

April 2, 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, UNITS 1 AND 2 - REQUESTS FOR  
CODE RELIEF ISIR -11, ISIR-12 AND ISIR-13 (TAC NOS. Mb6352, MB6353,  
MB6354, MB6355, MB6356 AND MB6357)

Dear Mr. Bakken:

By letter dated September 12, 2002, the Indiana Michigan Power Company, submitted Relief Requests ISIR-11, ISIR-12 and ISIR-13 requesting the use of proposed alternatives to the pressure retaining bolting inspection requirements of Section XI of the American Society of Mechanical Engineers *Boiler and Pressure Vessel Code*.

The Nuclear Regulatory Commission (NRC) staff has reviewed the Relief requests. The NRC staff's safety evaluation is enclosed. Pursuant to Title 10 of the *Code of Federal Regulation*, Part 50.55a(a)(3)(i), the proposed alternatives described in Relief Requests ISIR-11, ISIR-12 and ISIR-13 are authorized on the basis that the alternative inspections provides an acceptable level of quality and safety. The proposed alternatives are authorized for the third 10-year inservice inspection interval.

Sincerely,

*/RA/*

L. Raghavan, Chief, Section 1  
Project Directorate III  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket Nos. 50-315 and 50-316

Enclosures: Safety Evaluation

cc w/encls: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ASME SECTION XI INSERVICE INSPECTION PROGRAM THIRD INTERVAL

RELIEF REQUEST

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 September 12, 2002, the Indiana Michigan Power Company, submitted Relief Requests ISIR-11, ISIR-12 and ISIR-13 requesting the use of proposed alternatives to the pressure retaining bolting inspection requirements of Section XI of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* (Code).

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(g), requires inservice inspection of pressure retaining bolting be performed in accordance with Section XI of the ASME Code, except where relief has been requested and granted or proposed alternatives have been authorized by the Commission pursuant to 10 CFR 50.55a(a)(3)(i), (a)(3)(ii) or (g)(6)(i). In the case of the subject relief requests the licensee has proposed alternatives to the code which provide an acceptable level of quality and safety. In proposing the alternatives the licensee must demonstrate that: (1) the proposed alternatives would provide an acceptable level of quality and safety, or (2) compliance would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety.

3.0 TECHNICAL EVALUATION

3.1 Inservice Inspection Program Alternative Request ISIR-11, Use Of Code Case N-616, Alternative Requirements For VT-2 Visual Examination of Class 1, 2, and 3 Insulated Pressure Retaining Bolted Connections

3.1.1 Code Requirements for which Relief is Requested

1989 Edition (No Addenda), of the ASME Boiler and Pressure Vessel (B&PV) Code Section XI:

Table IWB-2500-1 requires that the Class 1 connections be VT-2 examined each outage. Tables IWC-2500-1 and IWD-2500-1, for Class 2 and 3 connections respectively, require that Class 2 and 3 connections be VT-2 examined each inspection period.

Subparagraph IWA-5242(a): 'For systems borated for the purpose of controlling reactivity, insulation shall be removed from pressure retaining bolted connections for VT-2 visual examination.

### 3.1.2 Licensee's Proposed Alternative to Code

Indiana Michigan Power Company (I&M) proposes the use of ASME Code Case N-616 for Class 1, 2, and 3 insulated systems borated for the purpose of controlling reactivity. VT-2 visual examinations during the system pressure tests required by IWB-5000, IWC-5000, and IWD-5000 would be performed without insulation removal, when the bolting material is resistant to boric acid degradation. The following restrictions will apply to those locations where this alternative request is used:

1. Pressure testing hold times will comply with ASME Section XI requirements (e.g., 4 hours for insulated components).
2. This alternative request will not apply to:
  - (1) Type 17-4PH stainless steel (SA-564 Grade 630) heat treated below 1100°F or with a hardness ( $R_c$ ) greater than 30.
  - (2) Type 17-4PH (SA-193 Grade B6) bolting heat treated below 1100°F or with  $R_c$  greater than 30.
  - (3) A-286 (SA-453 Grade 660) that is preloaded to greater than 100 ksi.
3. Use of Code Case N-616 will not apply to bolted connections where the associated piping, valve bodies, and pump casings contain less than 10% chromium, and are not in the proper heat treatment condition.

### 3.1.3 Licensee's Basis for Relief

Pursuant to 10 CFR 50.55a(a)(3)(i), authorization is sought to utilize ASME Code Case N-616 as an alternative to the requirements specified in the ASME B&PV Code Section XI, 1989 Edition, Subparagraph IWA-5242(a). Corrosion resistant bolted connections on borated systems consist of materials with chromium content greater than or equal to 10%, which are resistant to boric acid degradation. The basis for a minimum chromium content being used as a measure of susceptibility to degradation is established in Code Case N-616. In previous refueling outages, Class 1 bolted connections were inspected with insulation removed in accordance with IWA-5242(a). Where boric acid residues were identified and corrosion resistant bolting removed, no degradation was evident on the bolting material. These results were consistent with expectations that no boric acid corrosion degradation mechanism exists on the corrosion resistant materials.

