Indiana Michigan
Power Company
500 Circle Drive
Buchanan, MI 49107 1395

INDIANA MICHIGAN POWER

February 8, 2002
AEP:NRC: 2591

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

SUBJECT: Donald C. Cook Nuclear Plant Unit 1
Docket No. 50-315
Emergency License Amendment Request for One-Time Limited Duration Exemption from Ice Condenser Inlet Door Surveillance Testing

Dear Sir or Madam:

Pursuant to 10 CFR 50.90, Indiana Michigan Power Company (I&M), the licensee for Donald C. Cook Nuclear Plant Unit 1, proposes to amend Facility Operating License DPR-58. I&M proposes to add a license condition 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 doors are within specified limits as required by Technical Specifications (TS) 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5, respectively. The exemption will be in effect until the next Unit 1 entry into Mode 5 of sufficient duration.

The proposed TS change is being requested on an emergency basis pursuant to 10 CFR 50.91(a)(5). I&M recently determined that the procedure for verifying the ice condenser inlet door opening, closing, and frictional torque does not adequately fulfill the TS surveillance requirement. Since verification of the door opening, closing, and frictional torque cannot be performed with the unit in Modes 1 through 4, compliance with the TS would require Unit 1 to be shut down and cooled down. I&M has performed a special test on Unit 2 during its current refueling outage and used the results of that test to provide reasonable assurance that the Unit 1 doors are operable. I&M, therefore, considers it unnecessary to subject the unit to the shutdown and cooldown transient. However, if Unit 1 enters Mode 5 for a sufficient duration prior to the fuel cycle 18 refueling outage, I&M will perform the surveillance testing required by TS 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5.

A001

Enclosure 1 to this letter provides an oath and affirmation affidavit pertaining to the proposed amendment. Enclosure 2 provides a detailed description and safety analysis to support the proposed amendment, including detailed justification for approving the amendment on an emergency basis, an evaluation of significant hazards considerations pursuant to 10 CFR 50.92(c), and an environmental assessment. Attachment 1 to this letter provides a report describing the methodology and results of a special test performed on the Unit 2 inlet doors and conclusions regarding Unit 1 inlet doors. Attachment 2 provides a listing of new commitments made in this letter. Attachment 3 provides the marked-up Operating License page for Unit 1. Attachment 4 provides the proposed Operating License page with the changes incorporated for Unit 1.

I&M requests approval of the proposed amendment by February 14, 2002, to preclude an unnecessary shutdown, cool-down, and heat-up of the unit as discussed above. The amendment will be implemented following approval.

No previous submittals affect the license pages that are affected by this proposed amendment. If any future submittals affect these license pages, I&M will coordinate the changes to the pages with the NRC Project Manager to ensure proper page control when the associated license amendment requests are approved.

If you have any questions or require additional information, please contact Mr. Gordon P. Arent, Manager of Regulatory Affairs, at (616) 697-5553.

Sincerely,

A. C. Bakken, III
Senior Vice President, Nuclear Operations

/jen

Enclosures:
1 Affidavit
2 Evaluation of the Proposed Changes

Attachments

1 Review of Ice Condenser Lower Inlet Door 40° Opening and Closing Force/Torque Data
2 Commitments
3 Marked-Up Proposed Operating License Changes
4 Proposed Operating License Page

c: K. D. Curry
J. E. Dyer
MDEQ - DW & RPD
NRC Resident Inspector
R. Whale

bc: G. P. Arent
P. B. Cowan, w/o attachments
R. W. Gaston
S. A. Greenlee
S. B. Haggerty
D. W. Jenkins, w/o attachments
J. E. Pollock
M. W. Rencheck w/o attachments
J. F. Stang, Jr., - NRC Washington, DC
T. R. Stephens

Enclosure 1 to AEP:NRC:2591

AFFIRMATION

I, A. Christopher Bakken III, being duly sworn, state that I am Senior Vice President, Nuclear Operations 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

[signature]

A. C. Bakken III
Senior Vice President, Nuclear Operations

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 8 DAY OF February, 2002

[signature: Jennifer L Kernosky]
Notary Public

My Commission Expires 5/24/05

Application for Emergency License Amendment
One-Time Limited Duration Exemption from Ice Condenser Inlet Door Surveillance Test

1.0 DESCRIPTION

Pursuant to 10 CFR 50.90, Indiana Michigan Power Company (I&M), the licensee for Donald C. Cook Nuclear Plant (CNP) Unit 1, proposes to amend Facility Operating License DPR-58. I&M proposes to add a license condition 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 doors are within specified limits as required by Technical Specifications (TS) 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5, respectively. The exemption would be in effect until the next Unit 1 entry into Mode 5 of sufficient duration.

The proposed TS change is being requested on an emergency basis pursuant to 10 CFR 50.91(a)(5). I&M recently determined that the procedure for verifying the ice condenser inlet door opening, closing, and frictional torque does not adequately fulfill the TS surveillance requirement. Since verification of the door opening, closing, and frictional torque cannot be performed with the unit in Modes 1 through 4, compliance with the TS would require Unit 1 to be shut down and cooled down. I&M has performed a special test on Unit 2 during its current refueling outage and used the results of that testing to provide reasonable assurance that of the Unit 1 doors are operable. I&M, therefore, considers it unnecessary to subject the unit to the shutdown and cooldown transient. However, if Unit 1 enters Mode 5 for other reasons prior to the fuel cycle 18 refueling outage, I&M will perform the surveillance testing required by TS 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5.

2.0 PROPOSED CHANGE

The proposed change would add a new License Condition to Section 2.C of the CNP Unit 1 Facility Operating License, License No. DRP-58. The proposed License Condition is as follows:

> "Technical Specification surveillance requirements 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5 need not be performed until prior to ascension into Mode 4 at the completion of the fuel cycle 18 refueling outage. If Unit 1 enters Mode 5 for sufficient duration prior to the fuel cycle 18 refueling outage, I&M will perform the surveillance testing required by TS 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5."

The exemption provided by the above license condition would be effective upon NRC approval of this license amendment request.

3.0 BACKGROUND

Description of Ice Condenser Inlet Doors

There are 48 ice condenser inlet doors. The doors are essentially pairs of insulated panels vertically hinged to a frame that has a center post. The doors are normally held closed against the door seal by the differential pressure produced by the higher density cold air of the ice condenser. The closed doors form a barrier to air flow through the ice condenser compartment during normal plant operation. The closed doors also provide continuation of thermal insulation around the lower section of the crane wall to minimize heat input that would promote sublimation and mass transfer of ice in the condenser compartment. In the event of a loss of coolant accident (LOCA) that would cause a pressure increase in the containment lower compartment, the pressure on the doors would cause them to open, venting air and steam from the containment lower compartment into the ice condenser compartment. The ice condenser inlet doors and their accident functions are described in detail in Chapters 5 and 14 of the CNP Updated Final Safety Analysis Report (UFSAR).

Current Requirements

TS surveillance requirements 4.6.5.3.1.b.3, 4, and 5 require that the ice condenser inlet doors be demonstrated operable during shutdown at least once per 18 months by:

- Testing each one of the doors and verifying that the torque required to open each door is less than 195 inch-pounds when the door is 40 degrees open. This torque is defined as the "door opening torque" and is equal to the nominal door torque plus a frictional torque component. (TS 4.6.5.3.1.b.3)

- Testing each one of the doors and verifying that the torque required to keep each door from closing is greater than 78 inch-pounds when the door is 40 degrees open. This torque is defined as the "door closing torque" and is equal to the nominal door torque minus a frictional torque component. (TS 4.6.5.3.1.b.4)

- Calculation of the frictional torque of each door tested in accordance with TS 4.6.5.3.1.b.3 and TS 4.6.5.3.1.b.4. The calculated frictional torque shall be less than or equal to 40 inch-pounds. (TS 4.6.5.3.1.b.5)

Basis for Current Requirements

TS surveillance requirements 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5 provide assurance that the reactor coolant system fluid released during a LOCA will be diverted through the ice condenser bays for heat removal, and that excessive sublimation of the ice bed will not occur

because of warm air intrusion. The surveillance requirement is consistent with TS 4.6.7.3.1.b.3 of NUREG 0452 (Reference 1), and SR 3.6.16.5 of NUREG 1431 (Reference 2).

Surveillance Procedure History

During the extended Unit 1 and 2 outages occurring between 1997 and 2000, I&M determined that there were inadequacies in ice condenser surveillance procedures, including the procedure for verifying inlet door torque pursuant to TS surveillance requirements 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5. Accordingly, the ice condenser surveillance procedures were completely re-written. The re-written procedures considered measurement uncertainty and establishment of a qualification process for personnel performing the surveillance tests to demonstrate proficiency with the test methods. The re-written surveillance procedure for verifying ice condenser inlet door torque was last completed for Unit 1 in November 2000. Some of the door opening force measurements recorded during this test were less than the door closing force measurements. These results have subsequently been recognized as inaccurate. However, the test results were within the limits stated in the TS and the procedure, and were not questioned at that time.

In January 2002, an NRC Resident Inspector observing inlet door surveillance activities during the Unit 2 refueling outage posed several questions pertaining to the test methodology. It was also noted that the recorded door opening force measurements were less than the door closing force measurements and the validity of the test results was questioned. The test methodology was subsequently determined to be inadequate. Given that the methodology was common to both Units 1 and 2, the Unit 1 ice condenser inlet doors were declared inoperable on January 31, 2002, at 1358 Eastern Standard Time.

Reason for Requesting Emergency Amendment

Regulation 10 CFR 50.91(a)(5) states that where the NRC finds that an emergency situation exists, in that failure to act in a timely way would result in derating or shutdown of a nuclear power plant, or in prevention of either resumption of operation or of increase in power output up to the plant's licensed power level, it may issue a license amendment involving no significant hazards consideration without prior notice and opportunity for a hearing or for public comment. The regulation also states that the NRC will decline to dispense with notice and comment on the determination of no significant hazards if it determines that the licensee has abused the emergency provision by failing to make timely application for the amendment and thus itself creating the emergency. The regulation requires that a licensee requesting an emergency amendment explain why the emergency situation occurred and why the licensee could not avoid the situation. As explained below, an emergency amendment is needed to preclude an unnecessary plant shutdown and cooldown, and I&M could not have reasonably avoided the situation or made timely application for an amendment.

Reason Emergency Situation Has Occurred

An amendment is needed to preclude an unnecessary plant shutdown and cooldown because the surveillance test cannot be performed with the plant in Modes 1 through 4. Performance of the test requires personnel access to the lower plenum of the ice condenser and to the openings in the crane wall in the lower volume of containment, immediately outside the inlet doors. During reactor operation, these areas are locked high radiation areas. The dose received by personnel performing the tests with the unit at power would be prohibitive.

Additionally, in order to limit airflow through the open lower inlet doors during the test ventilation barriers are erected outside each lower inlet door. These barriers could impede air and steam flow into the ice condenser during a LOCA. Furthermore, the barrier material would be easily transportable to the containment recirculation sump, where it could block flow areas through the sump screens. Since both the ice condenser and the emergency core cooling systems must be operable in Modes 1 through 4, performance of the ice condenser inlet door surveillance test would require that the unit be shut down and cooled down to Mode 5.

Based on the special testing described in Attachment 1 to this letter, I&M considers that the doors are fully capable of performing their safety function even though the TS surveillance requirement may not have been met. Accordingly, I&M considers that a plant shutdown and cooldown to perform the testing is unnecessary. However, a license amendment is required to allow the doors to be returned to an operable status without fully satisfying the TS surveillance test. Since the doors must be returned to an operable status by February 14, 2002, to avoid a shutdown, I&M considers that an emergency situation as defined in 10 CFR 50.91 exists in that there is not adequate time for prior notice and opportunity for a hearing or for public comment.

Reason the Situation Could Not Have Been Avoided

The re-written surveillance procedure did not have a long performance history. The testing performed during the extended Unit 1 and 2 outages and during the current Unit 2 refueling outage were the only prior performances of the re-written procedures. Therefore, there has not been a substantial number of opportunities to identify the inadequacies. The re-written surveillance procedures were believed to be of generally high quality. Additionally, the results previously obtained using the re-written procedure literally met the criteria specified in the TS. Therefore, personnel did not recognize that the results may have been invalid.

I&M therefore considers that there is justification for requesting the proposed license amendment on an emergency basis.

4.0 TECHNICAL ANALYSIS

The proposed amendment to allow a one-time limited duration exemption from TS surveillance requirements 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5 is based on special testing performed on Unit 2 inlet doors during the unit's current refueling outage. Attachment 1 to this letter provides a report describing the methodology used, results of the special test, and the basis for the conclusions that result from that testing regarding the Unit 1 inlet doors. As detailed in that report, I&M has concluded that, although the lower inlet doors were previously tested using an invalid test methodology, had the lower inlet doors been tested using a valid test methodology, the results would have demonstrated compliance with the TS 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5 criteria. Therefore, the Unit 1 ice condenser inlet doors are currently fully capable of performing their design basis function and should be considered to be operable.

