March 28, 2003

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

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE V.C. SUMMER NUCLEAR STATION (VCSNS), LICENSE RENEWAL APPLICATION - SECTIONS 2.4, 2.5, 3.6, AND 4.0 AND APPENDIX B

Dear Mr. Byrne:

By letter dated August 6, 2002, South Carolina Electric & Gas (SCE&G) submitted, for the Nuclear Regulatory Commission's (NRC's) review, an application pursuant to 10 CFR Part 54 to renew the operating license for VCSNS. The NRC staff is reviewing the information in the license renewal application and has identified areas where additional information is needed to complete the review.

The enclosed requests for additional information (RAIs) are numbered to coincide with the numbering of the license renewal application. These RAIs concern Sections 2.4, 2.5, 3.6, and 4.0 and related Appendix B sections.

The staff is willing to meet with SCE&G and to clarify the RAIs before SCE&G submits its responses. If you have any further questions, please contact me at 301-415-1025 or rca@nrc.gov.

Sincerely,

/***RA***/

Rajender Auluck, Senior Project Manager
License Renewal Section
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No: 50-395

Enclosure: As stated

cc w/enclosure: See next page

Mr. Stephen A. Byrne
Senior Vice President, Nuclear Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
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NAME	R.Subbaratnam	RAuluck	Y. Edmonds (Ltr. Only)	S. Lee
Date	3/27 /03	3/28 /03	3/27 /03	3/28 /03

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C. Munson
RLEP Staff

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J. Knox, EEIB, DE
J. Ma, EMEB, DE
K. Landis
C. Julian
K. Cotton
L. Plisco, RII
K. Clark
M. Kotzalas

Requests for Additional Information

2.4 SCOPING AND SCREENING RESULTS: STRUCTURES

2.4.1 Reactor Building

RAI 2.4.1-1 LRA Section 2.4.1, "Reactor Building," states that the reactor building consists of a cylindrical wall, a shallow-dome roof and a foundation mat with a depressed incore instrumentation pit under the reactor vessel. The foundation mat bears on fill concrete that extends to competent rock. Table 2.4-2, "Reactor Building Component Types Subject to Aging Management review and Their Intended Functions," lists Foundations as a component type. Since Table 3.5-1, Item 9, lists reduction in foundation strength due to erosion of porous concrete subfoundation as an AMR result for the foundations in Table 2.4-2, the staff interprets that component type "foundations" to include the foundation mat and the fill concrete, which is the subfoundation. Verify whether the staff's interpretation is correct. If not correct, state what the foundations consist of. The auxiliary building, control building, fuel handling building, intermediate building, turbine building, and service water discharge structure are also supported on fill concrete, and Foundations is also listed as a component type for these structures. However, Table 3.5-1,Item 9, is not listed as an AMR result for these buildings. Clarify why Table 3.5-1,item 9, is listed as an amr result only for the reactor building but not for other buildings whose foundations are also supported on a fill concrete subfoundation.

RAI 2.4.1-2 Section 2.4.1.3, "Penetrations," states that double O-rings are used to seal the doors of two personnel airlocks and an equipment hatch and are not considered a long-lived components because they are tested and replaced when warranted by their condition, and therefore do not require an AMR. According to 10 CFR 54.21(a)(1)(ii) a component which is not subject to replacement based on a qualified life or specified time period is subject to an AMR. Since the O-rings may fail in the intervals between tests and you did not indicate that the O-rings have a specified time period for replacement, provide a justification that the O-rings meet the requirement of 10 CFR 54.21(a)(1)(ii).

RAI 2.4.1-3 Table 2.4-2, "Reactor Building Component Types Subject to Aging Management Review and Their Intended Functions", lists "Anchorage", "Anchorage/Embedments (exposed surfaces)," and Embedments as component types requiring AMR. Since the first half of the component type Anchorage / Embedments is Anchorage, which is identical to the component type Anchorage, and the second half is identical to the component type Embedments, This is confusing. Clearly describe each component type so that staff can distinguish the three component types.

RAI 2.4.1-4 Indicate whether there are any masonry block walls in the reactor building which are subject to an AMR.

