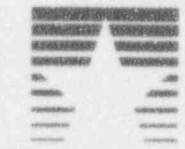

Log # TXX-95136
File # 10010
909.5
Ref. # GL 92-08

August 8, 1995

**C. Lance Terry**
*Group Vice President*

U. S. Nuclear Regulatory Commission
Attn: Document Control Room
Washington, D.C. 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES) - UNIT 1
DOCKET NO. 50-445
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
FOLLOW UP TO GENERIC LETTER 92-08 (TAC NOS. M85536 AND 85537)

REF: 1) NRC Letter dated December 20, 1994, from Mr. Roy P. Zimmerman to Mr. C. Lance Terry

2) TU Electric Letter logged TXX-95004 dated February 24, 1995, from Mr. C. Lance Terry to NRC

3) NRC Letter dated May 17, 1995, from Mr. Timothy J. Polich to Mr. C. Lance Terry

4) TU Electric Letter logged TXX-95185 dated July 7, 1995, from Mr. C. Lance Terry to NRC

Gentlemen:

Reference 1 requested that Texas Utilities Electric Company (TU Electric) provide additional information regarding Thermo-Lag fire barrier material received and installed at CPSES. In Reference 2, TU Electric responded to that request.

During a teleconference on April 20, 1995, the NRC Staff orally requested additional information regarding Reference 2, and in a letter dated May 17, 1995 (Reference 3), NRC requested further information in writing. Attachment 1 provides TU Electric's response to the Staff's oral questions, and Attachment 2 provides TU Electric's response to the Staff's written questions. In several cases, it was only necessary to identify where TU Electric previously responded to essentially the same NRC question and the NRC previously accepted TU Electric's response. Moreover, in a conference call with the NRC staff on July 6, 1995, the NRC expanded the scope of the subject request for additional information, beyond TU Electric's understanding of the written request for information and the earlier conference call. TU Electric requested(Reference 4) and was verbally granted an additional 35 days to respond to the new information requested by the NRC.





A029.1

To summarize the status of the Thermo-Lag fire barrier material received and installed at CPSES Units 1 and 2, TU Electric has applied the same quality assurance (QA) program to the procurement, receipt, and installation of Thermo-Lag for Units 1 and 2, and has performed numerous tests to qualify the Thermo-Lag configurations at CPSES. Based upon the level of quality assurance placed on Thermo-Lag under TU Electric QA program and tests, TU Electric's previous submittals have demonstrated that the Thermo-Lag received and installed at CPSES is able to perform its fire protection function and is in conformance with the CPSES licensing basis. Furthermore, in Inspection Report 50-445/93-08 and in Supplemental Safety Evaluation Reports (SSERs) 26 and 27 for CPSES (NUREG-0797), the NRC concluded that TU Electric's QA program as applied to Thermo-Lag is strong and that the installed Thermo-Lag fire barriers in CPSES Unit 2 are acceptable. Additionally, with respect to the issues discussed in this and the referenced letters, TU Electric believes that Thermo-Lag installed in CPSES Units 1 and 2 is in compliance with NRC requirements and will perform as required. Therefore, TU Electric does not feel that the compensatory measures taken to achieve compliance with Generic Letter 92-08 are applicable to CPSES Units 1 and 2.

If you have any questions regarding the information in the attachments, please contact Roger Walker at (817) 897-8233 or Obaid Bhatty at (817) 897-5839.

Sincerely,

C. L. Terry

OB/ob
Attachments
Enclosures

c - Mr. L. J. Callan, Region IV
Mr. D. F. Kirsch, Region IV
Mr. K. S. West, NRR
Mr. T. J. Polich, NRR
Mr. W. H. Rasin, NEI
Resident Inspectors

RESPONSE TO CLARIFICATIONS REQUESTED
DURING APRIL 20, 1995, TELECONFERENCE

During a teleconference with the NRC staff, on April 20, 1995, TU Electric agreed to provide clarifications to reference 2 to facilitate the NRC staff's review associated with the installed CPSES Unit 1 Thermo-Lag materials.

Via this letter TU Electric is providing these clarifications. Reference 2 is enclosed to expedite your review. The NRC staff's inquiries, as we understand them, and our clarifications are provided below.

NRC Question

(1) TXX-95004 provided by TU Electric to respond to the 50.54(f) letter (reference 1) does not distinguish between Unit 1 and Unit 2. What were the controls for procurement, receipt and installation for CPSES Unit 1?

TU Electric Response

TU Electric letter TXX-95004 did not distinguish between CPSES Unit 1 and Unit 2 because TU Electric applied the same quality assurance controls to Unit 1 and Unit 2. In particular, TU Electric applied quality assurance controls for procurement, receipt and installation of Thermo-lag fire barriers for CPSES Unit 1. These controls covered the attributes specified in reference 1. These controls were applied for the licensed CPSES Unit 1 Thermo-lag installation (1989-1991), and the later upgrades in the 1993-1994 design modification of the fire barriers. These aforementioned attributes are described in table 1 and table 2 of reference 2, and are applicable to both CPSES Units.

NRC has asked whether prefabricated Thermo-Lag materials installed in Unit 1 have delaminations and voids similar to those reported by TU Electric during the installation of Thermo-Lag in Unit 2. During installation of Thermo-Lag barriers in Unit 2, some instances of delaminations and unfilled voids were detected for some ½ inch thick (nominal) prefabricated conduit section material. These conditions were detected during site construction (i.e., saw cutting) and handling of conduit sections during installation. TU Electric letter TXX-92589 dated December 15, 1992, describes the comprehensive measures taken by TU Electric to determine the extent, root cause and corrective and preventive actions for ensuring that conduit section materials installed in Unit 2 were acceptable for use and consistent with materials qualified during TU Electric's fire endurance test program. TU Electric concluded that significant incidence of the delamination condition was limited to ½ inch thick (nominal) prefabricated conduit sections. The review also concluded that this condition was more prevalent within two specific lots of the ½ inch (nominal) prefabricated sections. These two lots were comprised entirely of material for use on 3-inch diameter conduits. The pieces that exhibited the subject condition

were either scrapped or repaired as specified by CPSES specifications and procedures. Additionally, TU Electric identified that some of the conduit section materials actually tested by TU Electric on 3-inch diameter conduit were from the same two material lots demonstrating the highest incidence of the subject condition. The results of these tests were satisfactory, and an inspection of the conduit assemblies following these tests determined that significant quantities of unconsumed Thermo-Lag material remained on 3-inch diameter and larger conduits. Thus, the existence of the delaminations and voids as were identified at CPSES did not adversely impact the ability of the affected Thermo-Lag to perform its fire barrier function. As described in SSER 26, the NRC staff determined that TU Electric's actions with respect to the voids and delaminations were adequate, and that Thermo-Lag conduit barriers installed in Unit 2 are acceptable.

The same site construction and handling techniques and in-process quality verification attributes that were used on Unit 2 (and identified the delaminations and voids discussed above) were employed for the installation of conduit barriers in Unit 1. No instances of delaminations and unfilled voids were identified on Unit 1. Furthermore, the lots with the highest incidence of voids and delaminations were not used in Unit 1. Therefore, delaminations and unfilled voids in conduit sections are not an issue for currently installed Unit 1 barriers. Furthermore, even if similar conditions were postulated to exist for Unit 1 conduit barriers, TXX-92589 and SSER 26 both conclude that such delaminations and voids would not lead to the failure of these qualified fire barrier configurations. Therefore, further verification activities for these conditions for installed Unit 1 Thermo-Lag barrier configurations are not necessary.

NRC has also asked whether the samples of CPSES Thermo-Lag material provided in support of the initial (1993) Nuclear Energy Institute (NEI) pyrolysis gas chromatography testing are sufficient to represent the chemical composition of the entire population of Thermo-Lag barriers installed at CPSES. Two samples (1 panel and 1 conduit section specimen) from TU Electric were selected and utilized by NEI, along with samples from Entergy Operations, Inc., Houston Lighting and Power Co. and Thermal Science, Incorporated (TSI) for performance of chemical testing. The results of the pyrolysis gas chromatography testing performed by NEI revealed no appreciable chemical differences between materials supplied by TU Electric and others. It should be emphasized that TU Electric is not relying solely on these chemical testing activities by NEI to demonstrate consistency in the chemical composition of Thermo-Lag materials installed at CPSES. As described in reference 2, TU Electric has applied its QA program to the procurement and receipt of Thermo-Lag for CPSES Units 1 and 2, which included shop (at TSI) surveillances performed by TU Electric to verify the acceptability of the in-process manufacturing of Thermo-Lag. More importantly, the results of TU Electric's extensive independent full-scale fire endurance test program, which utilized only material from CPSES stock inventory, demonstrated that Thermo-Lag barriers as installed at CPSES are capable of performing their design function; therefore, even if inconsistencies in the organic or inorganic chemical constituents of Thermo-Lag material were postulated, the numerous fire endurance tests

performed by TU Electric provide adequate confidence that such differences have no effect on the performance capability of Thermo-Lag barrier systems installed in CPSES Units 1 and 2. Additionally, the results of these tests did not identify any significant differences in the performance of the Thermo-Lag material itself (i.e., the numerous pieces of Thermo-Lag material exhibited consistent performance, and test failures were attributed to factors related to configuration rather than material performance). The CPSES tests of Thermo-lag material provide adequate confidence that there are no substantive material differences in the chemical composition of the Thermo-Lag barriers installed at CPSES. Consequently, further verification to demonstrate consistency in the chemical formulation of Thermo-Lag barrier materials installed at CPSES is not warranted.

Even though TU Electric does not believe that there is a technical or regulatory bases for requiring any further chemical sampling to support the acceptability of the Thermo-Lag installed at CPSES Units 1 and 2 as qualified fire barriers, TU Electric has, in response to suggestions from the NRC and to support the industry in its response to this aspect of the qualification of Thermo-Lag, decided to participate in the NEI test program to assess the chemical formulation of Thermo-Lag. In this respect TU Electric has provided an additional 10 samples to NUCON Lab, which is endorsed by NEI to perform the chemical analysis. Additionally, TU Electric performed its own tests, under the auspices of its Quality Control program using Infrared Spectroscopy method. Ten samples of Thermo Lag material were analyzed using Fourier Transform Infrared spectroscopy (FTIR). These samples were obtained from various locations of the plant. Based on FTIR testing, the samples are the same basic product formulation.

NRC Question

(2) TU Electric's response (reference 2) does not specify the extent of TU Electric's use of data provided by Thermal Science, Inc.(TSI) to support its seismic analysis.

TU Electric Response

As discussed in the Final Safety Analysis Report (FSAR) Table 17A-1 and TU Electric letter logged TXX-92626 dated December 22, 1992 (Enclosure §4.5.2), Thermo-Lag used for cable and raceway fire barrier and structural steel fireproofing is classified in TU Electric's design bases document DBD-ME-028 as non-seismic (Seismic Category None). However, since fire barrier and fireproofing materials are installed in areas containing safety-related equipment they must meet the requirements of Regulatory Guide 1.29. Specifically, failure of Thermo-Lag fire barrier systems and fireproofing materials during or after the design basis earthquake cannot reduce the functional capability of structures, systems, or components required to safely shut the plant down.

