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Refer to: RC-94-0032

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U. S. Nuclear Regulatory Commission  
Washington, DC 20555

Gentlemen:

Subject: VIRGIL C. SUMMER NUCLEAR STATION  
DOCKET NO. 50/395  
OPERATING LICENSE NO. NPF-12  
REQUEST FOR ADDITIONAL INFORMATION  
RESPONSE TO NRC GENERIC LETTER 92-08  
THERMO-LAG 330-1 FIRE BARRIERS

South Carolina Electric & Gas Company submits the attached pursuant to the subject NRC request.

I declare that the statements and matters set forth herein are true and correct to the best of my knowledge, information, and belief.

Should you have any questions, please call at your convenience.

Very truly yours,

John L. Skolds

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SOUTH CAROLINA ELECTRIC & GAS COMPANY

ADDITIONAL INFORMATION REGARDING GENERIC LETTER 92-08  
"THERMOLAG 330-1 FIRE BARRIERS"

GENERAL

The NRC's request for additional information regarding Generic Letter 92-08, "Thermo-Lag 330-1 Fire Barriers", requires identification of specific information related to Virgil C. Summer Nuclear Station's installed Thermo-Lag 330-1 fire barriers. Identification of the requested information related to cable and raceway performance parameters, ampacity derating, bounding test configurations, alternative resolutions, and schedule development require reliance on the success or failure of planned fire tests relative to NRC developed test and acceptance criteria which is in draft format. As identified in the initial response to Generic Letter 92-08, "SCE&G will continue to work with Thermal Science, Inc., NUMARC, and the industry to develop a course of action to ensure the Thermo-Lag fire barriers are capable of performing their design function." These efforts are in progress, NUMARC's Phase I fire tests have been completed and Phase II tests are scheduled to occur January 26 thru March 24, 1994, with an Application Guide issued April 15, 1994. The Phase I tests conducted by NUMARC provided an indication of the potential for upgraded Thermo-Lag 330-1 barriers to pass the prescribed fire tests and identified the "weaknesses" in baseline configurations. The 1-hour conduit tests conducted in Phase I testing provided evidence that no or minimal upgrades may be required for these configurations; however, sufficiently detailed information regarding application of performance parameters is not expected to be available until the NUMARC Application Guide is issued.

It is anticipated, at this time, that the results of NUMARC's Phase II fire tests will bound those configurations used at Virgil C. Summer Nuclear Station, with the exception of Cable Tray 3088. Practical upgrades or engineering analysis may be required to establish conformance to the test specimen performance parameters. Cable Tray 3088's unbounded "thermal mass" parameter will be fully evaluated to ensure the Thermo-Lag 330-1 barrier will be capable of performing its design function. Thorough determination of the bounding parameters and required upgrades or analyses will not be completed pending issuance of (and NRC agreement with) the NUMARC Application Guide.

I. REQUIRED INFORMATION FOR SECTION I.B., ITEMS 1 & 2:

Thermo-Lag 330-1 barrier material is used in five locations at Virgil C. Summer Nuclear Station. The specific component function of the electrical circuits associated with each barrier was provided in SCE&G's initial response to Generic Letter 92-08. Each of the Thermo-Lag 330-1 installations is described below including the purpose, fire rating, type, dimensions, and estimated linear feet/square feet (as appropriate):

1. 18-inch-wide cable tray 3088, which transitions to 12-inches, is protected with Thermo-Lag 330-1 panels to provide a 1-hour fire barrier (Barrier ID #58-TW) to meet the separation requirements of Appendix R to 10 CFR Part 50. Cable Tray 3088 is protected along

- approximately 55 linear feet. Approximately 220 square feet of Thermo-Lag 330-1 barrier material is used in this location.
2. 3-inch-diameter conduit XX-7177A is protected with Thermo-Lag 330-1 preshaped conduit sections to provide a 1-hour fire barrier (Barrier ID #74-TW) to meet the separation requirements of Appendix R to 10 CFR Part 50. Conduit XX-7177A is protected along approximately 4 linear feet.
  3. Two 4-inch-diameter conduits VUL21A are protected with Thermo-Lag 330-1 preshaped conduit sections to provide a 1-hour fire barrier (Barrier ID #59-TW) to maintain swing component capability. Conduits VUL21A are protected for a combined length of approximately 50 feet.
  4. Conduit XX-1478A, Conduit XX-1479A, and Pull Box PB-NI-15 are protected by a vertical self-supporting structure (3-sided boxed enclosure fastened to a rated firewall) constructed of Thermo-Lag 330-1 panel to provide a 1-hour fire barrier (Barrier ID #24A-TW) to meet the separation requirements of Appendix R to 10 CFR Part 50 for conduit XX-1478A only. The dimensions of this structure varies along it's approximate 25 foot length with the bounding "width" dimension being approximately 26 inches at PB-NI-15 and a bounding "depth" dimension of approximately 10 inches along the conduit. An estimated 80 square feet of Thermo-Lag 330-1 barrier material is used in this location.
  5. The supports (threaded rod and unistrut) for the "A" Service Water Booster Pump horizontal radiant energy heat shield (Barrier ID #76-TW) are protected with Thermo-Lag 330-1 panel (unistrut) and Thermo-Lag 330-660 flexi-blanket (threaded rod). The Thermo-Lag 330-660 flexi-blanket is not considered to be within the scope of Generic Letter 92-03. An estimated 120 linear feet of unistrut is installed to support the radiant energy heat shield and is protected by an estimated 160 square feet of Thermo-Lag 330-1 material. The Thermo-Lag 330-1 panels are installed on the unistrut in a manner similar to other Thermal Science, Inc. recommended unistrut installation applications.

