December 23, 2004

Mr. Mano K. Nazar
American Electric Power
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, UNITS 1 AND 2 - ALTERNATIVE TO REPAIR REQUIREMENTS OF SECTION XI OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS CODE FOR REACTOR VESSEL HEAD PENETRATIONS (TAC NOS. MC4900 AND MC4901)

Dear Mr. Nazar:

By letter dated October 22, 2004, as revised by letter dated October 27, 2004, Indiana Michigan Power Company (IM, or the licensee) requested relief from specific requirements in the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) for the Donald C. Cook Nuclear Plant (CNP), Units 1 and 2. The licensee proposed an alternative to the ASME Code Section XI requirements that preclude welding over or embedding an existing flaw. The request is based on the use of the Westinghouse repair methodology as documented in Westinghouse Topical Report WCAP-15987-P, Revision 2, "Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations," which was reviewed and approved by the U. S. Nuclear Regulatory Commission (NRC) staff on July 3, 2003 (ML031840237). The NRC staff verbally approved your request in a telephone conversation held on October 28, 2004, between J. Zwolinski, et al. (IM), and T. Chan and L. Raghavan, et al. (NRC).

Based on the attached safety evaluation, the NRC staff concludes that the proposed alternative provides an acceptable level of quality and safety. Therefore, pursuant to Title 10 of the *Code of Federal Regulations* Section 50.55a(a)(3)(i*)*, the NRC staff authorizes the proposed alternative in Relief Request 2004-ISIR-14 to the repair requirements of ASME Code Section XI IWA-4120(a), and ASME Code Section III NB-4131, NB-2538, and NB-2539.1 at CNP, Units 1 and 2, for the third 10-year inservice inspection interval.

The detailed results of the staff's review are provided in the enclosed safety evaluation. If you have any questions concerning this matter, please call Mr. F. Lyon of my staff at (301) 415-2296.

Sincerely,

/RA/

Margaret A. Kotzalas, Acting Chief, Section 1
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-315 and 50-316

Enclosure: Safety Evaluation

cc w/encl: See next page

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Docket Nos. 50-315 and 50-316

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cc w/encl: See next page

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**Previously concurred
*SE dated 12/2/04

ADAMS ACCESSION NUMBER: **ML043500152**

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

INSERVICE INSPECTION PROGRAM RELIEF REQUEST 2004-ISIR-14

INDIANA MICHIGAN POWER COMPANY

DONALD C. COOK NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-315 AND 50-316

1.0 INTRODUCTION

By letter dated October 22, 2004, as revised by letter dated October 27, 2004, Indiana Michigan Power Company (IM, or the licensee), submitted relief request 2004-ISIR-14 for the Donald C. Cook Nuclear Plant (CNP), Units 1 and 2 to use an embedded flaw repair technique if cracks were found on the inside and/or outside diameter of the CNP, Units 1 and 2 vessel head penetration (VHP) nozzles or on the J-groove attachment welds. These techniques would be used in lieu of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Section III requirements that preclude welding over or embedding an existing flaw.

2.0 REGULATORY BASIS

The Inservice Inspection (ISI) of the ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g), except where specific relief has been granted by the Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 50.55a(g)(6)(i). The regulation at 10 CFR 50.55a(a)(3), states in part that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) will meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that ISI of components and system pressure tests conducted during the first 10-year interval, and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The ISI code of record for third 10-year ISI interval at CNP, Units 1 and 2 is the 1989 Edition of Section XI of the ASME Code.

3.0 INSERVICE INSPECTION PROGRAM RELIEF REQUEST 2004-ISIR-14

3.1 ASME Code Components Affected

Relief Request 2004-ISIR-14 would allow repairs on the inside and outside diameter of VHP nozzles as well as the J-groove attachment welds of VHP.

3.2 Code Requirements for which Relief is Requested

The 1989 edition of the ASME Code Section XI, IWA-4120(a) states:

> Repairs shall be performed in accordance with the Owners Design Specification and the original Construction Code of the component or system. Later Editions and Addenda of the Construction Code or of Section III, either in their entirety or portions thereof, and Code Cases may be used.

