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

July 27, 1992

NRC INFORMATION NOTICE 92-55: CURRENT FIRE ENDURANCE TEST RESULTS FOR THERMO-LAG FIRE BARRIER MATERIAL

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 the results of current Thermo-Lag 330 fire endurance tests conducted for the NRC at the National Institute of Standards and Technology (NIST). It is expected that recipients will review the information for applicability to their facilities and consider actions as appropriate. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Discussion

The NRC has been reviewing Thermo-Lag 330 fire barrier systems to determine their ability to adequately perform their 1-hour or 3-hour fire resistive functions. The NRC has issued three information notices and a bulletin on this subject:

1. Information Notice 91-47, "Failure of Thermo-Lag Fire Barrier Material to Pass Fire Endurance Test," August 6, 1991
2. Information Notice 91-79, "Deficiencies in the Procedures for Installing Thermo-Lag Fire Barrier Materials," December 6, 1991
3. Information Notice 92-46, "Thermo-Lag Fire Barrier Material Special Review Team Final Report Findings, Current Fire Endurance Tests, and Ampacity Calculation Errors," June 23, 1992
4. Bulletin 92-01, "Failure of Thermo-Lag 330 Fire Barrier System to Maintain Cabling in Wide Cable Trays and Small Conduits Free from Fire Damage," June 24, 1992

NIST conducted small scale 1-hour and 3-hour fire endurance tests to determine the fire resistive properties of Thermo-Lag pre-formed panels.

On July 15, 1992, NIST conducted the 1-hour fire endurance test. The average thermocouple reading on the unexposed surface exceeded 162.7°C (325°F) (NRC cold side temperature limit) in approximately 22 minutes and the unexposed surface of the material reached an average temperature of 652°C (1206°F) at

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45 minutes. The unexposed surface of the material exhibited visible browning in 35 minutes. During the test, one thermocouple on the unexposed surface reached a peak reading of 935°C (1716°F), exceeding the corresponding furnace temperature of 923°C (1694°F), as the material burned and added heat to the baseline furnace temperature. The panels burned through at two locations in 46 minutes, resulting in a corresponding drop in surface thermocouple readings as cold air entered the furnace. At the end of 1-hour, approximately 85 percent of the unexposed surface was blackened.

The 3-hour test was conducted on July 17, 1992. The average thermocouple reading exceeded 162.7°C (325°F) in 2 hours and 20 minutes, the average temperature at the end of 3 hours was 206°C (403°F), and the peak thermocouple reading was 222°C (432°F). At the conclusion of the test, the material was soft and exhibited plastic deformation, and the fire-exposed stress skin crumbled upon contact. Nevertheless, visible signs of damage on the unexposed side were limited to off-gassing, slight browning, and crystallization at the surface.

The furnace used to conduct these tests was a natural gas-fired small scale type with internal dimensions of 0.94 m by 0.94 m by 1.09 m (37 inches by 37 by 42.9 inches). The top of the furnace was equipped with a frame for supporting horizontal test specimens of up to 0.81 m by 0.81 m (31.75 inches by 31.75 inches). An 86.5-mm (3.375-inch) wide steel lip attached around the lower edge of the frame supported the sample. This lip was insulated along its bottom, edge, and top with a nominal 13-mm (0.5-inch) thick ceramic-fiber blanket. Thus, the actual area of the sample exposed to the furnace was approximately 0.584 m by 0.584 m (23 inches by 23 inches).

To conduct this series of tests, nominally square samples were cut with dimensions from 0.794 m to 0.800 m (31.25 inches to 31.5 inches) on a side. After being placed in the horizontal sample frame and centered, with ribs facing upward (i.e., the ribbed face being the unexposed face), the gaps between the edge of the sample and the frame were loosely packed with strips of ceramic-fiber blanket. The test configuration used bricks placed side-by-side along the perimeter of the sample to hold the test samples in place. The stress skin on the 3-hour material was thereby restrained in compression at the edges of the panel around the lip of the furnace and restricted from separating from the panel.

The 1-hour fire endurance test was conducted on a Thermo-Lag 330 fire-barrier panel, "nominal" thickness 13 mm (0.5 inch). The actual thickness of the test sample ranged from 13.7 to 18.3 mm (0.540 to 0.720 inches). This material had stress skin on only the ribbed (unexposed) surface. The three-hour fire endurance test was conducted on a Thermo-Lag 330 fire-barrier panel, "nominal" thickness 25 mm (1 inch). The actual thickness of the test sample ranged from 27.7 to 39.6 mm (1.09 to 1.56 inches). This material had stress skin on both surfaces. The ribbed surface was on the unexposed side during the test.

The furnace temperature was measured with three slow-response chromel alumel thermocouples, which met the requirements in American Society for Testing and Materials (ASTM) Standard E-119. The furnace temperature during the tests followed the ASTM E-119 Standard time-temperature curve.

The unexposed material surface temperatures were monitored at five points, placing one thermocouple approximately at the center of the specimen, and one at the approximate center of each of its quarter sections. The temperature acceptance criterion was that the temperature rise on the unexposed surface not exceed 138.8°C (250°F) above its initial temperature of 23.9°C (75°F) as specified in the National Fire Protection Association (NFPA) Standard 251.

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

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

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| 91-52, Supp. 1 | Nonconservative Errors in Overtemperature Delta-Temperature (OT$\Delta$T) Setpoint Caused by Improper Gain Settings | 07/16/92 | All holders of OLs or CPs for Westinghouse (W)-designed nuclear power reactors. |
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OL = Operating License
CP = Construction Permit

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