July 2, 2004

Mr. Dennis L. Koehl
Site Vice President
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Nuclear Management Company, LLC
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Two Rivers, WI 54241

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION (RAI) REGARDING SEVERE ACCIDENT MITIGATION ALTERNATIVES FOR POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2 (TAC NOS. MC2049 AND MC2050)

Dear Mr. Koehl:

The staff has reviewed the analysis of severe accident mitigation alternatives (SAMAs) submitted by Nuclear Management Company, LLC in support of its application for license renewal for Point Beach Nuclear Plant, Units 1 and 2, and has identified areas where additional information is needed to complete its review. Enclosed is the staff's request for additional information.

As discussed with your staff, we request that you provide your responses to these RAIs within 60 days of the date of this letter. If you have any questions, please contact me at 301-415-2462.

Sincerely,
/RA/
Stacey Imboden, Project Manager
Environmental Section
License Renewal and Environmental Impacts Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 50-266 and 50-301

Enclosure: As stated

cc w/encl: See next page

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Request for Additional Information Regarding the Analysis of Severe Accident Mitigation Alternatives (SAMAs) for the Point Beach Nuclear Plant, Units 1 and 2 (PBNP)

1. The Severe Accident Mitigation Alternatives (SAMA) analysis was based on the most recent version of the PBNP Probabilistic Risk Assessment (PRA) for internal events (i.e., 2001 Level 1 model and March 2003 Level 3 model), which is an update of the individual plant examination (IPE) submittal transmitted to the U.S. Nuclear Regulatory Commission (NRC) in June 1993.

   Provide the following information regarding this PRA model:

   a. A description of the PRA work (Levels 1, 2, and 3) that has been completed since the IPE, and the results of the internal and external peer reviews of the work. This should include:

      i. A discussion of the various Level 1, 2, and 3 analyses completed for PBNP, including the dates and version identification.

      ii. A description and the results of the internal and external peer reviews of the analyses that have been performed since the IPE. This should include a description of the internal and external peer reviews of the MELCOR Accident Consequence Code System (MACCS2) and MAAP analyses.

      iii. An assessment of the impact of the weaknesses/areas for improvement identified in any of the peer reviews on the SAMA identification and evaluation process.

      iv. In Appendix F, Section F.2.2, NMC indicated that the WOG Peer Review stated "...that the PBNP PRA could be used effectively to support applications involving risk significance determinations supported by deterministic analyses once the items noted in the report are addressed." Later in the same discussion, after stating that issues other than documentation have not been addressed, NMC concluded that the issues "....are not expected to result in model changes that will significantly affect the overall results or conclusions of the SAMA evaluations." Reconcile the NMC conclusion with the WOG statement.

      v. A list of the changes made between versions, including Level 2 changes, and the CDF and the LERF for each version. Include the changes and their respective contributions to the reduction in the CDF between the IPE analysis and the most recent updated PRA (i.e., 1.15E-4 to 3.65E-5).

b. A breakdown of the contributions to CDF by initiating event and event type, and of the population dose (person-rem per year within 50 miles) by containment release mode in the following form, or equivalent (given below). Provide a discussion of late containment failure and no containment failure (since it is not apparent that they are not addressed in the SAMA analysis), especially since late failures can significantly contribute to total person-rem.

Containment Release Mode	Population Dose	% Contribution
SGTR		
Interfacing Systems LOCAs		
Containment isolation failure		
Early containment failure		
Late containment failure		
No containment failure		

c. A table/graph of the dominant contributors to the CDF from the most recent PRA similar to Figure 1.4-1 in the IPE. Also, provide the Tables of Basic Event Unavailability with Basic Event Identifiers and Importance Rankings (similar to Tables 3.3-1 and 3.4-2 in the IPE) from the most recent PRA.

d. A containment matrix describing the mapping of Level 1 results into the various accident sequences/release categories.

e. A description of the accident sequences used to represent each of the accident sequences/release categories shown in Table F.1-2, and a description of the methodology and criteria for binning endstates into the accident sequences/release categories shown in Table F.1-2 and used in the current Level 3 analysis.

