April 14, 2005

Mr. Mano K. Nazar
American Electric Power
Senior Vice President and Chief Nuclear Officer
Indiana Michigan Power Company
Nuclear Generation Group
One Cook Place
Buchanan, MI 49106

SUBJECT: DONALD C. COOK NUCLEAR PLANT, UNIT 1 - RELAXATION OF THE REQUIREMENTS OF FIRST REVISED ORDER (EA-03-009) REGARDING REACTOR PRESSURE VESSEL HEAD INSPECTIONS DATED FEBRUARY 20, 2004 (TAC NO. MC5675)

Dear Mr. Nazar:

The U. S. Nuclear Regulatory Commission (NRC) issued the First Revised Order Modifying Licenses (Order) EA-03-009 on February 20, 2004. The Revised Order EA-03-009 superseded the original Order Modifying Licenses (Effective Immediately) EA-03-009, dated February 11, 2003. The Order imposes requirements for pressurized-water reactor licensees to inspect reactor pressure vessel (RPV) heads and associated penetration nozzles as stated in Section IV.C.(5), (a) and (b). Section IV.C.(5)(b)(i), (ii) and (iii) mandate requirements for nondestructive examination of each penetration. Section IV.F of the Order states that requests for relaxation associated with specific penetration nozzles will be evaluated by the NRC staff using its procedure for evaluating proposed alternatives to the American Society of Mechanical Engineers Code in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3).

By letter dated January 20, 2005, the Indiana Michigan Power Company (the licensee), submitted a request for relaxation from certain nondestructive examination requirements of the Order for the Donald C. Cook Nuclear Plant, Unit 1 (Cook 1), reactor vessel head penetration nozzles. Specifically, you requested relaxation to implement an alternative to the requirements of Section IV, paragraphs C.(5)(b)(i) and C.(5)(b)(ii) of the Order for the examination distance below the toe of the J-groove weld on the RPV head penetration nozzles at Cook 1.

The NRC staff has completed its review and concludes, as documented in the enclosed safety evaluation, that you have demonstrated that compliance with the Order for the RPV nozzles specified would have resulted in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The NRC staff has found your request for relaxation of the Order acceptable, with a condition. Therefore, pursuant to Section IV, Paragraph F, of the Order, the NRC staff finds there is good cause shown to relax the Order and authorizes, until the fall of 2006 refueling outage at Cook 1, the proposed relaxation of the examination area for the specified nozzles, 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 the current or 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.

As stated above, this relaxation is authorized until the fall of 2006 refueling outage at Cook 1, when the vessel head is scheduled for replacement. The NRC staff based its evaluation on the licensee's deterministic evaluations based on the methodology in WCAP-14118, Revision 7, "Structural Integrity Evaluation of Reactor Vessel Head Penetrations to Support Continued Operation: D. C. Cook Units 1 and 2."

If you have any questions concerning this matter, please contact Mr. Fred Lyon at (301) 415-2296.

Sincerely,

***/RA/***

Aby S. Mohseni, Acting Director
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-315

Enclosure: Safety Evaluation

cc w/encl: See next page

April 14, 2005

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As stated above, this relaxation is authorized until the fall of 2006 refueling outage at Cook 1, when the vessel head is scheduled for replacement. The NRC staff based its evaluation on the licensee's deterministic evaluations based on the methodology in WCAP-14118, Revision 7, "Structural Integrity Evaluation of Reactor Vessel Head Penetrations to Support Continued Operation: D. C. Cook Units 1 and 2."

If you have any questions concerning this matter, please contact Mr. Fred Lyon at (301) 415-2296.

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cc w/encl: See next page
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FIRST REVISED ORDER MODIFYING LICENSES (EA-03-009) RELAXATION REQUEST

ALTERNATE EXAMINATION COVERAGE

FOR REACTOR PRESSURE VESSEL HEAD PENETRATION NOZZLES

INDIANA MICHIGAN POWER COMPANY

DONALD C. COOK NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-315

## 1.0 INTRODUCTION

By letter dated January 20, 2005, the Indiana Michigan Power Company (the licensee) submitted a request for relaxation from certain nondestructive examination requirements of the First Revised Nuclear Regulatory Commission (NRC) Order, EA-03-009, for the Donald C. Cook Nuclear Power Plant, Unit 1 (Cook 1), reactor pressure vessel (RPV) head penetration nozzles.

