary portion of the nozzle. The staff reviewed the hoop stress vs. distance graphs and the licensee's conclusions and finds them acceptable.

The licensee stated that the bottom of all penetration nozzles were threaded on the outer diameter to accommodate the attachment of a guide funnel although not all had been attached with guide funnels. The licensee considered the threaded portions of the penetration to be part of the wetted surface as described in the Order, thus requiring examination. The licensee stated that, with the exception of penetration number 73 (which was discussed previously) the minimum distance from the J-groove weld to the threads of the unfunneled nozzles was 0.68 inches. To support its proposed alternative examination, the licensee has demonstrated that hardship would result from implementing the surface examination on all portions of the VHP nozzles. Inspection of the threaded area of the nozzle using eddy current would create a hardship because the vendor performing the nozzle inspections does not have an eddy current probe capable of examining threaded surfaces. The licensee estimated that penetrant testing of the threaded areas of the nozzles would involve approximately 400 person-millirem per nozzle, based on a surface examination of penetration 73 during which the radiation exposure was more than 740 person-millirem.

As discussed for Request 1, the stresses in the unexamined portion of the nozzles are low, and the amount of time required to grow a crack from the unexamined section to the bottom of the J-groove is substantially more than one operating cycle. The NRC staff has reviewed the licensee's information and concludes that the proposed alternative examination provides reasonable assurance of structural integrity of the penetration and the weld.

Based upon the above information and the staff's evaluation of the licensee's information, this relaxation request is considered to be acceptable because the licensee has demonstrated that compliance with Order would result in hardship without a compensating increase in the level of quality and safety.

3.0 CONCLUSION

The staff concludes that the licensee's proposed alternative to perform UT of each RPV head penetration nozzle (i.e., nozzle base material) from 2 inches above the J-groove weld to the lowest elevation that can be practically inspected with a PCS24 probe, and the proposed alternative to perform eddy current or dye penetrant inspections of each RPV head penetration nozzle (i.e., nozzle base material) from 2 inches above the J-groove weld to all non-threaded wetted surfaces of the nozzle below the J-groove weld, provide reasonable assurance of the structural integrity of the RPV head, VHP nozzles, and associated J-groove welds.

The staff also concludes that performing inspections in accordance with Section IV.C.(1)(b) of Order EA-03-009 would result in hardship without a compensating increase in the level of quality or safety. Therefore, pursuant to Section IV, Paragraph F, of Order EA-03-009, the licensee has shown good cause, and the staff authorizes the proposed relaxation and alternative inspections for RPV head penetration nozzles at D. C. Cook Unit 2 for one standard operating cycle commencing with the start-up from the spring 2003 (U2C14) refueling outage, subject to the following condition:

> If the NRC staff finds that the crack-growth formula in industry report MRP-55 is unacceptable, the licensee shall revise its analysis that justifies relaxation of the Order within 30 days after the NRC informs the licensee of an NRC-approved crack-growth formula. If the licensee's revised analysis shows that the crack-growth acceptance criteria are exceeded prior to the end of the current operating cycle, this relaxation is rescinded and the licensee shall, within 72 hours, submit to the NRC written justification for continued operation. If the revised analysis shows that the crack-growth acceptance criteria are exceeded during the subsequent operating cycle, the licensee shall, within 30 days, submit the revised analysis for NRC review. If the revised analysis shows that the crack-growth acceptance criteria are not exceeded during either the current operating cycle or the subsequent operating cycle, the licensee shall, within 30 days, submit a letter to the NRC confirming that its analysis has been revised.

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