UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 8, 2009

Mr. Joseph N. Jensen
Senior Vice President and
Chief Nuclear Officer
Indiana Michigan Power Company
Nuclear Generation Group
One Cook Place
Bridgman, MI 49106

SUBJECT: DONALD C. COOK NUCLEAR PLANT, UNIT 2 (CNP-2) – EVALUATION OF RELIEF REQUEST (ISIR-29) TO EXTEND THE THIRD 10-YEAR INSERVICE INSPECTION (ISI) INTERVAL FOR REACTOR VESSEL WELD EXAMINATION (TAC NO. MD9934)

Dear Mr. Jensen:

By letters to the U.S. Nuclear Regulatory Commission (NRC) dated October 9, 2008, and January 14, 2009, Indiana Michigan Power Company requested approval to use an alternative to the requirements of the American Society of Mechanical Engineers Boiler and Pressure and Vessel Code, Section XI, Paragraph IWB-2412, Inspection Program B, for CNP-2. NRC approval was requested to extend the ISI interval for examination of reactor pressure vessel welds (Category B-A), and nozzle-to-vessel welds and inner radius sections (Category B-D), from 10 years to 20 years, including future ISI intervals to the end of the facility's license.

The NRC staff has completed its review of the proposed relief request. As documented in the enclosed safety evaluation, the NRC staff concludes that the proposed alternative is justified on the basis that it would provide an acceptable level of quality and safety. Therefore, the staff authorizes the proposed alternative pursuant to 10 CFR 50.55a(a)(3)(i) for the third 10-year ISI interval at CNP-2. The proposed alternative is authorized until February 28, 2020.

If you have any questions, please contact Terry Beltz of my staff at (301) 415-3049.

Sincerely,

Lois M. James, Chief
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-316

Enclosure:
Safety Evaluation

cc w/encl: Distribution via ListServ

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

INSERVICE INSPECTION (ISI) PROGRAM RELIEF REQUEST (ISIR-29)

TO EXTEND THE THIRD 10-YEAR INSPECTION INTERVAL FOR

REACTOR VESSEL (RPV) WELD EXAMINATION

INDIANA MICHIGAN POWER COMPANY

DONALD C. COOK NUCLEAR PLANT, UNIT 2

DOCKET NO. 50-316

1.0 INTRODUCTION

By letters dated October 9, 2008 (the submittal) (Reference 1), and January 14, 2009 (the supplement) (Reference 2), Indiana Michigan Power Company (the licensee) requested Nuclear Regulatory Commission (NRC) approval for the Donald C. Cook Nuclear Power Plant, Unit 2 (CNP-2) to use an alternative to the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, paragraph IWB-2412, Inspection Program B. The alternative was requested pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i).

The licensee requested approval for the use of the alternative to extend the ISI interval for examinations of RPV welds (Category B-A) as well as the nozzle-to-vessel welds and inner radius sections (Category B-D) from 10 years to 20 years, and through the end of the facility's operating license on December 23, 2037.

2.0 REGULATORY REQUIREMENTS

In accordance with 10 CFR 50.55a(g)(4), the licensee is required to perform ISI of ASME Code Class 1, 2, and 3 components and system pressure tests during the first 10-year interval and subsequent 10-year intervals that 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), subject to the limitations and modifications listed therein. The current CNP-2 code of record for the inspection of ASME Code Class 1, 2, and 3 components, will be Section XI of the ASME Code 1989 Edition (with no addenda).

The regulation in 10 CFR 50.55a(a)(3) states, in part, that the Director of the Office of Nuclear Reactor Regulation (NRR) may authorize alternatives to the requirements of 10 CFR 50.55a(g). In order for the Director of NRR to authorize an alternative in accordance with 10 CFR 50.55(a)(3)(i), the NRC staff must find that the licensee has demonstrated that the proposed alternative provides an acceptable level of quality and safety.

Enclosure

2.1 Background

The ISI of Category B-A and B-D components consists of visual and ultrasonic examinations intended to discover whether flaws have initiated, whether pre-existing flaws have extended, and whether pre-existing flaws that may have been missed in prior examinations. These examinations are required to be performed at regular intervals, as defined in Section XI of the ASME Code.

2.2 Summary of WCAP-16168-NP

In 2006, the Pressurized Water Reactor (PWR) Owners Group (PWROG) submitted topical report WCAP-16168-NP, Revision 1 (Reference 3) (henceforth referred to as the WCAP), to the NRC in support of making a risk-informed assessment of extensions to the ISI intervals for Category B-A and B-D components. In the report, the PWROG took data associated with three different PWR plants (referred to as the pilot plants), one designed by each of the main contractors for nuclear power plants in the United States, and performed the necessary studies on each of the pilot plants required to justify the proposal for extending the ISI interval for Category B-A and B-D components from 10 to 20 years.

