

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

August 6, 1991

NRC INFORMATION NOTICE NO. 91-47: FAILURE OF THERMO-LAG FIRE BARRIER MATERIAL
TO PASS FIRE ENDURANCE TEST

Addressees:

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

Purpose:

This information notice is intended to alert addressees to problems that could result from the use of or improper installation of THERMO-LAG material to satisfy the electrical raceway fire protection requirements for safe shutdown components specified in Section III.G.2 of Appendix R to Part 50 of Title 10 of the Code of Federal Regulations (10 CFR Part 50). 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 do not constitute any new Nuclear Regulatory Commission (NRC) requirements; therefore, no specific action or written response is required.

Description of Circumstances:

The Gulf States Utilities Company, the licensee for the River Bend Station (RBS), submitted Licensee Event Reports (LERs) 87-005, 89-009, 90-003, and an Informational Report to the NRC concerning deficiencies identified in fire barriers. The NRC staff reviewed test report information and associated documents regarding the RBS electrical raceway fire barriers to determine if the problems identified in the LERs and Informational Report could affect other NRC licensees. The electrical raceway fire barrier material used at RBS is THERMO-LAG, a product manufactured and supplied by Thermal Science, Incorporated, (TSI), of St. Louis, Missouri. TSI provides THERMO-LAG for 1-hour and 3-hour rated fire barriers.

A 3-hour fire endurance test of a 30-inch aluminum electrical cable tray was performed in October 1989 at the Southwest Research Institute (SwRI) for Gulf States Utilities Company. In this test, a THERMO-LAG envelope system failed resulting in high temperatures inside the cable tray envelope and loss of circuit integrity within approximately 60 minutes. Catastrophic failure and collapse of the tray occurred within 1 1/2 hours. The failure of this test raised concerns regarding the adequacy of THERMO-LAG cable tray enclosures protecting 30-inch wide cable trays.

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Discussion:

NRC requirements and guidelines for fire barriers are contained in various documents, including Appendix R to 10 CFR 50, Generic Letter 86-10, "Implementation of Fire Protection Requirements", and NUREG-0800, "Standard Review Plan." The extent to which these requirements or guidelines are applicable to a specific plant depends on plant age, commitments established by the licensee in developing the fire protection plan, the staff safety evaluation reports (SERs) and supplements, and the license conditions pertaining to fire protection. Fire barrier wrap material is designed to provide reasonable assurance that the effects of a fire are limited to one division of a safe shutdown related system while another division will remain free of fire damage.

The Gulf States Utilities Company uses THERMO-LAG to protect raceways and components throughout RBS that are related to safe shutdown. In addition, at least 40 NRC licensed facilities use THERMO-LAG to construct fire barrier assemblies with 3-hour and 1-hour ratings to enclose electrical raceway and other safe shutdown components.

During routine walkdown inspections in early 1987, RBS fire protection personnel identified degradation of the THERMO-LAG 1-hour and 3-hour rated barriers. During repairs to correct the deficiencies discovered during the walkdowns, the licensee found that the fire barriers had not been installed in accordance with the manufacturer's specifications. The large number of observed deficiencies prompted the licensee to expand these walkdown inspections to include all THERMO-LAG fire barriers. Hourly fire watches were posted in all affected safety-related areas pending completion of all inspections and correction of any deficiencies found. The licensee attributed the deficiencies to failure of the subcontractor installation and quality control inspection program.

During maintenance activities in early 1989, the licensee found additional deficiencies indicating an apparent deficiency in the installation and quality control inspection program. The subcontractor who installed the THERMO-LAG fire barriers at RBS was approved by TSI as a qualified installer. However, during the installation at RBS, the subcontractor removed the factory-installed components of the THERMO-LAG called "stress skin" and structural ribbing. The stress skin component, a wire mesh, is critical to the structural integrity of the fire product during fire exposure. The RBS fire protection personnel considered that all barriers were degraded because of the many sections of the inside layer of the stress skin that had been removed during initial installation at RBS.

