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U. S. Nuclear Regulatory Commission  
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Washington, D.C. 20555-0001

Donald C. Cook Nuclear Plant Units 1 and 2  
RESOLUTION OF CONTAINMENT STRUCTURAL ISSUES

Reference: Letter from M. W. Rencheck (I&M) to NRC Document Control Desk, transmitting Licensee Event Report 316/2000-003-00, "Containment Internal Concrete Structures Do Not Meet Design Load Margins," dated June 28, 2000.

Indiana Michigan Power Company (I&M), the Licensee for Donald C. Cook Nuclear Plant (CNP) Units 1 and 2, is providing a description of actions taken and planned to address a condition in which certain internal containment structural elements did not meet the design load margins as described in the plant's licensing basis, as a result of completing simplistic conservative evaluations of these structures. This condition was discussed with the Nuclear Regulatory Commission (NRC) Staff in two public meetings and reported to the NRC in the referenced letter, which includes commitments for I&M to take certain actions specific to Unit 1 and establish a plan and schedule for long-term corrective and preventive actions.

This letter describes the extensive reviews of containment internal structures that have been completed and documents the final course and schedule for long-term corrective and preventive actions, consistent with the commitments contained in the referenced letter and as described in public meetings. This letter summarizes the actions taken to ensure operability of containment structures prior to restart of either CNP unit. Prior to the restart of CNP Unit 2, conservative, simplified evaluations were performed to demonstrate that the Unit 2 containment structures were operable. Additional conservative evaluations, analyses, and calculations are being performed to demonstrate the Unit 1 containment structures are operable prior to the restart of Unit 1.

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I&M is currently performing refined analyses of the containment structures in parallel with the Unit 1 operability evaluations to obtain a timely and final resolution of these issues. In addition to documenting actions completed to date, this letter contains I&M's commitments to complete actions needed to bring these issues to final resolution, i.e., to demonstrate that these structures conform with their licensing basis. Attachment 1 to this letter addresses I&M's commitments made in the referenced letter. Attachment 2 contains a list of additional commitments contained in this letter.

Should you have any questions, please contact Mr. Wayne J. Kropp, Director of Regulatory Affairs, at (616) 697-5056.

Sincerely,

M. W. Rencheck  
Vice President Nuclear Engineering

/jen

Attachments

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J. F. Stang, Jr., NRC - Washington, DC  
R. K. Temple, Hopkins & Sutter

## ATTACHMENT 1 TO C1000-05

### RESOLUTION OF CONTAINMENT ISSUES

#### A. Background

As described during the June 1, 2000, and September 27, 2000, public meetings, significant reviews of Donald C. Cook Nuclear Plant (CNP) Unit 2 and Unit 1 containment internal structures have been completed. These reviews identified deficient or missing calculations, which are needed to demonstrate conformance with Updated Final Safety Analysis Report (UFSAR) design requirements, and physical deficiencies with certain containment subcompartment walls. The majority of these issues were initially identified and placed in the CNP corrective action process during the Expanded System Readiness Review (ESRR) that was performed in early 1999. The remainder of these issues were identified through resolution of these items using the corrective action process. Initially, transient mass distribution (TMD) analyses and bounding structural evaluations were performed to address deficient or missing design basis calculations. The TMD analyses, using the design basis methodology, were re-performed with reconstituted and revised input parameters, which yielded revised TMD output pressure loads. The revised TMD analyses outputs were then reviewed to determine their impact on the structural evaluations. It was as a result of reviewing the TMD analysis outputs, in May 2000, that Indiana Michigan Power Company (I&M) personnel identified design pressures impacting certain internal structures inconsistent with design basis margins, that raised an unreviewed safety question regarding the increases in postulated pressure loads.

