February 17, 2005

NOTE TO: File

FROM: Richard L. Emch, Jr., Senior Project Manager /RA/
Environmental Section
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

SUBJECT: DOCKETING OF DRAFT REQUEST FOR ADDITIONAL INFORMATION REGARDING SEVERE ACCIDENT MITIGATION ALTERNATIVES ANALYSIS IN SUPPORT OF THE ENVIRONMENTAL REVIEW OF CAROLINA POWER & LIGHT COMPANY'S LICENSE RENEWAL APPLICATION FOR BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2

On January 24 through 27, 2005, the NRC conducted an environmental site audit at the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP). During this audit, I provided representatives of Carolina Power & Light Company (CP&L) a draft request for additional information (RAI) regarding the severe accident mitigation alternatives (SAMA) analysis. The SAMA analysis was submitted by CP&L as part of environmental report for its application for license renewal for BSEP. This note to file makes that draft SAMA RAI publicly available. A letter formally providing the final version of the SAMA RAI to CP&L will be mailed in late February of 2005. The final version will be the same as the draft version except for very minor typographical corrections.

Attachment: As stated

Docket Nos.: 50-324 and 50-325

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DATE	2/17/05	2/17/05

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Request for Additional Information Regarding the Analysis of Severe Accident Mitigation Alternatives (SAMAs) for the Brunswick Steam Electric Plant, Units 1 and 2

1. The SAMA analysis is based on the most recent version of the Brunswick Steam Electric Plant (BSEP) Probabilistic Safety Assessment (PSA), i.e., the MOR03 model. Please provide the following information regarding this PSA model:

   a. The Unit 2 PSA is used to quantify the risk for both Units 1 and 2. Characterize the major differences in the results from the Unit 1 and Unit 2 PSAs, and any plant design or operational differences that may impact the SAMA analysis.

   b. Provide the CDF contribution due to station blackout events and ATWS events.

   c. Describe the evolution of the current Level 2 PSA relative to that described in the BSEP Individual Plant Examination (IPE). Include an explanation of the Level 2 metrics (last column) presented in the table in Section F.2.1 of the Environmental Report (ER).

   d. Provide a discussion of the Level 2 PSA models or assumptions that lead to the following results indicated in Table F-4 of the ER:
      i. the approximate 50 percent split of ATWS Class IV sequences between high/early and moderate early release categories,
      ii. the majority of Class IIIA sequences being assigned to the low/early release category, and
      iii. the relatively large fraction of Classes IA, IB and IIIC and the relatively small fraction of Class ID sequences being assigned to the intact containment release class.

   e. Briefly describe the approach used to determine the source terms for each release category. Clarify whether new MAAP analyses were performed as part of the development of the current model and how the MAAP cases were selected to represent each release category (i.e., based on the frequency-dominant sequence in each category or on a conservative, bounding sequence). Clarify how the MAAP calculations used to determine the source terms relate to the MAAP calculations that were used to support the improved success criteria (as mentioned in Section F.2.3 of the ER).

   f. Provide a breakdown of the annual population dose risk (person-rem/year) by containment release mode.

   g. Section F.2 of the ER indicates that a major upgrade and replacement of the IPE models was undertaken during 1998-2001 and that subsequent updates were made in 2001, 2002 and 2003. Provide a discussion, similar to that in Section F.2.1.1, of the major changes made in the 1998 and subsequent updates, and the resulting CDF and LERF for each update. Note that the internal events CDF cited in the August 9, 2001 extended power uprate (EPU) submittal was 2.55×10^{-5} per year. Include an explanation of why the CDF value of 5.49×10^{-5} per year based on MOR98R1 (as reported in Section F.2.1 of the ER) was not used.

h. It is stated that only 6 of 66 Level B facts and observations from the BWROG Peer Certification Review have been resolved in the version of the PSA used for the SAMA analysis. Provide additional information to substantiate the conclusion that no open issues would result in retention of a SAMA that was screened out based on the current PSA model results.

