

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

October 27, 1995

NRC INFORMATION NOTICE 95-49: SEISMIC ADEQUACY OF THERMO-LAG PANELS

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 about two specific concerns related to the use of Thermo-Lag 330-1 fire barrier material: (1) actual properties of the mechanical material could be significantly different than the numerical values used (or provided) by the vendor to demonstrate the seismic adequacy of Thermo-Lag 330-1 panels and (2) the actual weights of the installed Thermo-Lag panels could be appreciably higher than the weights calculated from the minimum thickness. 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.

Description of Circumstances

A July 21, 1992, petition filed by the Nuclear Information and Resource Service (Accession Number 9208280125) raised a "seismic issue" regarding the Thermo-Lag fire barrier. In response, the staff studied the issue and concluded that the "shattering of raceways or severing of cables required for safe shutdown are not credible scenarios" (letter from T. Murley to M. Mariotte, February 1, 1993 [Accession Number 9302110146]) under postulated seismic events at nuclear power plant sites. The staff response was based on acceptance of the analyses performed by a consultant of Thermal Science, Incorporated (TSI). TSI, which manufactures and supplies Thermo-Lag fire barrier material, provided the consultant with the mechanical properties of Thermo-Lag.

On November 11, 1994, the Tennessee Valley Authority (TVA) submitted the results of simulated seismic tests and mechanical properties tests related to the use of Thermo-Lag fire barrier material at Watts Bar Nuclear Plant (Accession Number 9411250234). These tests indicated significantly lower mechanical properties values compared to those used by the TSI consultant.

During the staff review of the application for an operating license for Comanche Peak Steam Electrical Station, Unit 2, the issue of uncertainties in the weight of Thermo-Lag panels arose.

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Discussion

The regulations that address the need for fire protection at nuclear power plants, that is, 10 CFR Section 50.48; Part 50, Appendix A, General Design Criterion 3; and Part 50, Appendix R, do not explicitly require fire barriers to be seismically qualified (i.e., to maintain their integrity after postulated seismic events). However, provision C.2 of Regulatory Guide 1.29, "Seismic Design Classification," addresses the issue of seismic Category II versus seismic Category I. In that context, a fire barrier is considered to be seismic Category II. Based on these provisions, the fire barriers are allowed to undergo damage during the postulated seismic events. However, the fire barriers should not be damaged to such an extent that they could reduce the functioning of the protected cables or other safety-related structures, systems, or components.

Two specific issues are discussed in the following paragraphs:

Seismic Adequacy of Thermo-Lag Fire Barrier

The seismic adequacy of various configurations of Thermo-Lag panels attached to the raceways has been determined by static analyses of the configurations, which were subjected to simultaneous horizontal and vertical accelerations of up to 7.5g and 5.0g, respectively. The analyses were performed by a TSI consultant using the mechanical properties (i.e., tensile strength, shear strength, and corresponding moduli) at various temperatures provided by TSI. The consultant concluded that the panels and conduit wraps were seismically adequate. On the basis of its review of these analyses, the staff concluded that properly installed Thermo-Lag panels and conduit wraps would not undergo appreciable damage during the postulated seismic events at the nuclear reactor sites. Because of the nonductile nature of the material, Thermo-lag panels and conduit wraps might crack and crumble into small fragments or powder under a strong vibratory motion; however, they would not cause damage to the protected raceways or other safety-related components or equipment in the vicinity of the raceways.

The November 1994 TVA submittal provided the results of mechanical properties tests related to the use of Thermo-Lag fire barrier material at Watts Bar Nuclear Plant. A comparison showed that the TVA-tested mechanical properties values were considerably lower than those used by the TSI consultant [Accession Number 9208260065]. Enclosure 2, of the TVA submittal shows, for example, that the average tensile strength of the 1.59-cm-thick [5/8-in.] Thermo-Lag panel at 53 °C (127 °F) varies between 2.38 megapascals (Mpa) [345 pounds per square inch (psi)] and 3.36 Mpa (488 psi), while the TSI consultant used 4.96 Mpa (720 psi).