Additionally, I&M has considered the risk implications of the proposed amendment. Since the special testing has demonstrated a reasonable degree of assurance that the inlet doors would perform their required function within their design-basis envelope consistent with the existing accident analyses, the proposed amendment does not create any increase in risk.

5.0 REGULATORY SAFETY ANALYSIS

5.1 No Significant Hazards Consideration

I&M has evaluated whether or not a significant hazards consideration is involved with the proposed change 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

   The proposed change is a one-time limited duration exemption that will allow continued operation of CNP Unit 1 until the next entry into Mode 5 of sufficient duration without performance of surveillance testing on the ice condenser inlet door opening torque and closing torque, and calculation of frictional torque. These doors perform a largely passive function and should not actuate (open) unless an accident occurs. The doors do not affect any accident initiators or precursors. There are no new failure modes for the doors created by this proposed change. These doors do not interact with any system whose failure or malfunction can initiate an accident. Therefore, the probability of occurrence of an accident previously evaluated is not significantly increased.

Consequences of an Accident Previously Evaluated

The ice condenser inlet doors function to mitigate an accident by opening to allow steam and gases from a loss of coolant accident to enter the ice condenser. The special test performed by I&M on Unit 2 has provided reasonable assurance that the Unit 1 door opening torque, closing torque, and frictional torque are within the established design criteria, and would meet the TS surveillance test criteria. As a result, there is reasonable assurance the doors will continue to perform their required functions until the next Unit 1 entry into Mode 5 of sufficient duration. Therefore, the consequences of an accident previously evaluated are not significantly increased.

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

   Response: No

   The proposed change allows operation of the unit throughout the remainder of its operating cycle without performance of certain TS surveillance requirements. Those surveillance requirements provide verification that the opening torque, closing torque, and frictional torque of the ice condenser inlet doors are acceptable. There are no new failure modes for the ice condenser doors created by the one-time limited duration exemption from the surveillance tests. The special test performed by I&M has provided a level of assurance that the doors will continue to operate in their designed manner. The doors do not interact with any system whose failure or malfunction can initiate an accident. Therefore, the proposed change does 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 margins of safety applicable to the proposed change are those associated with the limits on values for opening torque, closing torque, and frictional torque values specified in the TS surveillance requirement for the inlet doors. Since the special test performed by I&M on Unit 2 provides reasonable assurance of compliance with these limits for Unit 1, the applicable safety margin will be maintained. The proposed change does not reduce the capability of the doors to perform the design function required by the accident and safety analyses, nor does the proposed change impact the operational characteristics of the doors. Therefore, the proposed change does not involve a significant reduction in margin of safety.

In summary, based upon the above evaluation, I&M has concluded that the proposed change 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

TS and Regulations

Compliance with the TS and regulations that are relevant to the ice condenser doors is discussed below.

TS 3/4.6.5.3 – This TS requires that the ice condenser doors be operable in Modes 1, 2, 3, and 4, specifies actions if operability requirements are not met, and specifies the surveillance requirements necessary to demonstrate operability. The only elements of this TS affected by the proposed amendment are the surveillance requirements to verify the opening torque, closing torque, and frictional torque of the inlet doors. The proposed amendment would provide a one-time limited duration exemption from these requirements. Therefore, except for TS 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5, compliance with TS 3/4.6.5.3 is unaffected by the proposed amendment.

10 CFR 50.36(c)(3) – This regulation requires that TS contain surveillance requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met. The proposed amendment does not change the existing surveillance requirements stated in the TS. The proposed amendment allows the ice condenser doors to be considered operable, for a limited duration, based on special testing methods other than that specified in the existing surveillance requirement. These special testing and analysis methods will provide the assurance required by 10 CFR 50.36(c)(3) for the duration of the exemption. Therefore, compliance with this regulation is unaffected by the proposed amendment.

10 CFR 50, Appendix A, General Design Criteria as follows:

- Criterion 16-Containment Design
- Criterion 35-Emergency Core Cooling (to the extent that proper functioning of the ice condenser assures adequate water for operation of emergency core cooling systems during the recirculation phase)
- Criterion 38-Containment Heat Removal
- Criterion 40-Testing of Containment Heat Removal System
- Criterion 50-Containment Design Basis

The design of the ice condenser is unaffected by this proposed amendment. The manner in which doors fulfill their design function will be unchanged. Therefore, compliance with these regulations is unaffected by the proposed amendment.

UFSAR/Licensing Basis Documents

Compliance with the UFSAR/Licensing Basis Documents that are relevant to the ice condenser doors is discussed below.

UFSAR Sections 5.3.3.5.3, 14.3.4.5.4.1 (Unit 1), and 14.3.4 (Unit 2) define the design criteria and accident functions for the ice condenser inlet doors. Testing the doors is not discussed in these sections other than to note that the opening force can be tested. Therefore, compliance with current licensing basis requirements in the UFSAR is unaffected by the proposed amendment.

Unit 1 License Amendment 234 and Unit 2 License Amendment 217 (Reference 3) were based in part on an analysis of the water level in the emergency core cooling sump following a postulated LOCA. As documented in Attachment 1, I&M has conducted a review to determine whether the lower inlet door surveillance test inadequacies could have any impact on the results of that emergency core cooling sump analysis. I&M has concluded that the lower inlet door surveillance test inadequacies do not affect the results of the analysis.

I&M has reviewed other previous NRC correspondence pertaining to the ice condenser inlet doors and determined that current licensing basis requirements in the correspondence are unaffected by the proposed amendment.

I&M has reviewed its NRC commitment data base and determined that current licensing basis commitments are unaffected by the proposed amendment.

Other Regulatory Considerations

The proposed amendment is consistent with the position stated in the Federal Register, Vol. 66, No. 115, June 14, 2001, Page 32400, "Notice of Opportunity to Comment on Model Safety Evaluation on Technical Specification Improvement to Modify Requirements Regarding Missed Surveillances Using the Consolidated Line Item Improvement Process." This position is that it is overly conservative to assume that systems or components are inoperable when a surveillance has not been performed because the vast majority of surveillances do, in fact, demonstrate that systems or components are operable. When a surveillance is missed, it is primarily a question of operability that has not been verified by the performance of a surveillance requirement.

In conclusion, 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 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

I&M has evaluated this license amendment request against the criteria for identification of licensing and regulatory actions requiring environmental assessment in accordance with 10 CFR 51.21. I&M 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(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment needs to be prepared concerning the proposed amendment.

7.0 REFERENCES

1) NUREG 0452, "Standard Technical Specifications, Westinghouse Pressurized Water Reactors," Revision 4, dated September 1981.

2) NUREG 1431, "Standard Technical Specifications, Westinghouse Plants," Revision 2, dated June 2001.

3) Letter from J. F. Stang, NRC, to R. P. Powers, I&M, "Issuance of Amendments – Donald C. Cook Nuclear Plant, Units 1 and 2, (TAC Nos. MA6766 and MA6767)," dated December, 13, 1999.

ATTACHMENT 1 TO AEP:NRC:2591

REVIEW OF ICE CONDENSER LOWER INLET DOOR 40 DEGREE OPENING AND CLOSING FORCE/TORQUE DATA

NTS-2002-005-REP, Rev. 0

February, 2002

Cook Nuclear Plant
Ice Condenser Lower Inlet Door Surveillance Tests

Review of Ice Condenser Lower Inlet Door 40 Degree Opening and Closing Force/Torque Data

NTS-2002-005-REP, Rev. 0
February, 2002

Prepared By: ______________ / 2/8/02
Brenda G. Kovarik

Reviewed By: ______________ / 2/8/02
Paul W. Leonard

Approved By: ______________ / 2/8/02
Paul G. Schoepf

Table of Contents

1.0 Executive Summary

As a result of a series of questions raised regarding testing of the ice condenser lower inlet doors, it was determined that the test methodology for the 40 degree door tests performed at the end of the previous refurbishment outages did not result in a valid determination of the Operability of the doors.

A refined test methodology was developed and implemented via special procedure, 12-MHP-SP-LID, to perform testing and data acquisition on the Unit 2 lower inlet doors. The collected test data was then used in comparisons with the previously collected surveillance test data to support conclusions regarding the status of the ice condenser lower inlet doors.

This report concludes there is reasonable assurance that the Unit 1 ice condenser lower inlet doors are currently fully capable of performing their design basis function. Additionally, the Unit 2 ice condenser lower inlet doors remained fully capable of performing their design basis function during the previous cycle.

2.0 Purpose/Objective

The purpose of this report is to compare the data gathered from implementation of special test procedure 12-MHP-SP-LID, Rev. 1, on the Unit 2 ice condenser lower inlet doors, with surveillance data previously acquired during the most recent as-left surveillance tests on both the Unit 1 and Unit 2 ice condenser lower inlet doors. The objective of this report is to draw a conclusion regarding the current status of the Unit 1 ice condenser lower inlet doors and the status of the Unit 2 ice condenser inlet doors during the previous cycle based on comparison and analysis of the available data.

3.0 Background

Technical Specification Requirements

The ice condenser lower inlet doors are periodically tested in accordance with Technical Specification Surveillance 4.6.5.3.1.b. This surveillance requires:

1. Verifying that the torque required to initially open each door is less than or equal to 675 inch-pounds.
2. Verifying that the opening of each door is not impaired by ice, frost or debris.
3. Testing each one of the doors and verifying that the torque required to open each door is less than 195 inch-pounds when the door is 40 degrees open. This torque is defined as the "door opening torque" and is equal to the nominal door torque plus a frictional torque component.
4. Testing each of the doors and verifying that the torque required to keep each door from closing is greater than 78 inch-pounds when the door is 40 degrees open. This torque is defined as the "door closing torque" and is equal to the nominal door torque minus a frictional torque component.
5. Calculation of the friction torque of each door tested in accordance with "3" and "4" above. The calculated frictional torque shall be less than or equal to 40 inch-pounds.

UFSAR Criteria

Excerpts from UFSAR Sections which describe the performance criteria for the ice condenser lower inlet doors are contained in Attachment 1.

Previous Testing Methodology

The test methodology previously used to determine compliance with "3", "4" and "5" involved locating the door at the 40 degree position using a test fixture (Photo 1). A spring scale (Photo 2) was then placed on the test fixture and positioned to against the face of the door. The door was then opened approximately 1 inch to relieve the load on the spring scale. The door was then released, allowing it to return to the 40 degree position. A closing force was measured. The door was then returned to rest on the extension arm of the test fixture. The spring scale was then used to move the door slightly open from its rest position. This spring scale reading was then recorded as the opening force. The forces were converted to torque by multiplying each force by a 27 inch moment arm. Several issues have been identified with this methodology including:

1. Use of the test fixture (Photo 1) resulted in a moment arm that varied from the procedurally intended 27 inch moment arm. The door position also varied from the procedurally intended 40 degree door position depending on the specific door hardware and test fixture installation technique. The moment arm distance tended to be 27 inches or less and the door position tended to be greater than 40 degrees.

2. Due to inconsistencies in the methodology, previous opening force testing did not provide an accurate measure of door opening force.

As a result of these issues, the closing force measured in previous testing sometimes exceeded the measured opening force, which is contrary to intuition since the door springs aid door motion in the closing direction and oppose it in the opening direction.

Previous Testing Data

Data presented in Tables 2 and 3 reflects the as-left surveillance data from Unit 2 (April 2000) and Unit 1 (November, 2000). As previously noted, portions of the methodology used by past surveillances are now considered to produce an inadequate measure of compliance with the Technical Specification surveillance requirements. Specifically, the past tests did not consistently achieve a 40 degree open door position and did not consistently achieve a constant scale position on the door in relationship to the door hinge. The previous test methodology resulted in small angular variations (up to 5°) in the door position for each door. The position of the spring scale when measured from the center of the hinge varied from 27 inch down to ≈ 24.5 inch. Both of these test variations will affect the torque values derived for each door.

In addition, the previous opening torque test method and sequence, as described earlier, is now judged to be inadequate in that it did not provide an accurate measure of opening force/torque (in actuality, it may be a measure of the closing torque). Since the frictional torque is determined by dividing the difference between opening and closing torque by two, the frictional torque data is therefore also not considered to be valid. Although, the

previous tests may not have adequately evaluated the closing force/torque against the Technical Specification criteria, and did not provide an accurate measurement of door opening torque and frictional torque, the data from the tests performed can still be used to draw conclusions about the condition of the doors, and their ability to function to mitigate design basis accidents.