In accordance with IWA-4120(a), the licensee will follow the applicable requirements of the 1989 Edition of ASME Code Section III, in conjunction with the proposed alternatives as described below for RVH penetration repairs.

Base Metal Defect Repairs

ASME Code Section III, NB-4131 states that defects in base metals, such as VHP nozzles, may be eliminated, or repaired by welding, provided the defects are removed, repaired, and examined in accordance with the requirements of NB-2500.

ASME Code Section III, NB-2538 addresses elimination of base material surface defects and specifies defects are to be removed by grinding or machining. Defect removal must be verified by a magnetic particle or liquid penetrant examination using acceptance criteria of NB-2545, or NB-2546. If the removal process reduces the section thickness below the NB-3000 design thickness, then repair welding per NB-2539 is to be performed.

ASME Code Section III, NB 2539.1 addresses removal of defects and requires defects be removed or reduced to an acceptable size by suitable mechanical or thermal methods.

ASME Code Section III, NB-2539.4 provides the rules for examination of base material repair welds and specifies they shall be examined by magnetic particle or liquid penetrant methods with acceptance criteria per NB-2545, and NB-2546. Additionally, if the depth of the repair cavity exceeds the lesser of 3/8 inch or 10 percent of the section thickness, the repair weld shall be examined by the radiographic method using the acceptance criteria of NB-5320.

Weld Metal Defect Repairs

ASME Code Section III, NB-4451 states defects in weld metal shall be eliminated and, when necessary, repaired per NB-4452, and NB-4453.

ASME Code Section III, NB-4452 addresses elimination of weld metal surface defects and specifies defects are to be removed by grinding or machining. Defect removal must be verified

by magnetic particle, or liquid penetrant examination using acceptance criteria of NB-5340 or NB-5350. If the removal process reduces the section thickness below the NB-3000 design thickness, then repair welding per NB-4453 is to be performed.

ASME Code Section III, NB-4453.1 addresses removal of defects in welds and requires the defect removal be verified with magnetic particle or liquid penetrant examinations using acceptance criteria of NB-5340, or NB-5350, or in the case of partial penetration welds where the entire thickness of the weld is removed, and only a visual examination is required.

3.3 Licensee's Proposed Alternative and Basis for Use

Design, implementation of repairs, and inspections will be consistent with the embedded flaw repair process described in Westinghouse topical report WCAP-15987-P, Revision 2-P-A, "Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations." The embedded flaw repair overlay welds on the penetration J-groove welds will consist of a minimum of three deposited layers. The embedded flaw repair overlay welds on the inside diameter (ID) and the outside diameter (OD) of the penetration tube material will consist of a minimum of two deposited layers of weld, consistent with the approved topical report, to minimize welding-induced residual stresses, and material distortion. In the case of repairs on the ID surface, the two layer approach results in a reduced inlay excavation depth.

The licensee proposes one exception to the post-repair inspection process described in Westinghouse letter dated October 1, 2003, and included in WCAP-15987-P, Revision 2-P-A. The section titled "Sequence and Summary of WCAP Approval" immediately following the signature page of WCAP-15987-P, Revision 2-P-A requires that, following an embedded flaw repair of the J-groove weld, an ultrasonic inspection be performed from the nozzle ID, looking at the triple point to detect flaw growth and/or a leak path. The licensee proposes that, following an embedded flaw repair of the J-groove weld on Unit 2 Penetration 75, the post repair ultrasonic inspection from the nozzle ID looking at the triple point location be performed to the maximum extent possible (approximately 91 percent of the triple point).

3.4 Licensee's Basis for Use of Embedded Flaw Repair Process

In the NRC Safety Evaluation included in WCAP-15987-P, Revision 2-P-A, the NRC staff concluded that, subject to the specified conditions and limitations, the embedded flaw repair process described in the topical report provides an acceptable level of quality and safety. The NRC staff also concluded that the subject topical report is acceptable for referencing in licensing applications. The licensee has confirmed that CNP, Units 1and 2 meet the criteria for application of the embedded flaw repair process stated in Appendix C of WCAP-15987-P, Revision 2-P-A.