The First Revised NRC Order Modifying Licenses, EA-03-009 (hereinafter referred to as Order), issued on February 20, 2004, requires specific examinations of the 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 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 First Revised NRC Order for specific nozzles would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

For Cook 1, and similar plants determined to have a moderate susceptibility to primary water stress corrosion cracking (PWSCC) in accordance with Section IV, paragraphs A and B of the Order, the following inspections shall be performed such that at least the requirements of Section IV, paragraph C.(5)(a) or paragraph IV.C.(5)(b) are performed each refueling outage:

(a) Bare metal visual examination of 100 percent of the RPV head surface (including 360E around each RPV head penetration nozzle). For RPV heads with the surface obscured by support structure interferences which are located at RPV head elevations downslope from the outermost RPV head penetration, a bare metal visual inspection of no less than 95 percent of the RPV head surface may be performed provided that the examination

shall include those areas of the RPV head upslope and downslope from the support structure interference to identify any evidence of boron or corrosive product. Should any evidence of boron or corrosive product be identified, the licensee shall examine the RPV head surface under the support structure to ensure that the RPV head is not degraded.

(b) For each penetration, perform a nonvisual nondestructive examination in accordance with either (i), (ii), or (iii):

(i) Ultrasonic testing (UT) of the RPV head penetration nozzle volume (i.e., nozzle base material) from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 2 inches below the lowest point at the toe of the J-groove weld on a horizontal plane perpendicular to the nozzle axis (or the bottom of the nozzle if less than 2 inches [see Figure IV-1 of the Order]); OR from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 1.0-inch below the lowest point at the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater (see Figure IV-2 of the Order). In addition, an assessment shall be made to determine if leakage has occurred into the annulus between the RPV head penetration nozzle and the RPV head low-alloy steel.

(ii) Eddy current testing or dye penetrant testing of the entire wetted surface of the J-groove weld and the wetted surface of the RPV head penetration nozzle base material from at least 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 2 inches below the lowest point at the toe of the J-groove weld on a horizontal plane perpendicular to the nozzle axis (or the bottom of the nozzle if less than 2 inches [see Figure IV-3 of the Order]); OR from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 1.0-inch below the lowest point at the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater (see Figure IV-4 of the Order).

(iii) A combination of (i) and (ii) to cover equivalent volumes, surfaces, and leak paths of the RPV head penetration nozzle base material and J-groove weld as described in (i) and (ii). Substitution of a portion of a volumetric exam on a nozzle with a surface examination may be performed with the following requirements:

1. On nozzle material below the J-groove weld, both the outside diameter (OD) and inside diameter (ID) surfaces of the nozzle must be examined.

2. On nozzle material above the J-groove weld, surface examination of the ID surface of the nozzle is permitted provided a surface examination of the J-groove weld is also performed.

In addition, for those plants in the Moderate category, the requirements of Section IV, paragraphs C.(5)(a) and C.(5)(b) shall each be performed at least once over the course of every two refueling outages.

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

## 2.0 ORDER RELAXATION REQUEST FOR EXAMINATION COVERAGE FOR REACTOR PRESSURE VESSEL HEAD PENETRATION NOZZLES

### 2.1 Order Requirements for Which Relaxation is Requested

The licensee requested relaxation to implement an alternative to the requirements of Section IV, paragraphs C.(5)(b)(i) and C.(5)(b)(ii) of the Order for RPV head penetration nozzles at Cook 1. Specifically, the licensee requested relaxation on the examination distance below the toe of the J-groove weld.

### 2.2 Licensee's Proposed Alternative

The licensee proposes that the extent of the RPV penetration nozzle inspections below the J-groove weld specified in Section IV, paragraph C.(5)(b)(i) of the revised order be as follows:

> All CRDM nozzles shall be inspected to the maximum extent possible by remote ultrasonic and/or eddy current testing below the J-groove weld, i.e., down to the top of the thread relief. For the 15 nozzles for which dimensional data is not available (no previous inspections), the inspection shall extend to at least 0.5 inches below the lowest point on the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis).

### 2.3 Licensee's Basis for Relaxation

The licensee states that it is proposing an alternative to the above requirements for the upcoming Unit 1 Cycle 20 refueling outage because, for certain CRDM nozzles, compliance with the revised order would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The licensee's specific calculations indicate that a postulated 100 percent through-wall axial flaw, with its upper tip at the bottom of the inspection area specified in the proposed alternative, would not propagate to the toe of the J-groove weld prior to replacement of the Unit 1 RPV head (fall 2006 refueling outage). These calculations are illustrated by the crack growth curves in Figures 6-12 through 6-20 of WCAP-14118-P, Revision 7, which was transmitted to the NRC by letter from J. Jensen (licensee) dated June 24, 2004.