2. Provide the following with regard to the treatment of external events in the SAMA analysis:

   a. In section F.1.2.1.2 of the ER, Progress Energy states that "Based on a review of the IPEEE seismic results, no plant enhancements were identified and then not pursued based on cost concerns for Brunswick." Confirm whether there were any plant enhancements identified and not pursued for reasons other than cost. If so, provide a brief discussion.

   b. The 1988 BSEP PSA included external events with a seismic contribution to CDF of 6.6×10^{-5} per year. This was characterized as a preliminary seismic risk assessment and it was stated "that with more refined ongoing and planned analysis of seismic events, the core damage results will be significantly reduced." Describe any follow-on seismic risk analyses undertaken on BSEP.

   c. In Section F.1.2.1.5 of the ER, it is indicated that any averted cost-risk calculated for a SAMA is initially multiplied by two to account for the corresponding reduction in external events, and that insights from the external events evaluations are used, where appropriate, to modify the initial factor of two multiplier. However, a concluding sentence states that no adjustments have been made in the BSEP analysis to further alter the factor of two multiplier. Confirm that the averted cost-risk values reported for all SAMAs within Section F.6.1 of the ER include the factor of two. Identify those the SAMAs for which the factor was modified, if any.

3. The MACCS2 analysis for BSEP is based on a reference BWR core inventory at end-of-cycle, scaled by the power level for BSEP. The calculations were based on a 3-year fuel cycle (12 month reload) with an average power density for the assembly groups ranging from 24 to 30 MW/MTU. Current BWR fuel management practices use longer fuel cycles (time between refueling) and result in significantly higher fuel burnups. The use of the reference BWR core 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. Justify the adequacy of the SAMA identification and screening given the fuel enrichment and burnup expected at BSEP during the renewal period.

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

   a. It is not clear that all of the potential SAMAs identified in Sections F.5.1.3 - F.5.1.5 and in Tables F-13 and F-14 of the ER are included in Table F-15, e.g., specific SAMAs are not identified for several important events, such as events %TE_S, and OPER-ALTUNITXC in Table F-13. Provide a cross-reference between the potential SAMAs identified in these sections and tables and the SAMAs in Table F-15.

b. Briefly describe how the information in Table A-1 of the Addendum to Appendix F of the ER was used in the identification of SAMAs.

c. In Table F-15 of the ER, Phase I SAMA 38 is said to address the same issues as Phase I SAMA 27. However, SAMA 27 is indicated as "Not Used." Provide an evaluation for Phase I SAMA 38 (at 3 percent and 7 percent), including implementation costs.

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

a. Detailed descriptions of the PSA assumptions/modifications made to estimate the risk reduction are provided for each SAMA in Section F.6 of the ER. In order to accurately reflect the assumptions in the Summary table that is typically included in the staff's evaluation (see the summary table in prior EIS supplements for examples), provide a concise high-level statement for each SAMA that captures the assumed impact of the SAMA, e.g., eliminate all ISLOCA events; reduce RHR pump failure by a factor of two.

b. In Table F-16, the implementation cost for Phase II SAMA 1 is stated to be for a single unit site. However, the benefit estimate is based on the risk reduction achieved at both units. Even if only one portable DC generator is provided there may be some added cost for implementing the SAMA for both units. Provide an explanation.

c. The discussion of Phase II SAMA 13 indicates that this SAMA would not be beneficial for the loss of control rod drive (CRD) initiator but that there would be some benefit for other loss of makeup sequences. The benefit analysis indicates a 6.4 percent reduction in CDF and a 9.3 percent reduction in person-rem doses (dose risk). These reductions appear higher than expected considering that no CRD failures appear in the importance list of Table F-13. Please explain.

