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November 1, 1995
C321-95-2315

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

Dear Sir:

Subject: Oyster Creek Nuclear Generating Station (OCNGS)
Docket No. 50-219
Thermo-Lag Fire Barriers - Chemical Testing

In accordance with commitments described in GPU Nuclear letter to the NRC dated July 17, 1995 (C321-95-2184), this letter provides a report describing the results of the Nuclear Energy Institute (NEI) coordinated testing program regarding chemical consistency for Thermo-Lag Fire Barrier material properties, as applicable to OCNGS. The degree of chemical consistency with other industry samples adequately demonstrates that the OCNGS materials are equivalent to the materials tested in the industry fire endurance tests. In addition, this letter also provides information related to other material properties. This submittal closes out commitments made by GPU Nuclear letter to the NRC dated March 31, 1995 (C321-95-2114).

Sincerely,

J. J. Barton
Vice President & Director
Oyster Creek

JJB/DJD/crb
Attachment

cc: Administrator, Region I
Oyster Creek NRC Resident Inspector
Oyster Creek NRC Project Manager
A. Marion, NEI

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OYSTER CREEK
THERMO-LAG MATERIAL CHEMICAL TESTING

As discussed in our letter of July 17, 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), OYSTER CREEK NUCLEAR GENERATING STATION (TAC NO. M85581)". 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 in order to support the basis for establishing conclusions on the data collected.

1) Chemical Composition:

In our letter of July 17, 1995, we indicated that we were 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 OCNGS. Four OCNGS samples were taken and analyzed. The samples were taken from the following types of Thermo-Lag material.

3 hour preformed conduit-Installed in 1984; later abandoned in place
1 hour preformed conduit-Installed in 1986/87
1 hour preformed panel/board-Installed in 1986/87
Trowel Grade material-Removed from ductwork one hour fire barrier joint

The samples were compared by pyrolysis gas chromatography (PGC) using ASTM D3452 as a general guide. The analysis was performed by NUCON labs. The results and conclusions are documented in NUCON Report 06GN862/01. The NUCON report concludes that the OCNGS Thermo-Lag samples are consistent with each other with respect to chemical composition. In addition, the NUCON report also concludes that the OCNGS Thermo-Lag samples are consistent in terms of chemical composition with those tested by NEI as part of their fire barrier test program.

In addition to the OCNGS 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. In a letter to NEI dated October 20, 1995, the NRC acknowledged receipt of the NUCON report and provided guidance to licensees to resolve the materials questions. These results are submitted consistent with the NRC's review of the Crystal River Unit 3 submittal dated September 22, 1995. Based upon the NRC endorsement, we believe that this issue can be considered closed.

GPUN believes that the results of the OCNGS 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 OCNGS samples are representative of the in-plant population of preformed Thermo-Lag applications as well as trowel grade material used at OCNGS. While statistical inferences cannot be drawn from the number of OCNGS samples, the OCNGS samples contribute to the overall industry population which in a broader sense provides a higher confidence level in the consistency of Thermo-Lag production over time. Therefore, the methodology for selection of the OCNGS samples when viewed as contributing to an overall industry population is considered sufficient to conclude that the Thermo-Lag installed at OCNGS is chemically consistent with that tested by NEI as part of their fire barrier test program. These results adequately resolve concerns regarding potential varying chemical composition and its potential impact on the fire endurance rating of Thermo-Lag.

2) Material Thickness:

The issue of material thickness has most recently been addressed in GPU Nuclear letter to NRC dated September 22, 1995 (C321-95-2277), and is being verified by review of QA program records and additional detailed examinations of representative installed configurations, as described in the above referenced letter.

3) Material Weight and Density:

GPU Nuclear letter dated March 31, 1995, stated that this issue would be addressed in greater detail in a follow-up letter pending resolution of the chemical testing program.

At OCNGS, Thermo-Lag material weight and density were not explicitly verified during receipt inspection. However, an alternative to verifying weight and density as discussed below provides a reasonable basis for comparing OCNGS installed Thermo-Lag configurations with NEI fire barrier test configurations in order to establish fire endurance ratings.