As shown in Table 1 below, the minimum remotely inspectible distance for the 64 nozzles for which dimensional data is available is 0.369 inches. This occurs on the downhill side of Penetration 63, which is located in the row with a head angle of 38.6 degrees. Figure 6-16 of WCAP-14118-P, Revision 7, shows that a flaw located with its upper tip at 0.369 inches below the toe of the J-groove weld on the downhill side of Penetration 63 would take approximately 2.1 effective full power years (EFPY) to reach the weld. The licensee expects the existing RPV

head to be in service for no more than 1.38 EFPY following the Cycle 20 refueling outage inspection. Therefore, the proposed alternative would provide over 0.7 EFPY of margin against flaw propagation to the toe of the J-groove weld for Penetration 63. The margin for the remaining 63 nozzles with dimensional data would be significantly greater.

Figure 6-14 of WCAP-14118-P, Revision 7, is the crack growth curve for the downhill side of the row of nozzles having a head angle of 26.2 degrees. Calculations show this row as the most limiting row of nozzles with respect to crack growth. The crack growth curve of Figure 6-14 shows that a flaw located with its upper tip at 0.5 inches below the toe of the J-groove weld would take approximately 4.1 EFPY to reach the weld. Therefore, an inspection that extends 0.5 inches below the toe of the J-groove weld would provide approximately 2.7 EFPY of margin against flaw propagation to the weld for any row in which there are nozzles without available dimensional data.

The outside surface of the bottom of all the control rod drive mechanism nozzles are threaded with a relief at the top of the threads. The threads and relief extend for approximately 0.75 inches above the bottom of the nozzle. To reduce personnel radiation exposure, the nozzles are typically inspected using remotely operated ultrasonic and eddy current testing equipment. Ultrasonic testing of the threaded portions of the nozzle is not practical, since it could produce multiple tip diffraction signals, resulting in scans that are difficult or impossible to read. At this time, an ultrasonic probe capable of obtaining readable scans of threaded portions of the nozzle is not available. The eddy current probe used for nozzle inspections is not capable of examining the threaded surfaces. Development, qualification, and implementation of an eddy current probe capable of examining the threaded surfaces would result in a significant testing period and significant expense.

Although dye penetrant testing of threaded surfaces is possible, it would require that personnel be located under the RPV head to manually perform the surface cleaning and penetrant testing operations. The licensee estimates that dye penetrant testing threaded surfaces would result in personnel radiation exposure of approximately 300 to 700 person-millirem per nozzle. Therefore, the portion of the nozzle below the J-groove weld that can be inspected without significant radiation exposure to personnel is that portion from the bottom of the J-groove weld (including the toe of the weld) to the top of the threads and relief.

Due to the geometry involved in the vertical nozzles penetrating the hemispherical RPV head, the minimum remotely inspectible distance occurs on the “downhill” side of each nozzle. TABLE 1 provides dimensional data for the downhill side of the nozzles. The data is based on the results of previous inspections, performed prior to issuance of the original NRC Order. The data is a best estimate by personnel reviewing ultrasonic scan recordings. Below is a summary of the table.

- Dimensional data is available for 64 of the 79 CRDM penetrations.

- For 44 of the 64 nozzles that have dimensional data available, the remotely inspectible distance on the downhill side of the nozzle is less than the criterion of 1.0 inch plus the distance that the nozzle has an operating stress level of 20 ksi tension and greater, as specified in the second options of Section IV, paragraphs C.(5)(b)(i) and C.(5)(b)(ii) of the revised order.

- The minimum remotely inspectible distance for the 44 nozzles that have dimensional data available with distances less than the criteria specified in the order is 0.369 inches. This occurs on Penetration No. 63. The remotely inspectible distance for the remainder of the 44 nozzles with inspection data is greater than 0.6 inches below the toe of the J-groove weld.

- There is no reliable dimensional data available for 15 of the 79 nozzles. These nozzles were previously inspected using eddy current testing, which does not provide reliable data regarding the location of the toe of the J-groove weld.

The licensee plans to replace the Unit 1 RPV head during the fall 2006 refueling outage, which is the next outage following the upcoming Cycle 20 refueling outage. As described above, the licensee states that expenditure of outage time, resources, and personnel radiation exposure to inspect the threaded areas of the nozzle in order to comply with the criterion specified in the second options of Section IV, paragraphs C.(5)(b)(i) and C.(5)(b)(ii) of the revised order would not provide a compensating increase in the level of quality and safety for the one fuel cycle of remaining RPV head service life.