The conclusions that the ice condenser lower inlet door opening force was invalid resulted in declaring the Unit 1 ice condenser lower inlet doors inoperable on January 31, 2002 at 1358 hours. Currently, Unit 1 is operating at 100 % power. The procedure for performing surveillance requirement 4.6.5.3.1.b involves measuring and recording the force applied to a force gauge (spring scale) while manipulating the lower inlet doors through various positions. Therefore, performance of this test requires personnel access to the lower plenum of the ice condenser and to the openings in the crane wall in the lower volume of containment, immediately outside the lower inlet doors. During reactor operation, these areas are locked high (formerly extreme high) radiation areas. The dose received by personnel performing the ice condenser lower inlet door surveillance tests with the Unit at power would be prohibitive. Additionally, in order to limit airflow through the open lower inlet doors during the test (which can impact test results) ventilation barriers are erected outside each lower inlet door. These barriers are typically constructed from herculite or other durable material. These barriers cannot be erected with the Unit at power since the barriers would impede flow into and through the ice condenser during a design basis accident. Furthermore, the ventilation barrier material would be easily transportable to the containment recirculation sump, where it could block available flow areas through the sump screens. Based on these considerations, surveillance requirement 4.6.5.3.1.b cannot be performed with Unit 1 in Modes 1 through 4.

Maintenance and Testing History

The Unit 2 ice condenser lower inlet doors (springs, hinges, etc) were not subjected to maintenance activities during the operating cycle between June, 2000 and January, 2002 and the subsequent collection of the data in Table 1. The lower inlet doors were not subjected to ice condenser or containment system operational conditions that would tend to change/degrade the performance of the hinge and spring mechanisms.

At the start of the January, 2002, Unit 2 outage, several (11 of 48) doors failed their initial opening torque surveillance. The most probable cause of the failure of the lower inlet door as-found opening door force test is related to training/qualification and specifically insufficient practice or hands on experience. As a result, a valid test of the as-found lower inlet door initial opening force was not accomplished. The testing techniques and skill level employed by the test crew resulted in erratic test results. None of the crew performing the as-found test had ever performed this testing previously. The training required to perform this test consisted of a classroom session review of the procedure. There was also insufficient emphasis on the techniques required to satisfactorily use the associated measuring and test equipment. The unacceptably high

lower inlet door opening force values are not related to any physical condition or operation of the lower inlet doors, ice condenser or containment. If human error reduction techniques such as stopping when uncertain and/or procedure use and adherence had been utilized by the test crew including the AEP oversight person, the performance of the lower inlet door opening force test would have been stopped. While the investigation of these failures is still ongoing, the preliminary investigation indicates that these failures were largely attributable to procedure implementation techniques as a result of insufficient training/qualification and experience level.

Similarity of Unit 1 and Unit 2

Between early 1998 and late 2000, an ice condenser restoration project was completed for both Unit 1 and Unit 2. This project included the thawing of both ice condensers and inspection, repair, replacement and refurbishment of structural components. With regard to the lower inlet doors or lower inlet door area, significant work included replacement of the previous foam wedge style shock absorbers with collapsible metal air boxes and a redesign of the lower inlet door seal channel. Neither of these modifications had any impact on door torque. The redesign of the seal channel replaced the former carbon steel channel, with an uneven face area, with a stainless steel channel that provided a better fitup between the seal and door skin. The lower inlet doors were not removed from their hinges at any time during the restoration project. The majority of the lower inlet door springs were disconnected during the refurbishment to facilitate project activities such as movement of material through the lower inlet doors. The door springs were later reattached and adjusted. In some cases door springs were replaced and spring clips were realigned and refurbished. Several spring swivel pins were also replaced or refurbished. The lower inlet door hinge arm-to-hinge frame clearances were checked and where necessary, adjustments were made. These adjustments were made to several of the doors in both units. In summary, the work performed during the restoration projects improved the performance of the doors. There are no significant differences associated with the scope for the lower inlet doors for the Unit 1 and Unit 2 ice condensers. Additionally, the lower inlet doors and hardware (hinges, springs) are identical between Unit 1 and Unit 2. It is reasonable to expect, based on the scope of the ice condenser restoration project activities, that both units' lower inlet doors would be in a similar state of repair and functional readiness when the units restarted in June and December of 2000 (Unit 2 and Unit 1, respectively). Similarly, the operating and maintenance practices for the two ice condensers and containments are essentially the same. Therefore, it is reasonable to expect that the condition and functional readiness of the Unit 1 and Unit 2 ice condenser doors are similar at the present point in time, based on consideration of operating and maintenance practices.

As a result of the lower inlet door initial opening torque test failures on Unit 2 during January, 2002, examinations of the doors were performed to determine their condition. These examinations did not reveal any degradation of the doors, hardware or associated structures that would impair their function. Therefore, it is reasonable to conclude that the Unit 1 ice condenser lower inlet doors would be in a similar condition.

4.0 Discussion of New Testing Methodology

Mathematical Expression of Technical Specification Requirements

To fully understand the methodology used to collect the data and then compare these results with the Unit 1 as-left data, the specific Technical Specification Surveillance requirements must be evaluated from a mathematical perspective. The surveillance requirements state:

3. Testing each one of the doors and verifying that the torque required to open each door is less than 195 inch-pounds when the door is 40 degrees open. This torque is defined as the "door opening torque" and is equal to the nominal door torque plus a frictional torque component.

4. Testing each of the doors and verifying that the torque required to keep each door from closing is greater than 78 inch-pounds when the door is 40 degrees open. This torque is defined as the "door closing torque" and is equal to the nominal door torque minus a frictional torque component.

5. Calculation of the friction torque of each door tested in accordance with "3" and "4" above. The calculated frictional torque shall be less than or equal to 40 inch-pounds.

Rewriting these statements as mathematical equations yields:

Opening Torque (T_O) = Nominal Door Torque (T_D) + Frictional Torque (T_F)

$$T_O = T_D + T_F$$

Closing Torque (T_C) = Nominal Door Torque (T_D) – Frictional Torque (T_F)

$$T_C = T_D - T_F$$

Since T_D (Nominal Door Torque) is the same for both opening and closing force determination, the equations can be set equal to each other when solved for T_D.

$$T_O - T_F = T_C + T_F$$

Solving for T_O; $T_O = T_C + 2T_F$

Solving for T_C; $T_C = T_O - 2T_F$

These equations form the basis for the test methodology and also the ability to correlate data from one test to another. This correlation is further developed later in this report.

New Test Methodology

In early February, 2002, a new methodology for performing the ice condenser lower inlet door 40 degree surveillance tests was developed and implemented in special procedure 12-MHP-SP-LID, Rev. 1. The development of the new test methodology included a review of industry experience and refinement of those methodologies. The new procedure for measuring the lower inlet door opening and closing forces is summarized as follows:

- The door is positioned at approximately the 40 degree position using a template placed on the floor.
- A spring scale (with two sliding indicators, one on either side of the pointer, Photo 3) is placed against the door at a predetermined position and the door is balanced using the spring scale.
- The two sliding indicators are placed against the scale pointer.
- The force on the spring scale is gradually increased to the point where door movement in the open direction is detected, by visual observation. The reading on the spring scale at this point is the opening force.
- The force on the spring scale is gradually released until door movement in the closed direction is detected, again based on visual observation. The reading on the spring scale at this point is the closing force. (These steps were repeated two additional times for each door)
- The friction force is the difference between the maximum and minimum force, divided by two (2).
- Torques are calculated by multiplying the forces by the moment arm. The moment arm is a known dimension based upon the use of a predetermined position for the location of the spring scale.

All personnel that participated in the implementation of special procedure, 12-MHP-SP-LID, Rev 1, completed task specific training including the physical demonstration of the techniques prior to the performance of the special procedure. Data collected from the implementation of special procedure 12-MHP-SP-LID, Rev. 1 on the Unit 2 lower inlet doors in February, 2002 is presented in Table 1. There is high confidence in the accuracy and relevance of the data presented in Table 1 in determining the condition of the doors with respect to the criteria contained within the Technical Specifications. This is based on the straight forward nature of the test methodology contained in this procedure, and on both the repeatability and intuitive nature of the results (opening force exceeds closing force). The data acquisition training and implementation process was also periodically observed by the Performance Assurance Organization.

Summary of New Data

The data obtained from the performance of Special Procedure 12-MHP-SP-LID, Rev. 1 (Data Acquisition for Ice Condenser Lower Inlet Doors) is contained in Table 1, and is summarized as follows:

- The opening torque for each door met the Technical Specification acceptance criteria (< 195 inch-pounds). The maximum opening torque recorded for any door was 183.6 inch-pounds. The average opening door torque was 152.6 inch-pounds and the standard deviation was 14.3 inch-pounds. In summary, all doors met the acceptance criteria for opening torque, and the data was consistent based on the calculated standard deviation. The opening torque for any door was always greater than the closing torque for the door.
- The closing torque for each door met the Technical Specification acceptance criteria (> 78 inch-pounds). The minimum closing torque recorded for any door was 113.4 inch-pounds. The average closing torque was 132.3 inch-pounds and the standard deviation was 10.3 inch-pounds. In summary, all the doors met the acceptance criteria for closing torque, and the data was consistent based on the calculated standard deviation.
- The maximum hinge frictional torque for each door met the Technical Specification acceptance criteria (≤ 40.0 inch-pounds). The maximum frictional torque recorded for any door was 27.0 inch-pounds. The average frictional torque was 10.1 inch-pounds and the standard deviation was 6.3 inch-pounds. In summary, all the doors met the acceptance criteria for frictional torque, and the data was consistent based on the calculated standard deviation.

Preconditioning Concerns

With regards to preconditioning, the Unit 2 doors have been exercised several times prior to the collection of the 40 degree door test data via the special procedure. The one test that is most affected by preconditioning is the as-found opening force test. This test assesses the potential for the doors to have been impaired by opening from the formation of ice or frost. Prior to the performance of this test, several of the lower inlet doors opened as a result of a slight differential pressure developed between the containment's upper and lower compartments. This differential pressure condition occurred twice during the early stages of the current outage. The first condition occurred when the interlocks were defeated for one of the containment airlocks. The second condition occurred when ventilation alignments were changed within containment. During the first event, 14 of the lower inlet doors were identified as having opened. The exact number of doors that opened during the second event was not specifically recorded. Immediately following these events, the doors were physically closed during an entry into the ice condenser lower plenum, and were allowed to remain closed for greater than 24 hours prior to performance of the as-found opening force test. Prior to and during performance of the 40 degree door test, the doors are required to be exercised for other inspections and

test condition setup. The potential cause for increased friction on the door is essentially limited to roller bearing degradation. The potential cause for increased opening torque can be a combination of degraded hinge assemblies (bearings) and increased spring tension as a result of material property changes (not likely due to environment) or incorrectly adjusted spring tension. The potential cause for reduced closing force is only attributable to incorrectly adjusted spring tension. Exercising of the doors in Unit 2 prior to the acquisition of the 40 degree data does not cause a bias in the data obtained.

5.0 Analysis

Analysis Methodology

The following methodology was used to draw conclusions regarding the current status of the Unit 1 ice condenser lower inlet doors and the status of the Unit 2 lower inlet doors during the past operating cycle based on comparison and analysis of the available data:

- The data contained in Table 1 was reviewed to draw conclusions regarding the Unit 2 ice condenser lower inlet doors, with regard to the 40 degree position tests.
- The closing torque data contained in Table 1 was used in conjunction with the closing torque data in Table 2 (Unit 2 ice condenser as-left lower inlet door surveillance data from April, 2000) to establish a correction factor which was applied to closing torque data acquired using previous methodology.
- Unit 1 closing torque data contained in Table 3 was adjusted using the correction factor established above. The adjusted closing torque data was compared to the Technical Specification closing torque acceptance limits.
- Average and maximum friction torque values were obtained from the Table 1 data for Unit 2.
- Twice the average friction torque values from Unit 2 were applied to Unit 1 closing torque data contained in Table 3. These resulting values were compared to the Technical Specification opening torque acceptance limits.
- Twice the maximum friction torque values from Unit 2 were applied to Unit 1 closing torque data contained in Table 3. The resulting values were compared to the Technical Specification opening torque acceptance limits.
- Qualitative factors were considered such as the scope of the ice condenser restoration projects completed for each Unit between 1998 and 2000, the similarity of the Unit 1 and Unit 2 ice condenser designs, comparison of operating and maintenance practices for Unit 1 and Unit 2, and the relationship between the Technical Specification surveillance limits for the ice condenser lower inlet doors and the accident analyses. These factors were used to provide the basis for applying Unit 2 friction torque data to Unit 1 to establish a reasonable basis for drawing conclusions on the current status of the Unit 1 ice condenser lower inlet doors.
- An overall conclusion was drawn regarding the previous condition of the Unit 2 ice condenser lower inlet doors, with regard to the 40 degree position tests.
- An overall conclusion was drawn regarding the condition of the Unit 1 ice condenser lower inlet doors, with regard to the 40 degree position tests.

Assumptions and Limitations

- Values in Table 1, which have been recorded based on the implementation of special test procedure 12-MHP-SP-LID, are nominal values. The use of nominal values in this report is considered valid because the surveillance measurement uncertainties are randomly distributed. Consequently, the measurement uncertainties are not expected to affect the derivation of statistical parameters used to describe distribution of this data.

