August 24, 2005

Mr. Paul A. Harden
Site Vice President
Palisades Nuclear Plant
27780 Blue Star Highway
Covert, MI 49043

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION (RAI) REGARDING SEVERE ACCIDENT MITIGATION ALTERNATIVES (SAMA) FOR THE PALISADES NUCLEAR PLANT (TAC NO. MC6434)

Dear Mr. Harden:

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the severe accident mitigation alternatives (SAMA) analysis submitted by the Nuclear Management Company, LLC, (NMC) in support of its application for license renewal for the Palisades Nuclear Plant (Palisades), and has identified areas where additional information is needed to complete its review. The staff's request for additional information is provided in Enclosure 1.

The NRC staff and its contractor for the SAMA review, the Pacific Northwest National Laboratory, held a teleconference with representatives of NMC and its contractor, Erin Engineering, on August 9, 2005, to discuss the enclosed questions. Teleconference participants are listed in Enclosure 2. The conference call was useful in clarifying the intent of the staff's questions.

Two questions related to potential typographical errors in NMC's SAMA analysis were resolved during the teleconference. These questions and the applicant's responses are included in Enclosure 1. We request that you provide NMC's responses to the remaining questions within 60 days of the date of this letter, in order to support the license renewal review schedule. If you have any questions, please contact me at 301-415-1312 or via email at RGS@nrc.gov.

Sincerely,

/RA/

Robert Schaaf, Senior Project Manager
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 50-255

Enclosures: 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 Palisades Nuclear Plant

1. Provide the following regarding the PSA model:

   a. Provide a list of the major plant and modeling changes incorporated within each of the PSA versions listed in Section E.2.3, with an emphasis on the most recent changes in the Level 1 and 2 analysis. Also, supplement the Table in Section E.2.3 to include large early release frequency (LERF) or applicable Level 2 metrics, as applicable. (Numerous plant and PSA modeling changes since the IPE are described within Sections E.2.3.1 through E.2.3.8, but it is not clear in which version of the PSA these changes were incorporated).

   b. Identify the PSA version reviewed under the CEOG Peer Review. Provide a general description of the 9 Level A findings and their resolution (including the PSA version(s) in which the findings were addressed), and the 8 unresolved Level B comments and their planned closeout.

   c. Provide a breakdown of the population dose (person-rem per year within 50 miles) by containment release mode in the following form, or equivalent:

Containment Release Mode	Population Dose	% Contribution
SGTR		
ISLOCA		
Early Failure		
Intermediate Failure		
Late Failure		
No Failure		
Basement Failure		
Containment Isolation Failure		

   d. The baseline frequency for release category “L-L” appears to be erroneously reported as 4.37E-8 per year in Section 2.5.5.5 and Tables E.3-4 and E.3-5. The correct value appears to be 4.37E-6 per year, as reported in the individual tables in Sections E.6 and E.7. Confirm the correct value and address any impacts on the SAMA analysis.

      Resolved via August 9, 2005, teleconference: The applicant confirmed that 4.37E-6 per year is the correct baseline frequency value. No further response is required.

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

   a. In Section E.3.5 it is stated that plant-specific data was used based on ORIGEN2.1 calculations. Please elaborate on how plant-specific data was used.

If Palisades specific fuel burnup/management data was not used, provide an evaluation 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 burn-up, fuel enrichment and power level expected at Palisades during the renewal period.

b. Identify and briefly discuss the key MACCS2 input assumptions or other factors that contribute to the offsite economic cost risk at Palisades, e.g., per diem cost for relocated individuals, the costs to relocate an individual, and the value of farm and non-farm wealth.