The CPSES Seismic/Non-Seismic Systems Interaction Program (DBD-ME-005) has addressed the requirements of Regulatory Guide 1.29 for the design and operation of both Unit 1 and Unit 2. In this program, Thermo-Lag is not

considered to be a potentially damaging source. Gross failure/falling of the material under CPSES design basis, seismic inertial loading is not credible. This position is supported by the following:

- Thermo-Lag panels and sections are secured in place with extensive use of mechanical fasteners, staples, additional stress skin, and steel bands. The fasteners assure that the material is positively attached to the electrical raceway which has been seismically qualified for the added weight;

- Earthquake studies do not indicate gross failure and falling of fire barrier materials due to seismic inertia when the material is adequately attached to the supporting structure; and

- Local cracking/chipping of Thermo-Lag materials used for raceway fire barrier and structural steel fireproofing applications may occur during a seismic event. However, the resulting debris would be relatively light, and impact of the debris on Seismic Category 1 components would not adversely affect the ability of such components to perform their safety functions.

Thus, TU Electric does not rely upon TSI data to support its conclusions that failure of Thermo-Lag will not adversely affect Seismic Category 1 structures, systems and components. In SSER 26, the NRC accepted TU Electric's program for addressing seismic concerns for Thermo-Lag materials installed at CPSES, finding that the failure of Thermo-Lag will not have damaging effects on Seismic Category 1 plant features, and specifically accepted the validity of the seismic designs of the raceway at CPSES Unit 2 that include Thermo-Lag as a fire barrier. Since the same program for addressing seismic concerns (including the acceptability of the raceway and the impact on Seismic Category 1 features) was used on Unit 1, further verification of mechanical properties of Thermo-lag is not warranted.

Thermo-Lag weights were considered in the hardware validation programs for electrical raceways at CPSES. The values for these weights are determined independent of TSI's input. Based on results of these validation programs, there is adequate confidence that in the maximum postulated seismic event in the FSAR for the plant, the Thermo-Lag material attached to the raceways will not result in a failure of the raceways or adversely impact safety related components.

NRC Question

(3) NRC recently performed an ASTM E84 flame spread rating test at National Institute for Standards and Technology which indicates that Thermo-Lag has a flame spread rating of approximately 30. The NRC staff therefore believes that the flame spread rating that TU Electric provided during the licensing process for Unit 2 (a flame spread rating of approximately 5) may be nonconservative.

TU Electric Response

As stated in reference 2 (Attachment 4, pg.3), TU Electric does not use Thermo-Lag to enclose intervening combustibles to achieve 20 feet separation, free of intervening combustibles, between safe shutdown trains. Additionally, TU Electric does not use Thermo-Lag as a radiant energy shield inside containment. Since the flame spread rating of Thermo-Lag is relevant only to its use in these two applications, the flame spread rating of Thermo-Lag is not an issue with respect to the Thermo-Lag installations for Comanche Peak Steam Electric Stations Units 1 and 2. Flame spread ratings previously provided by TU Electric were background information for the tests that had been performed for the material, and were not intended to imply that the reported rating was being credited by TU Electric for separation of fire safe shutdown raceways.

Additionally, NRC has raised questions regarding the adequacy of the installation of Thermo-Lag at CPSES Unit 1, based upon the discovery of certain nonconformances in the Unit 2 installations. There is adequate confidence in the acceptability of the installation of Thermo-Lag at CPSES Unit 1 based upon the following:

- As discussed in reference 2, TU Electric applied its quality assurance program to the installation of Thermo-Lag at CPSES. The NRC has inspected both the quality assurance program and the installation and has concluded that they are both acceptable[1].

- In 1994, TU Electric discovered 752 visual anomalies that were suspect nonconformances in Thermo-Lag that had previously been installed and inspected in CPSES Unit 2. This discovery was made as a consequence of evaluating Unit 2 installations by personnel involved in Unit 1's Thermo-Lag upgrade program. The conditions discovered were anomalous to as left Unit 2 conditions and were not wide spread. These anomalous conditions would therefore not be expected to be found in the Unit 1 installations. Furthermore, for several reasons (as summarized below), these anomalies would not cast doubt upon the acceptability of the Thermo-Lag installed at CPSES.

- The actual nonconformances were relatively small in number and affected only 7% Thermo-Lag installed in CPSES Unit 2.

- The nonconformances were minor in nature. For example they included:

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[1] Please note that these subjects were previously reviewed by the NRC, as documented in NRC inspection reports:
(i) 50-445/93-08; 50-446/93-08
(ii) 50-445/93-34; 50-446/93-34
(iii) 50-445/93-42; 50-446/93-42
(iv) 50-445/94-21; 50-446/94-21

- localized discontinuities in trowel grade material used to seal raceway envelopes against building structural surfaces, and

- localized discontinuities in coverage installed on various protruding items such as supports, nonessential conduits, etc.

- The nonconformances were subject to TU Electric's corrective action program. Most of the nonconformances were dispositioned as Use-As-Is; the remaining 62 nonconformances were dispositioned as rework/repair:

| | | |
|---|---|---|
| 245 | "Not A Nonconforming Condition" Dispositions | 32% |
| 445 | "Use-As-Is" Dispositions | 60% |
| 57 | "Repair" Dispositions | 7% |
| 5 | "Rework" Dispositions | 1% |
| 752 | Total Conditions Dispositioned | 100% |

- The root causes of those conditions specified for repair/rework are attributed to:

  - minor workmanship issues (approximately 87 percent)

  - incidental damage (approximately 13 percent)

  Field assessment by engineering determined that a significant portion of workmanship-related issues occurred in congested or difficult to access areas where high quality craftsmanship would be more difficult and consequently more difficult to inspect.

- With respect to Unit 2, corrective action has been taken for these nonconformances, and the installed Thermo-Lag is currently acceptable.

- The 62 nonconformance were dispositioned as rework/repair as a matter of convenience and conservatism. TU Electric has evaluated these nonconformances and has determined that each could have been dispositioned as acceptable-as-is. Therefore, none of the nonconformance would have adversely affected the fire protection function of the Thermo-Lag if it had been left uncorrected.

In summary, only a small percent of the Thermo-Lag in Unit 2 had nonconforming conditions, the nonconformances were minor, and none of the non conformances would have adversely affected the ability of the Thermo-Lag in Unit 2 to perform its safety function. In light of the above, the nonconformances identified in the Thermo-Lag in CPSES Unit 2 in 1994 do not cast doubt on the acceptability of the Thermo-Lag in Unit 1. Even if it were postulated that similar nonconformances existed in the Unit 1 Thermo-Lag, that Thermo-Lag would still be able to perform its fire protection function. As a result, additional verification of Thermo-Lag installations at CPSES is not warranted.

# RESPONSES TO NRC RAI DATED MAY 17, 1995

Responses specific to the NRC RAI dated May 17, 1995, are provided below. The questions from the aforementioned RAI are repeated for clarity.

## SECTION 1

NRC Question

> "The staff previously accepted the fire endurance information for CPSES Unit 2 in NUREG-0797, Supplements 26 and 27. The fire endurance information submitted by TU Electric unique to CPSES Unit 1 is still under review by the staff. The staff also concludes that the information regarding the presence of voids, cracks and delaminations for CPSES Unit 2 is acceptable, however, additional information is requested for Unit 1. The licensee should submit the methodology and schedule for verifying the Thermo-Lag materials at CPSES."

TU Electric Response

As stated in Attachment 1 (see response to NRC Question 1) to this letter, the same site construction and handling techniques and in-process quality verification attributes were employed for installation of conduit barriers in Unit 1, and no instances of delaminations and unfilled voids were identified. Therefore, delaminations and unfilled voids in conduit sections are not an issue for currently installed Unit 1 barriers. Furthermore, even if similar conditions were postulated to exist for Unit 1 conduit barriers, TXX-92589 and SSER 26 conclude that such delaminations and voids would not lead to the failure of qualified fire barrier configurations. Therefore, further verification activities for these conditions for installed Unit 1 Thermo-Lag barrier configurations are not necessary.

NRC Question

> "The results of the NEI chemical testing program were transmitted to the NRC on February 8, 1994. This program tested 12 samples from industry. TU Electric provided two of the 12 samples. The NEI testing protocol only evaluated organic components of Thermo-Lag. Inorganic components, which may be important to performance as a fire barrier, were not evaluated. Please provide additional information that demonstrates that two samples are adequate to represent the entire population of Thermo-Lag installed at CPSES."

TU Electric Response

As stated in reference 2 (Attachment 4, Pg.1), two samples (1 panel and 1 conduit section specimen) were selected and utilized by NEI, along with samples from Entergy Operations, Inc., Houston Lighting and Power Co. and TSI for performance of chemical te ting. The results of the pyrolysis gas chromatography testing performed by NEI revealed no appreciable chemical

differences between materials supplied by TU Electric and others. It should be emphasized that TU Electric is not relying solely on these chemical testing activities by NEI to demonstrate consistency in the chemical composition of Thermo-Lag materials installed at CPSES. As described in reference 2, TU Electric has applied its QA program (the program used on Unit 1 is the same program that was used on Unit 2) to procurement and receipt of Thermo-Lag, which included shop (at TSI) surveillances performed by TU Electric Quality Control Inspectors to verify the acceptability of the in-process manufacturing of Thermo-Lag. More importantly, the results of TU Electric's extensive independent full-scale fire endurance test program, which utilized only material from CPSES stock inventory, demonstrated that Thermo-Lag barriers as installed at CPSES are capable of performing their design function. Therefore, even if inconsistencies in the organic or inorganic chemical constituents of Thermo-Lag material were postulated, the numerous fire endurance tests performed by TU Electric provide adequate confidence that such differences have no effect on the performance capability of Thermo-Lag barrier systems installed at CPSES. Additionally, the results of these tests did not identify any significant differences in the performance of the Thermo-Lag material itself (i.e., the numerous pieces of Thermo-Lag material exhibited consistent performance, and test failures were attributed to factors related to configuration rather than material performance). The CPSES tests of Thermo-lag material provide adequate confidence that there are no substantive material differences in the chemical composition of the Thermo-Lag barriers installed at CPSES. Consequently, further verification to demonstrate consistency in the chemical formulation of Thermo-Lag barrier materials installed at CPSES is not warranted. As noted in Attachment 1, at the suggestion of the NRC staff and to assist the industry, TU Electric has decided to participate in the testing program on the chemical content of Thermo-Lag being conducted by NEI.

NRC Question

> "In the RAI [Ref. 1], the staff stated its concerns about the reliability of information and data supplied by TSI and that conclusions based on the vendors information were being re-evaluated. In addition, mechanical property information for Thermo-Lag provided by the Tennessee Valley Authority conflicts with the information provided by TSI. Therefore, additional verification of the mechanical properties of Thermo-Lag installed at CPSES is requested."

TU Electric Response

As discussed in detail in Attachment 1 (Response to NRC Question 2), TU Electric does not rely upon TSI data to support its conclusions that failure of Thermo-Lag will not adversely affect Seismic Category 1 structures, systems and components. In SSER 26, the NRC accepted TU Electric's program for addressing seismic concerns for Thermo-Lag materials installed at CPSES, finding that failure of Thermo-Lag will not have damaging effects on Seismic Category 1 plant features.