- Collection of force data during each door test consisted of three individual measurements for each parameter on each door. The three values were then averaged to reduce the effect of random variations in performance of the test. For purposes of this report, the 3-point average values from the procedure were used as starting input for the manipulation of data. This approach is considered reasonable since it parallels the way data would be treated for comparison to the acceptance criteria when actually performing a Technical Specification surveillance. However, since the initial averaging might smooth the data set and make it appear more consistent than it really is, a statistical review (Reference 14) using the raw data was performed to justify the use of 3-point average values. Use of the individual data points resulted in only minimal changes to data set averages and maximum values, as would be expected. However, standard deviation values also changed only slightly, which indicates that using initially averaged data created no significant smoothing effects. For example, a comparison of the two methods for the hinge friction torque from the 2002 Unit 2 testing showed the maximum value to be 27 inch-pounds vice 28.5 inch-pounds and the standard deviation to be 5.9 inch-pounds vice 6.0 inch-pounds. Even though the comparison shows that initial averaging does not significantly influence the data, the overall effect of using the alternate method will be assessed within the body of the report as further justification of this assumption.

- The maximum hinge torque determined for Unit 2 in 2002 is a reasonable bounding value for use in calculating each Unit 1 door opening torque. In lieu of using the maximum torque, an alternate statistical approach would be to use the mean value plus two or three standard deviations (2- or 3-sigma). In this case, the maximum hinge torque is well above 2-sigma and only slightly below 3-sigma. Therefore, use of the maximum value is considered reasonable. The overall effect of using a slightly more conservative 3-sigma approach will be assessed within the body of the report as further justification of this assumption.

- During the collection of the data, erroneous readings were discounted, and new data sets were obtained. Erroneous data occurred as a result of losing grip of the spring scale, loss of the air dam, and a misalignment of the spring scale to the door.

- As developed within this report, it is assumed that the Unit 1 ice condenser is essentially identical to the Unit 2 ice condenser, and that the data collected from Unit 2 (e.g., friction torque) can be applied to Unit 1.

Analysis of Current and Previous Data

Table 2 contains data from the Unit 2 as-left surveillance tests of the lower inlet doors performed in April, 2000. As noted previously, the opening torque test data and frictional torque test data are not considered to be valid as a result of the test methodology. This is highlighted by the fact that the opening forces contained within Table 2 are always lower than the closing forces. However, the relevance of the data in Table 2 can be assessed by comparison with data in Table 1, which is known to be valid. The following can be ascertained from review of the Table 1 and Table 2 data:

- The closing force values from the April 2000, Unit 2 as-left surveillance (Table 2) are similar to the closing force values measured recently and compiled in Table 1. This results in the closing torque data from the April, 2000 Unit 2 as-left surveillance (Table 2) showing a good correlation with the recent (Table 1) data. The Table 2 maximum and minimum closing torques are 173.1 inch-pounds and 130.4 inch-pounds, compared to maximum and minimum closing torques of 162.0 and 113.4 inch-pounds measured recently with the improved methodology, and compiled in Table 1. The standard deviations of the closing torque data for Tables 1 and 2 are 10.3 inch-pounds and 9.7 inch-pounds, respectively, further demonstrating the correlation of the data.
- The methodology for determining closing force/torque in April 2000 involved allowing the door to fall into the spring scale from ≈ 1 inch off the spring scale tip. Therefore, the previous methodology measured the force to both stop the door as it moved closed and hold the door. In contrast, the recently developed methodology for measuring closing force simply measures the force at which door movement commences in the closed direction. One would expect the Table 2 data to show slightly higher values of force/torque, which is the case. Therefore, the closing force/torque data compiled in Table 2 can be considered an accurate indicator of the condition of the doors with respect to closing force/torque. It should be emphasized that the Table 2 closing force/torque data is slightly non-conservative in that it includes the force/torque required to stop the door (therefore, it overstates the closing force/torque slightly).
- Given that the closing force/torque data in Tables 1 and 2 correlate, and given that the closing force/torque data in Table 2 is slightly biased as a result of the technique used to collect the data, as described above, a correction factor can be developed which could be applied to closing force/torque data collected using the previous methodology. Based on the averages, the closing torque data in Table 2 is higher than corresponding data in Table 1 by 12.3 inch-pounds.

Therefore, closing torque data collected with the previous methodology (Table 2 and 3) should be adjusted/corrected by subtracting 12.3 inch-pounds.

To perform this correction, the existing Table 3 closing torque data is adjusted by applying the 12.3 inch pound correction factor. The existing Table 3 closing torque data indicates a minimum closing torque value of 104.6 inch-pounds, compared to the Technical Specification acceptance criteria of > 78 inch-pounds. When the 12.3 inch

pound correction factor is applied to the Table 3 data, a minimum closing torque of 92.3 inch-pounds results. **Therefore, the corrected closing torque data from Table 3 meets the Technical Specification acceptance criteria.**

As noted previously, the average and maximum friction torque values from Table 1 were 10.1 inch-pounds and 27.0 inch-pounds. As defined by the Technical Specification surveillance criteria for the lower inlet doors, the hinge frictional torque (Tf) is:

Tf = 0.5(Opening Torque – Closing Torque)

Therefore, opening torque can be predicted given a closing torque and a friction torque. The opening torque is equal to the closing torque plus twice the frictional torque. Given the average and maximum frictional torque values from Table 1, and the corrected average and maximum closing torque from Table 3 of 117.6 inch-pounds (129.9 –12.3) and 164.3 inch-pounds (176.6 – 12.3), respectively, results in the following predicted opening torque values for Unit 1:

Average Closing Torque and Average Friction Torque

(117.6 inch-pounds) + [(2) x (10.1 inch-pounds)] = 137.8 inch-pounds opening torque,

which meets the Technical Specification acceptance criteria of < 195 inch-pounds.

Average Closing Torque and Maximum Friction Torque

(117.6 inch-pounds) + [(2) x (27.0 inch-pounds)] = 171.6 inch-pounds opening torque

which meets the Technical Specification acceptance criteria of < 195 inch-pounds.

Maximum Closing Torque and Average Friction Torque

(164.3 inch-pounds) + [(2) x (10.1 inch-pounds)] = 184.5 inch-pounds

which meets the Technical Specification acceptance criteria of < 195 inch-pounds.

Maximum Closing Torque and Maximum Friction Torque

(164.3 inch-pounds) + [(2) x (27.0 inch-pounds)] = 218.3 inch-pounds

which does not meet the Technical Specification acceptance criteria of < 195 inch-pounds

To determine which specific doors would not meet the Technical Specification acceptance criteria under the case where the maximum frictional torque from Table 1 is applied to the corrected Table 3 closing torque data, the torque relationships above can be solved for the Table 3 closing torque values required to exceed the Technical Specification acceptance criteria:

[(Closing Torque) – (12.3 inch-pounds)] + [(2) x (27.0 inch-pounds)] < 195 inch-pounds

Solving for Closing Torque in the equation above reveals that when the maximum friction torque is applied to the closing torque data from Table 3, any door which has a recorded closing torque in excess of 153.3 inch-pounds will not meet the Technical Specification acceptance criteria. A review of Table 3 indicates that five doors have closing torque values > 153.3 inch-pounds:

4 Right	208.2 inch-pounds opening torque
7 Right	201.5 inch-pounds opening torque
7 Left	198.1 inch-pounds opening torque
21 Right	213.8 inch-pounds opening torque
23 Right	218.3 inch-pounds opening torque

The case of combining the maximum opening torque with maximum friction torque, while representing a credible worst case scenario, is not an expected condition. This is based on review of the valid data for Unit 2 in Table 1, which indicates that the highest friction torques do not correspond to doors with the highest closing torques. For example, the two doors in Table 1 with the highest opening and closing torques (doors 14 Left and 20 Right, respectively) have relatively low friction torques. The friction torques for doors 14 Left and 20 Right are 6.8 inch-pounds and 12.2 inch-pounds, compared to a maximum friction torque of 27.0 inch-pounds for all Table 1 data.

To determine which specific doors would not meet the Technical Specification acceptance criteria under the more extreme case where the maximum frictional torque from Table 1 is applied to the maximum Table 3 (uncorrected) closing torque data, the torque relationships above can be solved for the Table 3 closing torque values required to exceed the Technical Specification acceptance criteria:

(Closing Torque) + [(2) x (27.0 inch-pounds)] < 195 inch-pounds

Solving for Closing Torque in the equation above reveals that when the maximum friction torque is applied to the maximum closing torque data from Table 3, any door which has a recorded closing torque in excess of 141.0 inch-pounds will not meet the Technical Specification acceptance criteria. A review of Table 3 indicates that eight doors have closing torque values > 141.0 inch-pounds:

2 Left	195.8 inch-pounds opening torque
4 Right	220.5 inch-pounds opening torque
6 Right	203.2 inch-pounds opening torque
7 Right	213.8 inch-pounds opening torque
7 Left	210.4 inch-pounds opening torque
15 Right	195.8 inch-pounds opening torque
21 Right	226.1 inch-pounds opening torque
23 Right	230.6 inch-pounds opening torque

The conclusions above are considered very conservative, and are based on the average of three tests per door, which is an accepted test practice. A statistical treatment of the available data using individual test points was also performed (Reference 14) to determine if an even more conservative approach would yield unacceptable results. Based on individual tests of each door, a worst case hinge friction of 28.7 inch-pounds was determined, with the mean plus 3-sigma value calculated to be 31.4 inch-pounds. **Using the largest hinge friction value (31.4 inch-pounds) with each of the individual door tests on Unit 1 indicated that 17 doors would exceed the Technical Specification limit of 195 inch-pounds opening force. However, the design basis limit of 252 inch-pounds (described below) was not exceeded in any instance.**

Door Torque Results vs. Analysis of Record

A review was conducted to determine whether the lower inlet door surveillance test inadequacies could have any impact on the results of the containment minimum recirculation sump water inventory analysis that was used to support a previous license amendment. To accomplish this, the analysis was reviewed to determine if any of its underlying assumptions could be affected by the test inadequacies. This review determined that, in the analysis, the force required to initially open the lower inlet door from the closed position, and to open the lower inlet doors to 40 degrees are significantly greater than the corresponding Technical Specification 4.6.5.3.1.b acceptance criteria. Consequently, it is concluded that that the lower inlet door surveillance test inadequacies do not affect the results of the containment minimum recirculation sump water inventory analysis. The details of the review that support this conclusion are provided below.

Unit 1 License Amendment 234 and Unit 2 License Amendment 217 were transmitted by a letter from J. F. Stang, NRC, to R. P. Powers, I&M, "Issuance of Amendments – Donald C. Cook Nuclear Plant, Units 1 and 2, (TAC Nos. MA6766 and 6767)," dated December, 13, 1999. These license amendments were based in part on an analysis of the water level in the emergency core cooling sump following a postulated LOCA. This analysis was documented in an attachment to I&M's request for the amendment. The

attachment consisted of Fauske and Associates, Inc. (FAI) report FAI/99-77, Revision 2, "Containment Sump Level Evaluation for the D. C. Cook Plant"

Subsequent to that amendment, the units were modified to route essential service water (ESW) pump flow through the containment spray heat exchanger during normal operations to assure acceptable minimum ESW pump flow is maintained. Accordingly, a new containment minimum recirculation sump water inventory analysis was performed. The modification resulted in a very small reduction in the minimum sump water levels for the limiting Mode 1 case. The new analysis is documented in FAI report, FAI/01-67, "Evaluation of Proposed Change to Containment Spray Heat Exchanger Configuration in D. C. Cook," dated September, 2001. This analysis modifies the prior analysis of record, FAI/99-77, Revision 2, to address the change in ESW operation. However, the portion FAI/99-77, Revision. 2 analysis involving performance of the lower inlet doors was unaffected by FAI/01-67. Therefore, FAI/99-77 was used as the basis for the review to determine the impact of the lower inlet door surveillance test inadequacies.