On May 29, 2000, during an evaluation of concrete structures in the CNP Unit 2 containment, I&M determined that a condition outside the design basis of the plant existed. I&M determined, based upon conservative simplified evaluations, that some containment internal concrete subcompartment structural elements, specifically, certain walls and floors, did not meet the design pressure load factor margin of 1.5 as described in the CNP UFSAR. As explained in the UFSAR, having a design pressure load factor margin of 1.5 means that these structures are expected to be able to withstand, without failure, a fifty percent increase in pressure load above the worst-case pressure postulated in an area. The conservative simplified structural evaluations included the results of revised postulated pressure loads derived from the containment TMD analysis. The input parameters to the TMD analysis, principally related to the physical configuration of the containment, had been conservatively changed yielding revised TMD output pressure loads.

Tracing the reviews of the ice condenser support structure, as an example of the reviews conducted on containment structures generally, demonstrates the process by which specific containment structural issues have been identified. Completing the initial simplified evaluation resulted in marginal capacity in the Unit 2 ice condenser support structure and in less than design basis capacity in the Unit 1 ice condenser support structure. In response to these results, I&M performed a calculation for the Unit 2 ice condenser support structure. This calculation demonstrated that the Unit 2 ice condenser support structure met the design basis capacity requirements with the exception of the steel support columns. Three steel support columns

appeared less than design basis capacity for one load combination, but maintained operability. This simplified calculation demonstrated operability of the Unit 2 ice condenser support structure, so, in parallel, I&M started a highly detailed analysis to determine whether the Unit 1 ice condenser support structure would demonstrate an adequate design basis capacity. In addition, I&M undertook a finite element analysis of the ice condenser floor for independent validation of the analytical results. Both the detailed analysis and the finite element analysis demonstrated the Unit 1 ice condenser floor support structure conformed to its design basis capacity. Although the above example depicts separate calculations being performed for each unit, the majority of the evaluations and/or calculations performed have bounded conditions for both units.

In a public meeting held on June 1, 2000, I&M described its findings related to Unit 2 containment subcompartment walls to members of the Nuclear Regulatory Commission (NRC) Staff. During this meeting, I&M also presented information related to the design and licensing basis for these structures, the current configuration of the structures, including which structures were degraded, and justification for operating the units while the structures were considered to be degraded.

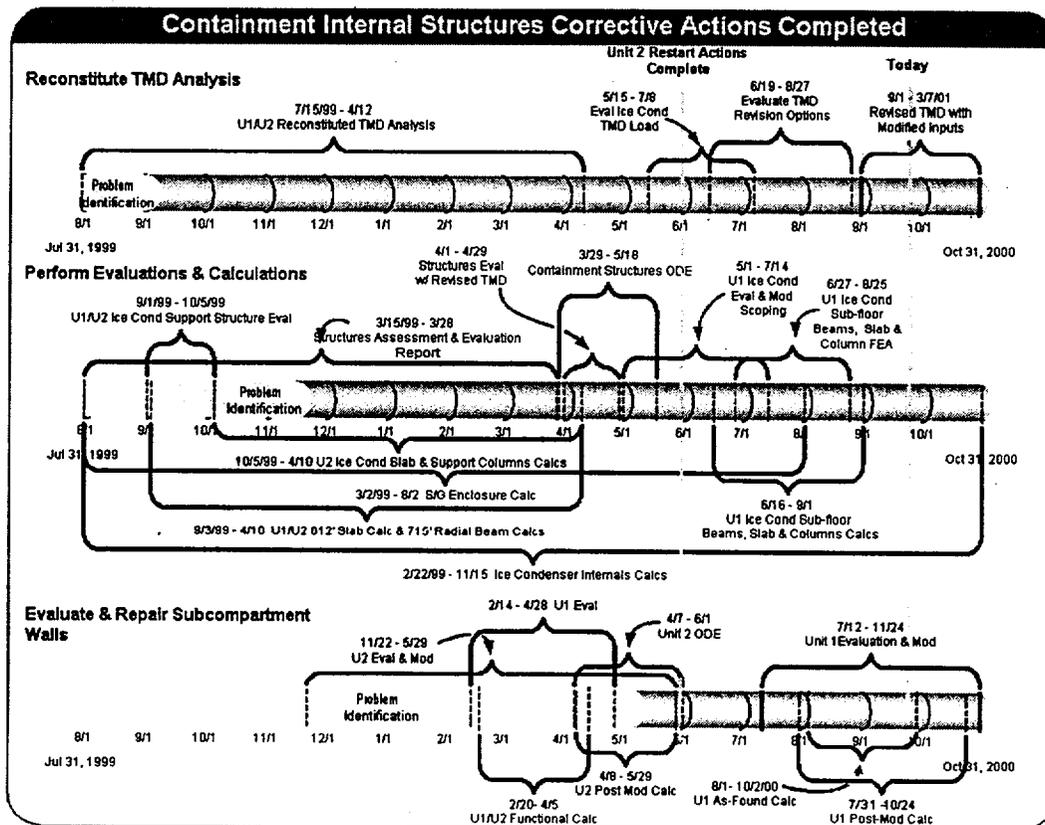
On June 28, 2000, I&M submitted Licensee Event Report (LER) 316/2000-003-00, "Containment Internal Concrete Structures Do Not Meet Design Load Margins," to document the condition in accordance with 10 CFR 50.73(a)(2)(ii)(B) (Reference 1). The LER contains the following two commitments as part of the corrective action:

- "A review of containment internal structures will be performed prior to Unit 1 startup to determine the extent of condition, repairs to structural elements will be made where applicable, and critical calculations will be reconstituted or evaluations performed to document operability of the Unit 1 structures."
- "The final course and schedule for long-term corrective and preventive actions to restore and maintain the design pressure loads factors for the internal containment concrete structure elements in both units will be determined prior to Unit 1 startup."

On September 27, 2000, in a public meeting on containment structures, I&M provided the NRC Staff with a comprehensive description of the containment structural issues found in Units 1 and 2, an update on the status of these issues, including resolution strategies, and the corrective actions implemented and planned. During this meeting, I&M described the activities completed to date for resolution of these issues, including creation of revised inputs to the TMD analyses, bounding structural evaluations, and extensive supporting calculations. Discovery and repair efforts for the Unit 1 containment subcompartment walls were also reviewed. Figure 1, below, a slide used during the September 27<sup>th</sup> public meeting, shows the extensive nature of the corrective actions undertaken to resolve these issues and depicts the numerous parallel analytical efforts being performed.

To ensure timely resolution of these issues, I&M engaged three vendor organizations with expertise in this type of structural analysis, including the reactor vendor, to complete corrective actions in parallel. Actions undertaken to resolve these containment structural issues include reconstituting the existing TMD analyses with new input parameters, using the new analyses results, as they were produced, to complete conservative simplified containment structural evaluations. Since the Unit 1 and Unit 2 containment structures are similar, the majority of the results from containment analyses and evaluations are bounding for both Unit 1 and Unit 2. In the case of the ice condenser floor support structure and the subcompartment walls, these structures are physically different between the units and therefore must be individually evaluated. A summary of this activity is depicted in Figure 1.

Figure 1



As explained below, calculations and evaluations needed to demonstrate that containment structures meet their design basis are scheduled to be completed in May 2001. This letter documents the reviews of containment internal structures that have been completed and describes the final course and schedule for long-term corrective and preventive actions, consistent with the commitments contained in Reference 1. Contained within the subsequent sections of this attachment is a description of the conservative simplified evaluations that have been performed to demonstrate operability of the Unit 2 containment structure and that will be completed to

demonstrate operability of the Unit 1 containment structure. Additionally, the following sections also describe the ongoing parallel activities being performed to facilitate timely final resolution of the remaining containment nonconformance issues.

