NMC
Committed to Nuclear Excellence

Point Beach Nuclear Plant
Operated by Nuclear Management Company, LLC

June 4, 2005

NRC 2005-0070
10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Point Beach Nuclear Plant Unit 2
Docket 50-301
License No. DPR 27

Response to Request for Additional Information Regarding Request for Exigent Review of Heavy Load Analysis

References:
1. NMC Letter to NRC Dated April 29, 2005
2. NMC Letter to NRC Dated May 13, 2005
3. NMC Letter to NRC Dated May 19, 2005
4. NMC Letter to NRC Dated June 1, 2005

In Reference 1, Nuclear Management Company, LLC (NMC), requested review and approval, in accordance with the provisions of 10 CFR 50.90 and 50.91(a)(6), of a proposed amendment to the licenses for Point Beach Nuclear Plant (PBNP), Units 1 and 2, to support a change to the PBNP Final Safety Analysis Report (FSAR) regarding control of heavy loads. The review for PBNP Unit 2 was requested on an exigent basis.

References 2 and 3 submitted supplements to the proposed amendment to provide the results of additional assessments and to incorporate additional technical justification for the proposed amendments. Additionally, Reference 2 retracted the proposed amendment for PBNP Unit 1 and proposed to apply the reactor vessel head (RVH) lift assessment on a one-time basis for the upcoming lift of the Unit 2 RVH. Reference 4 provided a response to questions posed by Nuclear Regulatory Commission (NRC) staff.

In a letter dated June 3, 2005, the NRC staff requested additional information regarding the proposed amendment. The NMC response is provided in Enclosure 1.

This letter contains no new commitments or changes to existing commitments.

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In accordance with 10 CFR 50.91, a copy of this application, with attachments, is being provided to the designated Wisconsin Official.

I declare under penalty of perjury that the foregoing is true and correct. Executed on June 4, 2005.

Dennis L. Koehl
Site Vice-President, Point Beach Nuclear Plant
Nuclear Management Company, LLC

Enclosure

cc: Regional Administrator, Region III, USNRC
Project Manager, Point Beach Nuclear Plant, USNRC
Resident Inspector, Point Beach Nuclear Plant, USNRC
PSCW

ENCLOSURE 1

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING REQUEST FOR REVIEW OF HEAVY LOAD ANALYSIS

The following information is provided in response to the Nuclear Regulatory Commission (NRC) staff's request for additional information (RAI) regarding Nuclear Management Company (NMC) letter dated May 13, 2005, which proposed an amendment to the license for Point Beach Nuclear Plant (PBNP) Unit 2, to support a change to the PBNP Unit 2 licensing basis regarding control of heavy loads. The NRC staff's questions are restated below with the NMC response following.

NRC Question 1:

What were the bases for establishing the human error probability (HEP) of 4.5E-4 for failure to initiate containment spray, and failure to establish containment sump recirculation after refueling water storage tank draindown in the postulated large loss-of-coolant accident scenario? What accident diagnosis and performance shaping factors were considered in the calculation of the HEP?

NMC Response:

Containment Spray Initiation HEP:

The Human Error Probability (HEP) for the initiation of containment spray was explicitly evaluated for this scenario. The two dominant contributors to the cognitive error were related to the potential to skip a step in a procedure and to misinterpret decision logic. The potential to recover from these errors was included because of adequate recovery time. This leads to a total cognitive error probability of 4.0E-4. Two operator actions are necessary for execution success. These are the starting of a containment spray pump along with the opening of one discharge valve. Both of these actions occur in the control room by use of clearly identified controls. Total execution error probability including credit for procedural recovery is 5.4E-5.

The following performance shaping factors were considered in the development of this HEP:

> Credit for training was provided based upon training developed specifically for this scenario. The degree and clarity of the cues and indicators was considered very good. Complexity of response was considered simple. Control room environment was considered normal and equipment considered accessible. Stress level was considered moderate to account for potential perceived consequences of the scenario. It was assumed that the manual actions would take approximately one (1) minute and would be performed within the first

30 minutes. Considering core uncovery would not occur for at least 108 minutes, a credit of greater than 60 minutes was provided for recovery actions. Because of the long time available for recovery, it is assumed that the recovery action to initiate containment spray is independent (i.e. zero dependence) of the original failure probability to initiate containment spray. The total of execution and cognitive error is 4.5E-4 dominated by the cognitive error.

Containment Sump Recirculation HEP:

A specific Human Error Probability (HEP) for failure to transfer to containment sump recirculation was not explicitly calculated for this scenario. It was assumed for this analysis that the HEP to transfer to containment sump recirculation for a Large LOCA would bound the failure probability for this scenario. It is recognized that the number of manual actions necessary to achieve recirculation for this scenario is similar to that of high-head recirculation due to the need to feed the Containment Spray pumps with the Residual Heat Removal (RHR) Pumps taking suction from the containment sump. However, through inspection of the HEP associated with high-head recirculation and low-head recirculation, it was determined that the dominant factor affecting the failure probability was the time available for recovery of a failed action. Time is important because it affects modifiers used to credit recovery including the stress, time and resources available to discover the error.

Since the time available to initiate containment sump recirculation is significantly less for a low-head recirculation scenario, the HEP for the low-head recirculation scenario is higher than for the high-head recirculation scenario. The time to recover from a failure to initiate containment sump recirculation in the RVH drop scenario is significantly more than available for containment sump recirculation for low-head recirculation due to the significantly lower decay heat in the RVH drop scenario. Therefore, the HEP for low-head containment sump recirculation for a large LOCA bounds the HEP for containment sump recirculation for a RVH drop scenario. The HEP for a large LOCA containment sump recirculation is 5.1E-3.