In both the ID and OD overlay repair welds, the proposed substitute examination methods have been demonstrated to be adequate for flaw detection and sizing as described in the Westinghouse letter dated October 1, 2003.

The embedded flaw repair process is considered a permanent repair that will last through the useful life of the reactor pressure vessel head. As long as an identified indication or primary water stress corrosion cracking (PWSCC) flaw remains isolated from the primary water

environment, the only known mechanism for any further potential propagation is fatigue. The calculated usage in this region is very low, because the reactor vessel head region is isolated from the transients that affect the hot leg or cold leg piping.

The thickness of the weld used to embed the flaw has been set to provide a permanent embedment of the flaw. The embedded flaw process imparts less residual stress than weld repair following the complete removal of the flaw.

Since Alloy 52/152 (690) weldment is considered highly resistant to PWSCC, a new PWSCC crack is not expected to initiate and grow through the Alloy 52/152 overlay to reconnect the primary water environment with the embedded flaw. The resistance of the Alloy 690 material and its associated welds, Alloys 52 and 152, has been demonstrated by laboratory testing in which no cracking was observed in a simulated pressurized water reactor environments, and in approximately ten years of operational service in steam generator tubes where no PWSCC has been found.

Therefore, the embedded flaw repair process is considered to be an alternative to ASME Code requirements that provides an acceptable level of quality and safety, as required by 10 CFR 50.55a(a)(3)(i).

3.5 Licensee's Basis for Exception to Post Repair Inspection Requirements for Unit 2 Penetration 75

Flaws on the nozzle ID of Unit 2 Penetration 75 were repaired in 1996. The repair was effected by excavating a rectangular section of the ID surface to remove the flaws. The excavated area on Penetration 75 was partially refilled with weld deposit. The excavated area on Penetration 75 cannot be ultrasonically inspected because the rough weld surface causes the ultrasonic probe to loose sonic coupling.

Unit 2 Penetration 75 was inspected during the current refueling outage in accordance with the First Revised NRC Order EA-03-009 by using a combination of surface and ultrasonic inspections as specified in Section IV.C(5)(b)(iii) of the order. As shown on Sketch 1 (see licensee's submittal dated October 27, 2004), these inspections included a surface examination, using liquid penetrant, of the entire J-groove weld on Penetration 75. These examinations identified a 1/4 inch rounded indication on the J-groove weld for Penetration 75. Based on its shape, the licensee considers that the indication is not likely to be service induced.

If approved, the licensee intends to use the embedded flaw repair process described in Reference 1 and 2 to repair the indication on the J-groove weld for Unit 2 Penetration 75. Reference 2 requires that, following an embedded flaw repair of the J-groove weld, an ultrasonic inspection be performed from the nozzle ID, looking at the triple point to detect flaw growth and/or a leak path. However, as noted above, the existing excavated area on the ID of Unit 2 Penetration 75 cannot be ultrasonically examined. Consequently, approximately 91 percent of the total triple point on Penetration 75 is inspectible. Although the triple point region on this penetration is not able to be completely inspected, the overlay welds would extend beyond the existing J-groove welds, providing a barrier to a leak path through the triple point from the weld. The proposed alternative also requires the entire overlay weld to receive a surface examination. Additionally, the periodic inspections performed in accordance with the

First Revised NRC Order EA-03-009 will continue to provide a mechanism for monitoring for evidence of a leak path. Therefore, the licensee considers that, following an embedded flaw repair of the J-groove weld on Unit 2 Penetration 75, an ultrasonic inspection performed from the nozzle ID, looking at the triple point region to the maximum extent possible (91 percent) provides an acceptable level of quality and safety.

3.6 Staff Evaluation

The NRC staff has reviewed the Westinghouse topical report WCAP-15987-P, Revision 2. In its July 3, 2003, letter (Reference 3), the NRC staff accepted the referencing of the subject topical report for use with the following conditions and limitations:

1. Licensees must follow the NRC flaw evaluation guidelines provided in the NRC letter dated April 11, 2003 (Reference 4).

2. The crack growth rate referenced in WCAP-15987-P, Revision 2 is not applicable to Alloy 600 or Alloy 690 weld materials, i.e., Alloy 52, 82, 152, and 182 filler material.