The analyses in the WCAP used probabilistic fracture mechanics (PFM) tools and inputs from the work described in the NRC pressurized thermal shock (PTS) risk re-evaluations (Reference 4 and Reference 5). The PWROG analyses incorporated the effects of fatigue crack growth and ISI. Design basis transient data was used as input to the fatigue crack growth evaluation. The effects of ISI were modeled consistently with previously-approved PFM codes (Reference 6). These effects were put into evaluations performed with the Fracture Analysis of Vessels – Oak Ridge (FAVOR) code (Reference 7). All other inputs were identical to those used in the PTS risk re-evaluation.

From the results of the studies, the PWROG concluded that the ASME Code, Section XI, 10-year inspection interval for Category B-A and B-D components in PWR reactor vessels can be safely extended to 20 years. Their conclusion from the results for the pilot plants was considered to apply to any plant designed by the three vendors (Westinghouse, Combustion Engineering, and Babcock and Wilcox (B&W)), as long as the critical, plant-specific parameters defined in Appendix A of the WCAP are bounded by the pilot plants.

2.3 Summary of NRC Safety Evaluation Report (SER) of WCAP-16168-NP

The staff's conclusion in its final safety evaluation of the WCAP (Reference 8) indicates that the methodology presented in the WCAP, in concert with the guidance provide by Regulatory Guide (RG) 1.174, to be acceptable for referencing in requests to implement alternatives to ASME Code inspection requirements for PWR plants in accordance with the limitations and conditions in the SER. In addition to showing that the subject plant is bounded by the pilot plants' information from Appendix A in the WCAP, the key points of the SE are summarized below.

1. The dates identified in the request for alternative should be within plus or minus one refueling cycle of the dates identified in the implementation plan provided to the NRC. Any deviations from the implementation plan (Reference 9) should be discussed in detail in the request for alternative ISI interval. The maximum interval for proposed ISI is 20 years.

2. The request for alternative ISI interval can use any NRC-approved method to calculate ΔT_{30} and $RT_{MAX\text{-}X}$. However, if the request uses the NUREG-1874 methodology to

calculate ΔT_{30}, then the request should include the analysis described in paragraph (6) of subsection (f) to the voluntary PTS rule. The analysis should be done for all of the materials in the beltline area with at least three surveillance data points.

3. If the subject plant is a B&W plant:

   - Licensees must verify that the fatigue crack growth of 12 heat-up/cool-down transients per year bound the fatigue crack growth for all of its design basis transients

   - Licensees must identify the design basis transients that contribute to significant fatigue crack growth

4. If the subject plant has RPV forgings that are susceptible to underclad cracking or if the RPV includes forgings with $RT_{MAX\text{-}FO}$ values exceeding 240°F, then the WCAP analyses are not applicable. The licensee must submit a plant-specific evaluation for any extension to the 10-year inspection interval for ASME Code, Section XI, Category B-A and B-D RPV welds.

3.0 TECHNICAL EVALUATION FOR RELIEF REQUEST (ISIR-29)

3.1 Components for Which Relief is Requested

The affected component associated with this relief request is the CNP-2 RPV. The following examination categories and item numbers from IWB-2500 and Table IWB-2500-1 of the ASME Code, Section XI, are addressed in this request:

Examination Category	Item No.	Description
B-A	B1.11	Circumferential Shell Weld
B-A	B1.12	Longitudinal Shell Welds
B-A	B1.21	Circumferential Head Weld
B-A	B1.22	Meridional Head Weld
B-A	B1.30	Shell-to-Flange Weld
B-D	B3.90	Nozzle-to-Vessel Welds
B-D	B3.100	Nozzle Inner Radius Areas

3.2 Code Requirement for Which Relief is Requested

An alternative was requested from the requirement of ASME Code, Section XI, IWB-2412, Inspection Program B, specifying that volumetric examination of essentially 100 percent of RPV pressure-retaining welds (Examination Categories B-A and B-D) be performed once each 10-year inspection interval. The licensee requested the extension of the third ISI interval for RPV pressure-retaining welds (Examination Category B-A and B-D) from 10 years to 20 years, up to the end of the facility's license.

3.3 Licensee-Proposed Alternative

The licensee proposed to defer the third ASME Code-required ISI of the CNP-2 Category B-A and B-D welds until the 2019 refueling outage. The licensee also proposed to then perform the fourth

ASME Code-required ISI in 2039. This schedule is consistent with the schedule for CNP-1 as described in Reference 9, with the exception that the licensee proposes to swap the scheduled inspection dates for CNP-1 and CNP-2. The third ISI interval for CNP-1 is planned to be performed in 2009 and a separate relief request for the ISI interval will be filed subsequently. The licensee states that this swap will not affect the planned distribution of inspections over the next 40 years of the PWR fleet.

