November 9, 2005

Mr. C. N. Swenson
Site Vice President
Oyster Creek Nuclear Generating Station
AmerGen Energy Company, LLC
P.O. Box 388
Forked River, NJ 08731

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION (RAI) REGARDING SEVERE ACCIDENT MITIGATION ALTERNATIVES (SAMA) FOR OYSTER CREEK NUCLEAR GENERATING STATION (TAC NO. MC7625)

Dear Mr. Swenson:

The U.S. Nuclear Regulatory Commission staff (the staff) has reviewed the SAMA analysis submitted by AmerGen Energy Company, LLC, in support of its application for license renewal for the Oyster Creek Nuclear Generating Station, and has identified areas where additional information is needed to complete its review. Enclosed is the staff's RAI.

We request that you provide your responses to this RAI 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 301-415-1191 or by e-mail at MTM2@nrc.gov.

Sincerely,
/RA/

Michael T. Masnik, Senior Project Manager
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No.: 50-219

Enclosure: As stated

cc w/enclosure: See next pages

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Request for Additional Information
Regarding the Analysis of Severe Accident Mitigation Alternatives (SAMA)
for the Oyster Creek Nuclear Generating Station (OCNGS)

1. The SAMA analysis is said to be based on the most recent version of the OCNGS probabilistic risk assessment (PRA) (Revision 2004B model dated March 2005). Provide the following information regarding this model:

   a. Provide the core damage frequency (CDF) due to anticipated transients without scram events.

   b. Section F.2.1 includes a list of the major differences in the PRA model between the original individual plant examination (IPE) and the current PRA. None of these items appear to involve hardware modifications:

      i. Confirm that no hardware modifications were major contributors to the change in CDF from the IPE to the current value.

      ii. Identify those model changes that had the greatest impact on the CDF.

   c. A 2004 self-assessment of the OCNGS PRA is described in Section F.2.5. Relative to this self-assessment, please indicate:

      i. Which revision of the PRA was reviewed in the self-assessment.

      ii. Who performed the review and their degree of independence relative to those who performed the PRA.

      iii. If the version reviewed was not the 2004A update, those steps taken to ensure the adequacy of the 2004B revision, given the extensive changes between the 2001 and the 2004B revisions.

   d. The modular accident analysis program (MAAP) and case identifiers in Table F-6A appear to include an accident class designator (e.g. IA, IB, and V). If this is correct, then the MAAP cases for a number of the consequence categories (e.g.1, 3, and 6) don't appear to be for the classes that are major contributors to the consequence categories as given in Table F-6. Describe the basis for the selection of the MAAP case used to determine the fission product release fractions and accident sequence timings for each consequence category.

   e. The Level 2 PRA appears to be essentially a complete revision of the IPE Level 2 analysis. Please confirm this and describe the reviews completed for the current Level 2 model and how the review findings have been addressed.

2. With regard to the treatment and inclusion of external events in the SAMA analysis:

   a. The seismic individual plant examination of external events (IPEEE) assumed that all relays that didn't meet Unresolved Safety Issue A-46 requirements were replaced or otherwise shown to be adequate. The staff safety evaluation report (SER) for A-46 noted that, at the time of issuance, this had not been completed. Confirm that all relays

that did not meet A-46 requirements have been replaced or otherwise shown to be adequate.

b. As described in Section F.1.2, the CDF for external events is 2.3 times the current internal events CDF; thus the total CDF is 3.3 times the internal events CDF. In the environmental report (ER), a factor of two multiplier is applied to the internal event benefits to reflect the potential for additional risk reduction in external events. The justification provided for use of the factor of 2 multiplier (rather than a factor closer to 3.3) is that the external events CDF is conservative and that a SAMA based on internal events insights would have a smaller benefit on external event risk than on internal event risk. These arguments need to be further substantiated, particularly in light of the fire analysis provided for SAMA 125.

c. The evaluation of SAMA 125 includes a re-analysis of the fire risk for two of the dominant fire zones identified in the IPEEE. This revision utilized more current fire initiating event frequencies and the plant logic models and data for the latest revision of the internal events PRA and discovered a previously unquantified failure mode. The result is a fire CDF that is twice that for internal events. In this regard, provide the following:

   i. Since only the two dominant fire zones were re-analyzed and they make up approximately 72 percent of the total fire CDF in the IPEEE, describe the impact on fire CDF if the remaining fire zones were re-analyzed.

   ii. Discuss the impact of the increased fire CDF on the external event multiplier and on the results of the SAMA assessment.

3. Provide the following information with regard to the SAMA identification and screening processes:

   a. In Table F-13, event OHECD1 has a risk reduction worth of 1.056, which indicates that the CDF would be reduced by about 5 percent if this operator error were reduced significantly. This event is stated to be addressed by SAMAs 92 and 127. In the evaluation of SAMA 92, the CDF is decreased by only 2 percent. A SAMA that would automate the opening of the control rod drive manual bypass valve would be possible and might lead to a CDF reduction closer to the 5 percent. Explain the difference between the expected and calculated CDF reductions, and whether automatic actuation of the bypass valve could be cost-beneficial.

   b. The disposition of Phase I SAMA 36 in Table F-15 makes reference to SAMA 90. However, SAMA 90 is listed as "not used." Similarly, the disposition of Phase I SAMA 82 makes reference to SAMA 126 which is listed as "not used." Provide the correct references for SAMAs 36 and 82.

