Indiana Michigan
Power Company
Cook Nuclear Plant
One Cook Plant
Bridgman MI 49106
616 465 5901

INDIANA
MICHIGAN
POWER

September 26, 2000

C0900-20
10 CFR 50.90

Docket Nos.: 50-315
50-316

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

Donald C. Cook Nuclear Plant Units 1 and 2
LICENSE AMENDMENT REQUEST
REACTOR COOLANT PUMP SEAL LEAK-OFF TWO-PHASE FLOW:
REVISED ANALYSIS AND RELATED CHANGES

Pursuant to 10 CFR 50.90, Indiana Michigan Power Company (I&M), the Licensee for Donald C. Cook Nuclear Plant (CNP) Units 1 and 2, proposes to amend facility Operating Licenses DPR-58 and DPR-74. I&M requests review and approval, pursuant to 10 CFR 50.59(c), of changes to the CNP licensing basis as described in the CNP Updated Final Safety Analysis Report (UFSAR). The current licensing basis requires no specific operator action in response to a loss of seal injection (LOSI) cooling to the reactor coolant pumps (RCPs). I&M is proposing a new licensing basis that involves actions to mitigate the effects of a LOSI. This change is needed to reflect RCP seal design performance based on a detailed engineering analysis. Since the proposed change involves new operator actions in response to a LOSI, I&M identified this as an unreviewed safety question, the resolution of which requires NRC review and approval.

Attachment 1 provides a detailed description of the proposed changes. Attachment 2 provides a mark-up of the UFSAR that reflects this proposed change. Attachment 3 describes the evaluation performed in accordance with 10 CFR 50.92(c), which concludes that no significant hazard is involved. Attachment 4 provides the environmental assessment.

I&M requests approval of this submittal by November 24, 2000. If necessary, an operability determination performed to support the Unit 2 startup could be applied to support the restart of Unit 1.

A001

Printed on recycled paper

This submittal makes no specific commitments.

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

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

Sincerely,

R. P. Powers
Vice President

/dmb

Attachments

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

AFFIRMATION

I, Robert P. Powers, being duly sworn, state that I am 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.

Indiana Michigan Power Company

R. P. P

Robert P. Powers
Vice President

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 26 DAY OF SEPTEMBER, 2000

Jennifer L Kernosky
Notary Public

My Commission Expires _____

JENNIFER L KERNOSKY
Notary Public, Berrien County, Michigan
My Commission Expires May 26, 2005

ATTACHMENT 1 TO C0900-20

DESCRIPTION OF THE PROPOSED ANALYSIS CHANGES

A. Summary of the Proposed Changes

Pursuant to 10 CFR 50.90, Indiana Michigan Power Company (I&M), the Licensee for Donald C. Cook Nuclear Plant (CNP) Units 1 and 2, proposes to amend facility Operating Licenses DPR-58 and DPR-74. I&M requests review and approval, pursuant to 10 CFR 50.59(c), of changes to the CNP licensing basis as described in the CNP Updated Final Safety Analysis Report (UFSAR). The current licensing basis requires no specific operator action in response to a loss of seal injection (LOSI) cooling to the reactor coolant pumps (RCPs). I&M is proposing a new licensing basis that involves actions to mitigate the effects of a LOSI. This change is needed to reflect RCP seal design performance based on a detailed engineering analysis. Since the proposed change involves new operator actions in response to a LOSI, I&M identified this as an unreviewed safety question, the resolution of which requires Nuclear Regulatory Commission (NRC) review and approval.

The proposed changes are described in detail in Section D of this attachment.

Background

The RCPs in use at CNP are vertical shaft pumps employing a controlled leakage seal assembly to restrict reactor coolant system (RCS) leakage (seal leak-off) along the pump shaft. The controlled leakage seal is called the Number 1 seal. Seal leak-off cools and lubricates the Number 1 seal. Insufficient seal leak-off, therefore, results in less than adequate cooling and lubrication to the Number 1 seal.

During normal operation, cooled and filtered high pressure charging water (seal injection) is admitted to an annular region in the pump casing around the pump shaft. At the top of this annular region is the Number 1 seal. At the bottom of the annular region, above the pump impeller, is a thermal barrier heat exchanger (TBHx) and labyrinth seal. Seal injection water pressurizes the annular region to slightly above RCS pressure. A portion of the seal injection water goes through the pump's lower radial bearing, up the pump shaft to the Number 1 seal, leaks across the faces of the seal and is directed back to the charging system through the seal leak-off return line. The leak-off effectively cools and lubricates the radial bearing and the Number 1 seal. The rest of the seal injection water goes down the pump shaft, through the TBHx and into the RCS through the labyrinth seal.