The licensee contends that unnecessary physical hazard and radiation exposure exists to personnel in erecting and removing scaffolding, and removing and reinstalling insulation at nominal operating pressures and elevated temperatures.

The licensee conducts pressure tests utilizing a four-hour hold time on systems borted for the purpose of controlling reactivity in accordance with ASME Section XI requirements.

#### 3.1.4 NRC Staff Evaluation

Cold working of the material that ultimately leaves the surface in tension provides a driving force for accelerated cracking. Heat treatment that does not sufficiently anneal the material to increase toughness leaves the material brittle and more susceptible to cracking; therefore, in employing Code Case N-616 certain actions must be taken in order to ensure that these factors are addressed. Code Case N-616 was approved by the ASME code committee on May 7, 1999, and is listed in Draft Regulatory Guide DG-1091, Table 2, "Conditionally Acceptable Section XI Code Cases." The stipulations stated in the Draft Regulatory Guide are:

1. Insulation must be removed for VT-2 examination during the system pressure test for any 17-4 PH stainless steel or 410 stainless steel stud or bolt aged at a temperature below 1,100 °F or with hardness above  $R_c$  30.
2. For A-286 stainless steel studs or bolts, the preload must be verified to be below 100 Ksi or the thermal insulation must be removed and the joint visually examined.
3. For nuts conforming to SA-194, removal of the insulation for visual inspection is not necessary.
4. A 4-hour hold time at operating temperature and pressure is required prior to conducting the VT-2 examination.

The licensee has committed to meeting these conditions. Therefore, the use of Code Case N-616 with the limitations committed to by the licensee is acceptable.

#### 3.1.5 Summary

Based on the previous discussion, the staff concludes that the use of Code Case N-616 with the limitations committed to by the licensee under the alternative proposed in Proposed Alternative ISIR-11, will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternative for the third 10-year ISI interval at Donald C. Cook Nuclear Plant, Units 1 and 2.

### 3.2 Inservice Inspection Program Alternative Request ISIR-12, Use Of Code Case N-307-3, for Pressure Retaining Bolting Greater than 2 inches in Diameter

#### 3.2.1 Relief Request ISIR-12 System/Components for Which Relief is Requested

Examination of Class 1 bolting, ASME Code Category B-G-1.

#### 3.2.2 Code Requirements for Which Relief is Requested

The licensee is requesting relief from the 1989 Edition of ASME Section XI, Table IWB-2500-1, Examination Category B-G-1 for the third 10-year interval.

- (a) Examination Figure IWB-2500-12 for Item B6.30 requires the examination volume be defined as the full volume of the load-bearing portion of the stud.
- (b) Table IWB-2500-1, Examination category B-G-1, requires that the examinations include both a surface and volumetric methods when the studs are removed (Item B6.30).

### 3.2.3 Licensee's Proposed Alternative to Code

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee requests approval to use the proposed alternative to Code.

For ultrasonic examinations (UT) inspections, the licensee proposes to use the ASME Code Case N-307-3. The volumetric examinations will be performed with procedures and personnel qualified in accordance with ASME Section XI, Appendix VIII

### 3.2.4 Licensee's Bases for Requesting Relief

- (a) In ASME Code Case N-307-2, which was passed by ASME on September 24, 1999 and incorporated in the 2000 Addenda of the ASME Section XI Code, the required volume was reduced to include the outside diameter to a radial depth of 1/4" when performing volumetric examinations on RPV (reactor pressure vessel) studs. ('Code Case N-307-3 was passed by the ASME Main Committee on February 16, 2001, and is scheduled for publication in the next ASME Supplement.')
- (b) Table IWB-2500-1 in the 2000 Addenda of the ASME Section XI Code specifies that a volumetric or surface examination be performed when RPV studs are removed. Code Case N-307-3 was developed to allow similar provisions for earlier editions of the Code. The only difference is the surface examination may be eliminated when performing volumetric examinations from the end of the stud or from the center-drilled hole. Changing the examination requirements to a volumetric examination only reduces the necessary manpower and is consistent with the as low as reasonably achievable (ALARA) principle. Typically, extensive cleaning of the heavy and contaminated studs is required prior to the fluorescent magnetic particle (MT) examinations, which creates logistic problems. Performing only a volumetric (UT) examination does not require extensive cleaning and does not generally create logistic problems. To perform the volumetric examination, only one end of the stud is required to be accessible and the total preparation and examination time is reduced by a factor of 10.

### 3.2.5 NRC Staff Evaluation

In lieu of the examination requirements of Section XI, Figure IWB-2500-12, Item B6.30, Code Case N-307-3 reduces the examination volume to that of a volumetric cylinder 1/4" deep from the root of the threads. The root of the threads are stress risers and preferred sites for crack initiation. Cracks at the root of the threads would be perpendicular to straight beam UT performed from the stud ends, and the cracks would create a corner trap for angle beam UT examinations performed from a center hole in the stud. The capabilities of a UT examination finding cracks in a stud is demonstrated through procedure and personnel qualifications. These are performance-based qualifications according to the requirements of Section XI, Appendix VIII, Supplement 8.

