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AEP
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April 13, 2004

AEP:NRC:4520-01
10 CFR 50.90

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O-P1-17
Washington, DC 20555-0001

SUBJECT: Donald C. Cook Nuclear Plant Units 1 and 2
Docket Nos. 50-315 and 50-316
License Amendment Request to Use Yield Strength Determined From Measured Material Properties for Reinforcing Bar in Structural Calculations for Control Rod Drive Missile Shields

Dear Sir or Madam:

Pursuant to 10 CFR 50.90, Indiana Michigan Power Company (I&M), the licensee for Donald C. Cook Nuclear Plant (CNP) Units 1 and 2, proposes to amend Facility Operating Licenses DPR-58 and DPR-74. I&M requests review and approval, pursuant to 10 CFR 50.59(c)(2)(viii), of a change to the CNP licensing basis as described in the CNP Updated Final Safety Analysis Report (UFSAR). The change allows the use of a reinforcing bar (rebar) yield strength value based on measured material properties, as documented in I&M rebar acceptance tests, in control rod drive missile shield (missile shield) structural calculations.

During the period between September 1997 and December 2000, I&M performed a reanalysis of the CNP containment structures. The Nuclear Regulatory Commission (NRC) subsequently reviewed the reanalysis and concluded that, with the exception of the missile shields, I&M used acceptable methods and appropriate assumptions and design parameters. In Reference 1, I&M informed the NRC that structural calculations for the missile shields used conservative yield strength values based on measured material properties as documented in certified mill test reports (CMTRs). The safety factors used in the structural calculations were consistent with the CNP licensing basis. Therefore, the safety margins in the missile shield design were unaffected. This methodology was incorporated into the CNP UFSAR under the provisions of 10 CFR 50.59 for use on a case by case basis.

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In Reference 2, the NRC staff stated that they had reasonable assurance that the missile shields will perform their intended function. However, the NRC staff concluded that the use of the CMTR rebar yield strength, in lieu of code specified material properties, in the structural calculations for the missile shields was not an acceptable method to restore the original design and licensing basis requirements and margins. In Reference 3, I&M informed the NRC it would submit a license amendment requesting NRC approval to allow the use of missile shield rebar strength based on material test data.

By letter dated November 12, 2003, I&M submitted a license amendment request (Reference 4) to allow the use of CMTR data for the missile shield structural calculation. Subsequently, in late February, 2004, I&M identified an NRC memorandum that provided additional information about the NRC's concern with the use of CMTR data (Reference 5). I&M withdrew that license amendment request (Reference 6) and committed to submit another license amendment request that includes data from acceptance tests performed when rebar was delivered to the site during original plant construction. This request for license amendment satisfies that commitment.

Enclosure 1 provides an affirmation statement pertaining to this letter. Enclosure 2 provides I&M's evaluation of the submitted change. Attachment 1 to this letter provides the rebar procurement specification.

Attachment 2 to this letter provides the rebar strength calculation. The calculation contains a chronology of the missile shield construction, drawings showing the location of the rebar, the CMTR data and the I&M acceptance test data, and a statistical evaluation of the data to determine an appropriate yield strength of the rebar that was used in the missile shields. Attachment 4 of this calculation is a copyrighted article, and a non-copyrighted abstract of the article has been substituted.

Copies of this letter and its attachments are being transmitted to the Michigan Public Service Commission and Michigan Department of Environmental Quality in accordance with the requirements of 10 CFR 50.91.

This letter contains no new commitments. Should you have any questions, please contact Mr. John A. Zwolinski, Director of Design Engineering and Regulatory Affairs, at (269) 697-5007.

Sincerely,

M. K. Nazar
Senior Vice President and Chief Nuclear Officer

RV/rdw

References:

1. Letter from Scot A. Greenlee, I&M, to NRC Document Control Desk, "Donald C. Cook Nuclear Plant Units 1 and 2, Response to Nuclear Regulatory Commission Request for Additional Information Regarding Containment Structure Conformance to Design Basis Requirements (TAC Nos. MB3603 and MB3604)," AEP:NRC:2520, dated July 16, 2002.

2. Letter from John F. Stang, NRC, to A. Christopher Bakken, III, I&M, "Donald C. Cook Nuclear Plant, Units 1 and 2 – Regarding Containment Structure Conformance to Design and Licensing Basis Requirements," dated March 21, 2003.

3. Letter from J. B. Giessner, I&M, to NRC Document Control Desk, "Donald C. Cook Nuclear Plant Units 1 and 2, Containment Structure Conformance to Design and Licensing Basis Requirements," AEP:NRC:3520, dated April 24, 2003.