2. In Section F.2.2, the CDF for internal events is given as 3.6×10^{-5} and the CDF for internal fires, seismic events, and internal flooding are given as, 1.2×10^{-5}, 1.3×10^{-6}, and 1.1×10^{-5} respectively. These internal fires, flooding and seismic CDFs, and the individual plant examination of external events (IPEEE) models, were not used in the identification and screening of SAMAs.

Provide the following information:

a. NUREG-1742 ("Perspectives Gained from the IPEEE Program," Final Report, April 2002), lists the significant fire area CDFs for PBNP (Page 3-24 of Volume 2). For each fire area, explain those measures that were taken to further reduce the CDF, and explain why these CDFs cannot be further reduced in a cost effective manner.

b. Identify those SAMAs from Table F.2-2 that could provide a significant risk benefit in the important internal fires, flooding and seismic events at PBNP. For each of these SAMAs, provide an estimate of the collective (internal and external event) benefit that these SAMAs would provide in the respective events.

3. According to Table F.2-1, NMC evaluated 202 SAMA candidates. As a result of initial screening, 137 SAMA candidates were eliminated, thereby leaving 65 SAMA candidates subject to the final evaluation process. It is not evident that the set of 65 SAMAs evaluated in the environmental report (ER) addresses the major risk contributors for PBNP.

   For each dominant contributor identified in the most current PRA (using, for example, Importance Measures), provide a cross-reference to the SAMAs evaluated in the ER which addresses that contributor. If a SAMA was not evaluated for a dominant risk contributor, provide the rationale to justify why SAMAs to reduce these contributors would not be cost beneficial.

4. According to Section 4.20.3, the SAMA analysis was performed based on a single unit implementation. It is not evident which SAMAs would benefit both units, and how the single-unit cost for such SAMAs were estimated (i.e., were the implementation costs divided by 2 to arrive at the single unit implementation costs?). Provide a list of those SAMAs (both procedural and hardware based) where both units would benefit, and confirm that the reported costs and benefits were developed on a consistent basis (i.e., a single-unit basis).

5. The list of references used to develop the candidate SAMAs for PBNP includes SAMAs from certain site-specific analyses (e.g., Watts Bar and Limerick) and design-specific analyses (e.g., CE System 80+), but it specifically does not enumerate which are identified from ERs from other plants seeking license renewal (see, pg. F-14). Provide the references for the other SAMA analyses that were considered and identify the SAMAs resulting from this review that were included in the PBNP analysis.

6. For certain SAMAs considered in the ER, there may be lower-cost alternatives that could achieve much of the risk reduction at a lower cost. For the subset of plant-specific SAMAs identified Table F.2-2, identify any lower-cost alternatives to those considered in the ER and whether they would be viable and cost-beneficial. Specifically include consideration of the candidate SAMAs found to be cost-beneficial, for example, those identified in the recent SAMA reviews for Ft. Calhoun, R.E. Ginna, and D.C. Cook.

7. SAMA candidates were considered potentially cost-beneficial if the cost of implementation was estimated to be less than two times the calculated benefit. The risk reduction benefit was assumed to be two times the calculated benefit from internal risk reduction to account for external events. This factor of two is not a universal substitute for consideration of external events.

Provide the rationale to demonstrate that the adjustment is sufficient to encompass the collective impact of several potentially non-conservative assumptions in the baseline analysis, and the added impact of uncertainties in the analysis on the SAMA evaluation process and results. Include the following in the discussion:

a. A list and brief description of non-conservative (and conservative) assumptions used in the baseline benefit calculation, an estimate of the impact on the calculated benefit, and an assessment of how the results of the final screening of SAMAs would change. Examples identified by the staff that should be addressed in the response include:

   i. The total bounding benefit estimated for each of the SAMAs only accounts for the benefits obtained during the 20 year period of the proposed life extension. This could underestimate the total benefit by 10-15 percent since each PBNP unit has more than 5 years of operation remaining on its existing license.

