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October 31, 1995
C311-95-2456

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

Gentlemen:

Subject: Three Mile Island Nuclear Station, Unit I (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
Supplemental Response to Request for Additional Information Regarding Generic Letter 92-08 "Thermo-Lag 330-1 Fire Barriers,"

The purpose of this letter is twofold. First, to submit, as committed to in GPU Nuclear letter C311-95-2265 dated July 7, 1995, the remainder of the information necessary to complete our response to the May 26, 1995 "Response to the Follow-up to the Request for Additional Information Regarding Generic Letter 92-08 (TAC No. M85615)". The attachment to this letter contains the previously unavailable, requested information. The information includes results obtained regarding the consistency of Thermo-Lag. The degree of consistency with other industry samples adequately demonstrates that the TMI-1 materials are equivalent to the materials tested in the industry fire endurance tests.

Additionally, we want to inform you that during the TMI-1 11R outage, work was performed which required the dismantlement of five fire barrier envelopes to complete cable pulls and make up terminations. The Fire Protection Engineer (FPE) and Quality Verification personnel witnessed the dismantlement and documented the as-found important installation parameters, construction details and construction methodology. Items which were verified included the location of the stress skin, "v" rib orientation, joint design, gap widths, pre-buttering of joints and material inspection for voids. The results of these efforts found the dismantled thermal barrier envelopes to support and validate the documentation contained in the installation package records.

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These actions were not performed to satisfy a commitment to the NRC, but to further validate our confidence in the quality of the fire barriers constructed at TMI-1.

Sincerely,

J. Knubel
Vice President and Director, TMI

WGH

Attachments
cc: Administrator, Region I
TMI Senior Resident Inspector
TMI Senior NRC Project Manager
NEI- Alex Marion

Supplemental Response to Request for Additional Information
Regarding Generic Letter 92-08

As discussed in our letter of July 7, 1995, GPU Nuclear committed to provide the results of site specific chemical composition testing of Thermo-Lag samples along with the industry wide results being coordinated by the Nuclear Energy Institute. This testing was performed by GPU Nuclear and the industry in response to a "Follow-up to the Request for Additional Information Regarding Generic Letter 92-08, Thermo-Lag 330-1 Fire Barriers, Issued Pursuant to 10 CFR 50.54(f) on February 10, 1994 - Three Mile Island Nuclear Station, Unit 1 (TAC NO. M85615)". This request for information was documented in NRC letter dated December 29, 1994.

The aforementioned NRC request was to "describe the specific tests and analyses that will be performed to verify that the thermo-lag fire barrier materials that are currently installed, 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 and 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."

The following provides our response with respect to the material properties and attributes specifically identified in the NRC letter of December 29, 1994 letter: NOTE that we have integrated the discussion with respect to the methodology employed to determine the sample size into the following discussions and the reasons we believe it is adequate to draw conclusions on the data collected.

1) chemical composition

In our letter of July 7, 1995, GPUN indicated it was participating in the NEI sponsored chemical test program intended to establish similarity between the materials previously tested as part of the NEI Fire Barrier Test Program and the materials installed at TMI-1. Five TMI-1 samples were taken and analyzed. The samples were taken from the following types of Thermo-Lag material:

- 3 hour preformed conduit-warehouse stock purchased in 1987,
- 1 hour preformed conduit-warehouse stock purchased in 1987,
- 3 hour preformed panel/board-warehouse stock purchased in 1987,
- 1 hour preformed panel/board-warehouse stock purchased in 1994 and
- Trowel grade material-removed from a 3 hour barrier joint in Fire Area CB-FA-2G installed in 1987.

The samples were compared by pyrolysis gas chromatography (PGC) using ASTM D3452 as a general guide. The analysis was performed by NUCON laboratories. The results and conclusions are documented in NUCON Report 06GN862/01. The NUCON report concludes that the TMI-1 Thermo-Lag samples

are consistent with each other with respect to chemical composition. In addition, the NUCON report also concludes that the TMI-1 Thermo-Lag samplesare consistent in terms of chemical composition with those tested by NEI as part of their Fire Barrier Test Program.

In addition to the TMI-1 specific sample testing, a total of 169 samples have been compared on an industry wide basis with samples previously analyzed for NEI as part of their Fire Barrier Test Program. The results of this comparison are contained in NUCON Report 06VA764/04. This report has been sent to the NRC by NEI letter dated October 3, 1995. In addition to the Pyrolysis Gas Chromatography performed for the 169 samples mentioned above, 33 Thermo-Lag samples were analyzed using energy dispersive x-ray spectroscopy (EDS) on ashed material. The NUCON report indicates consistency of these sample results with each other. Overall, NUCON concludes that the results of the PGC and EDS analysis of the Thermo-Lag samples tested show that all of the samples are consistent with one another in terms of organic and inorganic chemical composition.