3.4 Licensee Basis for the Alternative

The basis for the first alternative is found in the NRC-approved version of the WCAP (Reference 10) (henceforth referred to as WCAP-A). Plant-specific parameters for the subject plant are summarized in Enclosure 1 of the submittal. The format of the information is patterned after that found in Appendix A of the WCAP.

All of the critical parameters listed in Enclosure 1, Tables 1, 2, and 3, of the submittal are bounded by the WCAP-A pilot plant evaluations.

The WCAP notes that all reactor coolant pressure boundary failures to date have been identified as a result of leakage and were discovered by visual examinations. The Category B-N-1 visual examinations and the Category B-P pressure tests required at the end of each refueling outage are not affected by this alternative. The interval extension does not impact the defense-in-depth elements associated with the overall inspection philosophy.

3.5 NRC Staff Evaluation

The staff has reviewed Enclosure 1 of the submittal, in addition to the information provided in the supplement, to make this evaluation. The "Frequency and Severity of Design Transients" for CNP-2 were found to be bounded by the WCAP-A. Also, the CNP-2 RPV was single-layer clad and bounded by the WCAP-A.

Enclosure 1, Table 2, of the submittal provides additional information pertaining to previous RPV inspections and the schedule for future inspections. One planar indication was detected in the most recent ISI, but the indication was not located in the RPV beltline region and found to be acceptable in accordance with IWB-3500 of Section XI of the ASME Code. The proposed Third ISI Interval examination for CNP-2 would be in 2019, consistent with Reference 9, by swapping the dates between CNP-1 and CNP-2. Switching the dates of the ISI examinations between CNP-1 and CNP-2 would not affect the proposed distribution of inspections over the next 40 years and, therefore, is consistent with the intent of Reference 9. The information in Table 2 meets the regulatory guidance.

The calculation of through wall cracking frequency $(TWCF)_{95\text{-}TOTAL}$ was performed using Table 3 of the submittal as a basis. The submittal used the NUREG-1874 methodology to calculate ΔT_{30}. The staff requested that the basis of this calculation be substantiated, or that the licensee substitute a ΔT_{30} calculation based on currently approved methodology. In its January 14, 2009, response, the licensee provided a new Table 3 using an approved methodology for calculating ΔT_{30} found in RG 1.99, Revision 2. The staff verified the calculations and found them to be within regulatory guidance. The TWCF was found to be acceptably low as calculated through the methodology prescribed in the WCAP-A and detailed in Table 3 of the submittal.

At the time of issuance of the WCAP-16168-NP Safety Evaluation (SE), it was the intent of the NRC to establish a process by which licensees could receive approval to implement 20-year ISI intervals for the subject component examinations through the end of the facility's current operating license. This objective led to the provision established in the WCAP-16168-NP SE for licensees to submit a license condition requiring them to evaluate future volumetric ISI data in accordance with the criteria in the draft and/or final alternative PTS Rule, 10 CFR 50.61a. Subsequent guidance from the NRC's Office of General Counsel has resulted in a modification of this NRC position, as discussed below.

Based on the current guidance, the NRC staff will grant ISI interval extensions for the subject components on an interval-by-interval basis (i.e., only a facility's current ISI interval will be extended for up to 20 years). Licensees will have to submit subsequent requested alternatives for NRC review and approval to extend each following ISI interval from 10 years to 20 years, as needed. Based on this new NRC position, the requirement in the staff's SE on WCAP-16168-NP for a license condition to address the evaluation of future ISI data is no longer necessary, and the license condition requested for CNP-2 in its submittal will not be issued in conjunction with this requested alternative. Subsequent requested alternatives which seek to extend additional ISI intervals from 10 to 20 years for the subject component examinations should include the evaluation of a facility's most recent ISI data in accordance with the criteria in the final alternative PTS Rule, 10 CFR 50.61a, in order to obtain NRC staff approval. In addition, for purposes of technical and regulatory consistency, the WCAP-16168-NP SE will be revised to reflect these changes in NRC position regarding the implementation of ISI interval extensions based on WCAP-16168-NP.

In summary, the licensee has demonstrated that the CNP-2 RPV is bounded by the WCAP-A. The submittal demonstrates that there is no significant additional risk associated with extending the current ISI interval for Category B-A and B-D components from 10 years to 20 years.

4.0 CONCLUSION

Based on the above review and evaluation, the NRC staff concludes that extending the current ISI interval from 10 years to 20 years for the specified Category B-A and B-D components has no appreciable increase in risk. The staff bases its conclusion on the fact that the plant-specific information provided by the licensee is bounded by the data in WCAP-A, and that the request meets all the conditions and limitations described in WCAP-A, and the WCAP SE. The licensee's request for relief provides reasonable assurance of an acceptable level of quality and safety.

