Indiana Michigan
Power Company
500 Circle Drive
Buchanan, MI 49107 1373

AEP
INDIANA MICHIGAN POWER

June 29, 2001

C0601-09
10 CFR 50.90

Docket No.: 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
RESPONSE TO NUCLEAR REGULATORY COMMISSION REQUEST FOR ADDITIONAL INFORMATION
REGARDING LICENSE AMENDMENT REQUEST,
"REACTOR COOLANT PUMP SEAL LEAK-OFF TWO-PHASE FLOW"
(TAC NOS. MB0154 AND MB0155)

References:

1) Letter from R. P. Powers (I&M) to Nuclear Regulatory Commission (NRC) Document Control Desk, "License Amendment Request - Reactor Coolant Pump Seal Leak-Off Two-Phase Flow: Revised Analysis And Related Changes," C0900-20, dated September 26, 2000.

2) Letter from J. F. Stang (NRC) to R. P. Powers (I&M), "Donald C. Cook Nuclear Plant, Units 1 and 2 – Acceptance Review Regarding License Amendment Request, 'Reactor Coolant Pump Seal Leak-Off Two-Phase Flow,' dated September 26, 2000, (TAC Nos. MB0154 and MB0155)," dated December 27, 2000

3) Letter from M. W. Rencheck (I&M) to NRC Document Control Desk, "Response to Nuclear Regulatory Commission (NRC) Acceptance Review Regarding License Amendment Request, 'Reactor Coolant Pump Seal Leak-Off Two-Phase Flow' (TAC Nos. MB0154 and MB01550)," C0201-07, dated February 1, 2001.

A001

4) Letter from J. F. Stang (NRC) to R. P. Powers (I&M), "Donald C. Cook Nuclear Plant, Units 1 and 2 – Request for Additional Information (RAI) Regarding License Amendment Request (TAC Nos. MB0154 and MB0155)," dated March 29, 2001.

In Reference 1, Indiana Michigan Power Company (I&M), the Licensee for Donald C. Cook Nuclear Plant (CNP) Unit 1 and Unit 2, proposed to amend Facility Operating Licenses DPR-58 and DPR-74 to change the CNP licensing basis as described in the Updated Final Safety Analysis Report. The current licensing basis requires no specific operator action in response to a loss of seal injection (LOSI) cooling to the reactor coolant pumps. I&M proposed a new licensing basis that involves operator actions to mitigate the effects of a LOSI. I&M identified this as an unreviewed safety question, which requires NRC review and approval. I&M performed an operability determination addressing this condition to support the restart of Units 1 and 2.

In Reference 2, the NRC informed I&M that additional technical detail was needed to enable the NRC staff to make an independent assessment regarding the acceptability of the proposed amendment. In Reference 3, I&M responded to the NRC and provided a copy of a supporting report, MPR-2077, Revision 2.

In Reference 4, the NRC requested additional information based on its review of Reference 3. The attachment to this letter provides the information requested in Reference 4.

I&M has concluded that the evaluation of significant hazards considerations contained in Attachment 3 to Reference 1 and the environmental assessment contained Attachment 4 to Reference 1 are not affected. Attachment 2 identifies a commitment made in this submittal.

Should you have any questions, please contact Mr. Ronald W. Gaston, Manager of Regulatory Affairs, at (616) 697-5020.

Sincerely,

Joseph A. [signature] FOR

M. W. Rencheck
Vice President Nuclear Engineering

/bjb

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

ATTACHMENT 1 TO C0601-09

RESPONSE TO NUCLEAR REGULATORY COMMISSION STAFF REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST REACTOR COOLANT PUMP LOSS OF SEAL INJECTION

By letter dated February 1, 2001, from M. W. Rencheck, Indiana Michigan Power (I&M), to the Nuclear Regulatory Commission (NRC) Document Control Desk, I&M provided information to the NRC regarding a license amendment request changing the UFSAR description of the reactor coolant pump (RCP) seal's design performance. The NRC, by letter dated March 29, 2001, from J. F. Stang (NRC) to R. P. Powers (I&M), requested additional information regarding the February 1, 2001, submittal. The information provided below responds to the NRC's request for additional information.