Thermo-Lag weights were considered in the hardware validation programs for

electrical raceways at CPSES. The values for these weights are determined independent of TSI's input. Based on results of the seismic validation program, there is adequate confidence that in a maximum postulated seismic event at the plant, the Thermo-Lag Material attached to the raceways will not result in a failure of the electrical raceways or in any nearby safety related equipment. Therefore, verification of mechanical properties of Thermo-lag is not warranted.

NRC Question

> "In its submittal of February 24, 1995, the licensee stated that a "similar position" applies for Unit 1. The licensee's response concerning combustibility for Unit 2 is acceptable, provided the NEI combustibility methodology was not used. However, the licensee should submit its methodology for confirming its "similar position" for Unit 1. The flame spread rating of 5 for Thermo-Lag, referenced in the TU Electric submittal, is based on ASTM E-84, tests conducted by Underwriters Laboratories (UL); however, the Thermo-Lag configuration tested at UL is not representative of the configurations installed at CPSES. In the RAI, the staff stated that licensees must have valid information on the specific Thermo-Lag materials installed at it's plant. Therefore, the licensee should submit additional information concerning the flame spread rating of Thermo-Lag installed at CPSES."

TU Electric Response

As discussed in reference 2 (Attachment 3, Pg. 2 and Attachment 4, Pg. 3), TU Electric does not use Thermo-Lag to enclose intervening combustibles to achieve 20 feet separations, free of intervening combustibles, between fire safe shutdown trains. Additionally, TU Electric does not use Thermo-Lag as a non-combustible radiant energy shield inside containment nor to create combustible-free zones at CPSES Units 1 and 2. Since the flame spread rating of Thermo-Lag is relevant only to its use in these two applications; the flame spread ratings of Thermo-Lag is not an issue with respect to the Thermo-Lag installations for Comanche Peak Steam Electric Stations Units 1 and 2. Flame spread ratings previously provided by TU Electric were background information for the tests that had been performed for the material, and <u>were not</u> intended to imply that the reported rating was being credited by TU Electric for separation of fire safe shutdown raceways.

In a conference call with the NRC staff on July 6, 1995, the NRC expanded the scope of this question beyond TU Electric's understanding of the written request for information and the earlier conference call. The NRC staff requested that TU Electric address the combustibility of Thermo-Lag and the impact of that combustibility on the Fire Hazards Analysis (in particular the combustible loading assumed therein). TU Electric has considered this new request and has decided to respond in a conservative manner. Although TU Electric continues to consider the Thermo-Lag installations to be fully operational, TU Electric will revise the Fire Hazardous Analysis (FHA) in accordance with the methodology of the CPSES Fire Protection Report to incorporate Thermo-Lag as a combustible material. Based on the results of the available test programs, TU Electric will treat

Thermo-Lag in a manner similar to fire retardent plywood and cable jackets (Reference NRC Information Notice 95-27). TU Electric projects that this revision to the FHA will take about two years to complete.

SECTION 2

NRC Question

> "In the RAI [Ref. 1], the staff stated that some of the installation parameters can only be verified by detailed examination such as disassembling a representative sample of installed barriers and that installation records and procedures alone were not sufficient for identifying installation defects. Inspections of Thermo-Lag barriers at CPSES by the licensee has identified 752 potential discrepancies of which 62 required corrective action. Therefore, additional information concerning the licensee's methodology and schedule for verifying the important barrier parameters is requested."

TU Electric Response

As discussed in detail in Reference 2 (Attachments 2 and 4), TU Electric applied the same quality assurance program during the installation of Thermo-Lag at CPSES Units 1 and 2, which verified the important Thermo-Lag installation attributes identified by the NRC. The NRC inspected the quality assurance program as applied to installation of Thermo-Lag at CPSES, and in Inspection Report 50-445/93-08;446/93-08 for CPSES the NRC concluded that "the licensee has an effective in-process Thermo-Lag installation QA/QC program." Therefore, there is adequate confidence that the installation of Thermo-Lag in CPSES Units 1 and 2 is acceptable, and disassembly and additional verification of installed Thermo-Lag is not warranted.

As stated in Attachment 1 to this letter (pages 5 and 6), the nonconformances identified in the Thermo-Lag in CPSES Unit 2 in 1994 do not cast doubt on the acceptability of the Thermo-Lag in Unit 1. Even if it were postulated that similar nonconformances existed in the Unit 1 Thermo-Lag, that Thermo-Lag would still be able to perform its fire protection function. As a result, additional verification of Thermo-Lag installations at CPSES is not warranted in order to resolve these nonconformances.

Log # TXX-95004
File # 10010
909.5
Ref. # 10CFR50.54

February 24, 1995

**C. Lance Terry**
*Group Vice President*

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES)
DOCKET NOS. 50-445 AND 50-446
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION (RAI)
FOLLOWUP TO GENERIC LETTER 92-08 (TAC NOS. M85536 AND 85537)

REF: 1) NRC Letter dated December 20, 1994 from Mr. Roy P. Zimmerman to Mr. C. Lance Terry

Gentlemen:

The information requested by the referenced letter is provided in the attachments of this letter. Attachment 2 to this letter describes the activities which TU Electric has performed to verify the quality of procured and installed Thermo-Lag and to ensure that Thermo-Lag installed at CPSES is appropriately qualified. Attachment 3 to this letter provides TU Electric's answers to NRC's specific questions. In this regard, Attachment 4 identifies the manufacturing attributes that TU Electric has verified, and Attachment 5 identifies the installation attributes that TU Electric has controlled to ensure that the test configurations bound the as-installed configurations at CPSES.

As demonstrated in the attachments to this letter, TU Electric performed quality verification of purchased and installed Thermo-Lag through application of the TU Electric quality assurance (QA) program to the procurement and installation of Thermo-Lag. Additionally, TU Electric demonstrated the acceptability of the as-installed Thermo-Lag by performance of numerous full scale fire tests of Thermo-Lag raceway and cable barriers. These tests were performed by TU Electric, independent of Thermal Science Incorporated (TSI) technical guidance and the TSI quality assurance program. Therefore, TU Electric has verified the type of quality attributes identified in the referenced letter, and this verification provides adequate confidence that cables enclosed within such barriers installed at CPSES will perform their design function during and following a postulated fire.

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37 pp

TU Electric has previously provided the quality information to the staff to demonstrate the acceptability of installed Thermo-Lag configurations. Many of the issues identified in reference 1 were previously raised by the NRC, and were answered by TU Electric. NRC has accepted TU Electric's answers in the CPSES Safety Evaluation Report, NUREG 0797 Supplements 26 and 27. Even though Thermo-Lag is not generally classified as safety-related throughout the industry, TU Electric nevertheless invoked and applied its 10 CFR 50, Appendix B, QA program to the Thermo-Lag procured and installed at CPSES. This quality assurance program included in-process inspection of the fabrication process, receipt inspections, and a strong installation verification process, as well as extensive testing of the Thermo-Lag configurations as installed at CPSES. Furthermore, NRC has inspected the application of TU Electric's QA program to the procurement and installation of Thermo-Lag, and has consistently concluded that the program is comprehensive and well implemented. Therefore, additional tests and analysis are not necessary to verify that the as installed Thermo-Lag Fire Barrier materials at CPSES conform to NRC regulatory requirements.

In summary, TU Electric has verified that the Thermo-Lag material installed at CPSES meets applicable regulatory requirements and our commitments. TU Electric's accepted procurement and installation QA program was performed independently of TSI's QA program, and TU Electric's QA program verified those quality attributes necessary to demonstrate the acceptability of the as-installed product.

Should you require additional information, please do not hesitate to contact me or contact Obaid Bhatty at (817)897-5839 to coordinate this effort.

Sincerely,

C. L. Terry

OB/tg
Attachments

c - Mr. L. J. Callan, Region IV
Mr. D. D. Chamberlain, Region IV
Mr. K. S. West, NRR
Mr. T. J. Polich, NRR
Mr. W. H. Rasin, NEI
Resident Inspectors

ATTACHMENT 1
TO
TXX-95004

AFFIDAVIT

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

| | | |
|---|---|---|
| In the Matter of | ) | |
| | ) | |
| Texas Utilities Electric Company | ) | Docket Nos. 50-445 |
| | ) | and 50-446 |
| (Comanche Peak Steam Electric Station, Unit 1 & 2) | ) | |
| | ) | |

AFFIDAVIT

Charles L. Terry being duly sworn, hereby deposes and says that he is Group Vice President, Nuclear Production of TU Electric, the licensee herein; that he is duly authorized to sign and file with the Nuclear Regulatory Commission this response to followup to the Generic Letter 92-08 and request for additional information pursuant to 10 CFR 50.54(f), for the captioned facility; that he is familiar with the content thereof; and that the matters set forth therein are true and correct to the best of his knowledge, information and belief.

C. L. Terry
Group Vice President, Nuclear

STATE OF TEXAS )
)
COUNTY OF Somervell )

Subscribed and sworn to before me, on this 24th day of Feb, 1995.

SUSAN C. GRAVATT
NOTARY PUBLIC
STATE OF TEXAS
Commission Expires 3-24-97

Susan C. Gravatt
Notary Public

ATTACHMENT 2
TO
TXX-95004

# TU ELECTRIC'S QUALITY ASSURANCE PROGRAM AND TESTING FOR THERMO-LAG

# TU ELECTRIC'S QUALITY ASSURANCE PROGRAM AND TESTING FOR THERMO-LAG

## 1.0 INTRODUCTION

On December 20, 1994, NRC issued a letter which requested additional information regarding Thermo-Lag procured and installed at Comanche Peak Steam Electric Station (CPSES). The aforementioned letter concluded that reliance should not be placed on the quality assurance (QA) program of the manufacturer of Thermo-Lag, Thermal Science, Incorporated (TSI), for the purpose of assessing the adequacy of Thermo-Lag materials. The letter also stated that installed Thermo-Lag must be representative of tested materials and configurations.

The purpose of this attachment is to demonstrate that there is adequate confidence that the Thermo-Lag material at CPSES conforms with applicable requirements, and that the tested configurations for Thermo-Lag are representative of the as-installed configurations at CPSES. In particular, as described in each of the sections below, TU Electric has applied its own QA program for design, procurement, receipt, installation, and testing of Thermo-Lag and the results of TU Electric's QA program provide adequate confidence that the as-installed Thermo-Lag at CPSES is acceptable and will perform its design function.

## 2.0 APPLICABILITY OF TU ELECTRIC'S QA PROGRAM

Thermo-Lag does not perform a safety-related function. Table 17A-1 in the Final Safety Analysis Report (FSAR) for CPSES classifies Thermo-Lag at CPSES as non-safety-related. Therefore, the quality assurance requirements in Appendix B of 10 CFR Part 50 are not applicable to Thermo-Lag. Nevertheless, TU Electric applied applicable criteria of 10 CFR 50 Appendix B and ANSI N45.2 to the procurement and installation of Thermo-Lag materials. Additionally, TU Electric's procurement documents required TSI to establish and implement an Appendix B QA program for the Thermo-Lag supplied for CPSES.