   ii. Sensitivity analyses performed as part of previous SAMA evaluations for MACCS2 inputs such as evacuation and population assumptions could yield variations in population dose of as much as 20 percent.

   iii. The use of a reference pressurized water reactor (PWR) inventory scaled only for power (as opposed to a bounding operating cycle), could result in a significant underestimate of the fission product inventory of important long-lived radionuclides that dominate population dose (e.g., an underestimate of about 50 percent for Sr-90 and Cs-137) (See RAI #8b).

b. The SAMA analysis did not include an assessment of the impact of PRA uncertainties. Provide the following information to address these concerns:

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   i. An estimate of the uncertainties associated with the calculated core damage frequency (e.g., the mean and median internal events CDF estimates and the 5^{th} and 95^{th} percentile values of the uncertainty distribution).

   ii. An assessment of the impact on the final evaluation if risk reduction estimates are increased to account for uncertainties in the risk assessment. Consider the uncertainties due to both the averted cost-risk and the cost of implementation to determine changes in the net value for these SAMAs.

8. Provide the following information concerning the MELCOR Accident Consequences Code System (MACCS2) analyses:

   a. The discussion of meteorological data used in the analysis indicates that data for year 2000 were obtained from Point Beach NP (October to December) and Kewaunee NP (January to September), 3.6 miles north of PBNP. Please explain why a continuous year of data was not used for the analysis. Confirm that there were no significant gaps in time for the data sets (that the two data sets are continuous). Confirm that the 2000 meteorological data set is representative of the PBNP site and provide the rationale to justify its use, including the different stability typing schemes (i.e., sigma-theta and delta-T).

   b. The MACCS2 analysis uses a reference PWR core inventory at end-of-cycle calculated using ORIGIN. The ORIGIN calculations were based on a 3-year fuel cycle (12 month reload), 3.3 percent enrichment, and three region burnup of 11,000, 22,000, and 33,000 MWd/MTU. Current PWR fuel management practices use higher enrichments and significantly higher fuel burnup (greater than 45,000 MWd/MTU discharge burnup). The use of a reference PWR core (scaled only for power) instead of a plant specific cycle could significantly underestimate the inventory of long-lived radionuclides important to population dose (such as Sr-90, Cs-134 and Cs-137), and thus impact the SAMA evaluation. The fission product scaling was based on 1518 MWt; however, the sensitivity analyses in F.2.5 discussed a power level of 1678 MWt. Provide an assessment of the impact on population dose and on the SAMA screening and dispositioning if the SAMA analysis were based on the fission product inventory for the highest burnup, higher fuel enrichment and higher power level.

   c. The year 2035 projected population within the emergency planning zone (0.65 to 10 miles) in Table F.1-3 appears to under-predict the population compared to the reported population distribution in SECPOP2000, NUREG/CR-6525, Rev. 1, pg. F-7 (to 10 miles). Specifically, Table F.1-3 of the ER indicates 22,789 people within the emergency planning zone in 2035. An updated report from Ref. F.1-14 (“Wisconsin Population 2003, A Report on Projected State, County and Municipal Populations and Households for the Period 2000-2030") indicates that a 30 percent growth is expected through 2030. A 30 percent growth applied to the reported SECPOP2000 “Licensee Reported Population” values in NUREG/CR-6525 would result in greater than 35,000 people in this zone at year 2035. Confirm that the ER reported value is appropriate. If it is not, then evaluate whether the impact is significant and provide justification for which distribution is appropriate.

   d. The ER aggregate population for the fifty-mile radius is reported as 644,800 and the aggregate 11 county population as 836,137 in 1990. The ER states that the population estimates are produced on an element/county area-weighted basis. The counties of Outagamie and Winnebago have large metropolitan areas just within the 50-mile radius. Provide a discussion of the weighting of the populations of these counties in the rosette distribution (i.e., did the area-weighted basis properly distribute these populations within the rosette?).

