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NRCB 92-01

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

June 24, 1992

NRC BULLETIN NO. 92-01: FAILURE OF THERMO-LAG 330 FIRE BARRIER SYSTEM TO MAINTAIN CABLING IN WIDE CABLE TRAYS AND SMALL CONDUITS FREE FROM FIRE DAMAGE

Addressees

For Action:

All holders of operating licenses for nuclear power reactors.

For Information:

All holders of construction permits for nuclear power reactors.

Purpose

This bulletin notifies you of failures in fire endurance testing associated with the Thermo-Lag 330 fire barrier system that is installed to protect safe shutdown capability, requests all operating reactor licensees to take the recommended actions, and requires that these licensees provide the U.S. Nuclear Regulatory Commission (NRC) with a written response describing the actions taken associated with this bulletin.

Background

On August 6, 1991, the NRC issued Information Notice (IN) 91-47, "Failure of Thermo-Lag Fire Barrier Material To Pass Fire Endurance Test," which provided information on the fire endurance tests performed by the Gulf States Utilities Company on Thermo-Lag 330 fire barrier systems installed on wide aluminum cable trays and the associated failures. On December 6, 1991, the NRC issued Information Notice 91-79, "Deficiencies In The Procedures For Installing Thermo-Lag Fire Barrier Material," which provided information on deficiencies in procedures that the vendor (Thermal Science, Inc.) provided for installing Thermo-Lag 330 fire barrier material. As a result of on-going concerns associated with the indeterminate qualifications of Thermo-Lag 330 fire barrier installations, on June 23, 1992, the NRC issued Information Notice 92-46, "Thermo-Lag Fire Barrier Material Special Review Team Final Report Findings, Current Fire Endurance Testing, and Ampacity Calculation Errors."

Description of Circumstances

Upon reviewing INs 91-47 and 91-79, Texas Utilities (TU) Electric instituted a fire endurance testing program to qualify its Thermo-Lag 330 electrical

raceway fire barrier systems for its Comanche Peak Steam Electric Station. The testing was performed during the weeks of June 15 and June 22, 1992.

TU Electric's test program consisted of a series of 1-hour fire endurance tests (using the ASTM-E119 Standard Time Temperature Curve) on a variety of cable tray and conduit "mock-ups." TU Electric designed these "mock-ups" or test articles to duplicate existing installed plant configurations. Plant personnel used stock material to construct the test articles. The Thermo-Lag fire barrier installation on the test articles was performed in accordance with TU Electric's Thermo-Lag installation procedures. These procedures were developed from the vendor's recommended installation procedures.

The Thermo-Lag fire barrier systems for the TU Electric test articles were constructed using pre-formed 1-hour Thermo-Lag 330 panels and conduit shapes. The joints and seams were constructed by pre-buttering seams and joints with trowel grade Thermo-Lag 330-1 and holding the assembly together with stainless steel banding.

On June 17, 1992, the first test article was tested. This article consisted of a junction box with a 3/4-, 1-, and 5-inch conduit entering and exiting through the junction box. Throughout the 1-hour fire endurance test, the cabling routed inside the conduits was monitored in accordance with the American Nuclear Insurer's criteria for low voltage circuit integrity and continuity. Throughout the test, none of the cables experienced a failure in circuit integrity. The licensee noted that the thermocouple temperature on the inside cover of the junction box on the unexposed side reached 539 °F and that hot spots (temperatures on the cable in excess of 500 °F) on the 3/4-inch conduit and the 1-inch conduit developed. On June 18, 1992, the cables were pulled from the test article. There were no visible signs of thermal degradation on the cables routed in the 5-inch conduit. The cable inside the 3/4-inch conduit was thermally damaged in two locations and cable in the 1-inch conduit was damaged in one location.