4. Letter from M. K. Nazar, I&M, to NRC Document Control Desk "Donald C. Cook Nuclear Plant Units 1 and 2, Docket Nos. 50-315 and 50-316, License Amendment Request to Use Yield Strength Determined From Measured Material Properties for Reinforcing Bar in Structural Calculations for Control Rod Drive Missile Shield," AEP:NRC:3520-01, dated November 12, 2003.

5. Memorandum from L. B. Marsh, NRC, to G. E. Grant, NRC, "Donald C. Cook Nuclear Plant, Units 1 and 2 – Response to Task Interfaces Agreement (TIA 2001-15) Regarding Evaluation of Containment Structure Conformance to Design-

Basis Requirements (TAC NOS. MB3603 and MB3604)," dated January 13, 2003.

6. Letter from J. A. Zwolinski, I&M, to NRC Document Control Desk, "Donald C. Cook Nuclear Plant Units 1 and 2, Docket Nos. 50-315 and 50-316, Withdrawal of License Amendment Request to Use Yield Strength Determined From Measured Material Properties for Reinforcing Bar in Structural Calculations for Control Rod Drive Missile Shield," AEP:NRC:4520, dated March 2, 2004.

Enclosures:

1. Affirmation
2. Evaluation of the Proposed Change

Attachments:

1. Specification DCC CE 107 QCS, Revision 3, Reinforcing Steel Specifications
2. Calculation SD-040303-001, Revision 0, Unit 1 & 2 Control Rod Drive Missile Shield Reinforcing Steel Yield Strength

c: J. L. Caldwell, NRC Region III
K. D. Curry, Ft. Wayne AEP, w/o enclosures/attachments
J. T. King, MPSC, w/o enclosures/attachments
MDEQ – WHMD/HWRPS, w/o enclosures/attachments
NRC Resident Inspector
J. F. Stang, Jr., NRC Washington, DC

Enclosure 1 to AEP:NRC:4520-01

AFFIRMATION

I, Mano K. Nazar, being duly sworn, state that I am Senior Vice President and Chief Nuclear Officer of American Electric Power Service Corporation and Vice President of Indiana Michigan Power Company (I&M), that I am authorized to sign and file this request with the Nuclear Regulatory Commission on behalf of I&M, and that the statements made and the matters set forth herein pertaining to I&M are true and correct to the best of my knowledge, information, and belief.

American Electric Power Service Corporation

M. K. Nazar
Senior Vice President and Chief Nuclear Officer

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 13th DAY OF April, 2004

Notary Public

BRIDGET TAYLOR
Notary Public, Berrien County, MI
My Commission Expires Jun. 10, 2007

My Commission Expires 6/10/2007

Enclosure 2 to AEP:NRC:4520-01

Evaluation of the Proposed Change

References for this attachment are identified in Section 7.

1.0 DESCRIPTION

Indiana Michigan Power Company (I&M), the licensee for Donald C. Cook Nuclear Plant (CNP) Units 1 and 2, proposes to amend Facility Operating Licenses DPR-58 and DPR-74. I&M requests review and approval, pursuant to 10 CFR 50.59(c)(2)(viii), of a change to the CNP licensing basis as described in the CNP Updated Final Safety Analysis Report (UFSAR). The change allows the use of a reinforcing bar (rebar) yield strength value based on measured material properties, as documented in I&M rebar acceptance tests, in control rod drive missile shield (missile shield) structural calculations.

2.0 PROPOSED CHANGE

I&M proposes the addition of the following statement to UFSAR Section 5.2.3.

> "Additionally, as-tested reinforcing bar strength was utilized for the determination of design structural capacity in bending, for the control rod drive missile shields."

The proposed change will allow the use of actual rebar yield strength, based on properly substantiated data, in the missile shield calculation.

3.0 BACKGROUND

During the period between September 1997 and December 2000, I&M performed a reanalysis of the CNP containment structures, including the missile shields. The missile shield reanalysis was performed using relevant design code provisions that I&M interpreted as allowing the use of measured yield strength, as documented in certified mill test reports (CMTRs), to accommodate the calculated loads with required safety factors.

The Nuclear Regulatory Commission (NRC) subsequently performed a detailed review of the methods and calculations used for the reanalysis and performed a design audit in January, 2002 (Reference 1). Based on the results of their review and audit, as augmented by a request for additional information (Reference 2) and I&M's responses (References 3 and 4), the NRC staff concluded that, with the exception of the missile shields, I&M used acceptable methods and appropriate assumptions and design parameters in the containment structures reanalysis.