In December 1994, pursuant to 10 CFR 50.54(f), NRC sent followup letters to Generic Letter (GL) 92-08, "Thermo-Lag 330-1 Fire Barriers," to the licensees and construction permit holders that had used Thermo-Lag 330-1 fire barrier in their plants. These letters included a request for additional information and some background information. Item 1(9) requested information related to the mechanical properties of the Thermo-Lag material. A number of responses indicated that the licensees depended on the analyses performed by the TSI consultant.

Enclosure 1 of the November 1994 letter from TVA contains the results of the seismic testing performed by Wyle Laboratories of Huntsville, Alabama, for selected configurations of raceways with the Thermo-Lag panels installed. TVA sponsored the seismic tests and the mechanical properties tests to ensure (through shake-table testing and analyses) that Thermo-Lag will not adversely affect the safety performance of related equipment, for example, cables and cable trays. The staff review of the test results and of supplementary analyses performed by TVA indicates that the Thermo-Lag 330-1 fire barrier, when installed in accordance with the TVA installation procedure, will be able to withstand the postulated seismic events at the TVA Watts Bar plant without adverse effects on the safety-related systems and components.

Variation in Weight of the Fire Barrier Material

A review of the "as received" weights of Thermo-Lag 330-1 panels, prefabricated conduit sections, and 330-660 flexi-blanket fire barriers indicated that there could be a variation of as much as 45 percent in the unit weights of the fire barriers when calculated as a percentage of the weight associated with the thickest panel (maximum weight). The variation is primarily related to the variation in the thickness tolerances. For example, the thickness of a 1-hour-rated panel could vary between 1.27 cm [1/2 in.] and 1.91 cm [3/4 in.], thus indicating a variation of 33 percent. The remaining 12-percent variation could result from the variation in the density of the material. The weight of one layer of stress skin, staples, steel bands, and trowel-grade material (applied during the installation) can increase the average weight of a panel by about 10 percent. Depending on the method used by licensees in incorporating the weight of the Thermo-Lag fire barrier in seismic analysis of the raceways and their supports and anchorages, the effects of the variations could be nonconservative when the maximum unit weight of the fire barrier and its accessories (wire mesh, staples, bands) is higher than the nominal values considered in determining the loads on the raceways and their supports and anchorages.

Summary reports that are submitted to address the seismic adequacy of the electrical and mechanical equipment in accordance with GL 87-02 and Supplement 1 to GL 87-02, "Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors," dated February 19, 1987 and May 22, 1992, respectively, will be reviewed by the staff who will consider the effects of the fire barriers in assessing the integrated safety of the raceway systems and other equipment.

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.


Dennis M. Crutchfield, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Technical contact: Hans Ashar, NRR
(301) 415-2851

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95-46	Unplanned, Undetected Release of Radioactivity from the Exhaust Ventilation System of a Boiling Water Reactor	10/06/95	All holders of OLs or CPs for nuclear power reactors.
95-12, Supp. 1	Potentially Nonconforming Fasteners Supplied by A&G Engineering II, Inc.	10/05/95	All holders of OLs or CPs for nuclear power reactors.
95-45	American Power Service Falsification of American Society for Nondestructive Testing (ASNT) Certificates	10/04/95	All holders of OLs or CPs for nuclear power reactors.
95-44	Ensuring Compatible Use of Drive Cables Incorporating Industrial Nuclear Company Ball-Type Male Connectors	09/26/95	All Radiography Licensees.
95-43	Failure of the Bolt-Locking Device on the Reactor Coolant Pump Turning Vane	09/28/95	All holders of OLs or CPs for nuclear power reactors designed by Westinghouse Electric Corporation (W).
95-42	Commission Decision on the Resolution of Generic Issue 23, "Reactor Coolant Pump Seal Failure"	09/22/95	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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orig /s/'d by DMCrutchfield

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