GPUN believes that the results of the TMI-1 specific sample testing and the industry test program coordinated by NEI provide a reasonable basis to conclude that the chemical composition of Thermo-lag has not varied over time. The TMI-1 samples are representative of the in plant population of preformed Thermo-Lag applications installed in 1987 as well as trowel grade material used at TMI-1. While statistical inferences cannot be drawn from the number of TMI-1 samples, the TMI-1 samples contribute to the overall industry population which in a broader sense increases the confidence level in the consistency of Thermo-Lag production over time. In addition, TMI-1 material was furnished to NEI for their fire endurance testing program. Therefore, the methodology for selection of the TMI-1 samples when viewed as contributing to an overall industry population is considered sufficient to conclude that the Thermo-Lag installed at TMI-1 is chemically consistent with that tested by NEI as part of their Fire Barrier Test Program. This should close any concerns which exist with respect to varying chemical composition and its potential impact on the fire endurance rating of Thermo-Lag.

2) material thickness, 3) material weight and density and 4) the presence of voids, cracks and delaminations

These issues were most recently addressed in letter C311-95-2265 of July 7, 1995. There is no further information to be provided.

5) fire endurance capabilities

The issue of fire endurance capabilities was last addressed in our letter C311-95-2265 of July 7, 1995. In that letter, we stated that knowledge of industry wide chemical composition results would provide a basis to confirm applicability of generic industry data with respect to fire endurance capability. GPU Nuclear is evaluating the results of the NEI Fire Barrier Test Program and is utilizing the NEI Application Guide to establish fire endurance ratings for Thermo-Lag raceway systems. This is considered adequate for establishing fire endurance capabilities.

As previously stated above, there is a reasonable basis to conclude that chemical composition has not varied over time. TMI-1 samples and industry samples are chemically consistent with material tested as part of the NEI Fire Barrier Testing Program. Therefore, we conclude that installed configurations of Thermo-Lag raceways at TMI-1 can be compared with the results of the NEI Fire Barrier Test Program utilizing the NEI Application Guide to determine fire endurance capabilities of installed configurations

6) & 7) combustibility and flame spread rating

The issue of combustibility and flame spread rating was last addressed in our letter C311-95-2265 of July 7, 1995. In that letter we stated that GPU Nuclear recognizes Thermo-Lag as a combustible material. Combustibility and flame spread rating test results as provided to the NRC in NEI's letter of October 12, 1993 are considered adequate for establishing these material properties. The NEI Fire Test Program included ASTM E1321 (lateral flame spread) and ASTM E1354 (heat of combustion) tests performed at Underwriter's Laboratories. The results of these tests were provided to the NRC as attachments to NEI's letter of October 12, 1993 as supporting documentation for the Thermo-Lag 330-1 Combustibility Evaluation Methodology Plant Screening Guide. The NRC has recognized and referenced the results of this testing in enclosure 2, to Attachment 1, of Information Notice 95-27. Although the NRC has not endorsed the methodology presented in the NEI Combustibility Evaluation Methodology Plant Screening Guide, neither the specific testing method nor the testing results have been in question. GPUN believes the aforementioned combustibility and flame spread test results are adequate for establishing these two material properties.

Again, there is a reasonable basis to conclude that chemical composition has not varied over time. TMI-1 samples and industry samples are chemically consistent with material tested as part of the NEI Fire Barrier Test Program. Therefore, we conclude that the combustibility and flame spread ratings established in the NEI test program by Underwriters Laboratories can be applied to installed configurations of Thermo-Lag raceways at TMI-1 and need not be reconfirmed by plant specific testing.

8) ampacity derating

As stated above in item 1, there is a reasonable basis to conclude that chemical composition has not varied over time. We believe that the results of the industry test program provide a firm basis to close any concerns with respect to chemical composition and product consistency relative to ampacity derating.

The TMI-1 plan for evaluating ampacity derating is described in our letter C311-94-2307 of December 5, 1994. Additional information on this issue was provided in our letter C311-95-2119 of March 29, 1995.