In Reference 1, the NRC staff stated that they had reasonable assurance that the missile shields above the upper reactor cavity will perform their intended function. However, the NRC staff concluded that the use of the CMTR rebar yield strength, in lieu of code specified material properties, in the structural calculations for the missile shields was not an acceptable method to restore the original design and licensing basis requirements and margins. In Reference 5, I&M

informed the NRC it would submit a license amendment requesting NRC approval of the use of CMTR data for the missile shield structural calculation.

I&M submitted a license amendment request to allow the use of CMTR data for missile shield structural calculations (Reference 6). Subsequently, in late February, 2004, I&M identified an NRC memorandum (Reference 7) that provided details of the NRC's concern with the use of CMTR data, and I&M withdrew that license amendment request (Reference 8). In withdrawing the license amendment request, I&M committed to submit another license amendment request that uses I&M's rebar acceptance test data to support the requested change. This amendment satisfies that commitment.

4.0 TECHNICAL ANALYSIS

The missile shields are removable concrete structures that form the portion of the operating deck located above the reactor cavity. The operating deck is a part of the divider barrier that separates the lower containment from the upper containment. Following a loss-of-coolant accident, a steam line break, or a feedwater line break, the divider barrier prevents the steam released during the accident from bypassing the ice condenser.

The design of the concrete structures at CNP was performed in accordance with American Concrete Institute (ACI) 318-63, "Building Code for Reinforced Concrete." ACI 318-63 defines rebar yield strength as "Specified minimum yield strength or yield point of reinforcement in pounds per square inch. Yield strength or yield point shall be determined in tension according to applicable American Society for Testing and Materials (ASTM) specifications." For CNP, the applicable ASTM specification for reinforcing steel is ASTM A 615-68. Based on this definition, I&M believed that the use of CMTR yield strength for rebar was allowed by the CNP design basis.

ACI 318-63 does not provide specific guidance on evaluation of existing concrete structures. However, later editions of relevant concrete codes do have provisions for such evaluations. ACI 318-95, "Building Code Requirements for Structural Concrete," and ACI 349-01, "Code Requirements for Nuclear Safety Related Concrete Structures" both provide guidance on strength evaluations of existing structures. Section 20 of both ACI 318-95 and ACI 349-01 discusses "Strength Evaluation of Existing Structures," and Section 20.2.4 states, "If required, reinforcement or tendon strength shall be based on tensile tests of representative samples of the material in the structure in question." This confirms the applicability of measured yield strength to nuclear applications.

Reference 7 contains a review performed by the NRC of I&M's use of test data for rebar strength in the ice condenser end wall calculation and noted that the reinforcing steel procurement specification requires that ". . . (1) the buyer (licensee) shall be provided with CMTRs for each heat of steel by the supplier in accordance with American Society for Testing and Materials (ASTM) A 615-68 specification, and (2) in addition, the buyer will have independent tests

performed to confirm compliance with ASTM A 615-68 for tensile, yield point, and percent elongation for each heat." Reference 7 further states, "During the audit, the licensee provided certified test results as discussed above that were performed by Calumet Steel (the supplier) to certify that the rebar meets minimum guaranteed yield strength of 40 ksi [40,000 pounds per square inch]. However, documentation of the "check" tests performed by the licensee's laboratory was not available. The use of limited test data (total of three, one from each heat) although adequate for demonstrating that rebar meets the original licensing basis minimum design strength of 40 ksi, is not justified to support a higher yield strength in support of revision to the licensing basis ... ." The ice condenser end walls were subsequently shown to meet design basis capacity without reliance on rebar yield strength determined from test data (Reference 4).

The discussion contained in Reference 7 for the missile shields presented a similar basis for not accepting rebar strength determined from test data. Reference 7 notes, "For each heat, only one yield strength test value is provided. The licensee used rebar yield strength of 50.6 ksi to determine the moment capacity of the missile shield. The NRR [Nuclear Reactor Regulation] staff's initial review does not consider the use of very limited test data to support higher yield strength values for the installed rebar to be an adequate justification for revising the licensing basis and, is therefore, unacceptable. . . . Furthermore, the licensee did not provide any testing data that was obtained from the tension tests performed on a rebar that has been used in the missile shield structure at CNP. Therefore, the licensee's use of a revised yield strength of 50.6 ksi, which is about 26% higher than the code required minimum guaranteed design-basis yield strength of 40 ksi, for the missile shield structure is unacceptable."

