Mr. John R. McGaha, Jr.
Vice President Operations
Entergy Operations, Inc.
River Bend Station
P. O. Box 220
St. Francisville, LA 70775

October 16, 1996

SUBJECT: RIVER BEND STATION, UNIT 1 - REQUEST FOR ADDITIONAL INFORMATION, AMPACITY DERATING (TAC NO. M85596)

Dear Mr. McGaha:

By letter dated November 9, 1996, Entergy Operations, Inc. (EOI), submitted a response to the NRC Request for Additional Information related to Generic Letter (GL) 92-08, "Thermo-Lag 330-1 Fire Barriers," for the River Bend Station. By letter dated June 28, 1996, EOI provided a supplemental response to GL 92-08 on its ampacity derating methodology with respect to Thermo-Lag fire barriers. We and our contractor, Sandia National Laboratories, have developed additional questions on the ampacity evaluation which we will need responses to in order for us to complete our review. It is requested that EOI provide the response or a schedule for submittal within 60 days of receipt of this letter.

If there are any questions on this request, please let me know.

Sincerely,
ORIGINAL SIGNED BY:
David L. Wigginton, Senior Project Manager
Project Directorate IV-1
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Docket No. 50-458

Enclosures: 1) Request for Additional Information
2) Letter Report; Sandia National Laboratories, June 7, 1996

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REQUEST FOR ADDITIONAL INFORMATION
RIVER BEND STATION
FIRE BARRIER AMPACITY DERATING ISSUES
(TAC NO. M85596)

## 1.0 BACKGROUND

By letter dated November 9, 1995, Entergy Operations Inc. (EOI), submitted a response to the NRC Request for Additional Information (RAI) related to Generic Letter (GL) 92-08, "Thermo-Lag 330-1 Fire Barriers," for the River Bend Station (RBS) which includes Enclosure 1, Utility Calculation E-218 with Supplements A-C and Attachments 1-13 entitled "Ampacity Verification of Cables Within Raceways Wrapped with Appendix R Fire Protection Barrier." The licensee also provided by letter dated June 28, 1996, a supplemental response to GL 92-08 on its ampacity derating methodology with respect to Thermo-Lag fire barriers.

The RBS ampacity derating methodology is based on an analytical assessment of the nominal ampacity limits for the cables installed at RBS which includes factors such as the ambient temperature, grouping of conduits and cables and the ampacity impact based upon available test data.

## 2.0 QUESTIONS

### 2.1 Attachment 2, Licensee Submittal dated 11/9/95

Item 1: The subject item states that the licensee analysis will focus only on "required and abandoned Thermo-Lag wrapped raceways." This statement implies that those cables which were originally enclosed in fire barriers that were subsequently removed by the licensee will not be considered further by the subject analysis. Since the scope of GL 92-08 specifically address "all raceways protected by Thermo-Lag 330-1 (for fire protection of safe shutdown capability or to achieve physical independence of electrical systems)" the licensee analysis should include all cables which are either currently or previously enclosed by a fire barrier in order to assess any potential equipment age degradation impact on safety-related cable life. The licensee is requested to confirm the scope of its ampacity derating determinations.

ENCLOSURE 1

Item 10: The licensee implies that the subject analysis will "calculate the depth of cables in each wrapped tray (other than control cables)" and will "use this value to determine an ampacity derating adjustment for cable depth." It is not clear whether those control cables which run in raceways with power cables will be included in depth of fill calculations. The staff agrees with our contractor, Sandia National Laboratories (SNL) that the thermal insulation effects of low or non-continuously energized cables must be accounted for in the subject analysis [see Attachment 1(a)]. The licensee is requested to clarify the use of subject assumption in the applicable calculations.

2.2 Calculation E-218 - General Methodology

- Calculation E-218, Revision 0, Page 2 of 35, Item 7: The calculation cites that the licensee "takes credit for the guaranteed average diameters rather than guaranteed minimum cable diameters for 600 volt K and C cables. This assumption will result in slightly higher DCAs for these cable types." What is the difference between the guaranteed minimum diameter and average diameter? How large would the ampacity impact be if the minimum diameter is used? In general, it would be considered more appropriate to use the minimum diameter value because this would be more conservative, and the manufacturer has apparently indicated that these minimum values are not unlikely. If the derating cable ampacity (DCA) impact is significant, then the licensee should reassess its ampacity limits using the minimum cable diameter as the basis for analysis.

- Calculation E-218, Revision 0, Page 6 of 35, Item II-a-4: This item states that cables in K trays are based on an assumed depth of fill of 1.5 inches. This value appears again on Page 22 of 35, Item 1a, and Attachment 3 of E-218 is cited as the basis for this value. However, Attachment 3 of E-218 states that a depth of fill of 2.5 inches should be used for sizing cables in K trays. In particular, does a value of 1.5 inches bound the upper limit on depth of fill for all such trays? If not, then either an upper bound value or the actual value associated with a given case should be used in the calculation.

- Calculation E-218, Revision 0, Page 35 of 35, Item E: The licensee has not provided any detailed results for the calculation of ampacity limits for 5kV and 15kV cables. The licensee should either specify whether 5kV or higher voltage cables are applicable for the subject analysis. If 5kV or higher voltage cable systems are applicable to the subject analysis, the licensee should cite the tables from which the ampacity limits for these cables are derived, and should describe the appropriate derating factors applied to the tabulated ampacities.