4. Provide the following with regard to the Phase II cost-benefit evaluations:

   a. SAMAs 10 and 84 both involve the containment venting system. SAMA 10 involves the installation of a passive over-pressure relief capability and is estimated to result in a CDF reduction of 15 percent. SAMA 84 involves a modification to enable manual operation of the containment vent valves without support systems and is estimated to result in a CDF reduction of 1.7 percent. SAMA 10 was evaluated by eliminating a number of operator actions from the model but apparently does not change the hardware failure contributions to venting. SAMA 84 was evaluated by adding a redundant operator action to vent containment. One would expect the CDF reduction for these two SAMAs to be similar. Explain the reasons for the differences in the estimated CDF reduction for these SAMAs. Describe in more detail how the existing containment vent system is modeled in the PRA, and the specific plant modifications associated with the two SAMAs.

   b. In the evaluation of SAMA 67 (Section F.6.7), a revised baseline CDF and risk are determined using the seismic CDF of 3.63E-06 per year from the original IPEEE submittal and applying the release category frequency distribution for Class 1A (early) from the internal events baseline model. Both of these assumptions are questionable. As indicated in the IPEEE SER, the seismic CDF of 3.63E-6 per year was subsequently increased to 4.7E-06 per year. As indicated in Section F.6.27.3, seismic CDF is dominated by Class 1B (early) events and Class 1A (early) events do not have a major contribution. Accordingly, the use of the higher CDF and the release category frequency distribution for Class 1B would appear more appropriate. The NRC staff also notes that the seismic baseline risk developed for SAMA 124 appears applicable for SAMA 67 as well. Address these items and provide a revised evaluation of SAMA 67, as appropriate.

   c. The evaluation of SAMA 91 (Section F.6.11) includes a description of modeling the benefit of the SAMA for non-loss of offsite power cases. This description indicates the addition of an "OR" gate that includes opposite division basic events. Clarify how this results in a reduction in CDF.

   d. The net value table for SAMA 100 (Section F.6.16) indicates a base case cost risk of $4,462,000. This reflects a factor of 2 multiplier to account for external events, and is inconsistent with Note 2 to the table which states that a multiplier of 1.0 is used. The NRC staff estimates a net value of -$420 thousand, using a multiplier of 1.0 versus the - $354 thousand given in the ER. Clarify these apparent discrepancies.

   e. SAMA 109 is evaluated in two different sections of the ER with two different results. The evaluation of SAMA 109 contained in Section F.6.23 appears to take credit for the direct current supply only for station blackout scenarios and results in a 15.6 percent reduction in CDF and a net value of $599 thousand. The evaluation of SAMA 109 contained in Section F.6.28 (where this SAMA is re-named SAMA 125A) results in over a factor of 2 reduction in the revised CDF (that includes the fire contribution from the two dominant fire zones) and a net value of $3.3 million. Explain any differences in the assumed SAMA, i.e., plant modifications, and the modeling of the SAMA between these two sections.

f. In establishing the baseline for evaluating SAMA 125B (Section F.6.28), SAMA 109 (also referred to as SAMA 125A) is assumed to have already been implemented. Similarly, both SAMA 109/125A and SAMA 125B are assumed to have been implemented in establishing the baseline for evaluating SAMA 125C. SAMA 125C is not cost beneficial when prior implementation of SAMA 109/125A and SAMA 125B are assumed, but might be if these SAMAs are not implemented. Since there is no commitment for implementing SAMA 109/125A or SAMA 125B, it is inappropriate to credit their implementation when assessing the benefits of SAMA 125B and SAMA 125C, respectively. Provide either: a commitment regarding implementation of SAMA 109/125A and SAMA 125B, or the results of separate cost benefit assessments of SAMA 125A, SAMA 125B, and SAMA 125C.

g. SAMA 127, regarding operator training (Section F.6.30), is indicated to be important to implement even though a specific net value is not identified. However, the improvements envisioned as part of this SAMA are not clear. Provide additional information regarding how the current training practices/programs would be modified as part of this SAMA, and how the benefits would be quantified.

h. The evaluations of SAMAs 130 and 134 (Sections F.6.33 and F.6.36) make use of Figure 7 of Section 5.1 of the Oyster Creek IPEEE. The validity of this figure was questioned by the U.S. Nuclear Regulatory Commission staff during review of the IPEEE submittal, and it appears that the frequency of high winds could be underestimated by one to two orders of magnitude (the frequency of wind speeds exceeding 168 miles per hour is 5E-7 per year in the IPEEE versus a staff estimate of 7E-06 per year. The frequency of wind speeds exceeding 117 miles per hour is about 5E-6 per year in the IPEEE versus a staff estimate of 1E-03 per year). Explain how the evaluation of these two SAMAs (including the baseline risk from high winds and the risk reduction for each SAMA) would be affected if more appropriate values are used for the frequency of high winds.

i. In the evaluation of SAMA 132 (Section F.6.34), a value of 0.5 was assumed for the potential for a spurious trip of the combustion turbines, and the SAMA was estimated to have only a slightly negative net value. If the potential for a spurious trip was assigned a value of 0.4, this SAMA would be cost beneficial. Provide additional justification for the 0.5 value.