The FAI/99-77, Revision 2 analysis assumes lower inlet door opening and closing characteristics that result in 40 degree opening and closing torque values that are significantly larger than the Technical Specification 4.6.5.3.1.b acceptance criteria. Specifically, the analysis uses the uppermost lower inlet door opening characteristic curve shown on Figure 3, in FAI/99-77, Revision 2, Appendix C, "Ice Condenser Door Opening." This figure shows the total differential pressure across the lower inlet doors as a function of the percent of full door port area. The total differential pressure across the lower inlet doors is given in units of pounds per square foot (psfd), and equals the difference between the lower compartment pressure (P_{LC} in Figure 2 in FAI/99-77, Revision 2, Appendix C) and the ice condenser inlet plenum pressure (P_I in Figure 2 in FAI/99-77, Revision 2, Appendix C). Per FAI/99-77, Revision 2, Appendix C, a 40 degree open lower inlet door corresponds to 35 % of the full door flow area, and from Figure 3 in FAI/99-77, Revision 2, Appendix C, corresponds to a total differential pressure of 0.889 psfd. As Figure 2 in FAI/99-77, Revision 2, Appendix C shows, the average pressure on the lower inlet doors is equivalent to $P_{AV} - P_I$ where P_{AV} is the average of the lower compartment pressure (P_{LC}) and the ice condenser inlet plenum pressure (P_I). Therefore, the torque acting on a lower inlet door is:

$$T = (P_{AV} - P_I) \times A_{LID} \times \frac{W_{LID}}{2}.$$

Since the average pressure on the lower inlet doors ($P_{AV} - P_I$) is half of the total differential pressure across the lower inlet doors ($P_{LC} - P_I$), the lower inlet door torque is related to Figure 3 in FAI/99-77, Revision 2, Appendix C by

$$T = \frac{(P_{LC} - P_I)}{2} \times A_{LID} \times \frac{W_{LID}}{2}.$$

Since a lower inlet door panel is 42 inches wide by 92.5 inches tall, the torque requirement to open the lower inlet door 40 degrees in the minimum containment

recirculation sump water inventory analysis is

$$T_{40\%\,OPEN} = \frac{(P_{LC} - P_I)}{2} \times A_{LID} \times \frac{W_{LID}}{2}$$
$$= \frac{0.889\,psf}{2} \times (42\,in. \times 92.5\,in.) \times \frac{42\,in.}{2} \times \frac{sq.\,ft.}{144\,sq.in.}.$$
$$= 252\ inch - pounds$$

This opening torque value is significantly higher than the maximum allowable opening torque, which is stated in the Technical Specifications to be 195 inch-pounds. The analysis assumes that all of the lower inlet doors open the same way. The analysis also uses this same curve for determining how the lower inlet doors close when the pressure difference across the lower inlet doors decreases. Use of such high opening and closing torque values assures that the lower inlet door flow area is smaller than would be expected, and this is the appropriate direction of conservatism to minimize ice melt rate.

Regarding the initial opening torque, the recirculation sump water level analysis is also conservative relative to the Technical Specification 4.6.5.3.1.b acceptance criterion. The nominal initial opening pressure for the lower inlet doors was modeled as 0.01 psi (1.44 psf). This value is conservatively higher than the cold air head of 1 psf holding the lower inlet door closed (UFSAR Sec. 5.3.3.5.3). The analysis model corresponds to a lower inlet door opening torque of

$$T_{OPENING} = \Delta P_{OPENING} \times A_{LID} \times \frac{W_{LID}}{2}$$
$$= 0.01\,psi \times (42\,in. \times 92.5\,in.) \times \frac{42\,in.}{2}.$$
$$= 816\ in - lbf$$

which is significantly greater than the Technical Specification 4.6.5.3.1.b maximum allowable value of 675 inch-pounds.

In summary, the Table 3 as-left Unit 1 lower inlet door closing force data, in conjunction with the door hinge friction data from Table 1 provides a method to predict the opening torque values for Unit 1. Based on reasonable scenarios which combine either maximum closing torque and average friction torque or average closing torque and maximum friction torque, the doors would meet the Technical Specification 4.6.5.3.1.b acceptance criteria of < 195 inch-pounds opening torque. For the worst case and unlikely scenario of combining the maximum closing torque and the maximum friction torque, the data shows that as many as five doors may not meet the Technical Specification acceptance limit for opening torque. However, the values that would result from combining the maximum closing torque and the maximum friction torque would not invalidate the results of the containment sump analysis.

6.0 Conclusions

Both the Unit 1 and the Unit 2 ice condenser systems including the lower inlet doors were subjected to similar refurbishment prior to the current operation cycle. During the current operating cycle both the ice condenser and containment systems have been subjected to similar maintenance and operational activities. The lower inlet doors were previously tested using an invalid test methodology. Based upon the corollaries drawn within this report, had the lower inlet doors been tested with a valid test methodology, the results would have demonstrated compliance with the Technical Specification Criteria had the testing been performed within the required periodicity. As such, the Unit 2 ice condenser lower inlet doors remained fully capable of performing their design basis function and should be considered to be operable during the cycle. Additionally, the Unit 1 ice condenser lower inlet doors are currently fully capable of performing their design basis function and should be considered to be operable.

7.0 References and Inputs

1. Procedure 12-MHP-SP-LID, Rev. 1 (Data Acquisition For Ice Condenser Lower Inlet Doors) – This procedure collects door opening and closing forces when the door is 40 degrees open. Data from the implementation of this procedure is shown in Table 1.

2. DITs S-01035-00 and S-01035-01 – These Design Information Transmittals provide data collection requirements and bases for procedure 12-MHP-SP-LID.

3. Job Order R008766 (completed) – This Job Order is the repository for as-left surveillance data collected for Unit 2 in April, 2000. As-left surveillance data from Unit 2 in April, 2000 is shown in Table 2. (Performed prior to cycle 12)

4. Job Order R0087658 (completed) – This Job Order is the repository for as-left surveillance data collected for Unit 1 in November, 2000. As-left surveillance data from Unit 1 in November, 2000 is shown in Table 3. (Performed prior to cycle 17)

5. Job Order R0102475 (active) - This Job Order is the repository for data acquired during the performance of the special procedure, 12-MHP-SP-LID, Rev 1.

6. Condition Report 02025084, Series of performance problems, errors and violations related to the performance of procedure 12-MHP-4030.010.003.

7. Condition Report 02022012, Unit 2 Lower Inlet Door As-Found Initial Opening Door Force Test failure.

8. Procedure 12-MHP-4030.010.003, Rev. 0c, Ice Condenser Lower Inlet Door Surveillance – This is the normal lower inlet door surveillance procedure.

9. Technical Specification Surveillance Requirements 4.6.5.3.1.b – Inlet Doors – Provides surveillance requirements for the lower inlet doors.

10. FSAR Appendix M (Historical Data), Ice Condenser Component Evaluation Report.

11. Memo, James Hawley to Gordon Arent, 2/7/02, Evaluation of Lower Inlet Door Surveillance Failures With Respect to the Minimum Containment Recirculation Sump Water Inventory Analysis

12. UFSAR Sections 5.3.3.5.3, 14.3.4.5.4

13. Design Review Board Meeting No. 680 Comments and Resolution, February 7, 2002.

14. Memo, Mary Ma to Gordon Arent, February 8, 2002, Statistical Analysis of Lower Inlet Door Surveillance Results, Controlled Correspondence No. 2002-0399.

Table 1
Lower Inlet Door Data Collected from Implementation of 12-MHP-SP-LID Rev. 1

Bay/ Door	Average Closing Force (pounds)	Average Closing Torque (inch-pounds)	Average Opening Force (pounds)	Average Opening Torque (inch-pounds)	Hinge Friction Force (pounds)	Hinge Friction Torque (inch-pounds)		Bay/ Door	Average Closing Force (pounds)	Average Closing Torque (inch-pounds)	Average Opening Force (pounds)	Average Opening Torque (inch-pounds)	Hinge Friction Force (pounds)	Hinge Friction Torque (inch-pounds)
1R	5.2	140.4	6.0	162.0	0.4	10.8		13R	5.2	140.4	6.2	167.4	0.5	13.5
1L	4.6	124.2	5.5	148.5	0.5	12.2		13L	4.4	118.8	5.9	159.3	0.8	20.3
2R	5.0	135.0	6.1	164.7	0.6	14.9		14R	4.2	113.4	5.3	143.1	0.6	14.9
2L	5.0	135.0	5.9	159.3	0.5	12.2		14L	6.0	162.0	6.5	175.5	0.3	6.8
3R	4.9	132.3	6.1	164.7	0.6	16.2		15R	5.1	137.7	6.2	167.4	0.6	14.9
3L	4.9	132.3	5.5	148.5	0.3	8.1		15L	4.9	132.3	5.0	135.0	0.0	1.4
4R	5.3	143.1	6.3	170.1	0.5	13.5		16R	4.2	113.4	5.3	143.1	0.6	14.9
4L	4.6	124.2	5.3	143.1	0.4	9.5		16L	4.4	118.8	5.1	137.7	0.4	9.4
5R	4.7	126.9	4.8	129.6	0.0	1.4		17R	4.7	126.9	5.8	156.6	0.6	14.9
5L	4.9	132.3	6.0	162.0	0.6	14.9		17L	4.5	121.5	5.1	137.7	0.3	8.1
6R	4.6	124.2	5.8	156.6	0.6	16.2		18R	4.8	129.6	5.6	151.2	0.4	10.8
6L	5.3	143.1	5.8	156.6	0.3	6.8		18L	4.8	129.6	5.2	140.4	0.2	5.4
7R	4.3	116.1	5.4	145.8	0.6	14.9		19R	5.4	145.8	6.5	175.5	0.6	14.9
7L	5.4	145.8	5.6	151.2	0.1	2.7		19L	5.0	135.0	5.7	153.9	0.4	9.5
8R	5.0	135.0	5.7	153.9	0.4	9.5		20R	5.9	159.3	6.8	183.6	0.5	12.2
8L	5.0	135.0	5.1	137.7	0.0	1.4		20L	4.9	132.3	5.8	156.6	0.5	12.2
9R	4.5	121.5	6.5	175.5	1.0	27.0		21R	5.0	135.0	5.8	156.6	0.4	10.8
9L	4.6	124.2	4.9	132.3	0.2	4.1		21L	4.8	129.6	4.8	129.6	0.0	0.0
10R	4.8	129.6	5.9	159.3	0.6	14.9		22R	5.1	137.7	6.2	167.4	0.6	14.9
10L	4.8	129.6	4.9	132.3	0.1	1.4		22L	4.7	126.9	5.6	151.2	0.5	12.2
11R	5.2	140.4	6.2	167.4	0.5	13.5		23R	5.3	143.1	6.2	167.4	0.5	12.2
11L	5.2	140.4	5.3	143.1	0.0	1.4		23L	4.5	121.5	4.6	124.2	0.0	1.4
12R	4.5	121.5	5.3	143.1	0.4	10.8		24R	5.2	140.4	6.0	162.0	0.4	10.8
12L	5.0	135.0	5.0	135.0	0.0	0.0		24L	4.9	132.3	5.1	137.7	0.1	2.7

Maximum Closing Torque	162.0 inch-pounds
Minimum Closing Torque	113.4 inch-pounds
Average Closing Torque	132.3 inch-pounds
Std. Deviation in Closing Torque	10.3 inch-pounds
Maximum Opening Torque	183.6 inch-pounds
Minimum Opening Torque	124.2 inch-pounds
Average Opening Torque	152.6 inch-pounds
Std. Deviation in Opening Torque	14.3 inch-pounds

Maximum Hinge Frictional Torque	27.0 inch-pounds
Minimum Hinge Frictional Torque	0.0 inch-pounds
Average Hinge Frictional Torque	10.1 inch-pounds
Std. Deviation in Frictional Torque	5.9 inch-pounds

Technical Specification Criteria:

Closing Torque > 78 inch-pounds

Opening Torque < 195 inch-pounds

Frictional Torque ≤ 40 inch-pounds

Table 2
As-Left Lower Inlet Door Surveillance Data from Unit 2 in April, 2000

Bay/ Door	Average Closing Force (pounds)	Average Closing Torque (inch-pounds)	Average Opening Force (pounds)	Average Opening Torque (inch-pounds)	Hinge Friction Force (pounds)	Hinge Friction Torque (inch-pounds)		Bay/ Door	Average Closing Force (pounds)	Average Closing Torque (inch-pounds)	Average Opening Force (pounds)	Average Opening Torque (inch-pounds)	Hinge Friction Force (pounds)	Hinge Friction Torque (inch-pounds)
1R	4.8	130.4	4.2	112.6	0.3	8.9		13R	5.1	137.2	4.4	119.3	0.3	8.9
1L	5.8	155.3	4.9	132.8	0.4	11.2		13L	5.5	148.5	3.8	101.3	0.9	23.6
2R	5.6	150.7	4.3	116.9	0.6	16.9		14R	5.1	137.2	3.7	98.8	0.7	19.2
2L	5.6	150.7	5.1	137.2	0.3	6.8		14L	6.4	173.1	4.5	121.5	1.0	25.8
3R	6.3	170.9	5.2	139.6	0.6	15.7		15R	5.4	146.3	4.3	116.9	0.5	14.7
3L	5.5	148.5	4.1	110.2	0.7	19.2		15L	5.0	135.0	3.4	92.3	0.8	21.3
4R	5.2	139.6	4.3	114.8	0.5	12.4		16R	4.9	132.8	4.2	112.6	0.4	10.1
4L	5.3	141.8	3.8	103.4	0.7	19.2		16L	5.3	141.8	4.2	112.6	0.5	14.6
5R	4.9	132.8	4.3	114.8	0.3	9.0		17R	5.4	146.3	4.2	112.6	0.6	16.9
5L	5.0	135.0	3.9	105.8	0.5	14.6		17L	5.3	141.8	3.9	105.8	0.7	18.0
6R	5.1	137.2	4.1	110.2	0.5	13.5		18R	5.6	150.7	4.3	116.9	0.6	16.9
6L	5.3	143.9	4.8	128.3	0.3	7.8		18L	5.3	141.8	3.4	92.3	0.9	24.7
7R	4.9	132.8	4.1	110.2	0.4	11.3		19R	5.7	153.9	4.7	126.1	0.5	13.9
7L	5.5	148.5	4.4	119.3	0.5	14.6		19L	5.8	155.3	4.1	110.2	0.8	22.5
8R	5.0	135.0	4.2	112.6	0.4	11.2		20R	5.8	155.3	4.8	130.4	0.5	12.4
8L	5.6	150.7	4.4	119.3	0.6	15.7		20L	5.3	141.8	3.8	101.3	0.8	20.3
9R	5.8	155.3	5.1	137.2	0.3	9.0		21R	4.9	132.8	3.4	92.3	0.8	20.3
9L	4.8	130.4	3.9	105.8	0.5	12.3		21L	5.4	146.3	4.2	112.6	0.6	16.9
10R	5.6	150.7	4.0	108.0	0.8	21.3		22R	5.4	146.3	4.1	110.2	0.7	18.1
10L	5.3	141.8	3.7	99.1	0.8	21.3		22L	5.9	159.8	4.8	128.3	0.6	15.8
11R	5.5	148.5	4.0	108.0	0.8	20.3		23R	5.5	148.5	4.3	114.8	0.6	16.9
11L	5.6	150.7	4.1	110.2	0.8	20.3		23L	5.2	139.6	4.0	108.0	0.6	15.8
12R	5.1	137.2	4.3	116.9	0.4	10.1		24R	5.1	137.2	4.3	116.9	0.4	10.1
12L	5.3	141.8	4.3	116.9	0.5	12.4		24L	4.8	130.4	3.7	99.1	0.6	15.7