d. Phase II SAMA 18 is modeled by setting the loss of 4 kV bus initiators to zero and is stated to reduce the CDF by 3.1 percent. Figure F-2 of the ER indicates that the total CDF due to loss of AC "E"-bus (emergency bus) is 5.7 percent. Explain the difference. Also, discuss if eliminating the failure of an "E"-bus during other initiating events also makes a contribution to the estimated benefit for this SAMA.

e. The cost of implementing Phase II SAMA 31 is given as $250,000 . This seems high for changes that appear to be limited to improved training and communications equipment. Provide a further explanation for this cost.

f. The description of the estimated benefit of Phase II SAMA 32 in Section F.6.21 of the ER indicates that only improvements in the North Central and North West areas elevation 20' of the reactor building were considered. Table F-16 indicates that the cost of implementation for this SAMA is based on work in additional fire areas (including the South area, the control room cabinets, and the Switchgear Rooms. Please reconcile these apparent inconsistencies and justify the cost estimate.

g. Information in Sections F.6.11.1 and F.6.28 of the ER indicate that Phase II SAMA 16 is not cost-beneficial. However, the entry in Table F-16 for this SAMA states that the cost of implementation is less than the averted cost-risk ($135,817), and that this SAMA has been retained for further evaluation. Clarify this apparent discrepancy.

h. Phase I SAMA 25 (5th Diesel Generator) is estimated in Table F-15 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.

6. Section F.7.2 of the ER provides the results of an uncertainty analysis of the Level 1 PSA used for determining the benefit of various SAMAs. This indicates that the mean CDF is a factor of 2.11 greater than the point estimate CDF used in the SAMA evaluations and is only slightly less than the 95 percentile value.

   a. Provide an assessment of the impact of using the mean CDF results on the cost benefit analysis and justify not considering these results in determining which SAMAs to retain for consideration.

   b. Based on information in F.7.2, several events are assigned an error factor (EF) of 10.0. Depending on the event, this may be conservative and can skew the results (including the mean and 95th) toward higher values. Provide a more concise description (or listing) of exactly where and why these EFs were used. Provide an assessment of the impact on the uncertainty analyses results if an EF of 3 instead of 10 is assumed.

7. Provide the following with regard to the calculation of replacement power costs:

   a. Provide the basis for the assumption (related to replacement power costs) that the remaining unit would have to be shut down after a core damage event.

   b. Provide an assessment of the impact of this assumption on the results of the SAMA analysis, i.e., would certain cost-beneficial SAMAs no longer be cost-beneficial if this assumption were not made.

   c. Provide a table showing the averted cost-risk (at 3 percent and 7 percent) for each Phase II SAMA assuming only one unit is affected (similar to the table on page F-85 of the ER).

8. The ER states that several cost-beneficial SAMAs exist that could be examined further. However, it is not clear which SAMAs will be further reviewed. Identify (list) which SAMAs Progress Energy plans to further evaluate, and describe the anticipated process for performing such an evaluation, e.g., the plant's action tracking system, or corrective action program.

9. 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 BSEP. For the following SAMAs, provide a brief statement regarding the applicability/feasibility of the alternative for BSEP, and a further evaluation (similar to those evaluations provided in the ER) if the alternative could be potentially cost-beneficial at BSEP:

   - Provide means for alternate safe shutdown makeup pump room cooling, e.g., via fire protection system (Quad Cities, Phase II SAMA 1),

- Provide alternate ventilation for various rooms, e.g., using portable equipment or blocking open doors for RHR pump room, HPCS pump room, RCIC pump room (Nine Mile Point, Unit 2, SAMA 23),

- Enhance procedures to provide more specific guidance for loss of service water events (Nine Mile Point, Unit 2, SAMA 213),

- Reduce unit cooler contribution to emergency diesel generator unavailability through increased testing frequency or redundant cooling (Nine Mile Point, Unit 2, SAMA 221), and

- Enhance procedures to provide more specific guidance for loss of instrument air events (Nine Mile Point, Unit 2, SAMA 222).