NRC's December 20, 1994, (Reference 1) request for additional information states that reliance should not be placed on TSI's QA program. Although, TU Electric specified that TSI must have an approved QA program, it is not necessary to rely upon TSI's QA program to conclude that the quality of Thermo-Lag accepted and installed at CPSES is acceptable, because TU Electric utilized its own QA program to verify the quality of Thermo-Lag. In particular, as discussed below, TU Electric has performed source inspections, surveillances, and audits to verify the quality of the Thermo-Lag being manufactured by TSI and supplied to CPSES. Therefore, independent of TSI's QA program, the application of TU Electric's QA program provides adequate confidence that the Thermo-Lag installed at CPSES will be able to perform its intended function.

NRC has inspected and reviewed the application of TU Electric's QA program to Thermo-Lag. Based upon the results of these inspections and reviews, NRC concluded that TU Electric's quality assurance program as applied to Thermo-Lag materials is strong.[1]

## 3.0 DESIGN SPECIFICATIONS

TU Electric has issued design specifications for Thermo-Lag.

TU Electric Specification 2323-MS-38H "Cable and Raceway Fire Barriers and Structural Steel Fireproofing"[2] defines TU Electric's procurement, source, receipt, and installation inspection methodology, including verification criteria imposed on this material. This specification requires that CPSES Quality Control (QC) receipt inspection verify the weight/density ($lbs/ft^2$) of Thermo-Lag panels and preshaped conduit sections. In addition, this document specifies the minimum weight/density values acceptable for panels and the various sizes of preshaped conduit section sizes. Specification 2323-MS-38H also requires CPSES QC receipt inspectors to verify the following:

- material thickness;
- no holes or cracks exist in the material wider than 0.05 inches;
- no holes or cracks exist in the material that extend through the material to the stress skin;
- and no signs of visible damage (e.g., gouges, breaks, tears, etc.).

## 4.0 PROCUREMENT INSPECTIONS, SURVEILLANCE AND AUDITS

From the Thermo-Lag material physical verification information contained in Specification 2323-MS-38H, TU Electric Procurement Engineering developed Pre-Engineered Item Data Sheet (PEIDS)[3] for Thermo-Lag fire barrier materials. This document contains the physical, weight/density, and condition criteria to be followed by CPSES QC personnel performing source inspections.

TU Electric, when purchasing Thermo-Lag fire barrier material, issues a purchase order (PO) to TSI. The PO specifies the fire barrier materials needed. TU Electric sends a QC representative to TSI's manufacturing facility in St. Louis, Missouri, to perform QC Verification Plan (VP) VP-

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1 Refer to TU Electric letter logged TXX-92589 dated December 15, 1992; NRC IR 50-445/93-08; 50-446/93-08; and NUREG-0797 Supplement 26, pg. 9-20.

2 Previously supplied to NRC via TU Electric letter logged TXX-92589 dated December 15, 1992.

3 Previously supplied to NRC via TU Electric letter logged TXX-92589 dated December 15, 1992.

NES0011-03, "Source Inspection Verification Plan - Thermo-Lag Fire Barrier Materials," prior to shipment. This VP verifies the thickness, weight/linear density, condition of the material, and the material moisture content of the shipment. Once the VP has been satisfied, the TU Electric QC representative authorizes release of the material for shipment.

In addition to source inspections, CPSES personnel also perform audits and surveillances of TSI activities to assure that these activities are being properly performed. In the past, these audits and surveillances have included reviews of the following attributes:

1. Products listed in the purchase order shall be identical in formulation to those products previously tested and supplied in accordance with TU Electric Specification 2323-MS-38H, Revision 1.

2. Prefabricated materials shipped shall be fully cured. "Fully Cured" is defined as a moisture reading of 70 or less on the 0 to 100 scale of the delmhorst moisture meter model dp or equivalent.

3. The dry film thickness (DFT) of Thermo-Lag prefabricated shapes are as follows:

   330-1 Prefabricated panels: 1/2 in. minimum
   330-1 Prefabricated conduit sections: 1/4 in., and 1/2 in. minimum
   330-660 Flexi-blanket: 1/4 in. minimum
   (Unless otherwise specified in the PO line item)

4. The weight per square foot of Thermo-Lag 330-1 prefabricated panels shall be 3.0 lbs/sq-ft minimum and 5.25 lb/sq-ft maximum. The weights for nominal 4x6.5 foot panels shall be a minimum weight of 78 pounds per panel and a maximum weight of 136.5 pounds per panel.

5. For 1/2 in. minimum DFT Thermo-Lag 330-1 prefabricated conduit sections (1/2 round, 3 ft. long), the following matrix shall be used for minimum/maximum weights:

| Nominal Conduit Dia: | 0.75" | 1" | 1.5" | 2" | 3" | 4" | 5" | 6" |
|---|---|---|---|---|---|---|---|---|
| Max Weight/Piece (Lbs/Sections) | 4.0 | 4.5 | 5.7 | 6.6 | 8.9 | 10.9 | 13 | 15 |
| Min Weight/Piece (Lbs/Section) | 2.3 | 2.6 | 3.3 | 3.9 | 5.3 | 6.6 | 7.9 | 9.4 |

6. For 1/4 in. minimum DFT Thermo-Lag 330-1 prefabricated conduit sections (1/2 round, 3 ft. long), the following matrix shall be used for minimum/maximum weights:

| Nominal Conduit Dia: | 0.75" | 1" | 1.5" | 2" |
|---|---|---|---|---|
| Max Weight/Piece (Lbs/Sections) | 4.0 | 4.3 | 5.1 | 5.9 |
| Min Weight/Piece (Lbs/Section) | 2.1 | 2.3 | 2.6 | 2.9 |

7. The weight per square foot of Thermo-Lag 330-660 prefabricated material is 1.6 lbs/sq-ft minimum and 2.3 lb/sq-ft maximum, unless otherwise specified in the PO line item.

8. Prefabricated Thermo-Lag materials shall be free of damage as follows:

   A) No holes or cracks wider than 0.05".

   B) No holes or cracks extending through the material to the stress skin.

   C) No visible mechanical damage (i.e., gouges, breaks, tears, etc.)

9. Where applicable, materials (trowel grade) shall be shipped such that, at time of receipt, there is not less than six months shelf life remaining.

10. Thermal Science, Inc. shall notify TU Electric of any changes made in formulation or fabrication of materials prior to shipment. The notification shall, as a minimum, include:

    a) Technical justification explaining why product end properties were not affected.

    or

    b) Test results or analysis which indicates that the new formulation meets or exceeds the requirements of the originally supplied product.

11. Verification of in-process activities utilizing TSI procedures (which are reviewed and approved by TU Electric).

12. Verification of personnel/training.

13. Verification that repairs are in compliance with TSI procedures (which are reviewed and approved by TU Electric).

Thus, TU Electric has performed audits and surveillances of the quality of a comprehensive set of attributes associated with the manufacturing of Thermo-Lag supplied to CPSES.

NRC's request for additional information states that contrary to representations made by TSI to TU Electric, TSI may not have trained its employees to repair delaminations, cracks, and voids. Although TU Electric did not directly verify that all applicable TSI personnel received the training in question, CPSES personnel did observe that a significant number of personnel received TSI training. As a result of these observations, TU Electric determined that TSI personnel were being trained to repair delaminations, cracks, and voids and the training was adequate for its intended purpose. In any event, TU Electric has previously described the measures taken (including its own comprehensive inspections) to resolve concerns pertaining to unfilled longitudinal cracks and delamination detected in some preshaped conduit section materials during installation in Unit 2. These measures provide adequate confidence independent of TSI that these concerns do not affect Thermo-Lag material installed or procured at CPSES. The NRC also agreed with TU Electric's resolution of these concerns[4]. Therefore, even if TSI did not train all of its employees after voids and delaminations were first detected, this would not affect the qualification of Thermo-Lag materials at CPSES.

In summary, TU Electric performed source inspections, surveillances, and audits for the critical characteristics of Thermo-Lag. The results of these inspections, surveillances, and audits provide adequate confidence that the Thermo-Lag material shipped to CPSES conforms to TU Electric's specified requirements.

NRC has performed inspections and reviews of TU Electric's source inspections, surveillances, and audits for Thermo-Lag. Based upon the results of these inspections and reviews, NRC concluded that TU Electric's activities pertaining to the procurement and quality assurance of Thermo-Lag materials are strong.[4]

## 5.0 RECEIPT INSPECTIONS

Upon receipt of TSI shipments at CPSES, TU Electric QC performs Verification Plan VP-NES0011, "Receipt Inspection Verification Plan - Thermo-Lag Fire Barrier Materials." This VP verifies the part number/identification of the material, performs a general receipt inspection of the material, performs a review of the material to determine that the items received are as specified and undamaged and verifies that the quality authorization to ship is traceable to the PO for the material in the shipment. Additionally, TU

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[4] Refer to TU Electric letter logged TXX-92589 dated December 15, 1992; NRC IR 50-445/93-08; 50-446/93-08; and NUREG-0797 Supplement 26, pg. 9-20.

Electric QC verifies the material formulation by comparison of the certificate of compliance with manufacturing documents, including weight and size. Once the fire barrier materials have been determined to satisfy the requirements of the receipt inspection VP, the material is released to the warehouse.

The results of these inspections provide adequate confidence that the Thermo-Lag material accepted at CPSES conforms with specifications.

NRC has performed inspections and reviews of TU Electric's receipt inspections for Thermo-Lag. Based upon the results of these inspections and reviews, NRC has concluded that TU Electric's quality assurance for receipt of Thermo-Lag is strong.[5]

## 6.0 INSTALLATION

TSI did not perform the Thermo-Lag installation functions at CPSES. Thermo-Lag at CPSES was installed by qualified TU Electric contractors in accordance with a QA program approved by TU Electric. TU Electric's installation process exceeded TSI's recommendations.

During installation, pertinent quality verifications, attributes and acceptance standards have been incorporated in work packages as check lists. In-process and final quality inspections are also documented on applicable checklists.[6]

The in-process and final installation inspections (for both initial and upgraded installations) have included both material and installation attributes. For example, these inspections check for:

I. THERMO-LAG INSTALLATION

a. Surface preparation and raceway condition.

b. Qualification of applicators.

c. Product identification and shelflife.

d. Surface preparation prior to Thermo-Lag application.

e. Panel Fasteners per design.

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[5] Refer to TU Electric letter logged TXX-92589 dated December 15, 1992; NRC IR 50-445/93-08; 50-446/93-08; and NUREG-0797 Supplement 26, pg. 9-20.

[6] Please note that these subjects were previously reviewed by the NRC, as documented in NRC inspection report (IR):
(i) 50-445/93-08; 50-446/93-08
(ii) 50-445/93-34; 50-556/93-34
(iii) 50-445/93-42; 50-446/93-42
(iv) 50-445/94-21; 50-446/93-21

f. Band Spacing per design (internal and external).

g. Presence of fire stops per design.

h. Thermo-Lag 330-1 application to prebutter joints.

i. Panel Installation per design.

j. Thermo-Lag 330-660 mixing.

k. Flexi-blanket fastening material and installation process.

l. Thermo-Lag on building steel per engineering documents.

II. THERMO-LAG FIRE BARRIER FINAL ACCEPTANCE

a. Hardware/spacing - Thermo-Lag 330-1

b. Hardware/spacing - Thermo-Lag 330-660

c. Thermo-Lag Dry Film Thickness (DFT).

d. Continuity.

e. Visual Defects.

f. Coverage of protruding items.

g. Thermo-lag located per ECE-M1/M2-1700 (CPSES design drawings).

h. Location of firestops per design.

i. Topcoat application.