The licensee requested approval for the use of the alternative to extend the current ISI interval from 10 years to 20 years, and through the end of the facility's operating license in 2037. The NRC staff is only authorizing the alternative for the current ISI interval through February 28, 2020. Mr. Michael Scarpello of your staff agreed to this effect during a phone conversation with NRC staff on March 13, 2009, during which the NRC staff provided verbal authorization for extension for the proposed alternative (ADAMS Accession No. ML090720704).

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

5.0 REFERENCES

1. Letter from L. Weber, Indiana Michigan Power Company, to USNRC Document Control Desk, re: Donald C. Cook Nuclear Plant 2, "Request for Relief to Extend the Unit 2 Inservice Inspection Interval for Reactor Vessel Weld Examination and Request for License Amendment for Submittal of ISI Information and Analyses," dated October 9, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML082980354).

2. Letter from L. Weber, Indiana Michigan Power Company, to USNRC Document Control Desk, re: Donald C. Cook Nuclear Plant 2, "Request for Relief to Extend the Unit 2 Inservice Inspection Interval for Reactor Vessel Weld Examination and Request for License Amendment for Submittal of ISI Information and Analyses – Response to Request for Additional Information (TAC No. MD9934)," dated January 14, 2009 (ADAMS Accession No. ML090430400).

3. Westinghouse Owners Group to USNRC Document Control Desk and Chief Financial Officer, Transmittal of WCAP-16168-NP, Rev. 1, "Risk-Informed Extension of Reactor Vessel In-Service Inspection Interval," dated January 26, 2006 (ADAMS Accession No. ML060330504).

4. NUREG-1806, Vol. 1, "Technical Basis for Revision of the Pressurized Thermal Shock (PTS) Screening Limit in the PTS Rule (10 CFR 50.61)," published August 2007 (ADAMS Accession No. ML072830074).

5. NUREG-1874, "Recommended Screening Limits for Pressurized Thermal Shock (PTS), completed March 1, 2007 (ADAMS Accession No. ML070860156).

6. Topical Report WCAP-14572-NP-A, "Westinghouse Owners Group Application of Risk-Informed Methods to Piping Inservice Inspection Topical Report" (ADAMS Accession No. ML012630375).

7. Report ONRL/NRC/LTR-04/18, "Electronic Archival of the Results of Pressurized Thermal Shock Analyses for Beaver Valley, Oconee, and Palisades Reactor Pressure Vessels Generated with the 04.1 version of FAVOR," dated October 15, 2004 (ADAMS Accession No. ML042960391).

8. Letter from Ho K. Nieh, USNRC, to Gordon Bischoff, Westinghouse Owners Group, re: "Final Safety Evaluation for Pressurized Water Reactor Owners Group (PWROG) Topical Report (TR) SCAP-16168-NP, Revision 2, "Risk-Informed Extension of the Reactor Vessel In-Service Inspection Interval" (TAC No. MC9768)," dated May 8, 2008 (ADAMS Accession No. ML081060051).

9. Westinghouse Owners Group to USNRC Document Control Desk re: OG-06-356, PWR Owners Group "Plan for Plant Specific Implementation of Extended Inservice Inspection Interval per WCAP-16168-NP, Revision 1, "Risk-Informed Extension of the Reactor Vessel In-Service Inspection Interval," dated October 31, 2006 (ADAMS Accession No. ML082210245).

10. Westinghouse Owners Group to USNRC Document Control Desk re: "Transmittal of NRC Approved Topical Report WCAP-16168-NP-A, Rev. 2, "Risk-Informed Extension of Reactor Vessel In-Service Inspection Interval" (TAC No. MC9768), dated June 13, 2008 (ADAMS Accession No. ML082820046).

Principal Contributor: Daniel Widrevitz

Date: June 8, 2009

June 8, 2009

Mr. Joseph N. Jensen
Senior Vice President and
Chief Nuclear Officer
Indiana Michigan Power Company
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One Cook Place
Bridgman, MI 49106

SUBJECT: DONALD C. COOK NUCLEAR PLANT, UNIT 2 (CNP-2) – EVALUATION OF RELIEF REQUEST (ISIR-29) TO EXTEND THE THIRD 10-YEAR INSERVICE INSPECTION (ISI) INTERVAL FOR REACTOR VESSEL WELD EXAMINATION (TAC NO. MD9934)

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If you have any questions, please contact Terry Beltz of my staff at (301) 415-3049.

Sincerely,
/RA/
Lois M. James, Chief
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
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Docket No. 50-316

Enclosure:
Safety Evaluation

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