February 19, 2002

MEMORANDUM TO: William D. Reckley, Chief
Section 1
Project Directorate III
Division of Licensing Project Management

FROM: Robert C. Hagar, Acting Chief **/RA/**
Design Basis Review Section
Plant Systems Branch
Division of Systems Safety and Analysis

SUBJECT: SAFETY EVALUATION OF PROPOSED TECHNICAL SPECIFICATIONS CHANGES TO DONALD C. COOK NUCLEAR PLANT, UNITS 1, RELATED TO ICE CONDENSER INLET DOOR SURVEILLANCE TESTING (TAC NO: MB3989)

By letter dated February 8, 2002, and supplemented by letter dated February 10, 2002, Indiana Michigan Power Company, the licensee for Donald C. Cook Nuclear Plant, Unit 1, requested changes to the Technical Specifications (TS) allowing a one-time limited duration exemption from the surveillance requirement to verify that the opening, closing, and frictional torque of the ice condenser inlet door are within the specified limits as required by Technical Specifications (TS). The exemption will be in effect until the next entry into Mode 5 of sufficient duration.

The Plant Systems Branch has reviewed the licensee's proposed TS changes and finds them to be acceptable. Our evaluation is attached.

Docket No. 50-315

Attachment: As stated

Contact: Chang-Yang Li, SPLB/DSSA/NRR
415-2830

February 19, 2002

MEMORANDUM TO: William D. Reckley, Chief
Section 1
Project Directorate III
Division of Licensing Project Management

FROM: Robert C. Hagar, Acting Chief**/RA/**
Design Basis Review Section
Plant Systems Branch
Division of Systems Safety and Analysis

SUBJECT: SAFETY EVALUATION OF PROPOSED TECHNICAL SPECIFICATIONS CHANGES TO DONALD C. COOK NUCLEAR PLANT, UNITS 1, RELATED TO ICE CONDENSER INLET DOOR SURVEILLANCE TESTING (TAC NO: MB3989)

By letter dated February 8, 2002, and supplemented by letter dated February 10, 2002, Indiana Michigan Power Company, the licensee for Donald C. Cook Nuclear Plant, Unit 1, requested changes to the Technical Specifications (TS) allowing a one-time limited duration exemption from the surveillance requirement to verify that the opening, closing, and frictional torque of the ice condenser inlet door are within the specified limits as required by Technical Specifications (TS). The exemption will be in effect until the next entry into Mode 5 of sufficient duration.

The Plant Systems Branch has reviewed the licensee's proposed TS changes and finds them to be acceptable. Our evaluation is attached.

Docket No. 50-315

Attachment: As stated

Contact: Chang-Yang Li, SPLB/DSSA/NRR
415-2830

<u>DISTRIBUTION</u>: ADAMS SPLB r/f JStang RHagar CLi

DOCUMENT NAME: G:\SPLB\SECTION B - HAGAR\LI\DC COOK SE.WPD

OFFICE	SPLB:DSSA:NRR	SC:SPLB:DSSA			
NAME	CLi:bw	RHagar			
DATE	02/14/02	02/19/02	/ /02	/ /02	/ /02

Attachment

SAFETY EVALUATION REPORT
BY PLANT SYSTEMS BRANCH
FOR D. C. COOK NUCLEAR PLANT, UNIT 1
RELATED TO ICE CONDENSER INLET DOOR SURVEILLANCE TESTING

1.0 Background

By letter dated February 8, 2002, and supplemented by letter dated February 10, 2002, Indiana Michigan Power Company, the licensee for Donald C. Cook Nuclear Plant (CNP), Unit 1, requested changes to the TS allowing a one-time limited duration exemption from the surveillance requirement to verify that the opening, closing, and frictional torque of the ice condenser inlet door are within the specified limits as required by TS. The exemption will be in effect until the next entry into Mode 5 of sufficient duration. The licensee concluded that based on its analysis shown in Reference 1 for the average closing torque or average friction torque, the lower inlet doors would have demonstrated compliance with the Technical Specification criteria. However, for the worst case combination of maximum closing torque and maximum friction torque, the data shows that as many as five doors may not meet the TS acceptance limit for opening torque.