2.4.2 Other Structures

RAI 2.4.2-1 LRA Section 2.4.2.1, "Auxiliary Building," of the LRA states: "The Hot Machine Shop is a steel framed building with metal siding designed to withstand earthquake loads and tornado wind loads to the extent required for prevention of damage to seismic Category I structures. The north wall of the Auxiliary Building is separated from the Hot Machine Shop by a seismic gap. The failure of the Hot Machine shop will not prevent the satisfactory

accomplishment of any required safety-related functions. The Hot Machine Shop is therefore not subject to an aging management review." Does your statement mean that the Hot Machine Shop was so designed that it will not collapse under earthquake loads and tornado wind loads or that it may collapse but it will not impact on, or be in contact with, seismic Category I structures? Does the word "failure" in your statement include the collapse of the Hot Machine Shop? If not, define the kind of failure. Your statement appears to be a reason for including the Hot Machine Shop from scope, but not for excluding it from an AMR. LRA Table 2.2-2, "Structural Scoping Results," lists the Hot Machine Shop as in scope, the reason being that its intended functions are those that meet the requirements of 10 CFR 54.4(a)(2), and involve a seismic II/I concern. Your statement in Section 2.4.2.1 appears to be inconsistent with the intended functions listed in Table 2.2-2. Clarify whether or not the Hot Machine Shop is in scope and requires an AMR, and provide a justification for your determination.

RAI 2.4.2-2 LRA Section 2.4.2.1, "Auxiliary Building," states that the southwestern portion of the auxiliary building supports two large tanks, the refueling water storage tank and the reactor make-up water storage tank. The staff finds that these two tanks are not listed in Table 2.4-3 "Auxiliary Building Component Types Subject to Aging Management Review and Their Intended Functions". If you determine that these two tanks are subject to an AMR, provide the information on component type, intended functions, and AMR results for these two tanks. If not, provide a justification for their exclusion.

RAI 2.4.2-3 The staff finds that you did not list grout as a component that requires an AMR in Section 2.4. Indicate whether grout is subject to an AMR. If you determine that grout is subject to an AMR, provide the information on component type, intended functions, and AMR results for the grout. If not, provide a justification for its exclusion.

2.5 SCOPING AND SCREENING RESULTS: ELECTRICAL

RAI 2.5-1 Appendix B of NEI 95-10 identifies uninsulated ground conductors, isolated-base bus, non-segregated-phase bus, and segregated-phase bus as passive components. In Section 2.5 of the LRA, you indicate that these components were screened out. In addition, you indicate that they are considered out of scope for license renewal because they do not perform any intended functions. Explain why each of these passive components performs no intended function at VCSNS defined in 10 CFR 54.4. For uninsulated ground conductors, amplify in your response how each of the following criteria is addressed.

(a) GDC 3, "Fire Protection," states: "SSCs important to safety shall be designed ... to minimize ... the probability ... of fires." Explain why uninsulated ground conductors are not relied on (or credited) in safety analyses or plant evaluations in the design of SSCs important to safety to minimize the probability of fires pursuant to GDC 3.

(b) GDC 17, "Electric Power Systems," states "Provisions shall be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies." Explain why uninsulated ground conductors are not relied on (or credited) in safety analyses or plant evaluations in the design of SSCs important to safety pursuant to GDC 17. As a part of this explanation clarify (1) why unisulated ground conductors are not relied on to meet GDC 17 in the design of loss of power

instrumentation for opening the offsite power supply breaker to the 7200 volt Class 1E bus, (2) the preferred offsite power system including the switchyard and transmission network to assure onsite electrical safety system are capable of withstanding electrical system disturbances (e.g., electrical faults, lightning surges), and (3) the EG - Generator & Main Transformer system to assure onsite electrical safety systems are capable of withstanding electrical system disturbances (e.g., electrical faults, lightning surges)].