2.3 Calculation E-218 - Specific Analyses

- Calculation E-218, Revision 0, Page 29 of 35, Item "Chart 2": There appears to be two possible discrepancies in the values cited in this chart (i.e., for the 10AWG 7/C and 12/C cables, and for the 12AWG 7/C and 9/C cables). In general, the ampacity limits should decrease with an increase in the number of conductors. For all cases, except the two pairs cited, this expectation is met. The licensee is requested to verify the ampacity values cited in Column 3 of the subject chart and to resolve the apparent discrepancies for the two cable pairs.

- The licensee application of the National Electric Code (NEC) conductor grouping ampacity correction factors for more than three conductors in a cable or raceway is considered incomplete. In the case of conduits, the NEC correction factors should be applied to the conduit system as a whole whenever the total count of conductors exceeds three. In contrast, the licensee has only applied these factors to individual multiconductor cables when the conductor count for a given cable exceeds three. This is an incomplete and nonconservative treatment. The licensee analyses should be revised to fully account for the conductor count adjustment factors for all conduit systems in which the conductor count exceeds three.

- Calculation E-218, Revision 0, Page 24 of 35, Item "Chart 1": This item is described as a table of allowable ampacities for L-trays. The base ampacity values are from the Insulated Cable Engineers Association (ICEA) P-46-426 tables for a cable located in free air with no derating factors applied. The use of open air ampacity values for a general cable tray appears inappropriate and must be either corrected or further justified by the licensee. In particular, this practice is not consistent with accepted ampacity design practices, and hence would require explicit and detailed justification and validation. The licensee should also provide justification and validation for the K-tray or revise the subject calculation as necessary.

The licensee has cited the 1984 version of the NEC handbook as the basis for its assumed conductor count correction factors. However, since 1990, NEC has published an updated listing of correction factors which are more conservative for conductor counts of 10 or more. The older (1984) values included an assumption of 50 percent or more load diversity in the installed cables. The licensee should either apply the more recent values in its corrections, or should specifically justify the applicability of the older adjustment factors on the basis of existing cable load diversity.

2.4 Nominally Overloaded Cable Analyses

Attachment 9 to Calculation E-218 documents supplemental assessments performed by the licensee for four specific cables that are nominally identified as

operating at least part of the time under overload conditions with respect to ampacity limits. Two of the four cables service certain compressor power loads. There are several points of concern related to the supplemental assessments for these two specific cables:

- If these cables have operated under the stated conditions for any significant length of time, then the cables may have already exceeded their rated life expectancy. Rough estimates performed by SNL as part of this review indicate that these cables may exceed their nominal "40 year at 90°C" life in as little as seven years. The licensee should provide an assessment of the impact of past operations on the operating life of these cables in addition to any assessment for future operating conditions.

- The final justification for the acceptability of the operating conditions of these two cables is based largely on the manufacturer's stated overload conditions for operation. These overload ratings are not generally intended to cover anticipated conditions of normal operation, but are intended to cover only rarely encountered and unexpected emergency conditions of operation. Hence, reliance on overload ratings in this case is potentially inappropriate. At the least, this practice represents a fundamental departure from accepted ampacity assessment practices, and as such should be thoroughly justified and reviewed before being accepted as a cable design practice. In particular, the licensee should consider the full context of the ICEA and Institute of Electrical and Electronic Engineers, Inc. (IEEE) overload ratings which set severe limits on these overload ratings. The licensee should provide significant additional justification and validation of the subject design practice.

- The licensee cites a specific passage in the IEEE 242 standard as the basis for its assessment of overload conditions [para. 11.5.2(3)]. A review of this section of the standard (1986 version) revealed no relevance whatsoever to the issue of cable overload conditions. The licensee should clarify its intent in citing the IEEE 242 standard.

- The licensee has cited a particular equipment qualification (EQ) test report as the basis for its assessment of operating life calculations for the subject cables (Okonite report SWGS-1282-2). The licensee is requested to provide further clarification to support its conclusions based on the subject EQ report.

The licensee DCA values are based upon an assumed ampacity derating factor (ADF) for a 3-hour wrapped cable tray of 20.5 percent. A more realistic ADF value might well indicate that the subject cables have been operating for some period of time in significant overload condition. The licensee should address the above concerns for worst case conditions or provide further justification for the assumed ADF value.

2.5 Enclosure 1 -- June 28, 1996, submittal

In general, it is not clear to what extent Enclosure 1, "River Bend Project Instruction on Ampacity Derating Evaluation," which was part of the licensee submittal dated June 28, 1996, supercedes Calculation E-218, Revision 0. In addition to the specific questions below, the licensee is requested to describe the relationship of the subject document with respect to other applicable station documents.

- Tables A.4.2.5 and A.4.3.4 of Enclosure 1 refers to a note for the ampacity derating factor (ADF) and ampacity correction factor (ACF) parameters for the 3-hour fire barriers. The applicable note states that the subject parameters will be provided by Reference A.5.1.15. The licensee is requested to submit Reference A.5.1.15 for staff review.

- Enclosure 1 describes conduit group and tray stack which utilizes a group wrap of Thermo-Lag material to form a single enclosure around each raceway type grouping. The subject configurations represent a significant departure from the simple configurations tested under IEEE Standard P848, "Procedure for the Determination of the Ampacity Derating of Fire Protected Cables" methodology. It should be noted that Tennessee Valley Authority has submitted ampacity derating test reports for similar configurations for staff review. The licensee is requested to provide justification for these nonstandard fire barrier configurations.

Attachment 1(a): A Letter Report to the U.S. NRC, Revision 0, dated June 7, 1996, prepared by Steve Nowlen of Sandia National Laboratories