During abnormal conditions involving a LOSI, the annular region cannot be maintained at a higher pressure than the RCS. As a result, hot, unfiltered RCS water (primary coolant) flows into the annular region through the labyrinth seal and is then cooled by component cooling water (CCW) as it passes through the TBHx. The cooled primary coolant then flows up the pump

shaft, cooling and lubricating the radial bearing and Number 1 seal in the same manner as previously described for seal injection water.

B. Description of the Current Requirements

The current licensing basis requires no operator action on a LOSI. This is reflected in UFSAR section 9.2.3, "System Design Evaluation," which states:

> On a loss of seal injection water to the reactor coolant pump seals, seal water flow may be reestablished by manually rerouting the flow or starting a standby charging pump. Even if the seal water injection flow is not re-established, the plant can be operated indefinitely since the thermal barrier cooler has sufficient capacity to cool the reactor coolant flow which would pass through the thermal barrier cooler and seal leak-off from the pump volute.

C. Bases for the Current Requirements

Based on Westinghouse Electric Company (Westinghouse) design for the RCPs, it was believed to be within the design capability of the RCP TBHx to permit sustained (essentially indefinite) pump operation without seal injection over the full range of Westinghouse recommended seal leak-off flow rates.

D. Need for Revision of the Requirement

I&M has learned, as a result of an engineering analysis it commissioned, that when the seal leak-off rates are less than 2 gpm, the cooled primary coolant exiting the TBHx may overheat as it flows up the pump shaft and through the bearing prior to reaching the seal. Under these conditions, the pressure reduction across the Number 1 seal can result in the overheated primary coolant flashing to steam (two phase flow) at the seal face or in the downstream leak-off return piping. Seal performance cannot be predicted with two-phase flow in the downstream piping and, therefore, two-phase flow must be precluded. Operator actions may now be required on a LOSI to offset reduced cooling capacity and to avoid two-phase flow (additional details are provided in Section F, Bases for the Proposed Change). The required operator actions following a LOSI are:

- If high seal return line temperatures occur before seal injection can be restored, the unit will be tripped and the affected RCP(s) secured.
- Back-pressure will then be controlled in the seal leak-off return line to prevent flashing.
- The unit may remain in hot standby indefinitely, but if a cooldown is performed, the cooldown rate will be controlled to ensure the differential pressure across the seals permits adequate seal leak-off flow to maintain cooling.

E. Description of the Proposed Changes

I&M proposes a change to the licensing basis as described in the UFSAR. I&M proposes to change the licensing basis such that operator actions are needed to mitigate the effects of a LOSI. If the change to the licensing basis is approved, I&M intends to change the UFSAR to delete the current discussion describing continuous RCP operation following a LOSI. Instead, the UFSAR will describe the potential for seal leak-off flow high temperature alarms to be received following a LOSI. If the high temperature alarms are received, the unit will be tripped and the affected RCPs will be secured. If needed, back pressure can be established in the seal leak-off line to preclude flashing, and plant cooldown can be restricted to a rate that maintains differential pressure across the seal.

Attachment 2 provides a markup of the UFSAR that reflects this proposed change.

F. Bases for the Proposed Change

The above described actions to minimize the effect of the reduced seal leak-off rates have been identified and are readily achievable. Plant and RCP tripping are anticipated transients that do not involve plant operation outside design limits or prescribed procedures. Using conservative heat-up rate assumptions, operators will have a minimum of 90 minutes, following the first RCP seal leak-off temperature alarm, to establish adequate seal leak-off back pressure. This can be accomplished by raising volume control tank pressure within the current normal operating band using the same methods and procedures routinely used during normal operations. The prescribed maximum cooldown rate is well within the range of current operating practice and, if all RCPs need to be secured, is less limiting than current procedures specify for natural circulation cooldown rates of the RCS.

In summary, by securing the affected RCPs and observing the established process controls, adequate RCP seal cooling following a LOSI continues to be maintained relying only on the cooling provided by CCW to the TBHx in each pump.