As stated in the Reference 7 discussion of the ice condenser end wall, and as discussed in Chapter 5 of the CNP UFSAR, in order to assure that reinforcing steel met appropriate specifications, I&M required that samples of rebar delivered to CNP be selected and tested to confirm compliance with the specified physical requirements and for certification of mill test reports (Attachment 1). Two specimens were taken for each heat of material. The I&M Concrete Reinforcement Bar Test Reports recorded two yield points and two tensile loads for each heat, which are divided by the nominal area of the bar (as given in ASTM A 615-68) to determine tensile strength and yield point in pounds per square inch (psi). This confirmatory rebar test data was not previously submitted to the NRC because I&M believed that the CMTR tensile test data provided appropriate justification for rebar strength beyond 40 ksi. This belief was based on the definition of yield strength given in ACI 318-63.

Rebar received at CNP during construction is traceable to specific locations in the plant via Mark Numbers, and by "How to be Used" notes on the Material Receipts. The rebar used in the missile shields' construction have been traced to their respective heats. Test data from both the steel manufacturer and from site acceptance testing for each of these heats is summarized in Table 1. As noted previously, two site acceptance tests were performed following receipt of material at the site for each heat. The samples were tested in accordance with the pertinent provisions of ASTM A 615-68 for tensile strength, yield point, and percent elongation.

I&M has calculated that the capability of the missile shields to withstand the bending moment imposed by a bounding 50 psi loss-of-coolant accident pressure differential, with a load factor (multiplier on pressure) of 1.5, can be achieved with a rebar yield strength of 46.5 ksi. I&M has evaluated the number 8 and number 11 rebar yield strength considering the site acceptance data, and determined a representative rebar strength value of 47,800 psi (47.8 ksi) for the rebar credited in the bending moment capacity of the missile shield structural calculation. The determination was limited to number 8 and number 11 rebar (number 5 rebar was also used in the missile shields) because only the number 8 and number 11 rebar are subjected to bending. Additionally, the test data together with an industry paper ("Variability of Mechanical Properties of Reinforcing Bars," American Society of Civil Engineers Journal of the Structural Division, May 1979) lead to the conclusion that number 5 rebar has a higher yield strength value than number 8 and number 11. The data for the number 5 rebar were therefore excluded from the analysis. The calculation that analyzed the material test data and determined the appropriate rebar yield strength value is provided in Attachment 2.

Since this rebar yield strength value of 47.8 ksi based on actual material test data exceeds the required strength of 46.5 ksi, the missile shields meet design basis capacity requirements when the measured material properties from representative samples of the structure are considered.

5.0 REGULATORY SAFETY ANALYSIS

5.1 No Significant Hazards Consideration

Indiana Michigan Power Company (I&M) has evaluated whether a significant hazards consideration is involved with the use of yield strengths in structural calculations for the missile shields based on measured material properties as documented in I&M reinforcing bar (rebar) acceptance tests. The I&M evaluation was performed by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of Amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability of occurrence or consequences of an accident previously evaluated?

Response: No

Probability of Occurrence of an Accident Previously Evaluated

This is a change in the method of determining the acceptability of accommodating the pressure load following a loss-of-coolant accident. No physical changes are being made to the plant and no potential accident initiators are introduced by this change. Thus, the probability of the occurrence of any accident previously evaluated is not significantly increased.

Consequences of an Accident Previously Evaluated

There is reasonable assurance that the ability of control rod drive missile shields (missile shields) to maintain their structural capability and continue to function as a part of the divider barrier separating the lower containment from the upper containment is not impacted by this change. The data obtained from rebar acceptance test reports demonstrate that the missile shields have adequate strength to accommodate the load that would be imposed under assumed accident conditions. As a result, the consequences of any accident previously evaluated are not significantly increased.

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No

The use of increased missile shield rebar yield strength for the missile shield structural capability under accident conditions does not alter the evaluation of the missile shields' structural capability during normal operation, the operational condition in which a new or different kind of accident would be initiated. The change does not physically alter plant components nor does it alter plant operation. The change does not adversely affect current system interfaces or create new interfaces that could result in an accident or malfunction of a different kind than previously evaluated.

Therefore, the proposed changes do not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

Response: No

The margin of safety for the missile shields is provided by the factors that are applied to the individual loads determining the load imposed on the missile shields under accident conditions. These code safety factors are sufficient to ensure that both anticipated and unanticipated loads can be withstood by the concrete structures. The use of yield strengths based on measured material properties as documented in the I&M rebar acceptance tests for the missile shield structural evaluation has no effect on the margin of safety provided by the load safety factors. I&M continues to use the same load factors that were used to license the Donald C. Cook Nuclear Plant.

Therefore, the proposed change does not involve a significant reduction in the margin of safety.

