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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

June 23, 1992

NRC INFORMATION NOTICE 92-46: THERMO-LAG FIRE BARRIER MATERIAL SPECIAL REVIEW TEAM FINAL REPORT FINDINGS, CURRENT FIRE ENDURANCE TESTS, AND AMPACITY CALCULATION ERRORS

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to inform addressees of (1) the findings of the NRC's Thermo-Lag Special Review Team, (2) current Thermo-Lag 330 fire resistance testing being conducted by Texas Utilities (TU) and Thermal Science, Inc. (TSI), and (3) errors found in the calculation of cable ampacity derating factors for Thermo-Lag fire resistive barriers. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Discussion

FINAL REPORT BY THE SPECIAL REVIEW TEAM FOR THE REVIEW OF THERMO-LAG FIRE BARRIER PERFORMANCE

The NRC has been reviewing the qualification of Thermo-Lag 330-1 fire barrier systems. The NRC previously issued two information notices on these fire barrier systems: (1) Information Notice 91-47, "Failure of Thermo-Lag Fire Barrier Material to Pass Fire Endurance Test," August 6, 1991, and (2) Information Notice 91-79, "Deficiencies in the Procedures for Installing Thermo-Lag Fire Barrier Materials," December 6, 1991.

On February 12, 1992, the NRC's Special Review Team for the review of Thermo-Lag fire barrier performance met with the Nuclear Utilities Management and Resources Council (NUMARC) to discuss the coordination of the industry's response to Thermo-Lag fire endurance, installation, and ampacity concerns. During the meeting, the staff provided NUMARC a proposed draft generic letter on the Thermo-Lag fire barrier issue for review and comment. The draft generic letter was included in the meeting minutes which were placed in the Public Document Room as an enclosure to a February 24, 1992, letter to NUMARC. In a letter of March 3, 1992, NUMARC commented on the proposed draft generic

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letter and committed to coordinate the industry's efforts associated with the issues involving Thermo-Lag. In addition, NUMARC requested that the NRC make available any additional information on the qualification of these barriers.

In response to this request, the NRC provided NUMARC the "Final Report-Special Review Team for the Review of Thermo-Lag Fire Barrier Performance," of April 21, 1992, (Attachment 1). The final report concluded that some licensees have not adequately reviewed and evaluated the fire endurance and ampacity test results for applicability to the Thermo-Lag fire barrier systems installed in their facilities. In addition, the final report stated that some facilities have used inadequate installation procedures to construct Thermo-Lag fire barriers on electrical raceways and equipment.

CURRENT THERMO-LAG 330-1 FIRE BARRIER ENVELOPE TESTING

As a result of the concerns in Information Notices 91-47 and 91-79, TU instituted a fire endurance testing program to qualify the Thermo-Lag fire barrier protective system specifically for its Comanche Peak Steam Electric Station. This testing was conducted during the weeks of June 15 and 22, 1992. The NRC witnessed the preparation of test specimens and the actual testing of the TU electric test articles.

The tests consist of a series of 1-hour fire endurance tests on a variety of cable tray and conduit "mock-ups". The "mock-ups" were designed to duplicate actual plant configurations. TU installed the fire barriers using stock material and actual plant procedures and personnel.

The first actual tests occurred on June 17, 1992. Three-quarter-inch, and one-inch and five-inch conduit configurations were tested. All tests passed American Nuclear Insurers criteria, in that electrical cable continuity was not lost. However, several temperature readings were above specifications for the 3/4-inch and 1-inch conduit tests, and for a junction box that was common to all the conduits. Additionally, subsequent investigation of the cabling revealed evidence of charring and blistering. NRC standards require that the protected components be free of fire damage.

Preliminary information from the second test of a 12-inch cable tray configuration on June 18, 1992, showed satisfactory results. Thermocouple temperatures on the protected cables were less than 325 °F.

The third test was conducted on June 19, 1992. This article was a wide (30-inch) ladder back cable tray configuration. At 17 minutes into the test, the Thermo-Lag panel on the bottom of the test article began to sag and the stainless steel banding was carrying the load of the panel. At 18 minutes, the joint at the interface between the tray support and the tray showed signs of weakening and separation. Internal temperatures within areas of this cable tray assembly exceeded 325 °F at 25 minutes. The joint fully separated in 41 minutes resulting in cable circuit integrity failure and fire damage to the cables.