The application of Thermo-Lag material to the heat shield support structure was prompted due to concerns identified during the June 3-7, 1985 audit of the compliance of The Virgil C. Summer Nuclear Station to Appendix R of 10 CFR Part 50. On July 24 and 25, 1985, South Carolina Electric & Gas Company (SCE&G) met with the NRC staff, both NRR and Region II, to discuss the Appendix 'R' reanalysis effort and Region II concerns identified during the previously mentioned audit (Reference Audit Report 50-395/85-26). At this meeting several methods of improving the fire resistance of the barrier supports were discussed between the staff and SCE&G. SCE&G provided an initial response and preliminary design information related to the heat shield support concerns in letter D. A. Nauman to H. R. Denton dated September 20, 1985. An update, due to revised design, was provided in letter O. W. Dixon to H. R. Denton dated December 30, 1985 which identified SCE&G's intention to use the Thermo-Lag material currently installed. In letter J.

B. Hopkins to D. A. Nauman dated May 22, 1986, SCE&G received a Safety Evaluation Report for the Virgil C. Summer Nuclear Station Appendix R Plant Modification Review which identified these modifications to the support assembly as "resolving" this issue and credited the Service Water Booster Pump horizontal radiant energy heat shield as "acceptable". (Reference SER dated 5/22/85, Section II.k). As stated in letter O. W. Dixon to H. R. Denton dated December 30, 1985, "The complete barrier assembly is considered non-rated since it functions as a radiant energy heat shield." The letter addresses the Thermo-Lag materials used and that the installation of these materials will be performed using design details which are consistent with 1-hour rated configurations, as demonstrated by test documentation available at that time.

## II. REQUIRED INFORMATION FOR SECTION II.B, ITEMS 1,2, AND 3

SCE&G has performed preliminary assessments of each of the 24 parameters identified in the NRC listing for each Thermo-Lag 330-1 barrier identified in Section I. Information related to these performance parameters is considered preliminary at this time since NUMARC's testing program could identify further parameters of importance or demonstrate that some of the parameters identified are insignificant. The following list of raceway parameters are those which are currently considered to be unknown or unverified.

1. Joint Gap Width (NRC Listing Item 17)
2. Panel Rib Orientation (NRC Listing Item 11)

The above performance parameters cannot be conclusively verified without performing destructive examinations, and instead, will be evaluated for potential impact based upon the data provided in NUMARC's Application Guide. Upgrades to baseline configurations, as are being performed in NUMARC's Phase II fire tests, may result in bounding these parameters such that the potential effects are considered insignificant. SCE&G will continue to monitor NUMARC's ongoing efforts to ensure significant performance parameters remain bounded and are adequately addressed. Destructive examination or significant effort to obtain conclusive data for these parameters is considered unnecessary at this time.

A discussion of each parameter identified above is provided:

1. Joint Gap Width

Pre-buttering, post-buttering, and/or general application of trowel material was performed at barrier joints. Inspection or installation guidance did not specify a minimum gap criteria for barrier joints. This performance parameter is considered to apply to butt joints and mitered joints. Joints which have been formed without severing the stress skin are not considered to be susceptible to separation failures typical to joints with gaps. One generic upgrade under investigation in NUMARC's Phase II tests is anticipated to negate the need to determine conclusive joint gap width. This upgrade will use stress skin and trowel material to reinforce barrier joints. SCE&G is considering this upgrade in lieu of

destructive examination; however, SCE&G's final course of action is contingent upon evaluation of the final contents of the NUMARC Application Guide.

## 2. Panel Rib Orientation

NUMARC's Phase II test program will bound perpendicular or parallel panel rib orientation on unsupported spans. Successful performance of these tests will bound this performance parameter.