NRC Question 1

"The statements on Page 3 of Attachment 1 [to Reference 1] indicate that a seal leak-off flow of 0.9 gpm (nominally 1 gpm with instrument uncertainty included) was used in the analyses. Please confirm that the actual instrument uncertainty is consistent with the 0.1 assumed in the analyses."

I&M Response to Question 1

Each of the reactor coolant pump (RCP) No. 1 seal leak-off lines is provided with both low-range (0 to 1 gpm) and high-range (0 to 6 gpm) flow instrumentation. The loop consists of a transmitter, an annunciator, a recorder, and the plant process computer. Since the recommendations in report MPR-2077 (Attachment 2 to Reference 1) were based on a nominal leak-off flow of 1 gpm, the total loop uncertainty for the low-range flow instrumentation is applicable for the LOSI analyses. The total loop uncertainty for the low range instrumentation is provided in Table 1.

Because the operators will be alerted to a low flow condition following the activation of the low-flow annunciator, the alarm indication is the applicable indication for the loss of seal injection (LOSI) evaluation. The positive total loop uncertainty for the alarm indication is 0.07 gpm and the alarm is set at 0.96 gpm. Therefore, the alarm is ensured to activate for a flow of 0.89 gpm. Since the calculations in report MPR-2077 used a bounding leak-off flow of 0.9 gpm for the LOSI analyses, the instrumentation uncertainty of 0.1 gpm assumed in report MPR-2077 is considered acceptable because it makes allowance for the lowest flow that would go undetected.

NRC Question 2

"It appears that some of the analyses were performed using a seal leak-off flow of 1 gpm rather than 0.9 gpm (e.g., analysis to determine time for raising volume control tank (VCT) pressure, analysis used to determine required VCT pressure, and analysis of effect of component cooling water (CCW) flow rate). Please explain how these analyses bound your proposed operation at a potential actual seal injection flow rate (considering instrument uncertainty) of 0.9 gpm."

I&M Response to Question 2

The thermal analyses have three objectives. These are to determine the minimum VCT pressure under LOSI conditions, the rate at which leak-off temperature will increase following a LOSI (i.e., how rapidly operators must respond), and the CCW flow requirements to the thermal barrier heat exchanger (TBHX). There are three variable parameters in the analyses that depend on plant conditions. These are the seal leak-off flow rate, the CCW temperature at the TBHX inlet, and the CCW flow rate to the TBHX. The CCW temperature and flow rate for the limiting cases were selected using bounding values. The analysis to determine minimum VCT pressure was performed using 0.9-gpm seal leak-off flow. The analysis to determine response time was originally performed using 1-gpm seal leak-off flow with added margin to consider the effects of a lower flow of 0.9 gpm. The analysis to consider cooling flow requirements is controlled by high leak-off flows, not low flows. Additional details of the analysis for the operator response time and the CCW flow rate to the TBHX (the analyses in which 1 gpm was used) are provided below.

Time for Raising VCT Pressure

Section 3.5.2 of report MPR-2077 recommends that all necessary actions by plant personnel to increase the VCT pressure following a LOSI event should be completed in 90 minutes. This recommended time limit was conservatively estimated based on analyses included in MPR-2077, Appendix C. These analyses demonstrate the rate at which the leak-off temperature will increase following a LOSI for initial leak-off flows of 1, 2, and 3 gpm. For an initial leak-off flow of 1 gpm, the leak-off temperature reaches the vendor recommended limit of 235°F in approximately 140 minutes. The limit of 90 minutes for operator action was selected to provide margin. An additional scoping analysis was performed in response to this RAI using an initial leak-off flow of 0.9 gpm. In this analysis the leak-off temperature reached the limiting temperature in about 125 minutes (see Figure 1). As expected, this is still greater than 90 minutes. Thus, the report's recommendation is considered bounding and acceptable.