Maximum Closing Torque	173.1 inch-pounds
Minimum Closing Torque	130.4 inch-pounds
Average Closing Torque	144.6 inch-pounds
Std. Deviation in Closing Torque	9.7 inch-pounds
Maximum Opening Torque	139.6 inch-pounds
Minimum Opening Torque	92.3 inch-pounds
Average Opening Torque	113.4 inch-pounds
Std. Deviation in Opening Torque	11.3 inch-pounds

Maximum Hinge Frictional Torque	25.8 inch-pounds
Minimum Hinge Frictional Torque	6.8 inch-pounds

Technical Specification Criteria:

Closing Torque > 78 inch-pounds

Opening Torque < 195 inch-pounds

Frictional Torque ≤ 40 inch-pounds

Table 3

As-Left Lower Inlet Door Surveillance Data from Unit 1 in November, 2000

Bay/ Door	Average Closing Force (pounds)	Average Closing Torque (inch-pounds)	Average Opening Force (pounds)	Average Opening Torque (inch-pounds)	Hinge Friction Force (pounds)	Hinge Friction Torque (inch-pounds)		Bay/ Door	Average Closing Force (pounds)	Average Closing Torque (inch-pounds)	Average Opening Force (pounds)	Average Opening Torque (inch-pounds)	Hinge Friction Force (pounds)	Hinge Friction Torque (inch-pounds)
1R	5.0	133.9	5.8	155.3	0.4	10.7		13R	4.2	113.6	3.5	94.5	0.4	9.6
1L	5.2	139.5	6.3	168.8	0.5	14.6		13L	4.5	121.5	3.6	97.9	0.4	11.8
2R	4.6	123.7	4.1	111.4	0.2	6.2		14R	4.5	121.5	3.5	93.4	0.5	14.1
2L	5.3	141.8	4.1	110.2	0.6	15.8		14L	4.5	121.5	4.3	114.8	0.1	3.4
3R	4.7	126.0	4.3	114.8	0.2	5.6		15R	5.3	141.8	6.4	172.1	0.6	15.2
3L	4.4	119.3	3.9	104.6	0.3	7.3		15L	4.8	129.4	5.0	136.1	0.1	3.4
4R	6.2	166.5	6.9	186.8	0.4	10.1		16R	4.6	123.7	4.8	128.3	0.1	2.3
4L	4.3	115.9	3.8	102.4	0.3	6.8		16L	4.0	108.0	3.9	104.6	0.1	1.7
5R	4.6	124.9	4.0	109.1	0.3	7.9		17R	3.9	104.6	2.9	78.8	0.5	12.9
5L	5.0	135.0	3.8	102.4	0.6	16.3		17L	4.8	128.3	5.4	145.1	0.3	8.4
6R	5.3	142.9	5.0	136.1	0.1	3.4		18R	4.5	120.4	3.0	81.0	0.7	19.7
6L	4.7	126.0	3.9	105.8	0.4	10.1		18L	4.9	131.6	4.6	124.9	0.1	3.4
7R	5.9	159.8	4.6	124.2	0.7	17.8		19R	4.7	126.0	4.8	130.5	0.1	2.2
7L	5.8	156.4	4.5	122.6	0.6	16.9		19L	4.5	121.5	3.8	101.3	0.4	10.1
8R	5.1	138.4	4.4	118.1	0.4	10.1		20R	4.3	114.8	3.6	96.7	0.3	9.0
8L	4.9	132.8	3.9	104.6	0.5	14.1		20L	4.7	127.1	6.3	168.8	0.8	20.8
9R	4.8	128.3	4.0	109.1	0.4	9.6		21R	6.4	172.1	6.6	177.7	0.1	2.8
9L	4.3	117.0	3.5	95.6	0.4	10.7		21L	4.0	108.0	6.3	171.0	1.2	31.5
10R	4.9	131.6	4.0	109.1	0.4	11.2		22R	4.7	126.0	3.8	103.5	0.4	11.3
10L	4.8	128.3	2.5	68.6	1.1	29.8		22L	5.2	140.6	5.4	145.1	0.1	2.3
11R	4.4	118.1	4.0	108.0	0.2	5.1		23R	6.5	176.6	5.0	136.1	0.8	20.3
11L	4.6	124.9	4.1	111.4	0.3	6.8		23L	4.3	117.0	3.1	84.4	0.6	16.3
12R	5.1	137.2	4.2	112.5	0.5	12.4		24R	4.3	114.8	3.7	99.0	0.3	7.9
12L	5.0	135.0	4.5	120.4	0.3	7.3		24L	4.5	121.5	3.7	99.0	0.4	11.2

Maximum Closing Torque	176.6 inch-pounds
Minimum Closing Torque	104.6 inch-pounds
Average Closing Torque	129.9 inch-pounds
Std. Deviation in Closing Torque	15.7 inch-pounds
Maximum Opening Torque	186.8 inch-pounds
Minimum Opening Torque	68.6 inch-pounds
Average Opening Torque	118.7 inch-pounds
Std. Deviation in Opening Torque	27.4 inch-pounds

Maximum Hinge Frictional Torque	31.5 inch-pounds
Minimum Hinge Frictional Torque	1.7 inch-pounds

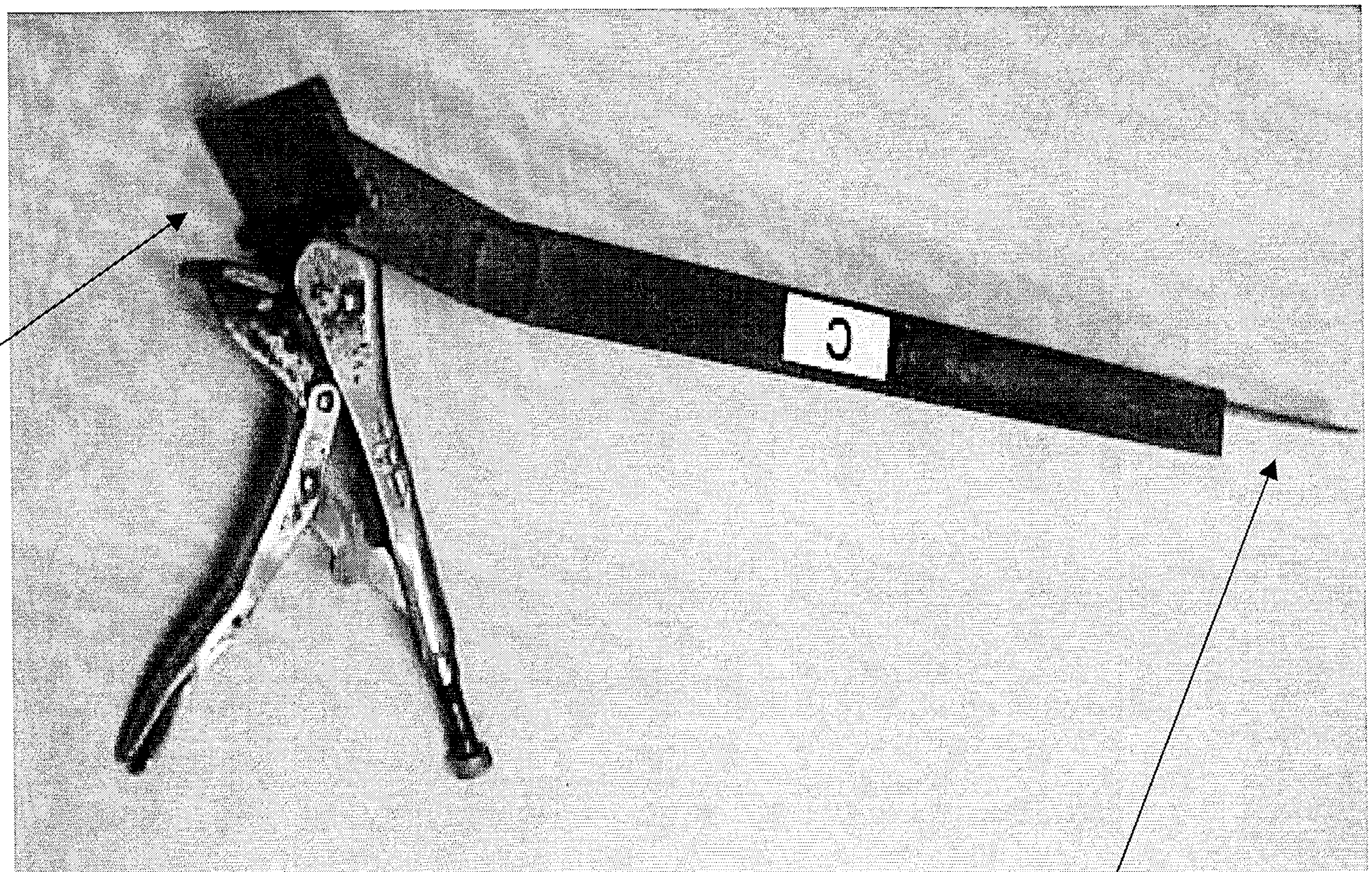
Technical Specification Criteria:

Closing Torque > 78 inch-pounds

Opening Torque < 195 inch-pounds

Frictional Torque ≤ 40 inch-pounds

Photo 1
Test Fixture Used Prior to February, 2002



Clamp to attach test fixture to lower inlet door center door jamb I-Beam

Swing arm which positions door at approximately 40 degrees when in extended position.