The results of the inspections described above provide adequate confidence that the as-installed Thermo-Lag at CPSES conforms with specifications.

7.0 TESTING

TU Electric conducted its own testing, independent of TSI, to qualify its as-installed Thermo-Lag configurations and to determine ampacity derating factors. The tests were performed for TU Electric by an independent test laboratory, Omega Point Laboratories, pursuant to an Appendix B QA program. The tests were performed on configurations installed and inspected by CPSES personnel using CPSES installation procedures. The Thermo-Lag material used for these tests was extracted from various lots of material in stock at CPSES to assure that the tests were performed on material that is representative of the material installed at CPSES.

TU Electric's tests involved large amounts of Thermo-Lag material and were representative of various types of Thermo-Lag used at CPSES (e.g., flat panels, ribbed panels, various sizes of preshaped conduits, flexi-blanket, trowel grade material, etc.). Approximately 1500 $ft^2$ of Thermo-Lag was used to construct 23 full scale test configurations in order to certify CPSES Thermo-Lag installations. Given the large amount of Thermo-Lag tested by TU Electric, the results of the tests are sufficient to assess the quality of the total population of Thermo-Lag used at CPSES. As a result of these tests, TU Electric determined that the Thermo-Lag material itself, as supplied to CPSES, performs its design function if properly configured (i.e., if Thermo-Lag joints are appropriately reinforced and an overlay is installed on the Thermo-Lag for small conduits).[7]

TU Electric tested a number of Thermo-Lag configurations. The test configurations were designed to envelope the various as-installed barrier configurations at CPSES. Engineering evaluations were performed in accordance with Generic Letter 86-10 to justify those as-installed configurations that deviated from the test configurations. Therefore, there is adequate confidence that test configurations are representative of the as-installed configurations at CPSES.

TU Electric provided the results of these tests to NRC, via TU Electric letter logged TXX-93023 and TXX-93353 dated January 19, 1993, and October 20, 1993 respectively. In NUREG-0797 Supplements 26 and 27, NRC agreed that the test configurations bound the as-installed configurations, and accepted the results of qualification tests for CPSES Unit 2. NRC is currently reviewing qualification tests for Unit 1 (Reference NRR TAC. No. 85536).

## 8.0 CONCLUSIONS

Based on the above, there is adequate confidence that the Thermo-Lag material supplied to CPSES conforms with specified TU Electric requirements based upon the following:

- Even though Thermo-Lag is not generally classified as safety related or subject to 10 CFR 50 Appendix B program by the industry, TU Electric designated Thermo-Lag as quality-related. As a result, TU Electric applied applicable criteria of 10 CFR 50 Appendix B and ANSI N45.2 to the procurement of Thermo-Lag materials.

- TU Electric performed source inspections, surveillances, and audits at TSI's facility to assure the quality of Thermo-Lag. In aggregate, these verifications address the important material attributes.

- TU Electric performed receipt inspections for Thermo-Lag materials to assure that, as received on site and prior to warehouse release, Thermo-Lag materials were acceptable for plant installation.

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[7] Refer to TU Electric letter logged TXX-92626 dated December 23, 1992, Enclosure § 4.2.6 and § 9.0.

- NRC has inspected and reviewed the application of TU Electric's QA program to Thermo-Lag and has concluded that it is acceptable.[8]

- Observation of test samples both before and after testing demonstrated that no apparent differences in material composition existed.

- As part of the NEI industry test program, various samples of Thermo-Lag panel and preshaped conduit section materials were subjected to pyrolysis gas chromatography testing by an independent laboratory in accordance with ASTM D-3452. Materials examined included stock inventory samples from TU Electric, Entergy Operations, Inc. and Houston Light and Power as well as recently manufactured materials by TSI. The results of this testing demonstrated that no appreciable differences in material chemical composition existed between samples[9].

There is adequate confidence that the materials tested by TU Electric were representative of materials installed at CPSES.

- As discussed above, there is adequate confidence that material accepted by TU Electric conforms with specified physical and documentation requirements.[10]

- The qualification tests were performed using CPSES stock material and are therefore representative of materials installed at CPSES.

- The tests involved large amounts and various types of Thermo-Lag and the test results are sufficient to assess the quality of the total population of Thermo-Lag at CPSES.

- Installation of material during qualification tests and in the plant was performed in accordance with CPSES installation procedures by CPSES personnel.

- The tested barrier configurations are representative of as-installed configurations of Thermo-Lag at CPSES.

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8 Refer to NRC IR 50-445/93-08; 50-446/93-08 and NUREG-0797 Supplement 26 pg. 9-19 and 9-20.

9 Refer to NEI letter to Mr. William T. Russell (NRR) dated February 8, 1994.

10 Please note that these subjects were previously reviewed by the NRC, as documented in NRC inspection reports:
(i) 50-445/93-08; 50-446/93-08
(ii) 50-445/93-34; 50-446/93-34
(iii) 50-445/93-42; 50-446/93-42
(iv) 50-445/94-21; 50-446/94-21

- TU has reported the test results to NRC. NRC has witnessed the qualification tests and performed inspections and reviews and has concluded that the test materials are representative of tne as-installed materials and that the tested configurations bound as-installed configurations.[11]

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11 Refer to TU Electric letter logged TXX-92589 dated December 15, 1992; NRC IR 50-445/93-08; 50-446/93-08; and NUREG-0797 Supplement 26, pg. 9-20.

ATTACHMENT 3
TO
TXX-95004

# TU ELECTRIC RESPONSES

# TU Electric Responses To
# Request for Additional Information Regarding
# Generic Letter 92-08
# "Thermo-Lag 330-1 Fire Barriers"
# Pursuant to 10CFR50.54(f)

## QUESTION 1A

Describe the specific tests and analyses that will be performed to verify that the Thermo-Lag fire barrier materials that are currently installed at Comanche Peak Steam Electric Station (CPSES), Units 1 and 2, or that will be installed in the future, are representative of the materials that were used to address the technical issues associated with Thermo-Lag barriers and to construct the fire endurance and ampacity derating test specimens. The tests and analyses shall address the material properties and attributes that were determined or controlled by TSI during the manufacturing process and the quality assurance program. The tests and analyses shall also address the material properties and attributes that contribute to conclusions that the Thermo-Lag materials and barriers conform to NRC regulations. These include:

(1) chemical composition
(2) material thickness
(3) material weight and density
(4) the presence of voids, cracks, and delaminations
(5) fire endurance capabilities
(6) combustibility
(7) flame spread rating
(8) ampacity derating
(9) mechanical properties such as tensile strength, compressive strength, shear strength, and flexural strength.

## RESPONSE TO 1A

There is adequate confidence that the Thermo-Lag materials installed at CPSES are representative of the materials that were used in TU Electric's qualification and ampacity derating tests for Thermo-Lag. This conclusion is based on the following:

1) As discussed in Section 4.0 and 5.0 of Attachment 2, TU Electric performed source inspections, surveillances, audits, and receipt inspections of Thermo-Lag material. These verification activities encompassed the important attributes for Thermo-Lag. As a result of these verifications, there is adequate confidence that the Thermo-Lag material accepted at CPSES conforms with specifications.

2) TU Electric's fire endurance tests and ampacity derating tests used Thermo-Lag material taken from the CPSES warehouse (from various lots) following receipt inspections. Therefore, the Thermo-Lag test material is representative of the material accepted and installed at CPSES.

3) As discussed in Section 7.0 of Attachment 2, the tests involved large amounts and various types of Thermo-Lag and the test results are sufficient to assess the quality of the total population of Thermo-Lag at CPSES.

Attachment 4 lists each of the attributes identified in the NRC's question and describes the activities performed by TU Electric to verify the attribute in question to the extent that the attribute is important for the Thermo-Lag installed at CPSES.

As discussed in Attachment 4, TU Electric did not verify some of the attributes identified by the NRC question because these attributes are not important for the qualification or ampacity derating factor of the Thermo-Lag installed at CPSES. For example:

- Some of the attributes identified by NRC (e.g., tensile strength, compressive strength, etc.) have not proven essential in determining ampacity derating properties or developing adequate structural enhancements for acceptable fire endurances performance.

- With respect to CPSES, the NRC has previously concluded that voids, cracks, and delaminations would not have a significant effect on the performance of properly installed Thermo-Lag.[12] Nevertheless, as discussed in Section 4.0 of Attachment 2, TU Electric has taken action, including comprehensive inspections, to resolve NRC concerns in this area.

- TU Electric has previously demonstrated to NRC that density rather than thickness is the critical characteristic for the performance of Thermo-Lag.[13] Nevertheless, as discussed in Section 4.0 of Attachment 2, TU Electric has verified the thickness as well as the density of Thermo-Lag.

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12 Refer to DD-93-11, 37 NRC 402, 412-413 (1993)

13 Refer to TU Electric letter logged TXX-90255 dated July 13, 1990; NRC letter to TU Electric dated July 20, 1990; TU Electric letter logged TXX-92626 dated December 23, 1992, Enclosure § 4.3.5.

- Thermo-Lag at CPSES is designated as a non-seismic commodity.[14] Furthermore, TU Electric and NRC have determined that any failure of Thermo-Lag as a result of seismic event would not adversely impact the function of seismic Category I components because the Thermo-Lag would tend to crack, chip, and crumble and not fail in a gross manner.[15] Therefore, further tests and analysis pertaining to Thermo-Lag's mechanical properties are not warranted.

- Based on its own evaluations and supported by data compiled on a generic basis by NEI, TU Electric has previously demonstrated that combustibility and flame spread rating issues are not a significant concern for CPSES, and NRC has accepted these conclusions.[16]

## QUESTION 1B

Describe the methodology that will be used to determine the sample size and demonstrate that the sample size will be large enough to ensure that the information and data obtained will be sufficient to assess the total population of in-plant Thermo-Lag barriers and the materials that will be installed in the future. In determining the sample size, consider the time of installation and manufacture of the various in-plant materials and barrier installations. Give the number and types (e.g., panels, conduit preshapes, trowel-grade material, stress skin) of samples that will be tested or analyzed.

## RESPONSE TO 1B

As discussed in Attachment 2, there is adequate confidence that Thermo-Lag materials installed at CPSES conform with specified requirements. In particular, TU Electric took the following steps to control the quality of Thermo-Lag and to assure that the Thermo-Lag material accepted and installed at CPSES conforms with applicable requirements:

- TU Electric applied its Appendix B QA program to the procurement and installation of Thermo-Lag at CPSES.

- TU Electric issued specifications for Thermo-Lag, including identification of important attributes for verification by TU Electric.

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[14] Refer to CPSES FSAR Table 17A-1.

[15] Refer to TU Electric letter logged TXX-92626 dated December 22, 1992, Enclosure § 4.5.2; NUREG-0797 Supplement 26 pg. 9-19 and DD-93-11 37 NRC 113, 128 (1993)

[16] Refer to TU Electric letter logged TXX-93023 and TXX-93060 dated January 19, 1993, and January 25, 1993, respectively, and NUREG-0797 Supplement 26 Page, 9-19.

- TU Electric performed source inspections, surveillances and audits of important Thermo-Lag attributes.