Cooling Water Flow Rate Effects

The effect of CCW flow rate to the TBHX on the No. 1 seal leak-off temperature was analyzed in a supplemental MPR letter report dated May 26, 2000, (Attachment 3 to Reference 1). The supplemental letter report documents the results of additional sensitivity analyses for CCW flows below 30 gpm. The analyses also varied the leak-off flow rates between 1 to 6 gpm. The analyses showed that a CCW flow rate of 20 gpm is adequate to maintain the RCP bearing temperature below the vendor recommended limit of 235°F and the leak-off temperature below 270°F. The analyses also showed that the minimum CCW flow requirement increases with seal leak-off flow. The bounding CCW flow rate of 20 gpm was determined for a maximum leak-off flow of 6 gpm with the CCW inlet temperature at 105°F and the RCP not running. The low leak-off flows (less than 1 gpm) have little effect on the minimum CCW flow requirement. This can be seen in report MPR-2077, Appendix B, Table 3-1 and Table 3-2.

NRC Question 3

"Please provide justification for no action when reactor coolant system (RCS) temperature is less than 350°F."

I&M Response to Question 3

Analyses have been performed to determine the No. 1 seal leak-off temperature following a LOSI for an RCS temperature of 350°F. The analyses were performed for a range of seal leak-off flows (1 to 1.5 gpm), CCW flows (20 to 30 gpm), and CCW inlet temperatures (105 to 120°F). Each case was also analyzed with the RCP running and the RCP not running. The maximum seal leak-off temperature for a leak-off flow of 1 gpm, RCP not running, CCW flow of 20 gpm, and CCW inlet temperature of 120°F was less than the vendor recommended limit of 235°F. The results with the RCP not running are used since the high RCP leak-off-temperature alarm point is 185°F and the RCP will be tripped when the leak-off temperature exceeds this value. Thus, the RCP will not be running at leak-off temperatures above 185°F (the LOSI analyses assume that the RCP will not be running for all cases that result in seal leak-off temperatures over 185°F).

Since the previous analyses did not consider a potential 0.9 gpm seal leak-off condition, additional scoping analyses were performed using a seal leak-off flow of 0.9 gpm and the same range for CCW flow and temperature. The highest leak-off temperature of 231°F is observed for a leak-off flow of 0.9 gpm with a CCW flow of 20 gpm, the CCW inlet temperature at 120°F, and the pump not running. Again, the maximum temperature is less than 235°F and no action is required.

NRC Question 4

"In Attachment 1 [to Reference 1], you recommended no controls on CCW flow rate or temperature. Please confirm that measures are in place to ensure that the minimum acceptable CCW flow rate of 20 gpm and CCW temperature of 105°F (as presented in the analyses) are maintained."

I&M Response to Question 4

A minimum CCW flow rate of 35 gpm is maintained to the RCP TBHX. The 35-gpm value is identified as the minimum required flow rate in Table 9.5-2 of the CNP Updated Final Safety Analysis Report for CCW flow to the RCP TBHX.

A CCW flow balance is performed during every refueling outage to set the system throttle valves. The flow balance acceptance criteria for the TBHXs are a minimum flow of 35 gpm for Unit 1 and 36 gpm for Unit 2. The most recent CCW flow balance testing, performed in support of plant restart, included additional provisions to assure that minimum required CCW flow rates to components could be maintained during accident and other system alignments with a degraded pump. CCW flow to the RCP TBHX has a control room indication that is checked to be normal per a plant procedure when placing an RCP in operation. This procedure requires a minimum CCW flow to the TBHX of 35 gpm.

