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

May 28, 1993

NRC INFORMATION NOTICE 93-41: ONE HOUR FIRE ENDURANCE TEST RESULTS FOR THERMAL CERAMICS KAOWOOL, 3M COMPANY FS-195 AND 3M COMPANY INTERAM E-50 FIRE BARRIER SYSTEMS

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 alert addressees to the results of fire endurance tests for Thermal Ceramics Kaowool, Minnesota Mining and Manufacturing Company (3M Company) FS-195, and 3M Company Interam E-50 1-hour fire barrier systems reviewed by NRC inspectors during a reverification inspection. 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

In Generic Letter 92-08, "Thermo-Lag 330-1 Fire Barriers," the staff stated it would evaluate other known fire barrier materials and systems that are used by licensees to fulfill NRC fire protection requirements pursuant to Appendix R to 10 CFR Part 50 of the Code of Federal Regulations. The staff has started its review of fire barriers manufactured by vendors other than Thermal Science, Incorporated, to verify the capability of the fire barrier systems to adequately perform their 1-hour or 3-hour fire-resistive functions and to meet stated ampacity derating values.

A reverification inspection was conducted by NRC inspectors at the Salem Nuclear Generating Station, owned by Public Service Gas and Electric Company (the licensee), the week of May 17, 1993. NRC inspectors reviewed fire endurance test results for the electrical raceway fire barrier systems used by the licensee to separate safe shutdown functions within the same fire area. The systems used were Thermal Ceramics Kaowool, 3M Company FS-195 and 3M Company Interam E-50. The fire test results, as documented in the fire barrier qualification test reports, are discussed below and are summarized in the attached table.

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IDE R-11C (IE Information Notices)

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Kaowool Fire Barrier

Thermal Ceramics, Inc., was formerly the Insulating Products Division of Babcock and Wilcox, Inc., of Augusta, Georgia. The licensee fire endurance testing basis for Kaowool is a Babcock and Wilcox fire test report of October 24, 1978. According to the report, five specimens of the Kaowool barrier were tested on cable trays in a small-scale furnace. The maximum length of the 45.7 cm [18 inch] wide cable trays was 61 cm [24 inches]. Cable fill ranged from 33 percent to 35 percent. According to the report, the fire test acceptance criterion was circuit integrity. The tests were not conducted or controlled by an independent testing laboratory.

The test report stated that the circuit integrity in one circuit was lost at 1 hour and 1 minute. It also stated that cable temperatures exceeded 139 °C [250 °F] above ambient air temperature in about 22 minutes. At 60 minutes into the test, the cable temperature was about 426.5 °C [800 °F]. Hose stream tests were not performed. The results section of the test report stated that cables in all tests exhibited signs of fire damage, such as charring.

3M Company FS-195 Fire Barrier

The licensee fire endurance qualification testing basis for the 3M Company FS-195 fire barrier system is a 3M Company test report of October 31, 1980. Test acceptance criteria were not reported. The report stated that this was a small-scale test at the 3M test facility. The figure in the report showing the test specimen was conceptual and did not give dimensions. According to the figure, the fire barrier was constructed by placing a cable tray in a metal air duct with the tray support in the middle of the duct. The metal duct was covered with FS-195, there was an air space around the cable tray, and the tray contained 40 percent cable fill.

According to the test report, the metal duct temperature on the unexposed side of the fire barrier material exceeded 139 °C [250 °F] above ambient in about 30 minutes. At 60 minutes the temperature was 326.5 °C [620 °F]. The test specimen was not subjected to a hose stream test. The condition of the cables at the end of the test was not reported.

3M Company Interam E-50 Fire Barrier

The licensee fire endurance qualification testing basis for the 3M Company Interam E-50 fire barrier system is a Twin City Testing Corporation test report of September 1986. The fire test acceptance criterion was stated as circuit integrity as specified by American Nuclear Insurers.

According to the test report, the cable tray test specimen was a 61 cm [24 inch] wide aluminum cable tray installed in the test slab in a horseshoe configuration. The vertical drops into the furnace were 58.4 cm [23 inches], and the horizontal run was 86.4 cm [34 inches]. The tray configuration was divided into four segments. A vertical run of solid bottom tray was connected to a ladder-back 90° radial bend. This bend was connected to a solid bottom tray segment, which was connected to a vertical ladder-back tray segment. The

test specimen also included an air drop. One half of the tray had 14 percent cable fill. The other half had 40 percent cable fill. A second test specimen consisted of one 12.7 cm [5 inch] diameter steel conduit and one 12.7 cm [5 inch] diameter aluminum conduit and a 25.4 cm [10 inch] by 25.4 cm [10 inch] by 15.2 cm [6 inch] junction box.

The fire barrier installation procedures appended to the test report specified multiple installation methods. However, the fire barrier construction details and methods of fire barrier application for the test specimens were not documented in the test report.