- TU Electric performed receipt inspections for many of the important Thermo-Lag attributes.

- TU Electric and its contractors performed installation inspections of a number of the important attributes.

Attachment 4 provides additional information showing how TU Electric verified the quality of Thermo-Lag material.

Additionally, as discussed in Sections 7.0 of Attachment 2, TU Electric's tests involved large amounts and various types of Thermo-Lag material. Given the large amount of Thermo-Lag tested by TU Electric, the results of the tests are sufficient to reasonably assess the quality of the total population of Thermo-Lag in CPSES. As a result of these tests, TU Electric determined that the Thermo-Lag material itself, as supplied to CPSES, performs its design function if properly configured.

In summary, TU Electric has verified the important attributes of the Thermo-Lag procured and installed at CPSES. Furthermore, TU Electric tested representative materials from various CPSES stock inventory. Therefore, there is adequate confidence that the as installed Thermo-lag at CPSES is representive of the Thermo-Lag material tested for the purpose of fire endurance rating and ampacity derating, and there is no need for an additional sampling program.

## QUESTION 1C

Submit the schedule for verifying the Thermo-Lag materials.

## RESPONSE TO 1C

As discussed in Attachment 2 and the responses to question 1A and 1B, TU Electric's QA program verified that the received and installed Thermo-Lag conforms with specification. Testing has been completed, and test results have been reported to NRC, as summarized in TU Electric's Engineering Report ER-ME-067, logged via TU Electric letter TXX-94092 dated March 24, 1994. In NUREG-0797 Supplement 26 and 27, NRC has accepted the test results with some open items for CPSES Unit 1 (refer to NRR TAC No. 85536).

## QUESTION 1D

After the analyses and the test have been completed, submit a written supplemental report that confirms that this effort has been completed and provide the results of the tests and analyses. Describe any changes to

previously submitted plans or schedules that result from the tests or analyses.

## RESPONSE TO 1D

As discussed in response to question 1C, TU Electric has already reported the test results to NRC. These test reports are summarized in TU Electric's Engineering Report ER-ME-067, logged TXX-94092 dated March 24, 1994. As discussed in this report, TU Electric's tests of Thermo-Lag were performed using material taken from various stock inventories, and the test results demonstrate that the Thermo-Lag as installed at CPSES is able to perform its design function.

## QUESTION 2A

Important Barrier Parameters

Describe the examinations and inspections that will be performed to obtain the important barrier parameters for the Thermo-Lag fire barrier configurations installed at CPSES Units 1 and 2 given below:

(1) Raceway orientation (horizontal, vertical, radial bends)
(2) Conduit
(3) Junction boxes and lateral bends
(4) Ladder-back cable tray with single layer cable fill
(5) Cable tray with T-section
(6) Raceway material (aluminum, steel)
(7) Support protection, thermal shorts (penetrating elements)
(8) Air drops
(9) Baseline fire barrier panel thickness
(10) Preformed conduit panels
(11) Panel rib orientation (parallel or perpendicular to the raceway)
(12) Unsupported spans
(13) Stress skin orientation (inside or outside)
(14) Stress skin over joints or no stress skin over joints
(15) Stress skin ties or no stress skin ties
(16) Dry-fit, post-buttered joints or prebuttered joints
(17) Joint gap width
(18) Butt joints or grooved and scored joints\
(19) Steel bands or tie wires
(20) Band/wire spacing
(21) Band/wire distance to joints
(22) No internal bands in trays
(23) No additional trowel material over sections and joints or additional trowel material applied
(24) No edge guards or edge guards
(25) Cable size and type (power, control or instrumentation)
(26) Cable jacket type (thermoplastic, thermoset) and materials
(27) Cable conductor insulation type (thermoplastic, thermoset plastic) and materials
(28) Cable fill and distribution of cables within the protected conduit or cable tray

(29) Proximity of cables to the unexposed (inside) surfaces of the fire barrier
(30) Presence of materials between the cables and the unexposed side of the fire barrier material (for example, Sealtemp cloth, which is used in the NUMARC test specimens)
(31) Cable operating temperature
(32) Temperatures at which the cables can no longer perform their intended function which energized at rated voltage and current.

## RESPONSE TO 2A

Each of the attributes listed in NRC's question was controlled as part of TU Electric's fire endurance test program to ensure that the test configurations bound the as-installed configurations at CPSES. Attachment 5 lists each of these attributes and describes the method by which the attribute was controlled by TU Electric. As discussed in response to question 1A and 1D and Section 7.0 of Attachment 2, TU Electric has already performed tests on representative Thermo-Lag fire barrier configurations. TU Electric reported the test results to NRC in TU Electric letters logged TXX-93023 and TXX-93353 dated January 19, 1993 and October 20, 1993 respectively. As these letters discuss, the Thermo-Lag test configurations bound the as-installed Thermo-Lag configurations at CPSES. TU Electric also evaluated configurations that deviated from the test configurations, and TU Electric letter logged TXX-93023 dated January 19, 1993 (Engineering Report ER-ME-082) justified the deviations as permitted by Generic Letter 86-10. The NRC has accepted these results for Unit 2 and for Unit 1 (with some open items for Unit 1). For example, in SSER 26 for CPSES Unit 2, NRC concluded that the fire barrier configurations tested by TU Electric "bounded the range of fire barrier sizes and configurations installed in CPSES Unit 2," and in SSER 26 and 27 NRC concluded that the deviations from the test configurations were acceptable.

## QUESTION 2B

Describe the methodology that will be applied to determine the number and type of representative in-plant fire barrier configurations that will be examined in detail and demonstrate that the sample size is adequate to ensure that the information and data that will be obtained are adequate to assess the total population of in-plant Thermo-Lag barriers. A large enough sample of the total population of configurations should be examined to provide reasonable assurance that the materials and important barrier parameters used to construct the in-plant barriers and any future barrier installations or modifications, are representative of the parameters used to construct the fire endurance test specimens.

## RESPONSE TO 2B

As discussed in Section 6.0 of Attachment 2, TU Electric conducted in-process and final installation inspections to verify important installation attributes and to verify that as-installed configurations conform with

specification. Additionally, as discussed in the response to question 2A TU Electric has tested representative Thermo-Lag fire barriers configurations and NRC has concluded that these configurations are representative.

## QUESTION 2C

Submit the schedule for obtaining and verifying all of the important barrier parameters.

## RESPONSE TO 2C

As discussed in response to questions 2A and 2B, the important installation parameters have been verified during installation inspections. Testing has been completed, and the tested configurations bound the as-installed configurations at CPSES.

## QUESTION 2D

After the information has been obtained and verified, submit a written supplemental report that confirms that this effort has been completed and provides the results of the examinations and inspections. Verify that the parameters of the in-plant configurations are representative of the parameters of the fire endurance test specimens. Describe any changes to previously submitted plans or schedules that result from the examinations.

## RESPONSE TO 2D

As discussed in response to question 2A, test results have been reported to NRC.[17] NRC has concluded in SSER 26 and 27 that the tested configurations bound the as installed configurations at CPSES.

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17 TU Electric letters logged TXX-93023 and TXX-93353 dated January 19, 1993 and October 20, 1993 respectively.

ATTACHMENT 4
TO
TXX-95004

# MANUFACTURING ATTRIBUTES

# MANUFACTURING ATTRIBUTES VERIFIED BY TU ELECTRIC (TUE) TABLE 1

| ITEM NO. | MANUFACTURING ATTRIBUTES | VERIFIED BY TUE | REMARKS |
|---|---|---|---|
| 1 | CHEMICAL COMPOSITION | YES<br>SEE REMARKS | TU ELECTRIC HAS PARTICIPATED IN THE NEI INDUSTRY TEST PROGRAM FOR CHEMICAL COMPOSITION. THE RESULTS OF THIS TESTING DEMONSTRATED THAT NO APPRECIABLE DIFFERENCE IN MATERIAL CHEMICAL COMPOSITION EXISTED BETWEEN VARIOUS SAMPLES COLLECTED FROM VARIOUS UTILITY STOCKS. REFER TO ATTACHMENT 2 SECTION 4.0 ITEMS 1 AND 11, AND SECTION 5.0. TU ELECTRIC QC VERIFIES VIA SURVEILLANCE THAT THE PRODUCTS SHIPPED BY TSI ARE IDENTICAL IN FORMULATION TO THOSE PRODUCTS PREVIOUSLY TESTED AND SUPPLIED IN ACCORDANCE WITH TU ELECTRIC SPECIFICATION 2323-MS-381I. THIS IS PERFORMED BY COMPARING CERTIFICATE OF CONFORMANCES. ALSO, REFER TO ATTACHMENT 2 SECTION 8.0.<br><br>ADDITIONALLY, AS DISCUSSED IN SECTION 7.0 OF ATTACHMENT 2, TU ELECTRIC'S TESTS INVOLVED LARGE AMOUNTS AND VARIOUS TYPES OF THERMO-LAG MATERIALS. GIVEN THE LARGE AMOUNT OF THERMO-LAG TESTED BY TU ELECTRIC, THE RESULTS OF THE TESTS ARE SUFFICIENT TO ASSESS THE QUALITY OF THE TOTAL POPULATION OF THERMO-LAG IN CPSES. AS A RESULT OF THESE TESTS, TU ELECTRIC DETERMINED THAT THE THERMO-LAG MATERIAL ITSELF, AS SUPPLIED TO CPSES, PERFORMS ITS DESIGN FUNCTION IF PROPERLY CONFIGURED. |
| 2 | MATERIAL THICKNESS | YES | MATERIAL THICKNESS IS VERIFIED AT SOURCE, RECEIPT AND INSTALLATION INSPECTION. REFER TO ATTACHMENT 2 SECTION 4.0 ITEM 3, AND SECTION 6.0 ITEM II C. |
| 3 | MATERIAL WEIGHT AND DENSITY | YES | MATERIAL WEIGHT AND DENSITY IS VERIFIED AT SOURCE, RECEIPT INSPECTION, AUDITS AND SURVEILLANCE. REFER TO ATTACHMENT 2 SECTION 4.0 ITEMS 5 AND 6. |
| 4 | THE PRESENCE OF VOIDS, CRACKS, AND DELAMINATIONS | YES | VERIFIED AT SOURCE, RECEIPT AND INSTALLATION INSPECTION. REFER TO SECTION 4.0 ITEM 8, SECTION 5.0 AND SECTION 6.0 ITEM II D AND E. |

## MANUFACTURING ATTRIBUTES VERIFIED BY TU ELECTRIC (TUE) TABLE 1

| ITEM NO. | MANUFACTURING ATTRIBUTES | VERIFIED BY TUE | REMARKS |
|---|---|---|---|
| 5 | FIRE ENDURANCE CAPABILITIES | YES<br>SEE REMARKS | TU ELECTRIC HAS DEMONSTRATED THAT THERMO-LAG PERFORMS ITS FIRE ENDURANCE FUNCTION. THIS HAS BEEN DEMONSTRATED BY 23 TESTS PERFORMED BY TU ELECTRIC. REFER TO ATTACHMENT 2, SECTION 7.0 .<br><br>UNIT 2 CONFIGURATIONS HAVE BEEN ACCEPTED BY THE NRC (REFER TO NUREG-0797 SUPPLEMENT 26 AND 27). UNIT 1 TESTS ARE UNDER REVIEW BY THE NRC. |