CCW temperature is monitored and an alarm is activated when the CCW temperature exceeds 95°F. The alarm response procedure directs the operator to either increase the essential service water flow to the CCW heat exchanger or lower the heat load on the CCW system. If these actions do not lower the CCW temperature, the operator is directed to enter the procedure for a malfunction of the CCW system.

During periods of plant cooldown, when the RCS is at or below 350°F, the CCW temperature may increase to 120°F. This condition is evaluated in the response to NRC Question 3.

NRC Question 5

"On Page 3-10 [of Attachment 2 to Reference 1], in relation to seal leak-off piping pressure, it is stated that the minimum pressure in the seal leak-off line is the VCT pressure. Please show how the dynamic pressure drop from the VCT to the charging pump suction (the point where the leak-off piping connects to charging pump suction piping) is accounted for in the calculations."

I&M Response to Question 5

In accordance with the acceptance criteria for the No. 1 seal identified in Table 3-1 of report MPR-2077, the functional requirement is the prevention of two-phase flow conditions at the

No. 1 seal outlet and the No. 1 seal leak-off piping. The requirement is governed by the No. 1 seal exit pressure.

Dynamic effects of flow from the VCT to the seal leak-off line connection occur only for those LOSI events in which the charging system continues to operate and the seal return flow remains aligned to the charging pump suction. This scenario is considered extremely unlikely to occur, and even if it did occur, the dynamic losses in this portion of the line would be small and would tend to be offset by similar losses in the seal return line from the RCP. Therefore, the net losses associated with these dynamic effects were not considered in the original determination of the required VCT pressure. Instead, the evaluation to determine required VCT pressure was performed as if the seal leak-off flow was returned directly to the VCT. Two other aspects of the determination of required VCT pressure in report MPR-2077 were also addressed in nominal rather than bounding fashion. Elevation differences between the seals and the VCT were ignored since the normal VCT level is close to the seal elevation and instrument uncertainty for VCT pressure measurement was not applied. This resulted in a nominal value for required VCT pressure, which is considered acceptable for this abnormal occurrence.

While such an approach might be defended for this abnormal occurrence, during a recent review of the report, I&M concluded that more conservative values and assumptions would be used. As a result, the VCT pressure instrumentation uncertainty, ±3.0 psi, the elevation head between the minimum VCT water level and the seal exit elevation, 2.1 psi, and dynamic effects, 0.3 psi (ignoring any compensating losses in the seal return line), have been included in the VCT pressure determination.

The plant procedure for RCP malfunctions now directs the operator to increase the VCT pressure to 33 psig following a LOSI. This value is based on a saturation pressure of 27 psi, a 3-psi allowance for instrument uncertainty, and a 3-psi allowance for the elevation and flow dynamic effects. A documented calculation is being performed to verify that 3 psi bounds the losses attributed to the elevation and dynamic effects. This calculation is scheduled for completion on July 31, 2001. I&M will notify the NRC if the calculated losses exceed 3 psi.

Comparison to No Significant Hazards Evaluation

The responses to the questions transmitted by the request for additional information do not affect the original evaluation performed in accordance with 10 CFR 59.92.

The original response to 10 CFR 50.92, Question 1 is as follows:

"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."

The information responding to the request for additional information provides supporting information and does not require a revision to this question as the basis for the response remains the same and continues to be valid. The proposed license amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

The original response to 10 CFR 50.92 Question 2 is as follows:

"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."

The information responding to the request for additional information provides supporting information and does not require a revision to this question as the basis for the response remains the same and continues to be valid. The proposed license amendment does not create the possibility of a new or different kind of accident from any accident previously analyzed.

The original response to 10 CFR 50.92 Question 3 is as follows:

"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 TBHX 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."

The information responding to the request for additional information provides supporting information and does not require a revision to this question as the basis for the response remains the same and continues to be valid. The proposed revision does not significantly decrease the margin of safety.