(c) Section 2.1.1.3.3 of the LRA states "Electrical systems and portions of electrical systems that are non-safety-related but whose failure could prevent the satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1)(i), (ii), and (iii) [Reference 2.1-1] are within the scope of license renewal (as outlined in 10 CFR 54.4(a)(2))." And the LRA further indicates in Table 2.2-3 that the "EC - Grounding & Cathodic Protection" system is out of scope of license renewal. However, the following statements in the FSAR imply that failure of grounding systems could prevent the satisfactory accomplishment of a function identified in 10 CFR 54.4(a)(1)(i), (ii), and (iii) and should therefore be considered within the scope of license renewal (as outlined in 10 CFR 54.4(a)(2)). The FSAR on page 8.3-17 states: "A low impedance ground return path is provided to facilitate the operation of ground fault detection or protective devices in the event of ground fault or insulation failure on any electrical load or circuit." In addition, the FSAR states: "... over-current protection exists for the cables in the non-Class 1E trays so that they cannot be a hazard to the Class 1E trays whose separation distance has been violated." Clarify why grounding systems should be considered outside the scope of license renewal.

RAI 2.5-2 Section 2.5 of the LRA does not identify fuse holders as part of any commodity group or in scope for aging management review. Clarify which commodity group fuse holders belong to.

RAI 2.5-3 Table 2.2-3 of the LRA indicates that the EP - Emergency Power system is out of scope for license renewal. Explain why the EP - Emergency Power system is out of scope for license renewal.

RAI 2.5-4 Table 2.2-3 of the LRA indicates that the EG - Generator & Main Transformer system is out of scope for license renewal. Explain why the EG - Generator & Main Transformer system is out of scope for license renewal. With main transformer and EG-Generator system bus duct failure, clarify how the two preferred offsite circuits are isolated.

4.4. ENVIRONMENTAL QUALIFICATION (EQ)

RAI 4.4-1 Section 4.4 (3rd paragraph) of the LRA indicates that each of the EQ documentation binders contains or references either a calculation of qualified life or an evaluation to justify a qualified life. For components that justify their qualified life based on an evaluation (versus a calculation) and whose qualified life evaluation meets the 10 CFR 54.3 definition for TLAA and is thus considered a TLAA for license renewal, describe and justify the method (when the Analytical EQ reanalysis method using calculations described in NUREG-1801 is not used) for extending the qualified life from 40 to 60 years.

RAI 4.4-2 Section B.3.1.2 of the LRA states: "The EQ Program provides reasonable assurance that the aging effects will be managed such that the components subject to aging management review will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation." Clarify the intent of this concluding statement given that Section 2.5 (3rd paragraph) of the LRA indicates that components in the EQ program are not subject to an aging management review.

RAI 4.4-3 Explain why (and to what extent) electrical penetration assemblies are not subject to the aging (or qualified life) requirements of 10 CFR 50.49. Assuming all electrical penetrations are included within the VCSNS Harsh EQ Program and required to meet 10 CFR 50.49, does this mean that the non-1E electrical penetrations qualified life analysis is considered a TLAA which will be re-analysed for 60 years? And does this mean non-1E electrical penetrations will also be subject to an aging management review?

RAI 4.4-4 With regard to the attribute, Data Collection & Reduction Methods, for reanalysis of the EQ aging evaluation, Section X.E1 of NUREG-1801 states: "A representative number of temperature measurements are conservatively evaluated to establish the temperatures used in an aging evaluation. Plant temperature data may be used in an aging evaluation in different ways, such as (a) directly applying the plant temperature data in the evaluation or (b) using the plant temperature data to demonstrate conservatism when using plant design temperatures for an evaluation. Any changes to material activation energy values as part of a re-analysis are to be justified on a plant-specific basis. Similar methods of reducing excess conservatism in the component service conditions used in prior aging evaluations can be used for radiation and cyclical aging." Clarify that the Virgil C. Summer EQ program is consistent with this attribute or justify the extent to which the EQ program is inconsistent with this attribute.

3.6 Aging Management of Electrical and Instrumentation and Controls

RAI 3.6-1 In LRA Section B 2.9, the applicant states that the Non-EQ Insulated Cables and Connections Inspection Program will be consistent with GALL program XI.E1, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements, as identified in NUREG-1801 prior to the period of extended operation. However, the program discussed in 3.6-1 does not agree with NUREG-1801. Explain (by comparing each element of GALL program XI.E1 and the applicant's AMP) how the applicant's AMP is consistent with GALL program XI.E1.