In summary, based upon the above evaluation, I&M has concluded that the proposed amendment involves no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements/Criteria

The following criterion, which is contained in Updated Final Safety Analysis Report Section 1.4.1, is applicable to the missile shields:

> "Those structures, systems and components of reactor facilities which are essential to the prevention, or the mitigation of the consequences, of nuclear accidents which could cause undue risk to the health and safety of the public shall be identified and then designed, fabricated, and erected to quality standards that reflect the importance of the safety function to be performed."

The missile shields will continue to meet applicable code requirements, thereby satisfying this criterion.

Based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Nuclear Regulatory Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

6.0 ENVIRONMENTAL CONSIDERATIONS

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

7.0 REFERENCES

1. Letter from John F. Stang, NRC, to A. Christopher Bakken III, I&M, "Donald C. Cook Nuclear Plant, Units 1 and 2 – Regarding Containment Structure Conformance to Design and Licensing Basis Requirements," dated March 21, 2003.

2. Letter from John F. Stang, NRC, to A. Christopher Bakken III, I&M, "Donald C. Cook Nuclear Plant, Units 1 and 2 – Request for Additional Information Regarding Containment Structure Conformance to Design-Basis Requirements (TAC Nos. MB3603 and MB3604)," dated May 31, 2002.

3. Letter from S. A. Greenlee, I&M, to NRC Document Control Desk, "Response to Nuclear Regulatory Commission Request for Additional Information Regarding Containment Structure Conformance to Design Basis Requirements (TAC Nos. MB3603 and MB3604)," AEP:NRC:2520, dated July 16, 2002.

4. Letter from S. A. Greenlee, I&M, to NRC Document Control Desk, "Donald C. Cook Nuclear Plant Units 1 and 2, Supplement to Nuclear Regulatory Commission Request for Additional Information Regarding Containment Structure Conformance to Design Basis Requirements (TAC Nos. MB3603 and MB3604)," AEP:NRC:2520-01, dated August 3, 2002.

5. Letter from J. B. Giessner, I&M, to NRC Document Control Desk, "Donald C. Cook Nuclear Plant Units 1 and 2, Containment Structure Conformance to Design and Licensing Basis Requirements," AEP:NRC:3520, dated April 24, 2003.

6. Letter from M. K. Nazar, I&M, to NRC Document Control Desk "Donald C. Cook Nuclear Plant Units 1 and 2, Docket Nos. 50-315 and 50-316, License Amendment Request to Use Yield Strength Determined From Measured Material Properties for Reinforcing Bar in Structural Calculations for Control Rod Drive Missile Shield," AEP:NRC:3520-01, dated November 12, 2003.

7. Memorandum from L. B. Marsh, NRC, to G. E. Grant, NRC, "Donald C. Cook Nuclear Plant, Units 1 and 2 – Response to Task Interfaces Agreement (TIA 2001-15) Regarding Evaluation of Containment Structure Conformance to Design-Basis Requirements (TAC NOS. MB3603 and MB3604)," dated January 13, 2003.

8. Letter from J. A. Zwolinski, I&M, to NRC Document Control Desk, "Donald C. Cook Nuclear Plant Units 1 and 2, Docket Nos. 50-315 and 50-316, Withdrawal of License Amendment Request to Use Yield Strength Determined From Measured Material Properties for Reinforcing Bar in Structural Calculations for Control Rod Drive Missile Shield," AEP:NRC:4520, dated March 2, 2004.

Table 1
Summary of Tensile Testing for Rebar Used in Control Rod Drive Missile Shields

Unit 1 Heat No.	Bar Size	Yield Point from CMTR, psi	Tensile Strength from CMTR, psi	Yield Point from I&M Site Bar Test Report, psi	Tensile Strength from I&M Site Bar Test Report, psi
C34105	#11	53,205	89,423	50,897 52,115	84,679 84,743
B37160	#11	54,487	83,333	51,025 50,833	85,320 82,948
C35157*	#8	57,468	85,316	51,265 50,759	81,645 82,278
Unit 2 Heat No.	Bar Size	Yield Point from CMTR, psi	Tensile Strength from CMTR, psi	Yield Point from I&M Site Bar Test Report, psi	Tensile Strength from I&M Site Bar Test Report, psi
B36171	#11	54,487	89,423	52,115 52,692	88,717 91,730
A37151	#11	50,641	84,615	50,448 50,192	80,961 81,282
B37340	#11	51,602	83,012	52,179 49,487	87,948 80,256
A36334	#11	55,769	85,576	50,384 49,935	82,307 83,589
C35157*	#8	57,468	85,316	51,265 50,759	81,645 82,278

*Note: Heat C35157 is used in the missile shields of both Unit 1 and Unit 2