#### B. Description of Current Conditions

As described during the June 1, 2000, and September 27, 2000, public meetings, significant reviews of Unit 2 and Unit 1 containment internal structures have been completed. These reviews identified deficient or missing calculations, which are needed to demonstrate conformance with UFSAR design requirements, and physical deficiencies with certain containment subcompartment walls. The majority of these issues were initially identified and placed in the CNP corrective action process during the Expanded System Readiness Review (ESRR) that was performed in early 1999. The remainder of these issues were identified through resolution of these items using the corrective action process. Initially, TMD analyses and bounding structural evaluations were performed to address deficient or missing design basis calculations. The TMD analyses, using the design basis methodology, were re-performed with reconstituted and revised input parameters, which yielded revised TMD output pressure loads. The revised TMD analyses outputs were then reviewed to determine their impact on the structural evaluations. It was as a result of reviewing the TMD analysis outputs, in May 2000, that I&M identified design pressures impacting certain internal structures inconsistent with design basis margins, that raised an unreviewed safety question regarding the increases in postulated pressure loads.

Since this time, as displayed in Figure 1 above, I&M has continued to refine the TMD analyses inputs, to perform bounding structural evaluations, and to perform new structural calculations. Continued refinements to TMD analyses inputs and bounding evaluations either demonstrate design basis conformance or help demonstrate that containment internal structures are operable, e.g., design margin of greater than 1.0.

Prior to Unit 2 restart, repairs of the physical deficiencies in certain Unit 2 subcompartment walls were completed. In addition, I&M completed two operability evaluations which address use of revised TMD analyses results, bounding evaluations and calculations, and where applicable, the design pressure load factor margins for specific containment structures. The first Unit 2 operability evaluation broadly addresses the aggregate effects of changes to the analyses and evaluations underlying the majority of containment structures. The second Unit 2 operability evaluation focuses specifically on the operability of certain containment subcompartment walls (walls at Azimuths 54, 126, 234, and 307 that extend horizontally from the crane wall to the containment shell, and vertically from the 612' elevation to the 638' elevation). These operability evaluations, based upon simplified conservative evaluations, conclude that: (1) containment structures are capable of withstanding the predicted pressure loading on structural components without a loss of function; and (2) the containment subcompartment walls have sufficient margin to withstand an increase in pressure load above the worst-case pressure

postulated in the affected areas. As a result, I&M demonstrated operability of the Unit 2 containment structures and subcompartment walls prior to restart of Unit 2.

Subsequent to Unit 2 restart, certain additional bounding evaluations and calculations for both units have been completed, confirming that additional Unit 1 structures meet design basis capacity requirements. Several of the simplified conservative evaluations performed for Unit 2 also bound Unit 1 containment structural elements. Since work remains to assure conformance of certain other structures with their design bases and Unit 1 results now rely on revised TMD outputs, two Unit 1 operability evaluations are being performed. The Unit 1 operability evaluations will be similar to those performed for Unit 2, but will reflect the additional work accomplished during the Unit 1 outage, including more finalized analyses and evaluations.

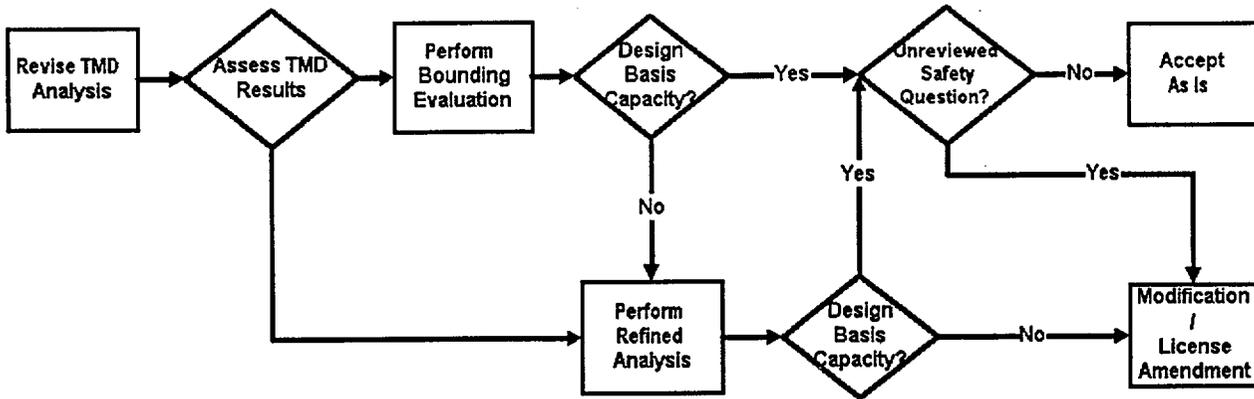
One of these Unit 1 operability evaluations will address the analytical work performed to demonstrate that the majority of the structures are operable despite missing or deficient calculations and TMD loading increases, and physical differences between the units. This operability evaluation will be able to rely on additional owner-accepted calculations and refined analyses completed since the Unit 2 operability evaluation. The second Unit 1 operability evaluation will address both the physical deficiencies identified in certain subcompartment walls and the calculations that are required to demonstrate that design margins for these walls are adequate. Significantly, initial reviews indicate that the Unit 1 walls have more margin than Unit 2 subcompartment walls.