RAI 3.6-2 Exposure of electrical cables to localized environments caused by heat, radiation, or moisture can result in reduced insulation resistance (IR). Reduced IR causes an increase in leakage currents between conductors and from individual conductors to ground. A reduction in IR is a concern for circuits with sensitive, low-level signals such as radiation monitoring and nuclear instrumentation since it may contribute to inaccuracies in the instrument loop. Visual inspection may not be sufficient to detect aging degradation from heat, radiation, or moisture in the instrumentation circuits with sensitive, low-level signals. Because low-level signal instrumentation circuits may operate with signals that are normally in the pico-amp range or lower in range, that they can be affected by extremely low levels of leakage current. These low levels of leakage current may affect instrument loop accuracy before the adverse localized changes are visually detectable. Routine calibration tests performed as part of the plant surveillance test program can be used to identify the potential existence of this aging

degradation. Provide a description of your aging management program that will be relied upon to detect this aging degradation in sensitive, low-level signal circuits.

RAI 3.6-3 LRA Table 3.6-1, Item 4 indicates that the aging management review for medium voltage cables exposed to moisture and voltage stressors concluded that aging management at VCSNS is not required. No instances of power cable failure at VCSNS due to moisture intrusion were found.

Most electrical cables in nuclear power plants are located in dry environments. However, some cables may be exposed to condensation and wetting in inaccessible locations, such as conduits, cable trenches, cable troughs, duct banks, underground vaults, or direct buried installations. When an energized medium-voltage cable is exposed to wet conditions for which it is not designed, water treeing or a decrease in the dielectric strength of the conductor insulation can occur. This can potentially lead to electrical failure. The growth and propagation of water trees is somewhat unpredictable. Provide a description of your aging management program that will be relied upon to provide reasonable assurance that the intended function of inaccessible medium-voltage cables that are not subject to the environment qualification requirements of 10 CFR 50.49 and are exposed to moisture while energized will be maintained consistent with the current license basis through the period of extended operation.

RAI 3.6-4 In Table 3.6-2, of the LRA , the applicant states that aging effects of non-EQ electrical penetration assemblies include embrittlement, cracking, melting, discoloration, swelling, loss dielectric strength leading to reduced insulation resistance, electrical failure caused by thermal/thermoxidative degradation of organics, radiolysis and photolysis (in ultraviolet-sensitive materials only) of organic, radiation-induced oxidation, and moisture intrusion. However, the applicant states that for the ambient environmental conditions at VCSNS, no aging effects have been identified that could cause a loss of function and no aging management is required.

In most areas within a nuclear power plant, the actual ambient environments are less severe than the nominal plant environment. However, in a limited number of localized areas, the actual environments may be more severe than the nominal plant environment. Insulation materials used in non-EQ electrical penetration assemblies may degrade more rapidly than expected in these adverse localized environments. The purposed of the aging management program is to provide reasonable assurance that the intended functions of electrical penetration assemblies exposed to adverse localized environments caused by radiation or heat will be maintained to be consistent with the current licensing basis through the period of extended operation. For non-EQ electrical penetration within the scope of license renewal exposed to adverse localized environments, provide a description of an aging management program for electrical penetration insulation exposed to an adverse localized environmental caused by heat, radiation, or moisture.

RAI 3.6-5 In a letter dated March 4, 2003, the NRC forwarded to the Nuclear Energy Institute (NEI) and Union of Concerned Scientists an interim staff guidance (ISG) on the identification and treatment of electrical fuse holders. The staff position indicated that fuse holders should be scoped, screened, and included in the aging management review (AMR) in the same manner as terminal blocks and other types of electrical connections that are currently being treated in the process. This position only applies to fuse holders that are not part of a larger assembly such as switchgear, power supplies, power inverters, battery chargers, circuit

boards, etc. Fuse holders in these types of active components are considered a piece parts of the larger assembly and are not subject to an AMR.

As discussed in NUREG-1760 “Aging Assessment of Safety-Related Fuses Used in Low- and Medium-Voltage Applications in Nuclear Power Plants,” operating experience identified that aging stressors such as vibration, thermal cycling, electrical transients, mechanical stress, fatigue, corrosion, chemical contamination, or oxidation of the connections surfaces can result in fuse holder failure. On this basis, fuse holders (including both the insulation material and the metallic clamps) are subject to an AMR and require an AMP for license renewal. Typical plant effects observed from fuse holder failures due to aging have resulted in challenges to safety systems, cable insulation failure due to overtemperature, failure of a containment spray pump to start, a reactor trip, etc. Therefore, managing age-related failures of fuse holders would have a positive effect on the safety performance of a plant. Provide a commitment to implement the fuse holder ISG.

