January 17, 2003

Mr. Stephen A. Byrne
Senior Vice President, Nuclear Operations
South Carolina Electric and Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88
Jenkinsville, South Carolina 29065

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION (RAI) REGARDING SEVERE ACCIDENT MITIGATION ALTERNATIVES FOR THE V. C. SUMMER NUCLEAR STATION

Dear Mr. Byrne:

The staff has reviewed South Carolina Electric and Gas Company's analysis of severe accident mitigation alternatives (SAMAs) submitted in support of its application for license renewal for the V. C. Summer Nuclear Station, and has identified areas where additional information is needed to complete its review. Enclosed are the staff's RAIs.

We request that you provide your responses to these RAIs by March 3, 2003, in order to support the license renewal review schedule. If you have any questions, please contact me at (301) 415-1124.

Sincerely,
/RA/
Gregory F. Suber, Project Manager
Environmental Section
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No.: 50-395

Enclosures: As stated

cc w/enclosures: See next page

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Request for Additional Information Related to Severe Accident Mitigation Alternatives (SAMAs) for the V. C. Summer Nuclear Station (VCSNS)

1. The SAMA analysis is based on the most recent version of the VCSNS probabilistic risk assessment (PRA) model for internal events (i.e., the UP3a model), which is a modification to the original individual plant examination (IPE) developed in 1993. Please provide the following information regarding this PRA model:

a. a summary description of the internal and external peer reviews of the level 1 and level 2 portions of this PRA;

b. a characterization of the findings of these internal and external peer reviews (if any), and the impact of any identified weaknesses on the SAMA identification and evaluation process;

c. additional information regarding the reasons for changes in core damage frequency (CDF) between the IPE model and the UP3a model. Specifically, Table F.1-2, attributes all of the changes in CDF to "model changes," while Table F.1-1 attributes some CDF reduction from plant improvements (plant improvement numbers 1 and 11). Please explain this apparent inconsistency. Also, please clarify how much of the approximate 70 percent reduction in CDF is attributed to PRA model changes and how much is attributed to actual plant improvements;

d. a breakdown of the internal event CDF and large early release frequency (LERF) by major contributors or accident classes, such as loss of offsite power (LOOP), station blackout (SBO), transients, anticipated transient without scram (ATWS), loss-of-coolant accident (LOCA), interfacing systems LOCA (ISLOCA), steam generator tube rupture (SGTR), and internal floods;

e. a breakdown of the population dose (person-rem per year within 50 miles) by containment release mode, such as SGTR, ISLOCA, containment isolation failure, early containment failure, late containment failure, and no containment failure;

f. for each containment release category (including LERF and non-LERF contributors): the associated release frequency, release magnitude (fission product release fractions), and MACCS-calculated conditional consequence measures. Please identify those release categories that are considered to contribute to LERF, and those categories to which SGTR and ISLOCA releases are assigned;

g. the definition of LERF used to distinguish a large-early release from a small-early or a large-late release; and

h. clarification of whether the reported CDF, LERF, and population dose values are per-reactor year or per-calendar year.

2. According to Table F.4-1 of Appendix F to the environmental report (ER), South Carolina Electric and Gas (SCE&G) evaluated 268 SAMA candidates. Of these 268 candidates, only nine were obtained from VCSNS-specific documents. As such, it is not clear that the set of SAMAs evaluated in ER addresses the major risk contributors for VCSNS. In this regard, please provide the following:

a. a description of how the dominant risk contributors at VCSNS, including dominant sequences and cut sets from the current PRA and equipment failures and operator actions identified through importance analyses, were used to identify potential plant-specific SAMAs for VCSNS. Indicate how many sequences and cut sets were considered and what percentage of the total CDF they represent;

b. a listing of equipment failures and human actions that have the greatest potential for reducing risk at VCSNS based on importance analysis and cut set screening;

c. for each dominant contributor identified in (b), provide a cross-reference to the SAMA(s) evaluated in the ER that addresses that contributor; and

d. a list of the subset of SAMAs (Table F.4-1, Phase 1 SAMAs) that are considered unique/specific to VCSNS other than the nine identified by References 16 and 17.