Photo 2
Spring Scale Used for Ice Condenser Lower Inlet Door Surveillance Tests

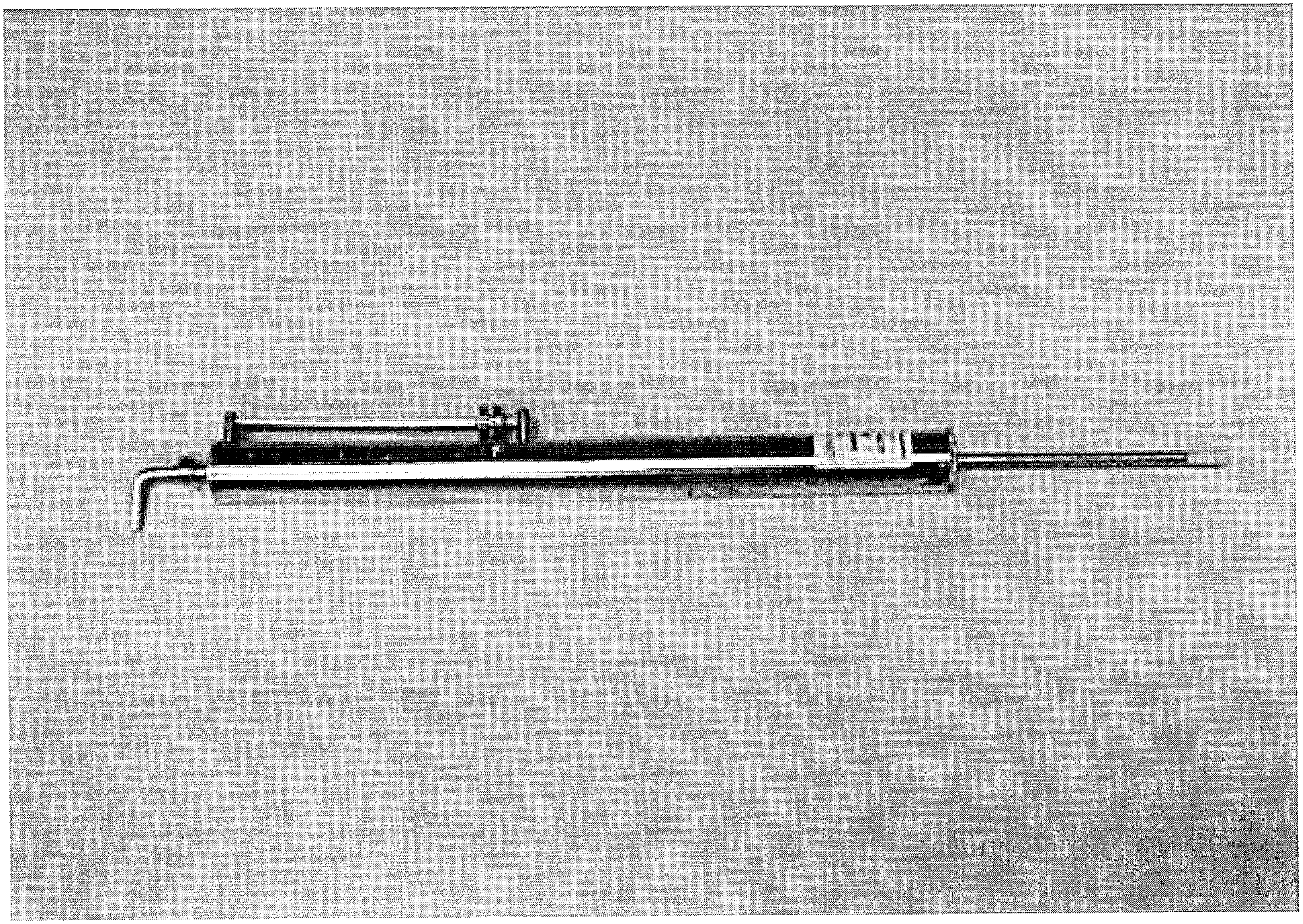


Photo 3
Spring Scale Close-up Showing Pointer and Sliding Indicators

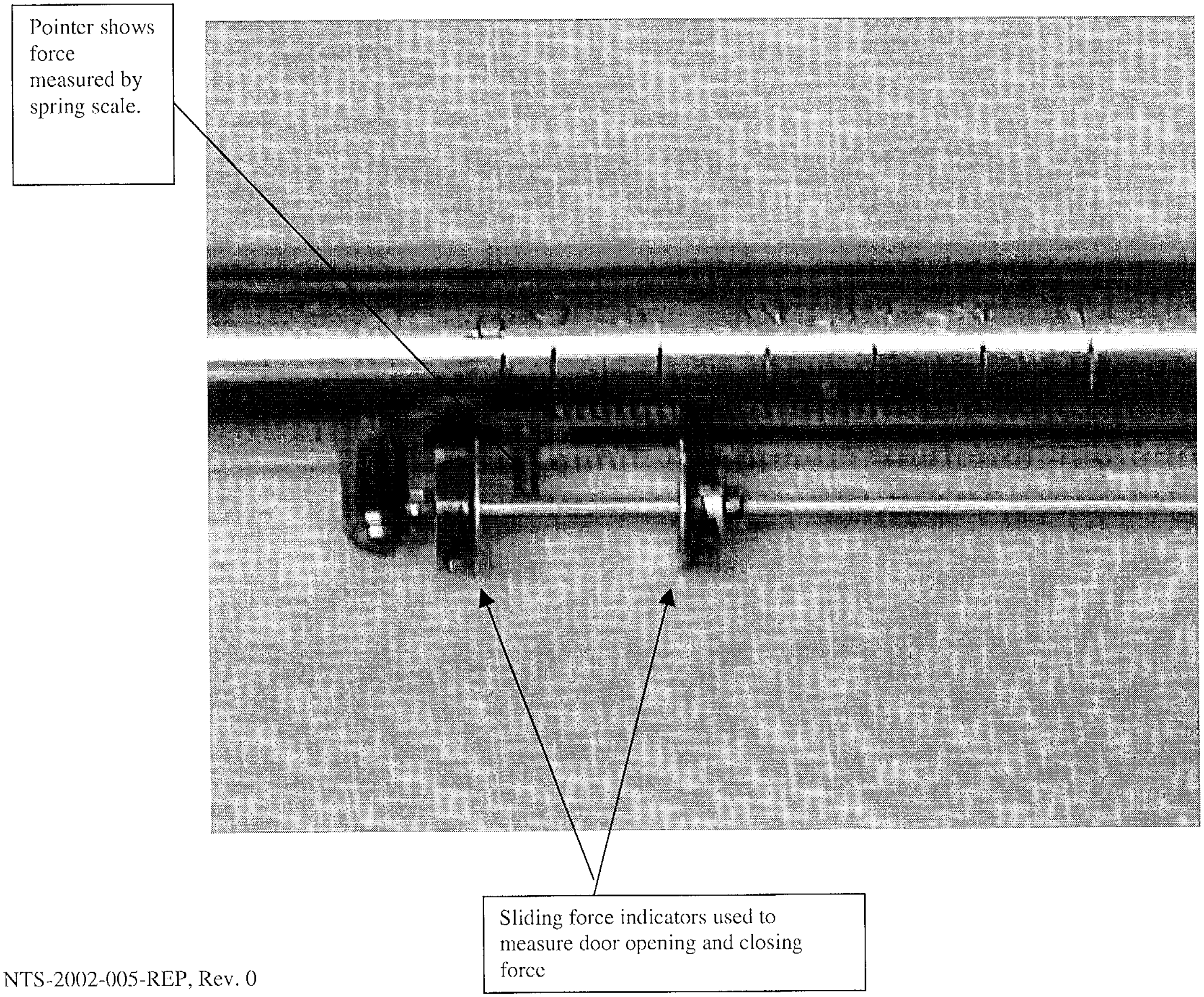
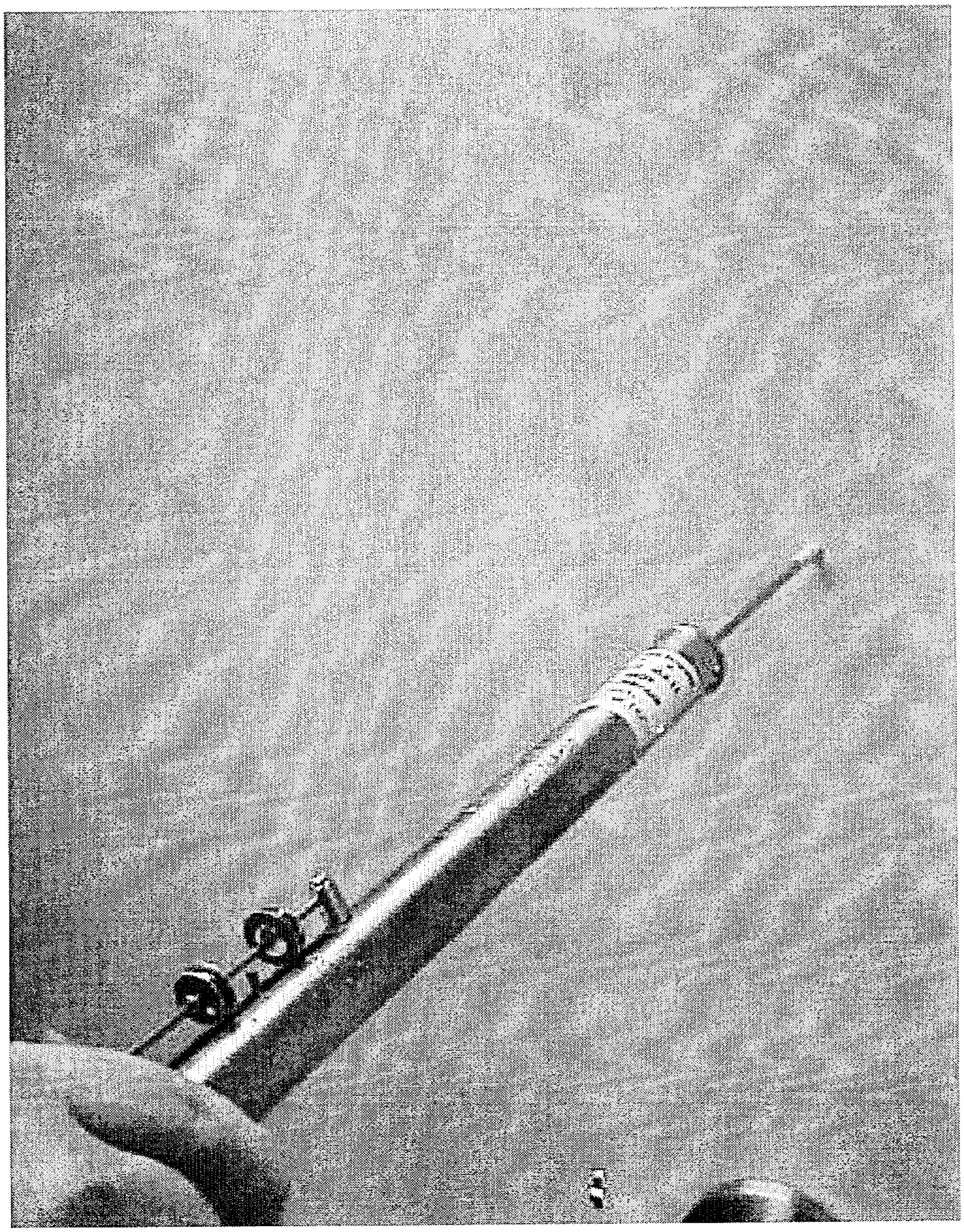


Photo 4
Spring Scale in Position Against a Common Door



Attachment 1
Updated Final Safety Analysis Report Excerpts

The following sections contain excerpts from the UFSAR where performance criteria for the ice condenser lower inlet doors are described.

Lower Inlet Door Design Criteria (from UFSAR Section 5.3.3.5.3)

Accident Conditions
Lower Inlet Doors

a) The doors open (at least partially) in the event of a primary coolant or steam leak which produces an equalization of the cold air head differential pressure across the doors of ½ to 1 lb./sq. ft.
b) The inlet doors and door ports of the ice condenser are designed to distribute steam to the ice condenser to limit mal-distribution to less than 150 % maximum, peak to average mass flow into the ice condenser, resulting from a postulated loss-of-coolant accident that causes the doors to open. That is, the ratio of the peak break flow entering any ice condenser bay to the average break flow entering each bay is limited to 1.5 for the accident transient.
c) The inertia of the doors is low, consistent with producing a negligible effect on initial pressure.
d) During blowdown, adequate flow area is provided for the effluent of condensate and melted ice to drain from the ice condenser, without impeding the distributed input of steam.

Ice Condenser Performance Criteria (from UFSAR Section 14.3.4.5.4)

Flow distribution to the ice condenser for any RCS pipe rupture that opens the ice condenser inlet doors, up to and including the double-ended RCS pipe rupture, is limited such that the maximum energy input into any section of the ice condenser does not exceed its design capability. The door port flow resistance and size provides this flow distribution for breaks that fully open the ice condenser inlet doors. For breaks that partially open the inlet doors, the lower inlet doors proportion flow into the ice bed limiting maldistribution.

For small pipe breaks, which generate less than the pressure drop required to fully open the spring-hinged, ice condenser inlet doors and result in the door performance being in the flow proportioning range, a larger than normal fraction of the break flow will pass through the deck by way of the divider deck bypass area and into the upper compartment.

Another case has been examined where it is postulated that a small break loss-of-coolant accident precedes a larger break accident which occurs before all of the coolant energy is released by the small break, (i.e., a double accident). During the small break blowdown, some quantity of steam and air will bypass the ice condenser and enter the upper compartment via leakage in the divider deck. The important design requirement for the case of a double accident is that the amount of steam leakage into the upper compartment must be limited during the first part (small break) of the accident so that only a small increase in final peak pressure results for the second part (double-ended break) of the postulated accident. The steam which reaches the upper compartment will then add to the peak pressure for the second part of the accident. Therefore, the containment spray system is used to limit the partial pressure of steam in the upper compartment due to deck bypass. The key elements which determine the double accident performance are the ice condenser lower doors, which open at a low differential pressure to admit steam to the ice condenser and limit the bypass flow of steam and thus the partial pressure of steam in the upper compartment, and the sprays which condense this bypass flow of steam and limit the partial pressure of steam in the upper compartment to a low value, less than 2 psia.

14.3.4.5.4.1 Inlet Door Performance

14.3.4.5.4.1.1 Introduction

In the event of a loss-of-coolant incident that would cause a pressure increase in the lower compartment, the doors open, venting air and steam relatively evenly into all sections of the ice condenser.