Figure 1
Seal Leak-Off Temperatures Following a LOSI

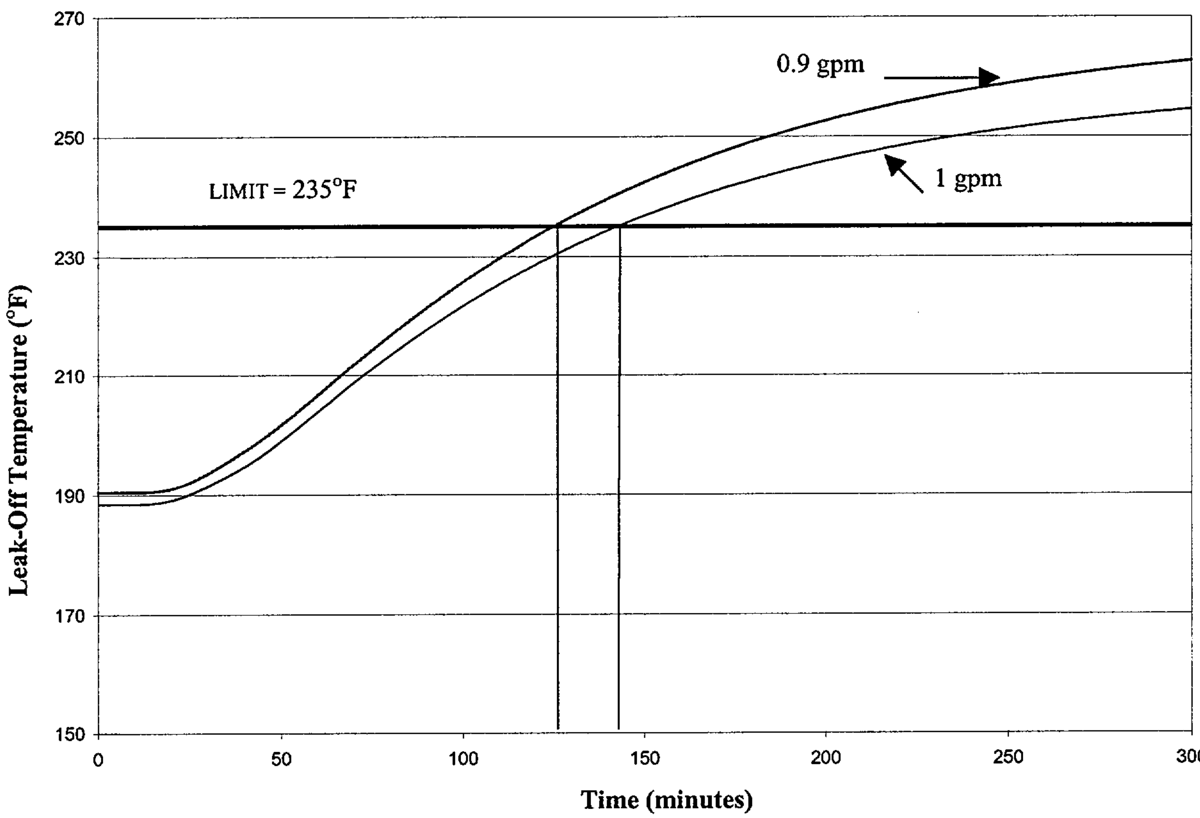

Table 1
Total Loop Uncertainty for Low Seal Leak-Off Flows (0 – 1 gpm)

	Positive Total Loop Uncertainty (gpm)	Negative Total Loop Uncertainty (gpm)
Alarm	0.07	-0.09
Plant Process Computer	0.06	-0.09
Recorder	0.09	-0.11

Note: Because of the methodology used to calculate the total loop uncertainty, the positive total loop uncertainty is subtracted from the setpoint, and the negative total loop uncertainty is added to the setpoint.

ATTACHMENT 2 TO C0501-07

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
A documented calculation is being performed to verify that 3 psi bounds the losses attributed to the elevation and dynamic effects. I&M will notify the NRC if the calculated losses exceed 3 psi.	July 31, 2001