On June 18, 1992, TU Electric performed a 1-hour fire endurance test on a 12-inch wide tray configuration. Preliminary test result information indicated that the configuration passed the test satisfactorily. Throughout the fire endurance test, the thermocouple temperatures on the cables inside the test article were less than 325 °F.

On June 19, 1992, a 30-inch wide ladder back tray configuration was tested. At 17 minutes into the test, the Thermo-Lag 330 panel on the bottom of the test article began to sag. At 18 minutes, the joint at the interface between the tray support and the tray showed signs of weakening and separation. The internal temperatures within areas of the test article showed signs of exceeding 325 °F at 25 minutes. The joint fully separated in 41 minutes resulting in cable circuit integrity failure and fire damage to the cables.

Discussion

Section 50.48(a) of Title 10 of the Code of Federal Regulations (10 CFR 50.48(a)) requires that each operating nuclear power plant have a fire

protection plan that satisfies Appendix A to 10 CFR Part 50, General Design Criteria (GDC) 3, "Fire Protection." GDC 3 requires structures, systems, and components important to safety be designed and located to minimize, in a manner consistent with other safety requirements, the probability and effects of fires and explosions. In 10 CFR 50.48(b), the NRC states that Appendix R to 10 CFR Part 50 establishes fire protection features required to satisfy Criterion 3 of Appendix A to 10 CFR Part 50 for certain generic issues for nuclear power plants licensed to operate prior to January 1, 1979. Sections III.G, III.J, and III.O of Appendix R are applicable to nuclear power plants licensed to operate prior to January 1, 1979. In 10 CFR 50.48(e), the NRC requires that all plants licensed to operate after January 1, 1979, shall complete all fire protection modifications needed to satisfy Criterion 3 to Appendix A of 10 CFR Part 50 in accordance with the provisions of their operating licenses.

NRC-approved plant fire protection programs as referenced by the Plant Operating License Conditions and Appendix R to 10 CFR Part 50, Section III G.1.a, "Fire Protection of Safe Shutdown Capability," require one train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control stations to be free from fire damage.

To ensure that electrical cabling and components are free from fire damage, Section III G.2 of Appendix R requires the separation of safe shutdown trains by separation of cables and equipment and associated circuits of redundant trains by a fire barrier having a 3-hour rating or enclosure of cable and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition to providing the 1-hour barrier, fire detection and an automatic fire suppression system shall be installed in the fire area.

Under fire conditions, the thermal degradation of an electrical raceway fire barrier system, such as the Thermo-Lag system, could lead to both trains of safe shutdown systems being damaged by fire. This may significantly affect the plant's ability to achieve and maintain hot standby/shutdown conditions.

The NRC considered the failures of the recent Thermo-Lag fire barrier fire endurance testing and has determined that the 1- and 3-hour pre-formed assemblies installed on small conduit and wide cable trays (wider than 14 inches) do not provide the level of safety as required by NRC requirements.

Requested Actions

All holders of operating licenses for nuclear power reactors, immediately upon receiving this bulletin, are requested to take the following actions:

1. For those plants that use either 1- or 3-hour pre-formed Thermo-Lag 330 panels and conduit shapes, identify the areas of the plant which have Thermo-Lag 330 fire barrier material installed and determine the plant areas which use this material for protecting either small diameter conduit or wide trays (widths greater that 14 inches) that provide safe shutdown capability.

2. In those plant areas in which Thermo-Lag fire barriers are used to protect wide cable trays, small conduits, or both, the licensee should implement, in accordance with plant procedures, the appropriate compensatory measures, such as fire watches, consistent with those which would be implemented by either the plant technical specifications or the operating license for an inoperable fire barrier.

3. Each licensee, within 30 days of receiving this bulletin, is required to provide a written notification stating whether it has or does not have Thermo-Lag 330 fire barrier systems installed in its facilities. Each licensee who has installed Thermo-Lag 330 fire barriers is required to inform the NRC, in writing, whether it has taken the above actions and is required to describe the measures being taken to ensure or restore fire barrier operability.