9. The calculated Offsite Economic Cost and Offsite Exposure Cost for Point Beach are factors of 30 and 10, respectively, lower than for the R.E. Ginna plant, which is also a Westinghouse 2-loop PWR. Much of the difference appears to be in the assumed release fractions, i.e., the fission product release factions for SGTR sequences appear small relative to R.E. Ginna. For the release classes that dominate the population doses at PBNP, provide a discussion of the bases for the release fractions, and a comparison of the release fractions to the results of recent industry or NRC calculations or studies (e.g., NUREG-1150).

10. Provide the requested information on the following issues:

    a. In Table F.2-1, SAMA #10 was screened out as PBNP does not have high head injection pumps. However, the underlying issue is an inadvertent actuation of a safety system due to a failure (e.g., loss of two 120VAC busses). Explain whether this more general situation (inadvertent initiation of a safety system) applies to PBNP as a contributor to CDF.

    b. SGTR-related improvements (e.g., SAMA 108) and automatic swap-over of recirculation (e.g., SAMA 126) stand out in terms of overall benefits ($565,000 and $531,000, respectively). Provide details of the benefit assessment of these SAMAs (i.e., SAMAs 108, 126, 149, 154, 155, 157). In addition, describe the modifications considered for these SAMAs, including any low cost options. The implication in the assessment of SAMA 108 is that the operator needs further information (e.g., instrumentation) to reduce the human error likelihood. Explain why the human error probability cannot be reduced by other means (e.g., training, procedures, etc.).

       Carolina Power and Light developed a detailed cost estimate of $265,000 for implementation of SAMA 126 at the H.B. Robinson plant (NUREG-1437, Supplement 13, pg. G-17). Table F.2-2 of the Point Beach ER indicates that the cost of implementation of this SAMA at “PTN” would be $450,000. Clarify the meaning of “PTN” and “EP” in Table F.2-2, and provide the justification for cost of implementation of this SAMA at Point Beach at greater than $1,000,000 per unit, given the much lower cost estimates for other plants.

    c. SAMAs 169 and 180 would appear to be marginally cost beneficial (within a factor 2) based on Table F.2-2 and F.2-3 results. Address whether these SAMAs would be cost beneficial when the impact of uncertainty in the cost/benefit assessment is considered.

d. SAMAs 181 through 193 include PRA-based procedural enhancements which appear cost beneficial (especially considering uncertainty). In Table F.2-2, these SAMAs have conclusions which state "Use of procedure step mark offs implemented." Clarify whether the CDF reduction presented in Table F.2-2 includes credit for this implementation. If it does, then there appears be a large benefit to further action; explain what additional options could be implemented and their costs. If it does not, then provide the residual benefit after implementation; explain why further action is not cost beneficial.

e. SAMAs 62 and 63 both provide for extended DC power during SBO. However, the difference in estimated benefits is significant. Discuss the rationale for the difference in benefit for these two SAMAs. In addition, address whether removing the AFW DC dependency would significantly improve DC lifetime during SBO.

f. The basis of conclusion for SAMA 151 indicates that "some credit can now be taken for use of placekeeping aids." Provide a description of the meaning of such aids and estimates of the associated benefit and implementation costs of this SAMA.

g. Provide the justification for using a factor of three reduction in the human error rate assumed for some procedure improvement SAMAs (i.e., SAMA 181, 183-189, 191, 192) rather than the factor of 10 used for others (i.e., SAMA 190 and 193).

11. As part of the sensitivity analyses (pg. F-19), NMC assumed a net power level of 564MWe per unit for calculating the cost of replacement power and used incremental factors of 10 percent and 100 percent on the Level 3 results (dose and economic impacts) to consider the effect of higher power levels on candidate SAMAs. NMC concluded that the onsite cleanup and replacement power cost overwhelm any changes to the cost/benefit analyses. Discuss whether the cost/benefit analyses could change a conclusion for a low-cost candidate SAMA (see, RAI #6).

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