TABLE 1

| Penetration Number | Angle degrees | Inspectible distance below J-groove weld downhill side inches |
|---|---|---|
| 1 | 0 | No data |
| 2 | 8.0 | 1.390 |
| 3 | 8.0 | 1.440 |
| 4 | 8.0 | 1.470 |
| 5 | 8.0 | 1.320 |
| 6 | 11.4 | No data |
| 7 | 11.4 | No data |
| 8 | 11.4 | No data |
| 9 | 11.4 | No data |
| 10 | 16.2 | No data |
| 11 | 16.2 | No data |
| 12 | 16.2 | No data |
| 13 | 16.2 | No data |
| 14 | 18.2 | No data |

| Penetration Number | Angle degrees | Inspectible distance below J-groove weld downhill side inches |
|---|---|---|
| 15 | 18.2 | 1.080 |
| 16 | 18.2 | No data |
| 17 | 18.2 | 1.160 |
| 18 | 18.2 | No data |
| 19 | 18.2 | 1.470 |
| 20 | 18.2 | No data |
| 21 | 18.2 | 1.080 |
| 22 | 23.3 | 1.160 |
| 23 | 23.3 | 1.160 |
| 24 | 23.3 | 0.689 |
| 25 | 23.3 | 1.119 |
| 26 | 24.8 | 0.919 |
| 27 | 24.8 | 1.039 |
| 28 | 24.8 | 1.239 |
| 29 | 24.8 | 0.649 |
| 30 | 26.2 | 0.809 |
| 31 | 26.2 | 1.160 |
| 32 | 26.2 | 0.959 |
| 33 | 26.2 | 0.689 |
| 34 | 26.2 | 1.319 |
| 35 | 26.2 | 1.159 |
| 36 | 26.2 | 1.079 |
| 37 | 26.2 | 0.919 |
| 38 | 30.2 | 0.839 |
| 39 | 30.2 | 0.839 |
| 40 | 30.2 | 0.879 |

| Penetration Number | Angle degrees | Inspectible distance below J-groove weld downhill side inches |
|---|---|---|
| 41 | 30.2 | 0.879 |
| 42 | 30.2 | 0.999 |
| 43 | 30.2 | 0.959 |
| 44 | 30.2 | 0.809 |
| 45 | 30.2 | 0.809 |
| 46 | 33.9 | 0.769 |
| 47 | 33.9 | 0.769 |
| 48 | 33.9 | 0.879 |
| 49 | 33.9 | 0.809 |
| 50 | 35.5 | 0.609 |
| 51 | 35.5 | 0.689 |
| 52 | 35.5 | No data |
| 53 | 35.1 | 0.649 |
| 54 | 35.1 | 0.879 |
| 55 | 35.1 | 0.919 |
| 56 | 35.1 | 0.799 |
| 57 | 35.1 | 0.879 |
| 58 | 36.3 | 0.689 |
| 59 | 36.3 | 0.729 |
| 60 | 36.3 | 1.039 |
| 61 | 36.3 | 0.959 |
| 62 | 38.6 | 0.809 |
| 63 | 38.6 | 0.369 |
| 64 | 38.6 | 0.809 |
| 65 | 38.6 | 0.749 |
| 66 | 38.6 | 0.569 |

| Penetration Number | Angle degrees | Inspectible distance below J-groove weld downhill side inches |
|---|---|---|
| 67 | 38.6 | 1.119 |
| 68 | 38.6 | 0.689 |
| 69 | 38.6 | 0.879 |
| 70 | 44.3 | No data |
| 71 | 44.3 | 0.609 |
| 72 | 44.3 | 0.999 |
| 73 | 44.3 | 0.769 |
| 74 | 48.7 | 0.819 |
| 75 | 48.7 | 0.819 |
| 76 | 48.7 | 0.699 |
| 77 | 48.7 | 0.819 |
| 78 | 48.7 | 1.019 |
| 79 | 48.7 | 1.059 |

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.

In its January 20, 2005, letter, the licensee seeks relaxation from the Order, where inspection coverage is limited at the bottom of the RPV head penetration nozzles due to the outside surface of the bottom of all the control rod drive mechanism (CRDM) nozzles being threaded with a relief at the top of the threads. The relief and threads cause difficulties for nondestructive examination, including ultrasonic testing, eddy current testing, and dye penetrant testing. Estimates from the previous inspection of the nozzles at Cook 1 indicate that, for 44 nozzles, the distance below the toe of the J-groove weld on the downhill side of the nozzle that is inspectible by ultrasonic or eddy current testing is less than the 1.0 inch criterion specified in the second options of Section IV, paragraphs C.(5)(b)(i) and C.(5)(b)(ii) of the Order. In addition, there is no dimensional data available for 15 nozzles.