Extent-of-condition reviews to bound the scope of identified deficiencies will be completed prior to restart of Unit 1. These extent-of-condition reviews will consider the scope of physical defects and implications of design deficiencies identified within the CNP containments. Completion of the Unit 1 operability evaluations, which will be finalized once the extent-of-condition reviews are done, is the final action needed to address the commitment in Reference 1 to document operability of the Unit 1 containment internal structures prior to Unit 1 startup.

### C. Plan and Schedule

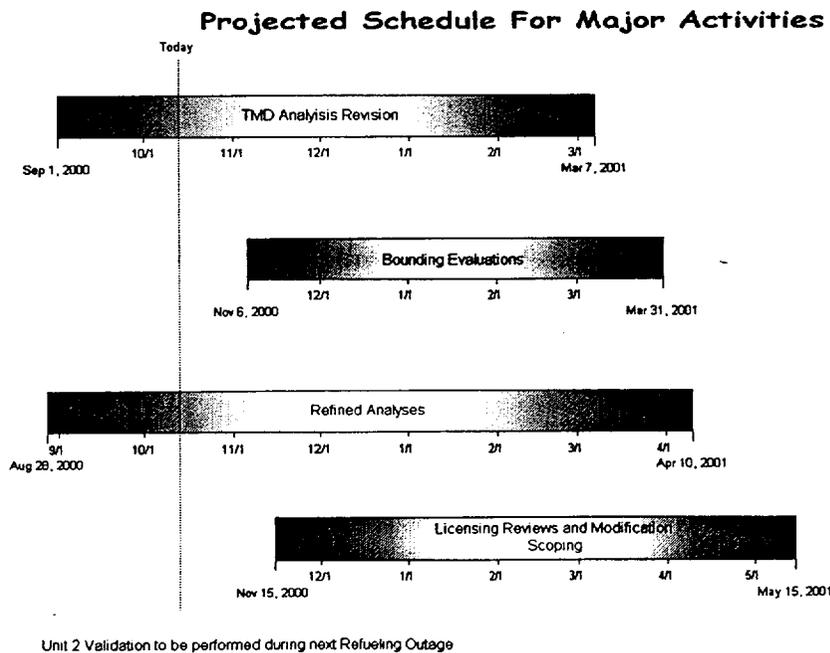
I&M has been taking a series of comprehensive iterative actions to address its findings in containment structures. To put the results achieved, and displayed in Figure 1, into perspective, we have reduced our problem resolution process to a flowchart shown in Figure 2, below. It is important to note that each of these steps has been or is being performed on the containment internal structures in parallel as shown in Figure 3. For example, the finite element analyses for the Unit 1 subcompartment walls and the Unit 2 subcompartment walls are currently being performed. The preliminary results from both of these finite element analyses indicate additional capacity is resident within the current configuration of the walls and preliminarily indicating the subcompartment walls in both units will achieve design basis capacity. Additionally, the TMD input parameters for these subcompartments are being validated through the performance of as-built walkdowns. The walkdown results will be used to refine the conservative inputs previously used.