3. Provide the following regarding the SAMA identification process:

a. Table A-1 of the Addendum to Appendix E of the ER provides a list of 266 potential SAMAs that were used to help identify potential enhancements for selected functions at Palisades. However, it is not clear from Appendix E of the ER how this list of SAMAs was specifically used to identify candidate SAMAs for evaluation. Briefly describe how the information in Table A-1 was used in the identification of SAMAs, including the rationale or criteria for eliminating each of the items in from consideration as a Palisades SAMA.

b. Two events in ER Table E.5-1 have a very large Risk Achievement Worth (RAW), as estimated by the staff (i.e., RXC-MECH-FAULTS and RXC-ELEC-FAULTS). In the case of the mechanical faults, the staff estimates that an order-of-magnitude increase in this event alone would increase the CDF to 6.8×10^{-5}. Provide an assessment of the value of ensuring that these RPS subsystems do not degrade with time, and whether or not a SAMA is warranted to ensure these subsystems do not degrade.

c. Appendix E of the ER indicates that SAMAs from Calvert Cliffs, also a Combustion Engineering plant, were reviewed for applicability to Palisades. However, none of the potentially cost-beneficial SAMAs identified in the Calvert Cliffs evaluation (NUREG-1437, Supplement 1) made it out of the generic list of industry SAMAs (Table A-1) and onto the list of Phase I SAMAs (Table E.5-3). The three potentially cost-beneficial SAMAs for Calvert Cliffs are:

- Change undervoltage, AFW actuation signal (AFA) block, and high pressurizer pressure actuation signals to 3-out-of-4, instead of 2-out-of-4 logic (SAMA 112 in Table A-1, SAMA 48a in Calvert Cliffs license renewal application).

- Implement internal flood prevention and mitigation enhancement (e.g., watertight doors) to prevent flood propagation (SAMA 155 in Table A-1, SAMA 66b in Calvert Cliffs license renewal application).

- Automate demineralizer water make-up to the CST and provide a dedicated diesel generator for this purpose (SAMA 172 in Table A-1, SAMA 74 in Calvert Cliffs license renewal application).

Provide a brief explanation of why these SAMAs are not applicable to Palisades.

4. Provide the following regarding the Phase I screening:

   a. Page 4-31 of the ER indicates that 16 candidate SAMAs remained after the Phase I screening, whereas Table E.5-4 identifies only 9 SAMAs. Resolve the discrepancy.

      Resolved via August 9, 2005, teleconference: The applicant indicated that the text on page 4-31 is in error. Nine SAMAs remained after Phase I screening, as indicated in Table E.5-4. No further response is required.

   b. SAMA 12 addresses several events in the Importance List Review tables (Tables E.5-1 and E.5-2) but was not retained for Phase II analysis due to it being a BWR mitigation feature. However, this SAMA proposes modifying the existing CVCS injection system to automatically operate during ATWS, and would seem to have applicability to a PWR. Provide further discussion of why SAMA 12 is not retained, including a cost estimate. In this discussion, consider the collective impact of all items in the Importance List Review tables that refer to SAMA 12.

   c. The discussion of Phase I SAMA 19 defers to Phase I SAMA 17. SAMA 17 addresses the failure of valves CV-3070 and CV-3071 due to filter plugging. It is not clear that filter plugging is the dominant initiating failure of these valves in SAMA 19. Please discuss.

   d. For Phase I SAMA 20, existing procedures to prevent traveling screen failure are assumed to be adequate. Re-evaluate the RRW given the operator action to ensure this event can be eliminated from consideration for a SAMA and address again accordingly.

5. Provide the following regarding the SAMA cost estimates:

   a. Provide a brief description of the methodology and major cost elements used to develop the cost estimates for the 23 Phase I SAMAs (e.g., was the estimate developed by Palisades or obtained from another source, does the estimate include the cost of replacement power during extended outages required to implement the modifications, does the estimate include recurring maintenance and surveillance costs or contingency costs associated with unforseen implementation obstacles).

   b. The cost of implementing Phase I SAMA 21 is given as $7,000,000. The cost of implementing a similar SAMA at Brunswick was estimated to be $100,000. Provide a further explanation for the significant cost associated with this SAMA.

6. For Phase II SAMA 3 and SAMA 4, provide a more detailed description of the PSA model changes made to reflect the SAMA implementation. Include the original and

modified failure probability values for each component assumed to be impacted by the SAMA.