NRC Question 2:

How did these HEPs, in combination with other equipment failure probabilities, in the postulated accident sequence(s) result in a conditional core damage probability (CCDP) estimate of 7.3E-3? What were the dominant cutsets that contributed significantly to the CCDP estimate of 7.3E-3? Which of the two HEPs were the significant risk drivers in the dominant cutsets?

NMC Response:

The following shows the dominant sequences associated with the bounding Conditional Core Damage Probability (CCDP) and Core Damage Probability (CDP):

Cutset ID	Percent Contribution to CCDP and CDP	Cutsets
1	69.3%	INIT-RVH-DROP * NORMAL-INJ * HEP-RECIRCULATION
2	6.1%	INIT-RVH-DROP * NORMAL-INJ * HEP-CONT-SPRAY
3-11	14.7%	INIT-RVH-DROP * NORMAL-INJ * HEP-A-RVLS * CS-TRAIN-A
12-17	4.8%	INIT-RVH-DROP * NORMAL-INJ * CM-FAILURE

INIT-RVH-DROP: The initiating event probability – the probability of RVH drop (bounding value of 5.6E-5 per lift)

NORMAL-INJ: Failure of all normal injection (bounding value of 1.0)

HEP-RECIRCULATION: Failure to establish containment sump recirculation (5.1E-3)

HEP-CONT-SPRAY: Failure to establish RV injection through containment spray (4.5E-4)

HEP-A-RVLS: Pre-initiator failure to align manual RVLS valve in open configuration (screening value of 0.1)

CS-TRAIN-A: Random equipment failures causing a loss of a single train of containment spray (various random equipment failure probabilities between 1.72E-3 and 8.82E-4)

CM-FAILURE: Various common mode equipment failures that lead to a loss of both trains of containment spray (various equipment common mode failure rates between 8.08E-5 and 4.15E-5)

The HEP that is most significant is the failure to establish containment sump recirculation after Refueling Water Storage Tank (RWST) drain down. This HEP contributes 69.3% of the total failure probability.

NRC Question 3:

What is the impact on the CCDP estimate if the HEP values were 1E-3, 1E-2, or 1E-1 instead of 4.5E-4?

NMC Response:

Sensitivity studies were performed to determine the effect on the CCDPs for both the HEP associated with initial injection using containment spray and the HEP associated with containment sump recirculation. The table below shows the results:

Sensitivity Study for the Failure to Establish Containment Sump Recirculation	
Containment Sump Recirculation HEP	**CCDP**
Bounding Value: 5.1E-3	7.3E-3
1E-2	1.2E-2
1E-1	1.0E-1

Sensitivity Study for the Failure to Establish RV Injection using Containment Spray	
RV Injection HEP	**CCDP**
Best Estimate Value: 4.5E-4	7.3E-3
1E-3	7.9E-3
1E-2	1.7E-2
1E-1	1.1E-1*

**When considering the best estimate value for the Reactor Vessel Head (RVH) drop probability (9.3E-6) only the sensitivity analysis performed using 1E-1 for the Reactor Vessel (RV) injection HEP would result in a CDP of greater than 1E-6 per lift. The HEP used in this sensitivity analysis is over two (2) orders of magnitude higher than the best estimate. In addition, this sensitivity analysis includes other conservativisms contained within the model including the assumption that the RVH drop would occur while over the RV (1.0 probability) and the assumption that all normal injection flow paths to the RV would be lost due to the drop (1.0 probability).*

NRC Question 4:

Please discuss the impact of the response to Question 5 in your May 13, 2005 letter on the probabilistic risk analysis.

NMC Response:

During telephone conferences between NRC staff and NMC representatives on May 24, and 27, 2005, the staff requested additional information with respect to the letter between NMC and the NRC dated May 13, 2005. Question five (5) from this telephone conference requested an evaluation of the effect of the potential head drop on the head assembly upgrade package specifically addressing the ability of the proposed temporary modification to properly function after the head drop.

Question five (5) was answered in Reference 4. The following discussion shows the potential impact on the PRA analysis for this scenario considering the possibility of a failure mode for the loss of one of the redundant RVH injection paths due to damage sustained from a RVH drop.

The containment spray to RVH injection line that connects to the RVLIS line contains a single manual valve. The failure modes considered for this valve includes a pre-initiator HEP for the valve to be in the closed position and undetected. To determine the extent of modeling necessary for this valve, a screening value of 0.1 was used for the pre-initiator HEP. The screening results demonstrated that the failure of this valve had little effect on the overall results and the screening value was left in the model without further detailed analysis. The impact of this valve and the loss of a single injection line is small because the HEPs associated with initial injection and the transfer to containment sump recirculation are the dominant failures since these failures cause the loss of both trains of injection.

This same screening value could be used to perform a sensitivity analysis for the probability of one line being damaged by the drop of the RVH. Therefore, the CCDP of 7.3E-3 would also apply and bound a sensitivity analysis for the loss of a line damaged by a RVH drop if the probability of damage was less than 0.1. An additional sensitivity study was performed assuming a 1.0 probability of damage to a single injection line. The CCDP for this evaluation is 1.8E-2.

When considering the best estimate value for the RVH drop probability (9.3E-6 per lift) and a CCDP of 1.8E-2 (assumes the loss of one of the RV injection paths with a probability of 1.0) results in a CDP of less than 1E-6 per left. This sensitivity analysis includes other conservativisms contained within the model including the assumption that the RVH drop would occur while over the RV (1.0 probability) and the assumption that all normal injection flow paths to the RV would be lost due to the drop (1.0 probability).