Figure 2



As stated during the September 27<sup>th</sup> public meeting, I&M has developed a plan containing a final course and schedule for long-term corrective and preventive actions to resolve the containment structure issues for both CNP units, and actions to confirm that the structures meet UFSAR design basis requirements, including design pressure load factors for the internal containment concrete structural elements. As shown in Figure 3 below, the plan includes four major steps (categories of related activities), which are depicted following the figure.

Figure 3



### TMD Analyses Revision Confirmation

The primary TMD analyses inputs are containment structure physical parameters (subcompartment volumes, flow areas, and flow paths) and mass/energy release information. During the recent dual-unit outage, selected inputs were conservatively reconstituted and the TMD analyses were revised to reflect the reconstituted inputs. This plan step is to develop realistic TMD inputs for cases where over-conservatism may have caused over-prediction of certain subcompartment pressures. In other cases, the conservative input assumptions will preclude the need for additional validation. Prior to completing the evaluation of the containment structures against design basis requirements, additional TMD inputs will be reconfirmed or refined, as required.

### Bounding Structural Evaluations

The subcompartment pressures obtained from the revised TMD analyses described above will be assessed following confirmation, using bounding structural evaluations to determine whether containment internal structures conform with design basis requirements. The bounding evaluations will use conservative, simplified analysis techniques. If the bounding evaluations do not confirm consistency with the design basis, a refined analysis will be performed as described below, or a physical plant modification or appropriate licensing action will be implemented.

### Refined Structural Analyses

Refined structural analyses will be performed for those portions of the structure impacted by increased subcompartment pressures and, as necessary, those portions of the structure that are determined to be inconsistent with the design basis using bounding evaluations. These refined structural analyses will use more sophisticated modeling tools to evaluate the containment structures against design basis requirements.

### Licensing Actions and Modifications

I&M anticipates that confirmation of the TMD analyses, bounding evaluations, and the refined analyses will confirm that the structures meet design basis requirements. If the structures do not meet design basis requirements, physical plant modifications or license amendments will be pursued as appropriate. I&M will develop appropriate licensing submittals for any new analytical techniques or reductions in margin that require NRC approval and are needed to demonstrate design basis conformance.

The steps in this plan are scheduled to be completed by May 15, 2001, with the exception of validating Unit 2 physical parameters that are inaccessible until the next scheduled Unit 2 refueling outage.

#### D. Conclusion

I&M conservatively demonstrated, using simplified structural evaluations, that containment structures had margin for safe operation before restarting Unit 2. I&M is using results from Unit 2 and additional refined analyses to ensure that the containment structures have margin for safe operation before restarting Unit 1. The actions described in this section complete the commitment in Reference 1 to determine the plan and schedule for long-term corrective and preventive actions. The actions under way will ensure design basis conformance is restored and the extent-of-condition is addressed.

- Reference: 1. Letter from M. W. Rencheck (I&M) to NRC Document Control Desk, Licensee Event Report 316/2000-003-00, "Containment Internal Concrete Structures Do Not Meet Design Load Margins," dated June 28, 2000.

ATTACHMENT 2 TO C1000-05

COMMITMENTS

The following identifies those actions committed to by Indiana Michigan Power Company (I&M) in this submittal. Other actions discussed in this submittal represent intended or planned actions by I&M. They are described to the Nuclear Regulatory Commission (NRC) for the NRC's information and are not regulatory commitments.

Commitment	Due Date
I&M will complete calculations and evaluations to demonstrate that Unit 1 containment structures meet their design basis requirements as described in Attachment 1 to this letter.	May 15, 2001
I&M will complete calculations and evaluations to demonstrate that Unit 2 containment structures meet their design basis requirements as described in Attachment 1 to this letter, subject to validation of design inputs.	May 15, 2001
Unit 2 design inputs will be validated during the next scheduled Unit 2 refueling outage as described in Attachment 1 to this letter.	Prior to Completion of Next Scheduled Unit 2 Refueling Outage
Physical plant modifications or licensing actions, if required, will be identified as described in Attachment 1 to this letter.	May 15, 2001