# MANUFACTURING ATTRIBUTES VERIFIED BY TU ELECTRIC (TUE) TABLE 1

| ITEM NO. | MANUFACTURING ATTRIBUTES | VERIFIED BY TUE | REMARKS |
|---|---|---|---|
| 6 | COMBUSTIBILITY | NOT APPLICABLE TO CPSES.<br><br>SEE REMARKS | TU ELECTRIC HAS PREVIOUSLY SUBMITTED INFORMATION TO THE NRC REGARDING COMBUSTIBILITY AND FLAME SPREAD RATING. (PLEASE REFER TO TU ELECTRIC LETTER LOGGED TXX-93060 DATED JANUARY 25, 1993 AND NUREG-0797 SUPPLEMENT 26 PG. 9-19). ALTHOUGH THE INFORMATION SUBMITTED WAS FOR UNIT 2, TU ELECTRIC HAS CONFIRMED THAT A SIMILAR POSITION APPLIES TO UNIT 1. THE INFORMATION PROVIDED BY TU ELECTRIC VIA TXX-93060 IS SUMMARIZED BELOW.<br>• THERMO-LAG IS NOT UTILIZED TO ELIMINATE INTERVENING COMBUSTIBLES IN ORDER TO OBTAIN A HORIZONTAL DISTANCE OF 20 FEET WITH NEGLIGIBLE INTERVENING COMBUSTIBLES BETWEEN REDUNDANT [UNIT 2] SAFE SHUTDOWN TRAINS. THIS IS DOCUMENTED BY THE "UNIT 2 FIRE SAFE SHUTDOWN ANALYSIS" AND THE "UNIT 2 PHYSICAL SEPARATION ANALYSIS AND UNIT 2 CABLES AND COMPONENTS IN COMMON AREAS".<br>• THERMO-LAG IS NOT UTILIZED AS A RADIANT ENERGY SHIELD INSIDE UNIT 1 OR UNIT 2 CONTAINMENT STRUCTURES.<br>• THERE IS NO THERMO-LAG INSTALLED IN NON-RACEWAY APPLICATIONS FOR UNIT 2 (I.E., AS USED FOR PROTECTION OF STRUCTURAL STEEL SUPPORTING 2 HOUR RATED GYPSUM WAS ASSEMBLIES AROUND STAIRWAYS) WHICH COULD ACT AS AN INTERVENING COMBUSTIBLE BETWEEN REDUNDANT SAFE SHUTDOWN TRAINS.<br>• CPSES PLANT AREAS WHERE THERMO-LAG INSTALLED ON UNIT 2 SAFE SHUTDOWN RACEWAYS COULD POTENTIALLY CONSTITUTE AN INTERVENING COMBUSTIBLE BETWEEN REDUNDANT [UNIT 2] EQUIPMENT OR COMPONENTS WERE ASSESSED. BASED ON FIRE PROTECTION FEATURES PROVIDED IN THESE AREAS, THE PROPERTIES OF THERMO-LAG AND OVERALL LOW QUANTITIES OF IN-SITU COMBUSTIBLES TO FUEL A POSTULATED FIRE, SIGNIFICANT FIRE PROPAGATION BETWEEN REDUNDANT UNIT 2 SAFE SHUTDOWN EQUIPMENT OR COMPONENTS ALONG RACEWAYS PROTECTED WITH THERMO-LAG IS NOT CONSIDERED CREDIBLE. |
| 7 | FLAME SPREAD RATING | YES | SEE ITEM 6 ABOVE. |

# MANUFACTURING ATTRIBUTES VERIFIED BY TU ELECTRIC (TUE) TABLE 1

| ITEM NO. | MANUFACTURING ATTRIBUTES | VERIFIED BY TUE | REMARKS |
|---|---|---|---|
| 8 | AMPACITY DERATING | YES | TU ELECTRIC HAS PERFORMED AMPACITY DERATING TESTING. THE RESULTS OF THE TESTS WERE SUBMITTED VIA TU ELECTRIC LETTER LOGGED TXX-93214 DATED MAY 26, 1993. |
| 9 | MECHANICAL PROPERTIES SUCH AS TENSILE STRENGTH, COMPRESSIVE STRENGTH, SHEAR STRENGTH, AND FLEXURAL STRENGTH | SEE REMARKS | REFER TO ATTACHMENT 3 RESPONSE TO QUESTION 1A. TU ELECTRIC HAS PERFORMED NUMEROUS FIRE ENDURANCE TESTS UTILIZING CPSES STOCK THERMO-LAG MATERIALS. BARRIER UPGRADE TECHNIQUES QUALIFIED DURING THESE TESTS HAVE RESOLVED MECHANICAL PROPERTY ISSUES RELATED TO THE FIRE RESISTANCE CAPABILITY OF THERMO-LAG. AS DESCRIBED IN ATTACHMENT 2, UPGRADED BARRIER CONFIGURATIONS HAVE BEEN INSTALLED IN UNIT 1 AND UNIT 2. ADDITIONALLY, TU ELECTRIC CONCURS WITH NEI RESPONSE RELATED TO THESE ATTRIBUTES IN ITS LETTER TO THE NRC DATED JANUARY 17, 1995. |

ATTACHMENT 5
TO
TXX-95004

ATTRIBUTES VERIFIED BY
TU ELECTRIC

## ATTRIBUTES VERIFIED BY TU ELECTRIC (TUE)
## TABLE 2

| ITEM NO. | IMPORTANT BARRIER PARAMETERS | VERIFIED BY TUE | REMARKS |
|---|---|---|---|
| 1 | RACEWAY ORIENTATION (HORIZONTAL, VERTICAL, RADIAL BENDS) | YES<br><br>SEE FOOTNOTE 1. | VERIFIED DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON HORIZONTAL AND VERTICAL RACEWAY ORIENTATIONS INCLUDING RADIAL BENDS. RACEWAY AND BARRIER MATERIALS UTILIZED WERE EXTRACTED FROM CPSES STOCK INVENTORY AND TEST CONFIGURATION WERE REPRESENTIVE OF THOSE AT CPSES. |
| 2 | CONDUIT | YES<br><br>SEE FOOTNOTE 1. | VERIFIED DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON CONDUIT CONFIGURATIONS REPRESENTATIVE OF THOSE INSTALLED AT CPSES. CONDUIT AND BARRIER MATERIALS UTILIZED WERE EXTRACTED FROM CPSES STOCK INVENTORY AND TEST CONFIGURATION WERE REPRESENTIVE OF THOSE AT CPSES. |
| 3 | JUNCTION BOXES AND LATERAL BENDS | YES<br><br>SEE FOOTNOTE 1. | VERIFIED DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON JUNCTION BOXES AND LATERAL BEND CONDULETS REPRESENTATIVE OF THOSE INSTALLED AT CPSES. JUNCTION BOX, CONDULET AND BARRIER MATERIALS UTILIZED WERE EXTRACTED FROM CPSES STOCK INVENTORY AND TEST CONFIGURATION WERE REPRESENTIVE OF THOSE AT CPSES. |
| 4 | LADDER-BACK CABLE TRAY WITH SINGLE LAYER CABLE FILL | YES<br><br>SEE FOOTNOTE 1. | VERIFIED DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON CABLE TRAYS WITH SINGLE LAYER CABLE FILL, REPRESENTATIVE OF THOSE INSTALLED AT CPSES. CABLE TRAY, CABLE AND BARRIER MATERIALS UTILIZED WERE EXTRACTED FROM CPSES STOCK INVENTORY AND TEST CONFIGURATION WERE REPRESENTIVE OF THOSE AT CPSES. |

## ATTRIBUTES VERIFIED BY TU ELECTRIC (TUE)
## TABLE 2

| ITEM NO. | IMPORTANT BARRIER PARAMETERS | VERIFIED BY TUE | REMARKS |
|---|---|---|---|
| 5 | CABLE TRAY WITH T-SECTION | YES<br><br>SEE FOOTNOTE 1. | VERIFIED DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON CABLE TRAY TEE SECTIONS WHICH BOUND THE FULL RANGE OF COMMODITIES INSTALLED AT CPSES. CABLE TRAY TEE SECTION AND BARRIER MATERIALS UTILIZED WERE EXTRACTED FROM CPSES STOCK INVENTORY AND TEST CONFIGURATION WERE REPRESENTIVE OF THOSE AT CPSES. |
| 6 | RACEWAY MATERIAL (ALUMINUM, STEEL) | YES<br><br>SEE FOOTNOTE 1. | VERIFIED DURING RECEIPT INSPECTION AND DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAD BARRIERS INSTALLED ON STEEL RACEWAYS, REPRESENTATIVE OF THOSE INSTALLED AT CPSES. RACEWAY AND BARRIER MATERIALS UTILIZED WERE EXTRACTED FROM CPSES STOCK INVENTORY. NO ALUMINUM RACEWAY MATERIALS ARE PROTECTED WITH THERMO-LAG BARRIERS AT CPSES. |
| 7 | SUPPORT PROTECTION, (PENETRATING ELEMENTS) | YES<br><br>SEE FOOTNOTE 1. | VERIFIED DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON THE FULL RANGE OF RACEWAY COMMODITY SIZES UTILIZED AT CPSES. AS PART OF THESE QUALIFICATION TESTS, REPRESENTATIVE RACEWAY SUPPORT MEMBERS WERE PROTECTED IN THE SAME MANNER AS THOSE INSTALLED AT CPSES. ALL RACEWAY, SUPPORT AND BARRIER MATERIALS WERE EXTRACTED FROM CPSES STOCK INVENTORY. |
| 8 | AIR DROPS | YES<br><br>SEE FOOTNOTE 1. | VERIFIED DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON CABLE AIR DROPS WHICH BOUND SUCH CONFIGURATIONS INSTALLED AT CPSES. ALL CABLE AND BARRIER MATERIALS WERE EXTRACTED FROM CPSES STOCK INVENTORY. |

## ATTRIBUTES VERIFIED BY TU ELECTRIC (TUE)
## TABLE 2

| ITEM NO. | IMPORTANT BARRIER PARAMETERS | VERIFIED BY TUE | REMARKS |
|---|---|---|---|
| 9 | BASELINE FIRE BARRIER PANEL THICKNESS | YES<br><br>SEE FOOTNOTE 1. | VERIFIED AT SOURCE, RECEIPT AND INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON THE FULL RANGE OF RACEWAY COMMODITY SIZES UTILIZED AT CPSES. AS PART OF THESE QUALIFICATION TESTS, THERMO-LAG PANELS EXTRACTED FROM CPSES STOCK INVENTORY WERE UTILIZED. THEREFORE, THERMO-LAG PANEL THICKNESSES TESTED ARE REPRESENTIVE OF THOSE INSTALLED AT CPSES. |
| 10 | PREFORMED CONDUIT PANELS | YES<br><br>SEE FOOTNOTE 1. | VERIFIED AT SOURCE, RECEIPT AND INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS COMPOSED OF PREFORMED CONDUIT PANELS INSTALLED ON THE FULL RANGE OF CONDUIT SIZES INSTALLED AT CPSES. ALL CONDUIT AND PREFORMED CONDUIT PANEL MATERIALS WERE EXTRACTED FROM CPSES STOCK INVENTORY. |
| 11 | PANEL RIB ORIENTATION (PARALLEL OR PERPENDICULAR TO THE RACEWAY) | YES<br><br>SEE FOOTNOTE 1. | VERIFIED DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON THE FULL RANGE OF RACEWAY COMMODITY SIZES INSTALLED AT CPSES. AS PART OF THESE QUALIFICATION TESTS, PANEL STIFFENER RIBS WERE ORIENTED IN THE SAME CONFIGURATION AS THOSE INSTALLED AT CPSES. |
| 12 | UNSUPPORTED SPANS | YES<br><br>SEE FOOTNOTE 1. | VERIFIED DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON THE FULL RANGE OF RACEWAY COMMODITY SIZES INSTALLED AT CPSES. AS PART OF THESE QUALIFICATION TESTS, UNSUPPORTED PANEL SPANS WERE UTILIZED WHICH BOUND THOSE INSTALLED AT CPSES. |