<u>Discussion of Risk</u>

The RCP Number 1 seal design in use at CNP since 1987 has been generally recognized as contributing to a reduction in the frequency of RCP seal failures. For example, in the recent closure of Generic Safety Issue 23, "Reactor Coolant Pump Seal Failure," the NRC staff noted (reference 1) that:

> The RCP seal failure issue was originally prioritized as a high-priority issue on the basis of the frequency with which RCP seal failures occurred during normal operation from the mid-1970s to the early 1980s. The actual, normal operational RCP seal failure frequency at that time exceeded the

> small-break loss-of-coolant accident (LOCA) frequency assumed in the WASH-1400 study by an order of magnitude. The normal operational seal failure rate has since been significantly reduced through improvements in design and operation of RCP seals.

The experience at CNP with the new seals is consistent with the staff's observations.

The probabilistic risk assessment (PRA) for CNP Units 1 and 2 does not specifically model a LOSI or any known contributor to RCP seal failures. Instead, RCP seal failures of sufficient magnitude are simply considered small-break (SB) LOCA initiators and are included by the CNP PRA in the frequency estimate for SBLOCAs. The current CNP PRA used RCP seal LOCA frequency estimates derived from a Westinghouse calculation. A new PRA is being prepared that uses the RCP seal LOCA frequency estimates presented in NUREG/CR-5750, "Rates of Initiating Events at U.S. Nuclear Power Plants: 1987-1995." The NUREG estimate for RCP seal LOCAs indicates a lower frequency compared to the older Westinghouse calculation.

In summary, the CNP PRA includes the effects of RCP seal failures from all causes in the SBLOCA frequency data used in the CNP PRA. Therefore, the proposed change to the licensing basis is encompassed by the CNP PRA and would not change the results of the PRA.

Based on the above, it is concluded that the use of RCP Number 1 seals having low leak-off rates does not result in a significant increase in risk.

G. Impact on Previous Submittals

No other previous submittals are affected by this request.

<u>References</u>

1). NRC Regulatory Issue Summary 2000-02, "Closure of Generic Safety Issue 23, Reactor Coolant Pump Seal Failure," dated February 15, 2000.

ATTACHMENT 2 to C0900-20

UPDATED FINAL SAFETY ANALYSIS REPORT PAGES
MARKED TO SHOW PROPOSED CHANGES

UNITS 1 & 2
Section 9.2.3

Page 26

UFSAR CHANGE NOT APPROVED

At least two separate and independent flow paths are available for reactor coolant boration; i.e., the charging line, or the reactor coolant pumps labyrinth seals. The malfunction or failure of one component does not result in the inability to borate the Reactor Coolant System. An alternate flow path is therefore available for emergency boration of the reactor coolant. As backup to the boration system, the operator can align the refueling water storage tank outlet to the suction of the charging pumps.

Boration during operating to compensate for power changes will be indicated to the operator from a combination of two sources: (a) the control rod movement and (b) the flow indicator in the boric acid transfer pump discharge line. When the emergency boration path is used, three indications to the operator are available. The primary indication is a flow indicator in the emergency boration line. The charging line flow indicator will indicate boric acid flow since the charging pump suction is aligned to the boric acid transfer pump for this mode of operation. The change in boric acid tank level is another indication of boric acid injection.

On loss of seal injection water to the reactor coolant pump seals, seal water flow may be reestablished by manually rerouting the flow or starting a standby charging pump. During operation without seal injection flow, the thermal barrier cooler serves to remove heat from the reactor coolant flow that passes through the thermal barrier cooler, thereby controlling the No. 1 seal leak-off temperature. In the event seal water injection flow cannot be reestablished prior to the reactor coolant pump No.1 seal leak-off flow temperatures exceeding the alarm setpoint, the plant will be tripped and the reactor coolant pump operation stopped. Process controls will be utilized to maintain adequate seal cooling after the affected RCP(s) are secured. ~~Even if the seal water injection flow is not re-established, the plant can be operated indefinitely since the thermal barrier cooler has sufficient capacity to cool the reactor coolant flow which would pass through the thermal barrier cooler and seal leakoff from the pump volute.~~

It can be concluded that proper consideration has been given to station safety in the design of the system.

Galvanic Corrosion

The only types of materials which are in contact with each other in borated water are stainless steels, Inconel, Stellite (or equivalent) valve materials and Zircaloy fuel element cladding. Those materials have been shown[1] to exhibit only an insignificant degree of galvanic corrosion when coupled to each other.