2.0 Staff Evaluation

After the initial review of Reference 1, the staff requested additional information regarding the impact of the containment performance resulting from postulated failures of the ice condenser inlet doors. In response, the licensee performed several bounding evaluation and supplemented the initial submittal in Reference 2. In the supplemental information, the licensee discussed the effects of different postulated failures of the lower inlet doors during a SBLOCA and a LBLOCA and the effects of mal-distribution from lower inlet door failures. The impact of the containment performance of a main steam line break is bounded by that of a LOCA.

2.1 SBLOCA

The significant design-basis issue for a SBLOCA is to assure that there is sufficient recirculation sump water level to preclude vortex of the emergency core cooling system pumps during the recirculation phase. Based on the discussion of CNPs current analysis-of-record for containment recirculation sump water inventory as described in References 3 and 4, the water volume needed for minimum recirculation sump water level is approximately 20% of the TS 3.6.5.1 value specified for minimum ice mass. This 20% is the amount of ice that must be melted to assure the minimum required sump water level following any LOCA. For the following two cases, the licensee postulated a worst case considering for potential impact on the minimum recirculation sump water level during the limiting SBLOCA.

First, for a single lower inlet door failing to open, the worst case for sump inventory would be no steam flow to the ice column immediately behind the affected door. This situation would reduces the available ice mass by 1/48 or about 2.1%. Comparing to the value of 20% of the TS 3.6.5.1 value for minimum ice mass that must be melted to assure the minimum required sump

water level, 80% of the TS required ice mass do not have to be melted. It takes approximately as many as 38 out of 48 doors being failed to reach an unacceptable sump water inventory. The worst case of five doors being failed does not result in an unacceptable sump inventory.

Secondly, for one or more lower inlet doors being opened prematurely, the worst case for sump inventory would be all steam to flow to the ice column immediately behind the affected doors or to the upper compartment via the bypass flow area. The size of the SBLOCA would be sufficiently small that the lower inlet door pressure differential is adequate to open the other doors. The containment pressure would increase gradually to the safety injection (SI) signal, which would initiate the containment equalization (CEQ) fan. The CEQ fans provide sufficient head to open the remaining lower inlet doors and preclude containment spray (CTS) actuation. Without CTS taking water from the sump, there would be sufficient water inventory in the sump.

2.2 LBLOCA

During CNP licensing application in answering ACRS questions, the licensee analyzed that failure of two doors to open would have about 1% change in operating deck differential pressure and essentially no change on the containment pressure. The significant design-basis issue for a LBLOCA is to assure that containment pressure can be maintained. The design of the lower inlet door assembly is such that the door assembly would fail at a pressure below the design pressure of the loop subcompartment boundaries, essentially acting like a rupture disk. The staff believes that in a LBLOCA the blowdown force is so strong that the small deviation of the door testing torque experienced in Unit 1 will not affect the peak containment pressure because the lower inlet doors will be opened rapidly and fully even with this deviation of the door testing tongue or with the rupture of the door.

The failure of one or more lower inlet doors to open would result in reduction of the vent area for the lower containment loop subcompartments. The reduction of the vent area would tend to increase the peak loop subcompartment pressures and potentially cause mal-distribution into the ice bed. To evaluate the maximum increase in the peak differential pressure of loop subcompartments, the licensee analyzed a worst case in Reference 2 that no inlet doors were providing venting relief. The doors were assumed not to provide venting even though the design configuration of the door is to “fail open” at differential pressures less than the peak within the loop subcompartment. The resultant differential pressure increase between the break subcompartment and adjacent loop subcompartment would be approximately 10%. The structure elements in the subcompartment have at least a 25% excess capacity and would continue to perform their function. Therefore, the structure integrity in the loop subcompartment can be maintained.