5. In Section F.6.39, AmerGen provides an evaluation of the combined impact of several SAMAs. With regard to this evaluation, provide the following:

a. In evaluating combinations of cost-beneficial SAMAs in Section F.6.39.1, the SAMAs appear to have been divided into four unique groups (Group1 - SAMAs 91, 99, 109; Group 2 - SAMA 125B; Group 3 - SAMA 127; and Group 4 - SAMAs 130 and 134), and the optimum SAMA within each group (judged in terms of maximum net value) was then identified. This resulted in a set of four optimum and unique SAMAs (i.e., SAMAs 109, 125B, 127, and 134). However, the combined effect of implementing these four SAMAs was not provided. Provide an assessment of the combined benefit of implementing the four high priority SAMAs identified.

b. An evaluation of synergies between non-cost-beneficial SAMAs is provided in Section F.6.39.2. The SAMAs considered in this evaluation were said to have been selected because they are close to being cost beneficial (i.e., have net values between 0 and -$50 thousand) and could potentially become cost-beneficial in combination with other SAMAs. However, for all but two of the SAMAs considered, the averted cost risk for each SAMA is essentially zero (the small negative net value is due to a cost of $50 thousand and essentially a zero benefit). Thus, combinations of these SAMA would not be expected to be cost-beneficial. Only two of the subject SAMAs (106 and 132) have a substantive benefit. Although these two SAMAs were considered as part of "Combination B2," they may be of more value if evaluated in concert with the four optimum cost-beneficial SAMAs identified in F.6.39.1. Justify that these two SAMAs would not be cost-beneficial if implemented in conjunction with the four cost-beneficial SAMAs.

c. Seven cost-beneficial SAMAs were identified in the baseline analysis (SAMAs 91, 99, 109, 125B, 127, 130, and 134). However, based on the evaluation of various combinations of SAMAs in Section F.6.39, and the discussion in Section F.6.39.3, it appears that only four of these SAMAs will receive any further consideration for implementation (SAMAs 109, 125B, 127, and 134). The assessments in Section F.6.39.1 indicate that the remaining three SAMAs would no longer be cost-beneficial if the four priority SAMAs are implemented, but this assessment does not address the impact of uncertainties (i.e., whether the three unimplemented SAMAs would remain non-cost-beneficial if uncertainties were considered). From the information provided, these three SAMAs may remain cost-beneficial even after implementation of the four priority SAMAs when uncertainties are considered. Provide an assessment of the upper bound net values associated with implementing the remaining cost-beneficial SAMAs (SAMAs 91, 99, and 130) assuming that the four priority SAMAs are implemented.

6. With regard to the sensitivity analyses, please address the following:

a. Two additional SAMAs have a positive net value when a 3 percent discount rate is used (SAMAs 10 and 132), and five additional SAMAs (beyond those in the 3 percent case) have a positive net value if the benefits are increased to represent the upper bound of the uncertainty assessment (SAMAs 84, 106, 124, 125C, and 138). Based on a staff assessment, SAMA 129 may also be cost-beneficial when uncertainties are considered (the results for SAMA 129 were omitted from Table F.7-3). A brief, qualitative discussion of each of the seven "new" cost-beneficial SAMAs is provided in Table F.7-4, but the thrust of the arguments is that the 95th percentile case is extreme, or that in the case of two SAMAs there could be competing effects. Even then however, four of these additional SAMAs appear cost-beneficial and have no competing effects. Provide an assessment of the upper bound net values associated with implementing the eight additional SAMAs (SAMAs 10, 84, 106, 124, 125C, 129, 132, and 138), assuming that the four priority SAMAs are implemented.

b. Those SAMAs that were screened out in Phase I based on cost (Code C or F) were reassessed assuming a 3 percent discount rate. The summary table that provides a further evaluation of those SAMAs (Table F.7-1) includes all screened SAMAs except SAMAs 26 and 42. Confirm that these two SAMAs would not become potentially cost-beneficial, or provide a further evaluation of these SAMAs.

7. A portion of the first paragraph in F.7.2 is missing. Provide the missing portion.

8. Section F.5.2 provides a very brief statement about implementation costs. Various references are provided regarding implementation costs, including cost estimates from other SAMA evaluations. However, for several SAMAs, the explanation for the cost estimate is not provided, nor are details for the modification. Provide a brief explanation for the cost estimate (i.e., provide more details to support the cost, for example, see SAMA 10) for Phase II SAMAs 7, 100, 108, 109, 110, 111, 112, 124, 125B, 133, 134, 136, and 138.

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