9) mechanical properties such as tensile strength, compressive strength, shear strength, and flexural strength:

For original installation of Thermo-Lag fire barrier envelopes, GPU Nuclear's contract with TSI required analysis by TSI to demonstrate that installed Thermo-Lag configurations remain intact after a Safe Shutdown Earthquake (SSE). The configurations were not required to remain "operable" in terms of fire endurance capability after an SSE. The requirement to remain intact is to ensure that installed Thermo-Lag does not become a missile as a result of an SSE and damage safety related equipment.

The analysis provided by TSI to demonstrate that installed Thermo-Lag configurations remain intact after an SSE is documented in TSI Technical Note 12584 "Stress Analysis of Thermo-Lag Subliming Compound Coating Applied to Electrical Power Trays and Conduit" prepared by Philip L. Gould dated February 2, 1984. Mechanical properties including tensile strength, flexural strength, flexural stiffness, initial modulus and shear strength are referenced in this analysis.

To address the issue of mechanical properties and attributes that contribute to conclusions that installed fire barrier configurations remain intact in the event of an SSE, GPU Nuclear performed the following:

a) Confirmation of mechanical properties

The stress analysis report prepared by Philip L. Gould contains a series of graphs which provide mechanical properties of Thermo-Lag. During the review process, GPUN elected to perform an independent test to verify the Thermo-Lag mechanical properties. The purpose of the test was to confirm a sufficient number of data points to obtain assurance that the information in the Gould analysis is appropriate.

GPUN performed a series of static bending tests to determine flexural stress capacities. The tests were performed at GPUN's Chemistry and Materials Laboratory on Thermo-Lag material in warehouse stock at TMI. The tests included samples of 1/4 inch and 1/2 inch thick Thermo-Lag with stress skin on one side and 1 inch thick Thermo-Lag with stress skin on both sides. All test samples were oriented to match the installed configuration. Samples taken from installed Thermo-Lag were not used since the suitability of specimens obtained for testing could not be guaranteed. We consider the results of the test to be applicable to installed Thermo-Lag for the following reasons:

We have previously concluded that the prefabricated board material currently installed is consistent with respect to chemical composition.

The inspection of manufactured boards for the presence of voids, cracks and delaminations provides reasonable assurance of board consistency.

The same inspection requirements are still invoked at TMI-1 as those for receipt of prefabricated Thermo-Lag during original installation.

The results of the flexural tests are documented in GPUN Chemistry/ Materials Report No. 5383-95-1151 "Thermo-Lag Mechanical Test Results" which GPUN considers proprietary. These results show that GPUN was unable to confirm the values provided in the Gould analysis. Therefore, GPUN used the results of the tests documented in the aforementioned report to perform an independent analysis of the Thermo-Lag as described below.

b) Analysis of installed Thermo-Lag configurations

GPUN performed an analysis of installed Thermo-Lag configurations for TMI-1. The analysis included installations attached directly to cable tray and conduit and free standing installations built around equipment and attached directly to walls or other structural elements. All configurations were treated as bending elements and therefore the only mechanical properties required for the analysis were flexural strength and modulus of elasticity. The results of the test previously mentioned were used to obtain ultimate flexural capacity and modulus of elasticity. The analysis conservatively uses the smallest flexural capacity and the largest modulus of elasticity obtained from any of the tests. The analysis also uses conservative support spacings and seismic accelerations. The results of the analysis are contained in GPUN Calculation C-1302-814-5320-001 which GPUN considers proprietary.

As shown in GPUN Calculation C-1302-814-5320-001, maximum calculated stresses for Thermo-Lag attached to cable tray and conduit are less than 10% of the ultimate flexural capacity determined from the tests described above. In addition, the maximum stresses in the most highly stressed free standing installation is less than 60% of the minimum ultimate capacity obtained from the previously described tests. For the installations, the results of the calculation have additional conservatism because no credit is taken for the effect of the steel bands on the Thermo-Lag installations. These bands greatly decrease stresses in the Thermo-Lag by decreasing the distance between supports. They also help insure that the material will stay attached to conduit even if cracking occurs. For the free standing installations, the equipment being protected will support the Thermo-Lag even if it is over stressed during a seismic event. In addition, as shown by the test results, even after it breaks, the Thermo-Lag stays attached to the stress skin. It therefore does not become a missile or create an interaction concern during a seismic event.

The results of our reanalysis confirms that the Thermo-Lag installed at TMI-1 is capable of maintaining structural integrity during and following an SSE.

The NUCON report on chemical composition, reanalysis of structural integrity and lab report documenting the results confirming flexural strength described above are not included in this response but are available for NRC review upon request.

The results of the tests and analysis described above do not result in any changes to previously submitted plans and schedules with respect to GPUN's resolution of the Thermo-Lag issue at TMI-1.