Within the context of the licensee's proposed alternative examination of the RPV head penetration nozzles, the licensee has demonstrated the hardship that would result to inspect relief and threaded areas in order to comply with the 1.0 inch criterion for these penetrations.

The licensee's proposal provides for obtaining examination distances equivalent to the previous examinations as listed in TABLE 1 and an examination distance of at least 0.5 inches below the toe of the J-groove weld for the 15 nozzles that do not have any dimensional examination data. The performance of a surface examination, such as a penetrant examination on all nozzles for which an examination distance of 1.0 inch below the J-groove weld using automated ultrasonic testing or eddy current testing is not achievable, would result in unnecessary radiation exposure to employees since it would not provide significant additional information about weld/material integrity.

The phenomenon of concern is PWSCC, which typically initiates in the areas of highest stress. The area of CRDM penetrations that has the highest residual stress is the area adjacent to the J-groove attachment weld. Therefore, it is most likely that PWSCC will initiate in an area adjacent to the J-groove attachment weld. Nozzle No. 63 was only able to achieve an inspection distance 0.369 inches below the toe of the J-groove weld. The licensee's crack growth analysis shows that it would take 2.1 EFPY to propagate to the toe of the J-groove weld.

The 0.5 inch minimum inspection distance below the J-groove weld for the nozzles that do not have any dimensional data is supported by the licensee's crack growth analysis. The results of the licensee's analysis show that a postulated flaw located at or below 0.5 inch below the J-groove weld would not propagate to the toe of the J-groove weld within the next operating period. The licensee's flaw evaluation was performed by postulating an axial through-wall flaw in the assumed area of missed coverage below the weld. The methodology is described in WCAP-14118, Rev. 7, "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: D. C. Cook Units 1 and 2." The licensee's deterministic flaw tolerance evaluation showed that an assumed through-wall flaw at 0.5 inches below the J-groove weld for nozzles at 0, 26.2, 38.6, 44.3, 48.7 degrees would take at least 4.1 EFPY to reach the J-groove weld. The licensee estimated the operating cycle for Cook 1 to be 1.38 EFPY for fuel cycle 20. Therefore, an examination of 0.5 inches below the toe of the J-groove weld would provide about 2.7 EFPY of margin against flaw propagation to the toe of the J-groove weld. Thus, the analysis indicates that there is no compensating increase in the level of quality and safety since the alternative examination provides reasonable assurance of structural integrity.

The licensee's analysis used the crack growth formula in Electric Power Research Institute Report Material Reliability Program (MRP) report MRP-55, "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 performed a preliminary assessment of the crack growth rate, but has not yet made a final determination on the acceptability of the subject industry report. Should the NRC staff determine the crack growth formula used by the licensee to be unacceptable, the licensee has committed to revise its analysis to incorporate an acceptable crack growth formula, as stated in its letter dated January 20, 2005 as follows:

> 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 the current or 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.

Based upon the information above, the NRC staff finds that the licensee's proposed examinations to the extent described above is acceptable as it provides reasonable assurance of the structural integrity of the RPV head, VHP nozzles and welds. Further inspections of the bottom of the nozzles to comply with the Order requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The NRC staff's evaluation is based on the licensee's deterministic evaluations using the methodology in WCAP-14118, Revision 7, "Structural Integrity Evaluation of Reactor Vessel Head Penetrations to Support Continued Operation: D. C. Cook Units 1 and 2."

## 3.0 CONCLUSION

The NRC staff concludes that the licensee's proposed relaxation for the examination of the VHP nozzles at Cook 1, provides reasonable assurance of the structural integrity of the RPV head, VHP nozzles and welds at Cook 1. Further inspections of these VHP nozzles in accordance with Section IV, Paragraph C.(5)(b), of the First Revised NRC Order EA-03-009 dated February 20, 2004, would result in hardship without a compensating increase in the level of quality and safety. Therefore, for good cause shown, and pursuant to Section IV, Paragraph F, of the Order, the NRC staff authorizes, until the fall of 2006 refueling outage, the proposed relaxation for the VHP nozzle examination at Cook 1, 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 the current or 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.

As indicated, this relaxation is authorized until the fall of 2006 refueling outage at Cook 1, when the vessel head is scheduled for replacement.

Principal Contributor: A. Keim

Date: April 14, 2005

cc:

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