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April 21, 1992

MEMORANDUM FOR: William T. Russell, Associate Director
for Inspection and Technical Assessment
Office of Nuclear Reactor Regulation

FROM: Thomas E. Murley, Director
Office of Nuclear Reactor Regulation

SUBJECT: FINAL REPORT - SPECIAL REVIEW TEAM FOR THE REVIEW OF
THERMO-LAG FIRE BARRIER PERFORMANCE

On February 12, 1992, the special review team for the review of Thermo-Lag fire barrier performance met with the Nuclear Utilities Management and Resources Council (NUMARC) to obtain a commitment for a coordinated industry response to our concerns. During the meeting, the team presented the results of its review and gave the attendees a proposed generic letter on Thermo-Lag fire barriers.

By a letter of March 3, 1992, NUMARC committed to coordinate the industry's efforts and requested additional technical information. The review team's final technical report is enclosed for transmittal by your staff to NUMARC and the vendor. The report, which has been reviewed by your staff, documents the results of the team's review and provides the technical bases for its findings and recommendations. The report identifies the full scope of the concerns and will facilitate discussions between the staff and NUMARC needed to resolve their questions and proceed with the issuance of the proposed generic letter.

The special review team is available to discuss its final report with you or your staff at your convenience.

A handwritten signature in dark ink, appearing to read "T. Murley", is written over the typed name.

Thomas E. Murley, Director
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc w/enclosure:
J. Sniezek

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TU has established roving fire watches for Unit 1, in accordance with its Fire Protection Manual. The roving fire watches cover plant areas where Thermo-Lag fire barrier configurations, similar to those which failed, are used to provide a fire endurance barrier for safe-shutdown equipment.


TSI is also instituting a fire endurance testing program. This program includes testing a new installation technique required for cable trays installed with gap widths greater than 0.030 inches. The new seam joining technique requires that either (1) stainless steel tie wires be placed through the stress skin at specified intervals or (2) stress skin and a layer of Thermo-Lag trowel grade material be placed over the entire seam length and banded in place. Preliminary results of a June 9, 1992, test using the new seam joining technique (on seams without wide gaps) on a 36-inch cable tray system and a 3/4-inch conduit assembly were considered successful by the vendor and testing laboratory.

The NRC will provide additional information on these fire endurance testing programs as it becomes available.

AMPACITY DERATING CALCULATION ERROR

In April 1992, the Washington Public Power Supply System, the licensee for Washington Nuclear Project, Unit 2, found a mathematical error in the calculation of the ampacity derating factor for the Thermo-Lag fire barrier enclosure of cable trays in Industrial Testing Laboratories (ITL) Incorporated Test Report ITL-82-5-355C. The error occurred when ITL adjusted the test current to baseline temperatures of 40 °C ambient and 90 °C cable. This adjustment is required when tests are performed at different ambient and cable temperatures. ITL used the correct equation for adjusting to temperature parameters that differ from the Insulated Cable Engineers Association (ICEA) publication P-46-426: $I' = I \times MF$ (where "I" is at 40 °C ambient and 90 °C cable temperature, and "I'" is at other ambient and cable temperature conditions). However, in calculating "I," ITL multiplied "I'" by "MF" instead of dividing. The NRC determined that the ampacity derating factor will change from 18 to 33 percent when the mathematical error is corrected. While reviewing other ITL test reports, the NRC staff found similar errors in other calculations performed by ITL in the adjustment equation for ambient and cable temperature conditions. The NRC also noted that the baseline currents obtained from the test vary widely (up to 32 percent) from those published in the ICEA publication P-54-440.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.


Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical contacts: Ralph Architzel, NRR
(301) 504-2804

Patrick Madden, NRR
(301) 504-2854

Attachments: *See File Jacket*

1. "Final Report - Special Review Team for the Review of Thermo-Lag Fire Barrier Performance," April 21, 1992
2. List of Recently Issued NRC Information Notices