Backfit Discussion

These types of fire barriers are currently installed at operating power reactor sites and are required to meet either a condition of a plant's operating license or the requirements of Section III.G of Appendix R to 10 CFR Part 50. The actions requested by this bulletin do not represent a new staff position but are considered necessary to bring licensees into compliance with existing NRC rules and regulations where these test results are relevant. Therefore, this bulletin is being issued as a compliance backfit under the terms of 50.109(a)(4). In addition, pursuant to the Charter of the Committee to Review Generic Requirements (CRGR), this bulletin is being issued as an immediately effective action (10 CFR 50.109(a)(6)). This bulletin is being issued with the knowledge of the CRGR.

Address the required written reports to the U. S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555, under oath or affirmation under the provisions of Section 182a, Atomic Energy Act of 1954, as amended and 10 CFR 50.54(f). In addition, submit a copy to the appropriate regional administrator.

This request is covered by Office of Management and Budget Clearance Number 3150-0012, which expires June 30, 1994. The estimated average number of burden hours is 60 person hours for each licensee response, including those needed to assess the new recommendations, search data sources, gather and analyze the data, and prepare the required letters. This estimate of the average number of burden hours pertains only to the identified response-related matters and does not include the time needed to implement the requested action. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Information and Records Management Branch, Division of Information Support Services, Office of Information Resources Management, U. S. Nuclear Regulatory Commission, Washington, D.C. 20555, and to the Paperwork Reduction Project (3150-0011), Office of Information and Regulatory Affairs, NEOB-3019, Office of Management and Budget, Washington, D.C. 20503.

Although no specific response is required with respect to the following information, the following information would assist the NRC in evaluating the cost of complying with this bulletin:

(1) the licensee staff's time and costs to perform requested inspections, corrective actions, and associated testing;

(2) the licensee staff's time and costs to prepare the requested reports and documentation;

(3) the additional short-term costs incurred to address the inspection findings such as the costs of the corrective actions or the costs of down time; and

(4) an estimate of the additional long-term costs that will be incurred as a result of implementing commitments such as the estimated costs of conducting future inspections or increased maintenance.

If you should have any questions about this matter, please contact one of the technical contacts listed below or the appropriate 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

Attachment:
List of Recently Issued NRC Bulletins

LIST OF RECENTLY ISSUED NRC BULLETINS

Bulletin No.	Subject	Date of Issuance	Issued to
91-01	Reporting Loss of Criticality Safety Controls	10/18/91	All fuel cycle and uranium fuel research and development licensees.
89-01, Supp. 2	Failure of Westinghouse Steam Generator Tube Mechanical Plugs	06/28/91	All holders of OLs or CPs for PWRs.
89-01, Supp. 1	Failure of Westinghouse Steam Generator Tube Mechanical Plugs	11/14/90	All holders of OLs or CPs for PWRs.
90-02	Loss of Thermal Margin Caused by Channel Box Bow	03/20/90	All holders of OLs or CPs for BWRs.
90-01	Loss of Fill-Oil in Transmitters Manufactured by Rosemount	03/09/90	All holders of OLs or CPs for nuclear power reactors.
89-03	Potential Loss of Required Shutdown Margin During Refueling Operations	11/21/89	All holders of OLs or CPs for PWRs.
88-10, Supp. 1	Nonconforming Molded-Case Circuit Breakers	08/03/89	All holders of OLs or CPs for nuclear power reactors.
89-02	Stress Corrosion Cracking of High-Hardness Type 410 Stainless Steel Internal Preloaded Bolting in Ahcnor Darling Model S350W Swing Check Valves or Valves of Similar Design	07/19/89	All holders of OLs or CPs for nuclear power reactors.
89-01	Failure of Westinghouse Steam Generator Tube Mechanical Plugs	05/15/89	All holders of OLs or CPs for PWRs.

OL = Operating License
CP = Constructon Permit