GPU Nuclear letter dated July 17, 1995, stated that quality control records documenting inspections for the presence of voids, cracks and delaminations provides reasonable assurance that prefabricated sections of Thermo-Lag are uniform. OCNGS receipt inspection checks for material thickness as well as additional detailed examinations to verify thickness of installed Thermo-Lag as documented in GPUN letter dated September 22, 1995 provides confidence that thickness of prefabricated sections of Thermo-Lag are sufficient to allow comparison with NEI tested assemblies.

As stated above in item 1, there is a reasonable basis to conclude that chemical composition has not varied over time. OCNGS samples and industry samples are chemically consistent with material tested as part of the NEI fire barrier testing program. Since chemical composition is considered consistent with that tested in the NEI fire barrier testing program and since there is confidence in both the uniformity of construction and thickness of prefabricated construction, we believe this to be adequate to allow comparison of OCNGS installed Thermo-Lag configurations with NEI fire barrier test configurations in order to establish fire endurance ratings. This provides reasonable assurance that material weight and density are acceptable without specifically verifying these attributes.

4) The Presence of Voids, Cracks and Delaminations:

The issue of the presence of voids, cracks and delaminations was last addressed in GPU Nuclear letter dated July 17, 1995. Based upon the NRC's letter of August 22, 1995, the OCNGS response of July 17, 1995 was considered acceptable.

5) Fire Endurance Capabilities:

Our previous response provided in GPU Nuclear letter dated July 17, 1995 stated that knowledge of industry wide chemical composition results will 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 testing 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 stated above in item 1, the results of the industry chemical consistency test program provide an adequate basis to conclude that chemical composition has not varied over time. OCNGS 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 OCNGS can be compared with the results of the NEI fire barrier testing program utilizing the NEI Application guide to determine fire endurance capabilities of installed configurations.

6 & 7) Combustibility and Flame Spread Rating:

Our previous response provided in GPU Nuclear letter dated July 17, 1995 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 Underwriters 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. GPU Nuclear believes the aforementioned combustibility and flame spread test results are adequate for establishing these two material properties.

As stated above in item 1, there is a reasonable basis to conclude that chemical composition has not varied over time. OCNGS samples and industry samples are chemically consistent with material tested as part of the NEI fire barrier testing 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 OCNGS 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 OCNGS plan for evaluating ampacity derating is described in GPU Nuclear letter (C321-94-2279) dated December 27, 1994. A response to the latest RAI on ampacity dated September 27, 1995 will be provided in a separate letter.

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 during and 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, GPU Nuclear 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.

GPU Nuclear performed a series of static bending tests to determine flexural stress capacities. The tests were performed on Thermo-Lag boards in stock at TMI at GPU Nuclear's Chemistry and Materials Lab. 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. 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.

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

We therefore consider it reasonable to use stock material at TMI-1 to independently verify flexural strength properties for Thermo-Lag for the purpose of confirming the structural adequacy of Thermo-Lag installed at OCNGS based upon the consistency observed in the chemical composition testing and during visual inspections of the Thermo-Lag material in the lab.

The results of the flexural tests are documented in GPU Nuclear Chemistry/Materials Report No. 5383-95-1151 "Thermo-Lag Mechanical Test Results" which GPU Nuclear considers proprietary. These results show that GPU Nuclear was unable to confirm the values provided in the Gould analysis. Therefore, GPU Nuclear 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

GPU Nuclear performed an analysis of installed Thermo-Lag configurations for OCNGS. The analysis included installations attached directly to conduit and free standing installations built around equipment and attached directly to walls or other structural elements. All configurations were conservatively tested as bending elements. Therefore, the only mechanical properties required for the analysis were flexural strength and modulus of elasticity. The results of the tests 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 GPU Nuclear Calculation C-1302-814-5320-001, which GPU Nuclear considers proprietary.

As shown in GPU Nuclear Calculation C-1302-814-5320-001, maximum calculated stresses for Thermo-Lag attached to 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 overstressed 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 OCNGS is capable of maintaining structural integrity during and following an SSE.

The NUCON report on chemical composition, the GPU Nuclear reanalysis of structural integrity and GPU Nuclear Chemistry/Materials report documenting the results confirming flexural strength described above 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 GPU Nuclear's resolution of the Thermo-Lag issue at OCNGS.