The door panels are provided with tension spring mechanisms that produce a small closing torque on the door panels as they open. The magnitude of the closing torque is equivalent to providing a one pound per square foot pressure drop through the inlet ports with the door panels open to a position that develops full port flow area.
The zero load position of each spring mechanism is set so that with zero differential pressure across the door panels the gasket seal holds the door slightly open. This provides assurance that all doors will be open slightly and relatively uniformly, prior to development of sufficient lower compartment pressure to cause flow into the ice condenser, therefore eliminating significant inlet maldistribution for very small incidents. For larger incidents the doors open fully and flow distribution is controlled by the inlet ports.

14.3.4.5.4.1.2 Design Criteria

Accident Conditions

a. All doors shall open to allow venting of energy to the ice condenser for any leak rate which results in a divider deck differential pressure in excess of the ice condenser cold head. The force required to open the doors of the ice condenser is sufficiently low such that the energy from any leakage of steam through the divider barrier can be readily absorbed by the containment spray system without exceeding containment design pressure.

b. Doors and door ports shall limit maldistribution to 150 % maximum, peak to average mass input for the accident transient which provides adequate margin in the design ice bed loadings. This is used for any reactor coolant system energy release of sufficient magnitude to cause the doors to open. The inlet doors of the

c. ice condenser are designed to open and distribute steam to the ice condenser in accordance with design basis above, for any postulated loss-of-coolant accident.

d. The doors are designed to eliminate the possibility of doors remaining closed, even for small break conditions. In particular, two degrees of freedom of rotation are incorporated in the hinges and the sealing gasket is designed to pull out for a postulated condition of sticking. The gasket material is itself selected to prevent sticking.

e. The basic performance requirement for lower inlet doors for design basis accident conditions is to open rapidly and fully, to ensure proper venting of released energy into the ice condenser. The opening rate of the inlet doors is important to ensure minimizing the pressure buildup in the lower compartment due to the rapid

f. release of energy to that compartment.

g. Ice condenser doors shall be protected from direct steam jet following a postulated steam line break.

14.3.4.5.4.1.3 Performance Capability

Figure 14.3.4-158 shows the door opening characteristics as a function of door differential pressure based on a linear spring constant. Notably, there is no special significance to be attached to a linear spring constant, and detail design of the door and spring system indicated that non-linear spring characteristics changed the release rate at which maximum maldistribution would occur, but did not change the maximum maldistribution value. The performance characteristics to be expected from the inlet doors would be typical of those shown in Figure 14.3.4-158. The effect of maximum variation of door proportioning characteristics indicates significantly less maldistribution than the 150 % limit.

Importantly, and as discussed in other reports, the ratio of maximum to average flow of steam into the ice condenser for pipe break sizes large enough to fully open the doors is limited by the door ports themselves to a reasonably low value, about 116 % of the average. The equilibrium position of the inlet door panels with zero differential pressure is slightly open (about 3/8 inch), which provides a small flow area at each door for uniform inlet flow into each segment of the ice bed. The doors are designed to eliminate the possibility of doors remaining closed, even for small break conditions. In particular two degrees of freedom of rotation are incorporated in the hinges, and the sealing gasket is designed to pull out for a postulated condition of sticking. The gasket material is itself selected to prevent sticking. Consideration is, however, given in the analysis of ice condenser performance to a hypothetical case of stuck doors at which the most severe of the above postulated malfunctions is overcome by the force on the door. Even in this hypothetical case the door panels would rupture, providing a sufficient flow path into the ice condenser to permit the ice condenser to function to limit containment pressure below design limits.

It is recognized that the springs are an important part of the lower ice condenser doors. These spring assemblies are designed such that the failure of any spring will not significantly change the operating characteristics of the ice condenser doors. This objective has been achieved in a practical manner by the use of four separate tension springs per door, which provides redundancy and assures adequate opening characteristics.

Accident Conditions

The basic lower inlet door performance requirement for design basis accident conditions is to open rapidly and fully, to insure proper venting of released energy into the ice condenser. The opening rate of the inlet doors is important to insure minimizing the pressure buildup in the lower compartment due to the rapid release of energy to that compartment. The rate of pressure rise and the magnitude of the peak pressure in any lower compartment region is related to the confinement of that compartment, and in particular the active volume and flow restrictions out of that compartment. The time period to reach peak lower compartment pressure due to the design basis accident is a fraction of a second. It is dependent upon flow restrictions and proximity to the break location. The opening rate of the inlet doors is wholly dependent upon the inertia of the door and the magnitude of the forcing function, which is the pressure buildup in the lower compartment due to the energy release. The ice condenser inlet door inertia is slightly less than the doors tested in the ice condenser full scale section tests. These tests demonstrate that door inertia has essentially no effect on the initial peak pressure.

The necessary performance of the ice condenser is further ensured by the door design incorporating a low pressure fail open characteristic. Even if it is postulated that the doors were held rigidly along the bottom edge, they would fail open at a differential pressure sufficiently low to allow venting from the lower compartment well within the limits of pressure capability of the structures.

ATTACHMENT 2 TO AEP:NRC:2591

COMMITMENTS

The following table identifies those actions committed to by Indiana Michigan Power Company (I&M) in this document. Any 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	Date
If Unit 1 enters Mode 5 for a sufficient duration prior to the fuel cycle 18 refueling outage, I&M will perform the surveillance testing required by TS 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5.	As required.

ATTACHMENT 3 TO AEP:NRC:2591

MARKED-UP PROPOSED OPERATING LICENSE CHANGES

6. A procedure identifying (a) the authority responsible for the interpretation of the data, and (b) the sequence and timing of administrative events required to initiate corrective actions.

Amendment No. 169

(8) The provisions of Specification 3/4.9.7 are not applicable for loads being moved over the pool for the duration of the spent fuel pool reracking project. Control of loads moving over the spent fuel pool during the spent fuel pool reracking project shall comply with the criteria of NUREG-0612 "Control of Heavy Loads at Nuclear Power Plants." Administrative controls shall be in place to prevent any load not rigged in compliance with the criteria of NUREG-0612 from passing over the spent fuel pool with the crane interlocks, required by T/S 3/4.9.7, disengaged.

Amendment No. 227

2.C(9) The surveillance requirements of Technical Specification 4.4.5.3 have been extended until the start of cycle 17, not to exceed January 31, 2001. In the event the steam generators are replaced prior to the start of cycle 17, the retired steam generators are exempted from further surveillance under T/S 4.4.5.3.

2.C(10) Technical Specification surveillance requirements 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5 need not be performed until prior to ascension into Mode 4 at the completion of the fuel cycle 18 refueling outage. If Unit 1 enters Mode 5 for a sufficient duration prior to the fuel cycle 18 refueling outage, I&M will perform the surveillance testing required by TS 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5.

*2.D <u>Physical Protection</u>

Amendment No. 122

The licensee shall fully implement and maintain in effect all provisions of the Commission-approved physical security, guard training and qualification, and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822) and to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The plans, which contain Safeguards Information protected under 10 CFR 73.21, are entitled: "Donald C. Cook Nuclear Plant Security Plan," with revisions submitted through July 21, 1988; "Donald C. Cook Nuclear Plant Training and Qualification Plan," with revisions submitted through December 19, 1986; and Donald C. Cook Nuclear Plant Safeguards Contingency Plan," with revisions submitted through June 10, 1988. Changes made in accordance with 10 CFR 73.55 shall be implemented in accordance with the schedule set forth therein.

E. Deleted by Amendment 80.

** 2.F. Deleted by Amendment 80.

Amendment No. 33

* 2.G In all places of this license, the reference to the Indiana and Michigan Power Company is deleted and all references to "the licensees" is amended to read "the licensee". The intent is to recognize the Indiana and Michigan Electric Company as the sole licensee of the Donald C. Cook Nuclear Plant.

* 2.H System Integrity

Amendment No. 49

The licensee shall implement a program to reduce leakage from systems outside containment that would or could contain highly radioactive fluids during a serious transient or accident to as low a practical levels. The program shall include the following:

1. Provisions establishing preventive maintenance and periodic visual inspection requirements, and

2. Integrated leak test requirements for each system at a frequency not to exceed refueling cycle intervals.

* 2.I Iodine Monitoring

Amendment No. 49

The licensee shall implement a program which will ensure the capability to accurately determine the airborne concentration in vital areas under accident conditions. This program shall include the following:

1. training of personnel,

2. Procedures for monitoring, and

3. Provisions for maintenance of sampling and analysis equipment.

Amendment No. 114 — 2.J In all places of this license, the reference to the Indiana and Michigan Electric Company is amended to read "Indiana Michigan Power Company."

Amendment No. 175 — 2.K The licensee is authorized to use digital signal processing instrumentation in the reactor protection system.

Amendment No. 157 — 3. This amended license is effective as of the date of issuance and shall expire at midnight October 25, 2014.

* Amendment No. 70 superseded the following Amendments for numbering: Nos. 33, 45 and 49.

** 2.F represents the original Paragraph of "2.G" that was not included on the Amended License (Amendment No. 12) when issued.

FOR THE NUCLEAR REGULATORY COMMISSION

Roger S. Boyd, Director
Division of Project Management
Office of Nuclear Reactor Regulation

Enclosure:

Appendix A - Technical Specifications

Date of Issuance: March 30, 1976

ATTACHMENT 4 TO AEP:NRC:2591

PROPOSED OPERATING LICENSE PAGE

Amendment No. 49

* 2.H System Integrity

The licensee shall implement a program to reduce leakage from systems outside containment that would or could contain highly radioactive fluids during a serious transient or accident to as low a practical levels. The program shall include the following:

1. Provisions establishing preventive maintenance and periodic visual inspection requirements, and

2. Integrated leak test requirements for each system at a frequency not to exceed refueling cycle intervals.

* 2.I Iodine Monitoring

Amendment No. 49

The licensee shall implement a program which will ensure the capability to accurately determine the airborne concentration in vital areas under accident conditions. This program shall include the following:

1. training of personnel,

2. Procedures for monitoring, and

3. Provisions for maintenance of sampling and analysis equipment.

Amendment No. 114

2.J In all places of this license, the reference to the Indiana and Michigan Electric Company is amended to read "Indiana Michigan Power Company."

Amendment No. 175

2.K The licensee is authorized to use digital signal processing instrumentation in the reactor protection system.

Amendment No. 157

3. This amended license is effective as of the date of issuance and shall expire at midnight October 25, 2014.

* Amendment No. 70 superseded the following Amendments for numbering: Nos. 33, 45 and 49.

** 2.F represents the original Paragraph of "2.G" that was not included on the Amended License (Amendment No. 12) when issued.

FOR THE NUCLEAR REGULATORY COMMISSION

Roger S. Boyd, Director
Division of Project Management
Office of Nuclear Reactor Regulation

Enclosure:

Appendix A - Technical Specifications

Date of Issuance: March 30, 1976

6. A procedure identifying (a) the authority responsible for the interpretation of the data, and (b) the sequence and timing of administrative events required to initiate corrective actions.

Amendment No. 169

(8) The provisions of Specification 3/4.9.7 are not applicable for loads being moved over the pool for the duration of the spent fuel pool reracking project. Control of loads moving over the spent fuel pool during the spent fuel pool reracking project shall comply with the criteria of NUREG-0612 "Control of Heavy Loads at Nuclear Power Plants." Administrative controls shall be in place to prevent any load not rigged in compliance with the criteria of NUREG-0612 from passing over the spent fuel pool with the crane interlocks, required by T/S 3/4.9.7, disengaged.

Amendment No. 227

2.C(9) The surveillance requirements of Technical Specification 4.4.5.3 have been extended until the start of cycle 17, not to exceed January 31, 2001. In the event the steam generators are replaced prior to the start of cycle 17, the retired steam generators are exempted from further surveillance under T/S 4.4.5.3.

2.C(10) Technical Specification surveillance requirements 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5 need not be performed until prior to ascension into Mode 4 at the completion of the fuel cycle 18 refueling outage. If Unit 1 enters Mode 5 for a sufficient duration prior to the fuel cycle 18 refueling outage, I&M will perform the surveillance testing required by TS 4.6.5.3.1.b.3, 4.6.5.3.1.b.4, and 4.6.5.3.1.b.5.

*2.D <u>Physical Protection</u>

Amendment No. 122

The licensee shall fully implement and maintain in effect all provisions of the Commission-approved physical security, guard training and qualification, and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822) and to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The plans, which contain Safeguards Information protected under 10 CFR 73.21, are entitled: "Donald C. Cook Nuclear Plant Security Plan," with revisions submitted through July 21, 1988; "Donald C. Cook Nuclear Plant Training and Qualification Plan," with revisions submitted through December 19, 1986; and Donald C. Cook Nuclear Plant Safeguards Contingency Plan," with revisions submitted through June 10, 1988. Changes made in accordance with 10 CFR 73.55 shall be implemented in accordance with the schedule set forth therein.

E. Deleted by Amendment 80.

** 2.F. Deleted by Amendment 80.

Amendment No. 33

* 2.G In all places of this license, the reference to the Indiana and Michigan Power Company is deleted and all references to "the licensees" is amended to read "the licensee". The intent is to recognize the Indiana and Michigan Electric Company as the sole licensee of the Donald C. Cook Nuclear Plant.