3. The nondestructive examination (NDE) requirements listed in the table below must be implemented for examinations of repairs made using the embedded flaw process.

Repair Location	Flaw Orientation	Repair Weld	Repair NDE	ISI NDE of the repair, Note 2
VHP Nozzle ID	Axial	Seal	UT and Surface	UT or Surface
VHP Nozzle ID	Circumferential	Note 1	Note 1	Note 1
VHP Nozzle OD above J-groove weld	Axial or Circumferential	Note 1	Note 1	Note 1
VHP Nozzle OD below J-groove weld	Axial or Circumferential	Seal	UT or Surface	UT or Surface
J-groove weld	Axial	Seal	UT and Surface, Note 3	UT and Surface, Note 3
J-groove weld	Circumferential	Seal	UT and Surface, Note 3	UT and Surface, Note 3

Notes: 1. Repairs must be reviewed and approved separately by the NRC.

2. Inspect consistent with the NRC Order EA-03-009 dated February 11, 2003, and any subsequent changes.

3. Inspect with personnel and procedures qualified with ultrasonic test (UT) performance-based criteria. Examine the accessible portion of the repaired region. The UT coverage plus surface coverage must equal 100 percent.

The licensee stated that it would use this Westinghouse topical report and would follow the conditions and limitations identified above. The licensee is able to perform 100 percent inspection when combining UT and surface examinations for the regions required by the NRC First Revised Order EA-03-009. The difficulty the licensee has is inspecting the triple point location for the ID excavated/repaired region of Penetration 75 as instructed by WCAP-15987-P-A, Revision 2. However, the licensee is able to inspect using UT a significant distance above the excavated/repaired region of these nozzles as part of the Order-required examinations. Therefore, the staff finds that should a leak path exist, the licensee would be able to detect a leak path UT signature in the interference fit region above the ID repair region during post repair and subsequent examinations (as required by the First Revised Order EA-03-009) for Penetration 75.

In addition, the licensee stated that it would follow the applicable requirements in the 1989 Edition of the ASME Code, Section III, in conjunction with the proposed alternatives for the VHP repairs. Since this edition of the Code is the same edition that is used in the technical basis of the WCAP-15987-P, Revision 2, the licensee does not need to perform a Code reconciliation between the original Code of Construction and the 1989 Edition of the ASME Code, Section III.

Therefore, the staff finds the use of the reactor VHP repair methodology as described in WCAP-15987-P-A, Revision 2, including the exception to the limited post repair UT inspection of the triple point for Penetration 75 at CNP, Unit 2 as discussed above, to be acceptable for the third 10-year ISI interval at CNP, Units 1 and 2.

4.0 CONCLUSION

Based upon the review of information provided by the licensee in support of the Relief Request 2004-ISIR-14, the NRC staff concludes that the proposed alternative for design, implementation of repairs, and inspections of the VHP nozzles and weldments in lieu of the defect repair requirements in the 1989 Edition of Sections III and XI of the ASME Code will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the use of the proposed alternative at CNP, Units 1 and 2, for the remainder of the third 10-year ISI intervals.

All other requirements of the ASME Code, Section III and XI for which relief has not been specifically requested and approved remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

5.0 REFERENCES

1. Westinghouse Topical Report, WCAP-15987-P-A, Revision 2, "Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations," dated December 2003. (ADAMS Accession NO. ML031840237)

2. Westinghouse Letter, LTR-NRC-03-61, J. S. Galembush to T. Chan and B. Benney, NRC, dated October 1, 2003; Subject: Inspection of Embedded Flaw Repair of a J-groove Weld. (ADAMS Accession No. ML032810457)

3. NRC Letter from H. Berkow, to H. Sepp, Westinghouse, "Acceptance for Referencing - Topical Report WCAP-15987-P, Revision 2, Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations," dated July 3, 2003. (ADAMS Accession No. ML031840237)

4. NRC Letter from R. Barrett to A. Marion, Nuclear Energy Institute, "Flaw Evaluation Guidelines," dated April 11, 2003. (ADAMS Accession No. ML030980322)

Principal Contributor: A. Keim

Date: December 23, 2004