To the extent that NUMARC's fire test results are satisfactory for specific test configurations on the basis of temperature, as provided for in the NRC draft test and acceptance criteria, the majority of the cable performance parameters identified in the NRC listing will be inconsequential. If fire tests demonstrate temperature criteria exceedances, one optional approach to resolution would be to evaluate cable functionality at the elevated temperatures. In this case, a determination of cable performance at elevated temperature would be necessary using cable performance test data and information for specific installed cable types. However, NRC has yet to finalize requirements for a cable functionality evaluation nor are test results yet available that would clearly indicate the scope of such evaluations. The degree and conservatism of cable functionality evaluation requirements implied by the NRC listing of cable parameters, and discussed in proposed Supplement 1 to Generic Letter 86-10, significantly exceeds the original requirements of Generic Letter 86-10.

Certain parameters of the NRC cable listing address issues relative to potential cable/barrier contact for cable trays. This is an unresolved issue at this time and barrier inspection in this regard would be difficult or impossible. Barrier contact would be most likely to occur in situations of large cable fills, a condition which is not present in the single cable tray barrier installed at Virgil C. Summer Nuclear Station. SCE&G recognizes that absence of a large cable fill does not preclude the possibility of cable/barrier contact; however, walkdown of this and other similar cable tray installations indicates tie wraps were used as a general installation practice to secure the installed cables to the tray's ladder rungs. This practice would minimize the probability of the occurrence of this condition.

Upon completion of NUMARC's Phase II test program and based upon the final content of (and NRC agreement with) the Application Guide, SCE&G will perform appropriate evaluations to ensure significant parameters are bounded using one or more of the following options:

1. Evaluate barrier based on most limiting condition of unknown or unverified parameters.
2. Destructive examination of barriers on a sample basis to obtain information on construction techniques.
3. Reviews of installation/inspection through documentation or testimony.

III. REQUIRED INFORMATION FOR SECTION III.B ITEMS 1,2, AND 3:

Cable Tray 3088's Thermo-Lag 330-1 fire barrier is currently considered to be outside the NUMARC Phase II test program. Cable Tray 3088 is a 18-inch tray which transitions to 12-inches along its length. Due to the dimensional increase of the 18-inch section of the tray, the percent cable fill reduces to less than 15 percent. Cable fills of less than 15 percent are not bounded in NUMARC's Phase II test program. This reduced cable fill (thermal mass) may impact the overall performance of the barrier; however, conclusive tests have not been performed by NUMARC to date. SCE&G intends to evaluate Cable Tray 3088's Thermo-Lag 330-1 fire barrier using NUMARC's Application Guide and engineering analysis. NUMARC's Expanded Generic Testing Program is expected to perform testing related to cable fills of less than 15 percent. The scope of this testing is to be identified (estimated) on April 1, 1994. SCE&G will monitor NUMARC's efforts related to this expanded testing.

The protection of the unistrut members of the radiant energy heat shield support system using Thermo-Lag 330-1 barrier material is not typical of the barriers identified to be of concern in Generic Letter 92-08. The performance parameters under development by NUMARC and the draft NRC test and acceptance criteria do not readily apply to the function this material serves. While the material is installed in a manner consistent with support protection for conduit and cable trays, the unexposed side (internal) temperature criteria, which is of primary concern with electrical raceways, does not apply to unistrut support protection. Minor installation inconsistencies which may result in "hot spots" along the unistrut member would not be expected to result in collapse of the heat shield, nor does it warrant considerations given to the protection of electrical raceways. In addition, sprinkler protection is provided both above and below the heat shield. Based on the application described above, and considering the prior NRC review and acceptance of this assembly, SCE&G considers this Thermo-Lag 330-1 application to be outside the scope of Generic Letter 92-08. SCE&G will evaluate this assembly to the extent possible based on NUMARC fire test results. An engineering analysis will be performed to qualify this assembly or support a request for exemption.

SCE&G has not identified any other installed plant configurations which are considered to be outside the scope of the NUMARC test program. Upon issuance of the NUMARC Application Guide, further evaluation by SCE&G may conceivably identify additional unbounded configurations. Should additional unbounded configurations be identified, or Cable Tray 3088 remain unbounded (following performance of analyses and/or comparison to NUMARC's Expanded Generic Test Program), a supplemental response will be provided to the NRC which describes the condition and SCE&G's course of action, which may include, but is not limited to:

1. Consider bounding the configuration through the results of a NUMARC expanded generic test program.
2. Participation in a utility targeted shared testing program.
3. Performance of a plant specific test program.

4. Performance of an engineering analysis to qualify the unbounded condition.

#### IV. REQUIRED INFORMATION FOR SECTION IV.B ITEMS 1,2,3, AND 4

A separate response is provided for each barrier identified in Section I of this report.