2.3 MAL-DISTRIBUTION

The licensee evaluated the effects of mal-distribution from lower inlet door failures. Under the current licensing basis, Section 5.3.3.5.3 of the UFSAR stated that the inlet door are designed to distribute steam to ice condenser to limit mal-distribution to less than 150% maximum, peak to average mass flow into the ice condenser, resulting from postulated LOCA that causes the door to open. In Reference 5, there is an analysis regarding the mal-distribution effects of inlet doors. In this analysis, the maximum variation in flow area due to door parameter tolerances was used. The resulting mal-distribution characteristic is a function of break sizes. For the

most critical break size of 6-inches the calculated mal-distribution is less than 150% with some margin. The margin becomes larger for smaller breaks or large breaks. In Reference 6, the effects of single door failures were analyzed. Assuming door fail to open or open with improper proportioning characteristics, it could result in a 5 percent increase in the peak mal-distribution, or could cause a maximum mal-distribution of about 146%.

TS 4.6.5.3.1.b.1 ensures that the doors will initially open in response to a SBLOCA, but as a result of the indeterminate surveillance for TS 4.6.5.3.1.b.3, 4, and 5, the opening, closing, and hinge frictional torque might vary from one door to another. If we postulate that multiple doors behave erratically as a result of the indeterminate surveillance, the 150% design limit as defined in the UFSAR may or may not be met. That is, depending on the extent of malfunction of doors, one or more doors may pass more than 150% of $1/48^{th}$ of the total flow. However, the licensee indicated that the important factor is the distribution of flow through the ice bed rather than the flow through the doors. Assuming conservatively that the ice bed behind each door is physically segregated from the ice bed behind the other doors, i.e., no crossflow considered, there are 48 parallel flow paths. Each flow path has several flow resistors in series: the lower inlet door, the turning vanes, the ice bed, and the intermediate and upper deck doors (or built-in bypass area). While this particular concept has not been explicitly analyzed, the pressure drop across the lower inlet door is relatively small compared to the design pressure drop through the ice condenser, so the effect of varying door resistance is tempered by its relatively small contribution to the overall pressure drop. That is, the effect on mal-distribution through the ice bed would not be significantly affected by a variation in door resistance. In reality, the flow paths are not segregated and cross flows due to both the pressure profile and the natural affinity of steam for ice will further smooth flow distribution through the ice bed. Even if the maximum mal-distribution could be slightly higher than 150%, it would not be sufficient to change the containment recirculation sump water inventory for SBLOCA or the peak containment pressure for LBLOCA.

3.0 Conclusion

Based on the above, the staff finds that the insufficient door testing will not affect the peak containment pressure. The small effect of subcompartment pressure differential is within the structure design margin. There will be sufficient containment recirculation sump water inventory for SBLOCA. The design basis maximum mal-distribution of 150% could be exceeded slightly, but would be insignificant to impact the containment recirculation sump water inventory for SBLOCA or the peak containment pressure for LBLOCA. Therefore, the staff concludes that the compliance of all the containment design criteria in 10 CFR 50, Appendix A, GDC 16 and GDC 35 are not affected.

4.0 References

1. Letter from A.C. Bakken, III, Indiana Michigan Power Company (I&M) to U. S. Nuclear Regulatory Commission, February 8, 2002.

2. Letter from A.C. Bakken, III, Indiana Michigan Power Company (I&M) to U. S. Nuclear Regulatory Commission, February 10, 2002.

3. Fauske and Associates, Inc. (FAI) report, FAI/01-67, “Evaluation of Proposed Change to Containment Spray Heat Exchanger Configuration in D. C. Cook, “ dated September, 2001.

4. FAI report, FAI/99-77, Rev. 2, “Containment Sump Level Evaluation for the D. C. Cook Plant,” dated September 1999.

5. WCAP-15302, Donald C. Cook Nuclear Plant Units 1 and 2 modifications to the Containment Systems Westinghouse Safety Evaluation, September, 1999.

6. WCAP-7689, Design and Performance Evaluation of Ice Condenser Inlet Doors, March, 1971.