ATTACHMENT 3 TO C0900-20

NO SIGNIFICANT HAZARDS CONSIDERATION EVALUATION

Indiana Michigan Power Company (I&M) has evaluated this proposed amendment and determined that it does not involve a significant hazard. According to 10 CFR 50.92(c), a proposed amendment to an operating license involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not:

1. involve a significant increase in the probability of occurrence or consequences of an accident previously evaluated;

2. create the possibility of a new or different kind of accident from any previously analyzed; or

3. involve a significant reduction in a margin of safety.

I&M proposes to amend facility Operating Licenses DPR-58 and DPR-74. I&M requests review and approval, pursuant to 10 CFR 50.59(c), of changes to the CNP licensing basis as described in the Donald C. Cook Nuclear Plant Updated Final Safety Analysis Report (UFSAR). The current licensing basis requires no specific operator action in response to a loss of seal injection (LOSI) cooling to the reactor coolant pumps (RCPs). I&M is proposing a new licensing basis that involves actions to mitigate the effects of a LOSI. This change is needed to reflect RCP seal design performance based on an engineering analysis. Since the proposed change involves new operator actions in response to a LOSI, I&M identified this as an unreviewed safety question, the resolution of which requires NRC review and approval.

The determination that the criteria set forth in 10 CFR 50.92 are met for this amendment request is indicated below.

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

The proposed change to the licensing basis recognizes that if RCP Number 1 seal leak-off rates are low, continuous RCP operation following a sustained LOSI may no longer be permitted. Tripping the plant, securing the affected RCPs, and maintaining hot standby conditions following a sustained LOSI will permit adequate RCP seal cooling by readily achievable process controls. These actions ensure that the probability of developing excessive seal leakage equivalent to that of a previously evaluated loss of coolant accident (LOCA), has not been significantly increased. Plant and RCP tripping are anticipated transients that do not involve plant operation outside design limits.

The consequences of large- and small-break (SB) LOCAs have been evaluated and it has been shown that the radiological consequences of these events do not result in unacceptable exposures to members of the public. Therefore, even if stopping of the RCPs following a LOSI and control of process parameters as described above does not preclude RCP seal failures, the consequences of such failure are bounded by the current accident analysis.

Therefore, the probability of occurrence or the consequences of accidents previously evaluated are not significantly increased.

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

The leakage resulting from failed RCP seals may be large enough to be considered a SBLOCA and industry data on SBLOCA initiating frequencies includes the contribution from failed RCP seals. SBLOCAs are a previously evaluated class of accidents. There is no new or different kind of accident created as a result of this change.

Therefore, the change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

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

The original design objective for the controlled leakage seal assemblies in the RCPs was to permit sufficient controlled leakage following a LOSI, such that cooling of the leakage provided by the thermal barrier heat exchanger would be sufficient to continue RCP operation unabated without challenging seal integrity. This is an implied margin of safety for seal integrity, even if not explicitly defined in the basis for any Technical Specification. It has been postulated that the reduced seal leak-off will no longer permit continuous RCP operation following a LOSI. The proposed change to the licensing basis recognizes this condition and requires pump tripping if seal injection cannot be restored prior to receiving high temperature alarms in the leak-off return lines. Pump tripping reduces the heat generated in the pump and permits readily achievable process controls to maintain adequate seal cooling and an adequate margin to seal failure.

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

In summary, based upon the above evaluation, I&M has concluded that the proposed change involves no significant hazards consideration.

ATTACHMENT 4 TO C0900-20

ENVIRONMENTAL ASSESSMENT

Indiana Michigan Power Company (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 this license amendment request meets the criteria for a categorical exclusion set forth in 10 CFR 51.22(c)(9). This determination is based on the fact that this change is being proposed as an amendment to a license issued pursuant to 10 CFR Part 50 that changes a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or that changes an inspection or a surveillance requirement, and the amendment meets the following specific criteria.

(i) The amendment involves no significant hazards consideration.

As demonstrated in Attachment 3, this proposed amendment does not involve significant hazards consideration.

(ii) There is no significant change in the types or significant increase in the amounts of any effluent that may be released offsite.

As documented in Attachment 1, there will be no significant change in the types or significant increase in the amounts of any effluents released offsite.

(iii) There is no significant increase in individual or cumulative occupational radiation exposure.

The proposed changes will not result in significant changes in the operation or configuration of the facility. There will be no change in the level of controls or methodology used for processing of radioactive effluents or handling of solid radioactive waste, nor will the proposal result in any change in the normal radiation levels within the plant. Therefore, there will be no significant increase in individual or cumulative occupational radiation exposure resulting from this change.