7. Provide the following regarding lower cost alternatives to some of the SAMAs considered:

   a. Phase I SAMA 1 (Additional Diesel Generator) is estimated in Table E.5-3 to cost more than $20M. This is presumably a safety grade installation with permanent connections to the E-buses. Address the viability and costs of providing a non-safety grade installation with more expedient connections as an alternative. For example, the Palisades site has a co-located (nearby) gas turbine generating facility. Address the viability and costs of providing non-safety grade backup power from this facility.

   b. Phase I SAMA 2 (portable generator for DC support) is screened out on the basis that it is less desirable and less cost-effective than the procedural changes considered in Phase I SAMA 10, which was retained. However, the evaluation of Phase I SAMA 3 (direct-drive diesel injection pump), which was also retained, indicates that a portable generator should be included for long-term SBO with the direct-drive diesel injection pump. Discuss whether a single portable generator could perform the functions required for both SAMA 2 and SAMA 3, in which case the benefits would be about $2.5M ($1.7M for SAMA 2/10 + $0.8M for SAMA 3) for a cost of less than $1.4M ($0.3M for SAMA 2 + $1.1M for SAMA 3).

   c. Phase I SAMA 15 is screened from further consideration based on the “potential leakage paths for contaminated sump water back to the SIRWT,” and hence increased dose to the control room requiring modifications to the control room HVAC. Clarify the operation during the re-circ phase as the words “potential” and “leakage paths” imply the by-pass pathway may or may not be present for this accident (i.e., implementation requires a failure check valve in by-pass lines). Also, address the possibility of “locking” open one or more valves in the return lines to provide the same flow that would be provided by the by-pass lines, avoiding the excess flow. Provide a cost estimate for the following alternatives to this SAMA: (1) adding by-pass lines with no modifications to the control room HVAC, and (2) locking-open return line valve(s) with no modification to the control room HVAC.

   d. Phase I SAMA 18 is screened from further consideration due to the cost of a dedicated pump and line for EDG cooling. The description implies that the FPS as a backup would not function if the SW cooling line fails. Explain why an additional line or a temporary connection could not be installed directly from the FPS (by-passing the SW lines) as a lower cost alternative. If feasible, assess the impact on the SAMA identification and evaluation process.

   e. Several low cost alternatives to major enhancements have been identified as potentially cost-beneficial in previous and current license renewal applications and might be applicable to Palisades. For the following SAMAs, provide a brief statement regarding the applicability/feasibility of the alternative for Palisades,

and a further evaluation of the impact on the SAMA identification and evaluation process if the alternative could be potentially cost-beneficial at Palisades:

- Modify procedures to conserve or prolong the inventory in the SIRWT during SGTR events (Ft. Calhoun, SAMA 92)

- Add accumulators or modify procedures on SIRWT bubblers and recirculation valves to avert/recover from premature recirculation actuation signal (Ft. Calhoun, SAMA 181)

- Provide portable power supply as backup to open PORVs during/following core damage (Ft. Calhoun, SAMA 183)

- Add capability to flash the field on the EDG to enhance SBO recovery (Ft. Calhoun, SAMA 184)

- Modify procedures and/or make hardware changes to provide alternate capability to increase heat removal from the RCS and accelerate RCS cooldown (Ft. Calhoun, SAMA 186)

- Modify procedures and enhance training to reduce human error associated with recovery following SBO (ANO-2, SAMA AC/DC-16)

- Modify procedures to shed CCW loads on loss of essential raw cooling water to extend component cooling water heat-up time (ANO-2, SAMA CW-06)

- Install backwash filters in place of existing service water pump discharge strainers to reduce probability of common cause failures (ANO-2, SAMA CW-27)

- Replace a containment sump valve(s) with air-operated valve(s) to reduce common cause failures (ANO-2, SAMA CC-20)

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REGARDING PALISADES SAMA ANALYSIS
AUGUST 9, 2005

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Enclosure 2

Palisades Nuclear Plant

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