The discrepancies identified between the manufacturer's installation manual, actual site installation manual and qualification fire tests resulted in the licensee conducting additional fire endurance testing. In October 1989, SwRI tested a U-shaped 30-inch wide aluminum ladder back cable tray enclosed in a 3-hour fire-rated barrier constructed of THERMO-LAG material. RBS personnel constructed the cable tray protective envelope in accordance with the manufacturer's published installation instructions.

During the 3-hour fire endurance test, all thermocouples inside the THERMO-LAG protected tray reached failure temperatures ($>325^{\circ}\text{F}$) in times ranging from approximately 45 minutes to 80 minutes. Conductor-to-ground failure occurred in the power cable at 60 minutes. The THERMO-LAG enclosure disintegrated at 77 minutes, and the cable tray collapsed at 82 minutes. The SwRI test results on the as-designed THERMO-LAG configuration prompted RBS to institute a fire watch patrol in all areas that depend on THERMO-LAG barriers for protection of safe shutdown capability.

Additional deficiencies, such as small holes, cracks and unfilled seams, were found in the THERMO-LAG material during walkdowns conducted in early 1990. The licensee conducted additional testing of as-installed barriers in November and December 1990. Certain 1-hour and 3-hour cable tray and conduit envelope tests failed. The envelopes were upgraded and tests of the upgraded barriers passed with the exception of the 3-hour cable tray envelope. Final resolution of the 3-hour envelope may include replacing existing fire wrap materials with fully qualified fire wrap, repairing and then qualifying in-plant fire wrap assemblies by supplemental fire tests, or rerouting the cables into acceptable enclosures.

Additionally, other fire barrier wrap design and installation concerns have been reported by RBS that indicate the possibility that NRC requirements for fire protection were not being met in all aspects. The type of concerns identified to date include the following:

1. Lack of documentation of qualification tests which demonstrate that aluminum conduits penetrating the THERMO-LAG protective envelope have been tested.
2. Lack of documentation of qualification tests for different joint installations that demonstrate that varying fitup methods (i.e., dry fitting) are qualified.
3. Lack of documentation of qualification tests of THERMO-LAG installations applicable to large cable trays. The licensee questioned the validity of extrapolating results from small cable tray tests to its 30-inch wide trays.

The NRC is particularly interested in obtaining information on fire barriers that have been found with deficiencies similar to those described in this notice. Documentation, in as much detail as practicable, of any such deficiencies discovered, especially in cases where a fire barrier may have been improperly installed or tested is important. Licensees may communicate the availability of information of this type by telephone to the NRC technical contact listed below. Information Notice No. 88-04, "Inadequate Qualification and Documentation of Fire Barrier Penetration Seals," provides additional discussion and considerations regarding qualification of installed fire barriers.

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

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

Technical Contact: Ralph Architzel, NRR
301-492-0804

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
89-56, Supp. 2	Questionable Certification of Material Supplied to the Defense Department by Nuclear Suppliers	07/19/91	All holders of OLs or CPs for nuclear power reactors.
91-46	Degradation of Emergency Diesel Generator Fuel Oil Delivery Systems	07/18/91	All holders of OLs or CPs for nuclear power reactors.
91-45	Possible Malfunction of Westinghouse ARD, BFD, and NBFD Relays, and A200 DC and DPC 250 Magnetic Con- tactors	07/05/91	All holders of OLs or CPs for nuclear power reactors.
91-44	Improper Control of Chemicals in Nuclear Fuel Fabrication	07/08/91	All nuclear fuel facilities.
91-43	Recent Incidents Involving Rapid Increases in Primary- to-Secondary Leak Rate	07/05/91	All holders of OLs or CPs for pressurized-water reactors (PWRs).
91-42	Plant Outage Events Involving Poor Coordina- tion Between Operations and Maintenance Personnel During Valve Testing and Manipulations	06/27/91	All holders of OLs or CPs for nuclear power reactors.
91-41	Potential Problems with The Use of Freeze Seals	06/27/91	All holders of OLs or CPs for nuclear power reactors.
88-63, Supp. 2	High Radiation Hazards from Irradiated Incore Detectors and Cables	06/25/91	All holders of OLs or CPs for nuclear power reactors, research reactors, and test reactors.

OL = Operating License
CP = Construction Permit