In lieu of the examination requirements of Section XI, Table IWB-2500-1, Item B6.30, Code Case N-307-3 eliminates surface examination of the RPV closure stud when removed. The function of UT examination is to find cracks in the stud volume. These cracks, if they exist, initiate from the surface. The function of the surface examination is to find cracks on the surface. Performing both volumetric and surface examinations on a stud duplicates the intent of the examinations which is to find cracks. Of the two nondestructive examination methods, surface examinations are tedious and subjective, and performance-based UT provides demonstrated assurances for finding cracks. Therefore, elimination of the surface examination does not diminish the effectiveness in detecting cracks.

Code Case N-307-3, was developed through a consensus building process. The NRC, through its normal participation in the ASME committee process, participated in this process through which it expressed the staff's opinion and support.

### 3.2.6 Summary

Based on the above information, the NRC staff has concluded that the proposed alternative (ISIR-12) to reduce the ultrasonic testing volume, and eliminate the surface examination will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the proposed alternative (ISIR-12) is authorized for the third 10-year ISI interval.

## 3.3 Inservice Inspection Program Alternative Request ISIR-13 Use Of Code Case N-627, for Pressure Retaining Bolting Greater than 2 inches in Diameter

### 3.3.1 Components for Which Relief is Requested

Class 1 reactor pressure vessel closure head nuts.

### 3.3.2 ASME Code Requirement from Which Relief is Requested

ASME Code, Section XI, 1989 Edition, "Rules for Inservice Inspection of Nuclear Plant Components," Table IWB-2500-1, Examination Category B-G-1, Reactor Vessel, Item No. B6.10, closure head nuts, requires a surface examination of all closure head nuts each interval.

### 3.3.3 Content of the Relief Request

Relief is requested to conduct a VT-1 visual inspection in lieu of the surface examinations of RPV closure head nuts as required by the 1989 Edition of ASME Code, Section XI, Table IWB-2500-1, Code Category B-G-1, Item No. B6.10.

### 3.3.4 Basis for Requesting Relief and Justification for Granting Relief

The licensee states that only the outside surface of the RPV closure head nuts is readily available for surface examination. The inside of the nuts is difficult to clean for either liquid penetrant or magnetic particle examination. It is also possible that pooling of the liquid penetrant or magnetic particles can occur because the nut must be placed on its side for examination. The licensee also stated that damage could occur to the nuts during handling due to the weight of the nuts and the difficulty of moving them.



The 1989 Edition of ASME Code, Section XI, does not provide acceptance criteria for Examination Category B-G-1 surface flaws found during the examinations. Beginning with the 1989 Addenda of ASME Code, Section XI, the examination requirement for RPV closure head nuts was changed from a surface examination to a visual VT-1 examination. In addition, the acceptance standards of IWB-3517 were adopted, which is the same standard for B-G-2 bolting. This examination technique and acceptance standard has not been changed in later editions of the Code.

The 1995 Edition of ASME Code, Section XI, with Addenda through 1996 includes a requirement to perform a VT-1 on RPV nuts instead of a surface examination. This Code edition and addenda have been approved for use in the latest revision to 10 CFR 50.55a.

### 3.3.5 Proposed Alternative Examination

The licensee proposes to use the alternative requirements of ASME Code Case N-627, "Visual Examination in Lieu of Surface Examination for RPV Closure Head Nuts, Section XI, Division 1."

The acceptance criteria of the 1995 Edition with Addenda through 1996, IWB-3517, will be used for the evaluation of the indications noted during examinations.

### 3.3.6 NRC Staff Evaluation

The examination requirement for RPV closure head nuts was changed from a surface examination to a VT-1 examination in the 1989 Addenda of ASME Code, Section XI. This change to the Code has been retained in later editions of the Code. There were two major reasons for making this change. The first reason is that the closure head nuts were susceptible to damage as a result of handling during the surface examination. The second reason was that due to the way that nuts are loaded (the threads are in compression), they are not susceptible to primary water stress corrosion cracking (PWSCC). The purpose of the surface examination is to identify evidence of PWSCC. The NRC staff is not aware of any occurrences of PWSCC in any kind of nuts. Therefore, performance of a VT-1 visual examination in lieu of a surface examination will provide adequate assurance of structural integrity of the RPV closure head nuts, while at the same time, eliminate the likelihood of damage associated with handling during a surface examination.

### 3.3.7 Summary

Based on the above evaluation, the NRC staff concludes that the use of ASME Code Case N-627 with the VT-1 examination requirements of the 1995 Edition of ASME Code, Section XI, Paragraph IWA-3517, provides an acceptable level of quality and safety for examination of the RPV closure head nuts. Therefore, the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the third ISI interval at D. C. Cook Units 1 and 2.

## 4.0 CONCLUSION

The NRC staff has concluded, based on the considerations discussed above, that there is reasonable assurance that the health and safety of the public will not be endangered by implementation of the proposed alternatives, and that such activities will be conducted in

compliance with the Commission's regulations, therefore, Relief Requests ISIR-11, ISIR-12 and ISIR-13 are authorized. All other ASME Code, Section XI requirements for which relief was not specifically requested and approved remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: John Stang

Date: April 2, 2003