1. The circuits associated with cable tray 3088 fall within the scope of the NUMARC program for ampacity derating. Cable tray 3088 was analyzed for ampacity considerations during initial barrier installation. A thermal analysis was performed which indicated the temperature rise inside the Thermo-Lag barrier did not exceed the temperature limitations of the enclosed cabling. The circuits associated with Cable Tray 3088 will be evaluated using the NUMARC Ampacity Test Report scheduled to be issued in August, 1994.
2. The circuits associated with conduit XX-7177A fall within the scope of the NUMARC program for ampacity derating. Conduit XX-7177A was analyzed for ampacity considerations during initial barrier installation. This analysis assumed a 28 percent ampacity derating based on information received from Thermal Science, Inc. Review of this analysis indicates further margin exists to allow for increased derating should review of the NUMARC Ampacity Test Report scheduled (estimated) for completion in August 1994 identify this need.
3. The circuits associated with conduit VUL21A falls within the scope of the NUMARC program for ampacity derating. Conduit VUL21A were analyzed for ampacity considerations during barrier installation. This analysis assumed a 0 percent ampacity derating; however, review of this analysis indicates margin exists to allow for ampacity derating consistent with the preliminary ampacity derating ranges identified in the TUEC test report using the IEEE P848 Draft II methodology with some modifications. SCE&G recognizes NRC acceptance of this methodology is still pending. NUMARC is estimating completion of the Ampacity Test Report in August, 1994 which will be used to assure an appropriate ampacity derating is allowed.
4. Ampacity derating concerns are not considered to apply to the circuits associated with Conduit XX-1478A, Conduit XX-1479A, and Pull Box PB-N1-15 which contain instrumentation circuits only.
5. Ampacity derating concerns are not considered to apply to the Service Water Booster Pump horizontal radiant energy heat shield unistrut supports. There is no electrical cabling associated with this support.

Should SCE&G identify concerns with specific cables due to ampacity derating, SCE&G will provide an update to the NRC which will describe the condition and SCE&G's planned course of action, which may include, but is not limited to:

1. Further engineering analysis to qualify the cable based on actual operating conditions and/or margin determinations.
2. Installation of circuits which allow for adequate derating margin.

V. REQUIRED INFORMATION FOR SECTION V.B

SCE&G is not considering alternatives as described in this section. SCE&G anticipates returning operability to the Thermo-Lag barriers identified in Section I based upon engineering analyses and practical upgrades emanating from guidance provided in the NUMARC Application Guide developed from the Phase II testing program or results of the NUMARC Expanded Generic Testing Program. Should SCE&G's evaluations identify a barrier to be outside the scope of the NUMARC Application Guide or testing programs, appropriate alternatives will be considered, and an update provided to the NRC which describes the condition and SCE&G's planned course of action. Barriers which are identified to be unbounded by the Phase II test program, but are bounded by the NUMARC expanded generic test program will not require an update to the NRC except to update any schedule impacts.

VI. REQUIRED INFORMATION FOR SECTION VI.B

Development of an integrated schedule to resolve Generic Letter 92-08 concerns is dependent upon many uncertainties and requires reliance of timely completion of activities not under SCE&G's control. In an effort to assist utilities in responding to this request for additional information, NUMARC's Fire Protection Working Group developed a response guidance document. This guidance document contains an activity schedule with estimated completion dates. NUMARC's ability to meet this completion schedule is dependent upon continued cooperation and participation of the NRC in NUMARC's Phase II Testing Program, Application Guide, and Ampacity Program. In addition, finalization of the NRC's test and acceptance criteria is crucial to a complete and final resolution to this issue.

SCE&G's schedule for resolution of Generic Letter 92-08 is as follows:

1. Receive final (with NRC Agreement) NUMARC Application Guide. Month 0 (Estimated 4/15/94)
2. Complete reviews, analyses, and examinations to establish bounded parameters and conceptual design. Month 6 (Estimated 10/15/94)
  - a. Dependent on timely issuance of NUMARC Ampacity Test Report estimated August, 1994



- b. Dependent on performance of NUMARC Generic Expanded Test Program. Estimate scope information available April 1, 1994 and requires completion prior to September 15, 1994.

- 3. Complete Design Month 12 (Estimated 4/15/95)
- 4. Complete Installation Month 24 (Estimated 4/15/96)

Estimated completion dates are subject to change based upon timely completion of NUMARC and NRC activities. This integrated schedule assumes all SCE&G Thermo-Lag 330-1 barriers remain bounded by NUMARC's testing program (Phase II or Expanded Generic).

#### VII. REQUIRED INFORMATION FOR SECTION VII

Sources of the information provided in response to this request for information are listed below:

- Plant Drawings
- Plant Design Calculations
- Inspection Procedures
- Installation Procedures
- Modification Packages
- Historical NRC Correspondence
- Engineering Walkdowns
- NUMARC Correspondence

Primary sources of information are controlled documents which required review and/or verification prior to issuance. An engineering walkdown was performed to verify those barrier attributes which are visible from floor level.