## ATTRIBUTES VERIFIED BY TU ELECTRIC (TUE)
## TABLE 2

| ITEM NO. | IMPORTANT BARRIER PARAMETERS | VERIFIED BY TUE | REMARKS |
|---|---|---|---|
| 13 | STRESS SKIN ORIENTATION (INSIDE OR OUTSIDE) | YES<br><br>SEE FOOTNOTE 1. | VERIFIED DURING RECEIPT INSPECTION AND DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON THE FULL RANGE OF RACEWAY COMMODITY SIZES INSTALLED AT CPSES. AS PART OF THESE QUALIFICATION TESTS, PANEL STRESS SKIN ATTRIBUTES INCLUDING ORIENTATION (WHICH IS INSIDE AT CPSES), USE AT JOINTS AND USE OF STRESS SKIN TIES WERE CONSISTENT WITH STRESS SKIN APPLICATIONS AT CPSES. |
| 14 | STRESS SKIN OVER JOINTS OR NO STRESS SKIN OVER JOINTS | YES<br><br>SEE FOOTNOTE 1. | VERIFIED DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON THE FULL RANGE OF RACEWAY COMMODITY SIZES INSTALLED AT CPSES. AS PART OF THESE QUALIFICATION TESTS, PANEL STRESS SKIN ATTRIBUTES INCLUDING ORIENTATION, USE AT JOINTS AND USE OF STRESS SKIN TIES WERE CONSISTENT WITH STRESS SKIN APPLICATIONS AT CPSES. |
| 15 | STRESS SKIN TIES OR NO STRESS SKIN TIES | YES<br><br>SEE FOOTNOTE 1. | VERIFIED DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON THE FULL RANGE OF RACEWAY COMMODITY SIZES INSTALLED AT CPSES. AS PART OF THESE QUALIFICATION TESTS, PANEL STRESS SKIN ATTRIBUTES INCLUDING ORIENTATION, USE AT JOINTS AND USE OF STRESS SKIN TIES WERE CONSISTENT WITH STRESS SKIN APPLICATIONS AT CPSES. |
| 16 | DRY FIT, POST-BUTTERED JOINTS OR PRE BUTTERED JOINTS | YES<br><br>SEE FOOTNOTE 1. | VERIFIED DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON THE FULL RANGE OF RACEWAY COMMODITY SIZES INSTALLED AT CPSES. AS PART OF THESE QUALIFICATION TESTS, ATTRIBUTES ASSOCIATED WITH JOINTS BETWEEN PREFABRICATED THERMO-LAG MATERIALS INCLUDING PRE-BUTTERING, GAP WIDTH, BUTT JOINTS, GROOVED/SCORED JOINTS, USE OF ADDITIONAL TROWEL GRADE MATERIAL AND USE OF EDGE GUARDS WERE CONSISTENT WITH JOINT CONFIGURATIONS AND APPLICATIONS INSTALLED AT CPSES. |
| 17 | JOINT GAP WIDTH | YES | REFER TO ITEM NO. 16 ABOVE. |

## ATTRIBUTES VERIFIED BY TU ELECTRIC (TUE)
## TABLE 2

| ITEM NO. | IMPORTANT BARRIER PARAMETERS | VERIFIED BY TUE | REMARKS |
|---|---|---|---|
| 18 | BUTT JOINTS OR GROOVED AND SCORED JOINTS | YES | REFER TO ITEM NO. 16 ABOVE. |
| 19 | STEEL BANDS OR TIE WIRES | YES | VERIFIED DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON THE FULL RANGE OF RACEWAY COMMODITY SIZES INSTALLED AT CPSES. AS PART OF THESE QUALIFICATION TESTS, ATTRIBUTES ASSOCIATED WITH BARRIER FASTENERS INCLUDING FASTENER TYPE, MATERIAL, SPACING, DISTANCE FROM JOINTS, USE OF INTERNAL BANDS IN CABLE TRAYS WERE CONSISTENT WITH FASTENER APPLICATIONS AT CPSES. |
| 20 | BAND/WIRE SPACING | YES | REFER TO ITEM NO. 19 ABOVE. |
| 21 | BAND/WIRE DISTANCE TO JOINTS | YES | REFER TO ITEM NO. 19 ABOVE. |
| 22 | NO INTERNAL BANDS IN TRAYS | YES | REFER TO ITEM NO. 19 ABOVE. |
| 23 | NO ADDITIONAL TROWEL MATERIALS OVER SECTIONS AND JOINTS OR ADDITIONAL TROWEL MATERIAL APPLIED | YES | REFER TO ITEM NO. 16 ABOVE. |
| 24 | NO EDGE GUARDS OR EDGE GUARDS | YES | REFER TO ITEM NO. 16 ABOVE. |

## ATTRIBUTES VERIFIED BY TU ELECTRIC (TUE)
## TABLE 2

| ITEM NO. | IMPORTANT BARRIER PARAMETERS | VERIFIED BY TUE | REMARKS |
|---|---|---|---|
| 25 | CABLE SIZE AND TYPE (POWER, CONTROL, OR INSTRUMENTATION) | YES<br><br>SEE FOOTNOTE 1 & 2. | VERIFIED DURING RECEIPT INSPECTION AND DURING INSTALLATION INSPECTION. TU ELECTRIC'S INDEPENDENT FIRE ENDURANCE TEST PROGRAM HAS QUALIFIED THERMO-LAG BARRIERS INSTALLED ON THE FULL RANGE OF RACEWAY COMMODITY SIZES INSTALLED AT CPSES. AS PART OF THESE QUALIFICATION TESTS, ELECTRICAL CABLES EXTRACTED FROM CPSES STOCK INVENTORY WERE INCLUDED WITHIN EACH FIRE BARRIER CONFIGURATION TESTED. THE CABLE TYPES SELECTED CONSISTED OF THE SAME TYPE, SIZE AND CONSTRUCTION AS THOSE PROTECTED BY THERMO-LAG BARRIERS AT CPSES. IN PERFORMANCE OF FIRE ENDURANCE TESTS, CABLE TEMPERATURES WERE MONITORED BY THERMOCOUPLES INSTALLED AT 6 INCH INTERVALS. IMMEDIATELY FOLLOWING CONDUCT OF HOSE STREAM TESTS, ENCLOSED CABLES WERE SUBJECTED TO INSULATION RESISTANCE TESTS TO VERIFY THEIR FUNCTIONALITY. ADDITIONALLY, FOLLOWING REMOVAL OF THE BARRIER MATERIALS, DETAILED VISUAL INSPECTION OF THE CABLES WAS PERFORMED BY QUALIFIED OMEGA POINT LABORATORY PERSONNEL TO CHECK FOR EVIDENCE OF CABLE DEGRADATION. IN THE EVENT THAT CABLE TEMPERATURES IN EXCESS OF THOSE ALLOWED BY THE TEST PROCEDURE WERE RECORDED, OR EVIDENCE OF POTENTIAL CABLE DEGRADATION WAS DETECTED UPON VISUAL INSPECTION, TU ELECTRIC PERFORMED FURTHER EVALUATION OF UNDERLYING CAUSES FOR SUCH DAMAGE AND/OR SUPPLEMENTAL CABLE FUNCTIONALITY EVALUATIONS. AS SUCH, ATTRIBUTES ASSOCIATED WITH ELECTRICAL CABLES SUCH AS SIZE, TYPE, JACKET AND CONDUCTOR MATERIAL COMPOSITION, CABLE FILL AND DISTRIBUTION, PROXIMITY TO INTERIOR BARRIER SURFACES, PRESENCE OF OTHER MATERIALS BETWEEN CABLES AND BARRIER SURFACES, CABLE OPERATING TEMPERATURE AND MAXIMUM TEMPERATURES FOR CABLE HAVE BEEN ADDRESSED. |
| 26 | CABLE JACKET TYPE (THERMOPLASTIC, THERMOSET PLASTIC) AND MATERIALS | YES | REFER TO ITEM NO. 25 ABOVE. |

## ATTRIBUTES VERIFIED BY TU ELECTRIC (TUE)
## TABLE 2

| ITEM NO. | IMPORTANT BARRIER PARAMETERS | VERIFIED BY TUE | REMARKS |
|---|---|---|---|
| 27 | CABLE CONDUCTOR INSULATION TYPE (THERMOPLASTIC, THERMOSET PLASTIC) AND MATERIALS | YES | REFER TO ITEM NO. 25 ABOVE. |
| 28 | CABLE FILL AND DISTRIBUTION OF CABLES WITHIN THE PROTECTED CONDUIT OR CABLE TRAY | YES | REFER TO ITEM NO. 25 ABOVE. |
| 29 | PROXIMITY OF CABLES TO THE UNEXPOSED (INSIDE) SURFACES OF THE FIRE BARRIER | YES | REFER TO ITEM NO. 25 ABOVE. |
| 30 | PRESENCE OF MATERIALS BETWEEN THE CABLES AND THE UNEXPOSED SIDE OF THE FIRE BARRIER MATERIAL (FOR EXAMPLE, SEALTEMP CLOTH, WHICH IS USED IN THE NUMARC TEST SPECIMENS) | YES | REFER TO ITEM NO. 25 ABOVE. |
| 31 | CABLE OPERATING TEMPERATURE | SEE REMARKS | REFER TO ITEM NO. 25 ABOVE. |
| 32 | TEMPERATURES AT WHICH THE CABLES CAN NO LONGER PERFORM THEIR INTENDED FUNCTION WHEN ENERGIZED AT RATE VOLTAGE AND CURRENT | SEE REMARKS | REFER TO ITEM NO. 25 ABOVE. |

**ATTRIBUTES VERIFIED BY TU ELECTRIC (TUE)**
**TABLE 2**

FOOTNOTES

1. Refer to TU Electric Fire Endurance Test Reports previously provided to NRC via TXX-93023 and TXX-93353 dated January 19, 1993 and October 20, 1993 respectively. Also refer to TU Electric's "Evaluation of Thermo-lag Fire Barrier Systems" (ER-ME-067, Rev. 3), logged TXX-94092 dated March 24, 1994.

2. Refer to TU Electric letters logged TXX-93060 and TXX-94267 dated January 25, 1993 and November 9, 1994 respectively. These letters describe TU Electric's position regarding cable jacket material, cable jacket damage and cable functionality evaluations.