3. The SAMA analysis did not include an assessment of SAMAs for external events. The VCSNS individual plant examination for external events (IPEEE) study has shown that the CDF due to internal fire-initiated events is about 8.5×10^{-5} per-reactor year. In addition, the risk analyses at other commercial nuclear power plants indicate that external events could be large contributors to CDF and the overall risk to the public. In this regard, the following additional information is needed:

a. NUREG-1742 ("Perspectives Gained from the IPEEE Program," Final Report, April 2002), lists the significant fire area CDFs for VCSNS (page 3-30 of Volume 2). While these fire-related CDF estimates may be conservative, they are still large relative to the VCSNS internal events CDF. For each fire area, please explain what measures were taken to further reduce risk, and explain why these CDFs cannot be further reduced in a cost-effective manner, and

b. NUREG-1742 lists seismic outliers and improvements for VCSNS (page 2-34 of Volume 2). Please confirm that all of the "plant improvements" that address the "anomalies & outliers" (as listed in the table) have been implemented. If not, please explain why, within the context of this SAMA study.

4. The SAMA analysis did not include an assessment of the impact that PRA uncertainties and external event risk considerations would have on the conclusions of the study. Some license renewal applicants have opted to double the estimated benefits (for internal events) to accommodate any contributions for other initiators when sound reasons exist to support such a numerical adjustment, and to incorporate additional margin in the SAMA screening criteria to address uncertainties in other parts of the analysis (e.g., an additional factor of two in comparing costs and benefits of each SAMA). Please provide the following information to address these concerns:

a. an estimate of the uncertainties associated with the calculated CDF (e.g., the mean and median CDF estimates and the 5^{th} and 95^{th} percentile values of the uncertainty distribution);

b. an assessment of the impact on the Phase 1 screening if risk reduction estimates are increased to account for uncertainties in the risk assessment, and the additional benefits associated with external events (if any); and

c. an assessment of the impact on the Phase 2 evaluation if risk reduction estimates are increased to account for uncertainties in the risk assessment, and the additional benefits associated with external events (if any). Please consider the uncertainties due to both the averted cost-risk and the cost of implementation to determine changes in the net value estimate for these SAMAs. (Note that some of the SAMA candidates, e.g., Phase II SAMA 3 and 7, could potentially become cost beneficial).

5. Please provide the following information concerning the MACCS analyses:

a. for the evacuation input, discuss any assumptions used for delayed start after declaration of an emergency and sheltering;

b. for meteorology input, clarify the source from which the annual data sets were obtained, e.g., the plant meteorological tower;

c. the MACCS analysis assumes all releases occur at ground-level and have a thermal content that is the same as ambient. These assumptions could be non-conservative when estimating offsite consequences. Please provide an assessment of the impact that alternative assumptions might have on the estimated offsite consequences (doses to the population within 50 miles) and the conclusions of the SAMA evaluation; and

d. please provide additional discussion to clarify what is meant by the following sentence in Section F.2.2, page F-14, "Each VCSNS category corresponded with a single release duration (either puff or continuous); MACCS2 categories Te and Ce required multiple releases."

6. In the Phase 2 assessment (Section F.5), the benefits associated with reducing population dose are reported in terms of percent reduction in LERF. Please provide this estimated benefit in terms of percent reduction in person-rem dose for each of the SAMAs that are quantitatively assessed.

7. 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. In this regard, please provide the following:

a. for the subset of plant-specific SAMAs identified in RAI 2d and for the Phase 2 SAMAs, discuss whether any lower-cost alternatives to those considered in the ER would be viable and potentially cost-beneficial;

b. SAMAs 92 and 93 address added DC capability with costs estimated as being greater than $1.88M, thus, eliminating them from further consideration. Please provide the averted-risk benefit from these SAMAs, and address whether less costly alternatives to the SAMAs suggested might make these alternatives viable. Specifically, consider and provide estimated costs and benefits for diesel-driven battery chargers, and cross-connects to the existing non-safety station batteries as two potential alternatives;

c. a plant has recently installed a direct-drive diesel to power an auxiliary feed water (AFW) pump for under $200K. Please provide the averted-risk benefit of supplemental AFW capability at VCSNS, and an assessment of whether such a SAMA could be a cost-beneficial alternative to a motor-driven pump (Phase 1 SAMA 176); and

d. please provide an assessment of the costs and benefits of an automatic safety injection pump trip on low refueling water storage tank level as an alternative to fully automating the switch-over from injection to recirculation (Phase 2 SAMA 24).

8. Referring to Table F.1-1, Plant Improvement No. 10, it is noted that this improvement would reduce CDF due to SBO events, yet was never implemented. Please discuss whether this improvement was considered in the SAMA study and, if not, why?

9. In Section F.7.1, a LERF sensitivity assessment is described. For completeness, please provide the source terms used (release fractions for each radionuclide, release categories, release timing, etc.) and the corresponding population doses for both Cases 1 and 2.

cc:

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