RAI 3.6-6 Explain why connection surface oxidation of highvoltage electrical switchyard bus is not considered a significant aging mechanism at the Virgil C. Summer Nuclear Station (VCSNS).

RAI 3.6-7 The most prevalent mechanism contributing to loss of high voltage transmission conductor strength is corrosion, which includes corrosion of steel core and aluminum strand pitting. Explain in detail why no aging effects related to conductor corrosion have been identified that would cause a loss of function for the extended period of operation. Also, explain why no significant aging effects related to wind loading vibration or sway on high-voltage connections have been identified at VCSNS.

RAI 3.6-8 Various airborne materials such as dust, salt, and industrial effluents can contaminate insulator surfaces. A large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover. Surface contamination can be a problem in areas where there are greater concentrations of airborne particles such as near facilities that discharge soot or near the seacoast where salt spray is prevalent. Cracks in insulators have been known to occur when the cement that binds the parts together expands enough to crack the porcelain. Mechanical wear is another aging effect for strain and suspension insulators because they are subject to movement. Movement of insulators can be caused by wind blowing the supported transmission conductor, causing it to swing from side to side. If this swinging is frequent enough, it could cause wear in the metal contact points of the insulator string and between an insulator and the supporting hardware. Provide a detailed assessment of surface contamination, cracking, and loss of material due to wear for high-voltage insulators and explain why these potential aging effects are not significant for VCSNS.

Mr. Stephen A. Byrne
VIRGIL C. SUMMER NUCLEAR STATION
South Carolina Electric & Gas Company

cc:
Ms. Kathryn M. Sutton, Esquire
Winston & Strawn Law Firm
1400 L Street, NW.
Washington, DC 20005-3502

Mr. R. J. White
Nuclear Coordinator
S.C. Public Service Authority
c/o Virgil C. Summer Nuclear Station
P.O. Box 88, Mail Code 802
Jenkinsville, SC 29065

Resident Inspector/Summer NPS
c/o U.S. Nuclear Regulatory Commission
576 Stairway Road
Jenkinsville, SC 29065

Chairman, Fairfield County Council
Drawer 60
Winnsboro, SC 29180

Mr. Henry Porter, Assistant Director
Division of Waste Management
Bureau of Land & Waste Management
Department of Health & Environmental Control
2600 Bull Street
Columbia, SC 29201

Mr. Gregory H. Halnon, General Manager
Nuclear Plant Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station,
Mail Code 303
P.O. Box 88
Jenkinsville, SC 29065

Mr. Melvin N. Browne, Manager
Nuclear Licensing & Operating Experience
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station,
Mail Code 830
P.O. Box 88
Jenkinsville, SC 29065

Ronald B. Clary
Manager, Plant Life Extension
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
P.O. Box 88
Jenkinsville, SC 29065

Mr. Alan P. Nelson
Nuclear Energy Institute
1776 I Street, NW., Suite 400
Washington, DC 20006-3708

Mr. William Suddeth
Government Information Librarian
Thomas Cooper Library
University of South Carolina
1322 Greene St.
Columbia, SC 29208

Ms. Sarah McMaster
Director
Fairfield County Library
300 Washington St.
Winnsboro, SC 29180

Ms. Pearson
1106 St. Barnabus Ch Rd.
Jenkinsville, SC 29065

Mr. Kamau Marcharia
Member County Council
Fairfield County
P.O. Drawer 49
Jenkinsville, SC 29065

Mr. Bret Bursey
SC Progressive Network
P.O. Box 8325
Columbia, SC 29202

Mr. Billy Hendrix
18662 Newberry Rd.
Blair, SC 29015

Mr. Stephen A. Byrne
VIRGIL C. SUMMER NUCLEAR STATION
South Carolina Electric & Gas Company

cc:

Mr. Gregory C. DeCamp
Constellation Nuclear Services
6120 Woodside Executive Ct.
Aiken, SC 29803

Mr. Kim Bowens
ICRC
1098 Old Levington Hwy.
Chapir, SC 29036

Ms. Lunelle Harmon
SCE&G
3364 SC Hwy. 219
Newberry, SC 29108