The temperatures within the fire barrier and the condition of the cables at the end of the test were not reported.

As a result of the issues raised during the inspection, the licensee posted fire watches as compensatory measures in accordance with plant procedures.

Discussion

The staff is continuing its review of these fire barrier systems including a reassessment of any previous staff reviews of these systems. The staff previously requested additional information on Kaowool from Thermal Ceramics, Incorporated, in a letter of April 27, 1993, and on the 3M fire barrier systems from 3M Company in a letter of May 4, 1993. The staff will evaluate whether further generic communications are needed to address the issues discussed above.

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.

Brian K. Grimes, Director
Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

Technical contact: Pat Madden, NRR
301-504-2854

Attachments:
1. Summary of Test Results
2. List of Recently Issued Information Notices

Summary of Test Results

PARAMETER	KAOWOOL	FS-195[1]	INTERAM E-50
Scale of test	Small-scale	Small-scale	Small-scale
Test laboratory	Not independent	Not independent	Not independent, but witnessed by Twin City Testing Corp.
Hose stream test	Not performed	Not performed	Performed
Cable damage	Charred	Unknown	Unknown
Tested configuration	Not representative of in-plant configurations	Not representative of in-plant configurations	Not representative of in-plant configurations[2]
Maximum temperature at 1 hour[3]	~426.5 °C [~800 °F]	326.5 °C [620 °F]	Unknown
Comments	Accepted by NRC 11/20/1979	Accepted by NRC 3/18/1981	Installed in 1991; not submitted to NRC

[1] In a letter of May 18, 1993, to the NRC, the 3M Company stated that the FS-195 fire barrier system is used only at Salem.

[2] 3M Company provided additional test reports to the licensee on May 20, 1993. The licensee is evaluating the applicability of these test reports to the in-plant configurations.

[3] NRC acceptance criteria is 139 °C [250 °F] above ambient.

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
93-40	Fire Endurance Test Results for Thermal Ceramics FP-60 Fire Barrier Material	05/26/93	All holders of OLs or CPs for nuclear power reactors.
93-39	Radiation Beams from Power Reactor Biological Shields	05/25/93	All holders of OLs or CPs for nuclear power reactors.
93-38	Inadequate Testing of Engineered Safety Features Actuation System	05/24/93	All holders of OLs or CPs for nuclear power reactors.
93-37	Eyebolts with Indeterminate Properties Installed in Limitorque Valve Operator Housing Covers	05/19/93	All holders of OLs or CPs for nuclear power reactors.
93-36	Notifications, Reports, and Records of Misadministrations	05/07/93	All U.S. Nuclear Regulatory Commission medical licensees.
93-35	Insights from Common-Cause Failure Events	05/12/93	All holders of OLs or CPs for nuclear power plants (NPPs).
93-34, Supp. 1	Potential for Loss of Emergency Cooling Function Due to A Combination of Operational and Post-Loca Debris in Containment	05/06/93	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

test specimen also included an air drop. One half of the tray had 14 percent cable fill. The other half had 40 percent cable fill. A second test specimen consisted of one 12.7 cm [5 inch] diameter steel conduit and one 12.7 cm [5 inch] diameter aluminum conduit and a 25.4 cm [10 inch] by 25.4 cm [10 inch] by 15.2 cm [6 inch] junction box.

The fire barrier installation procedures appended to the test report specified multiple installation methods. However, the fire barrier construction details and methods of fire barrier application for the test specimens were not documented in the test report.

The temperatures within the fire barrier and the condition of the cables at the end of the test were not reported.

As a result of the issues raised during the inspection, the licensee posted fire watches as compensatory measures in accordance with plant procedures.

Discussion

The staff is continuing its review of these fire barrier systems including a reassessment of any previous staff reviews of these systems. The staff previously requested additional information on Kaowool from Thermal Ceramics, Incorporated, in a letter of April 27, 1993, and on the 3M fire barrier systems from 3M Company in a letter of May 4, 1993. The staff will evaluate whether further generic communications are needed to address the issues discussed above.

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Original signed by
Brian K. Grimes

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Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

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*SPLB:DSSA	*DD:DSSA	*D:DSSA	*SPLB:DSSA	*SPLB:DSSA	*Tech Ed.
CMcCracken	MVirgilio	AThadani	JHolmes	SWest	MMejac
5/27/93	5/27/93	5/27/93	5/27/93	5/27/93	5/27/93

*OGCB:DORS	D:DORS	
GMarcus	BGrimes	
5/27/93	5/28/93	

DOCUMENT NAME: 93-41.IN

The temperatures within the fire barrier and the condition of the cables at the end of the test were not reported.

The licensee opted to treat its fire barriers as indeterminate and posted fire watches as compensatory measures in accordance with plant procedures after discussing the reported fire test results with the NRC inspectors.

Discussion

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OGCB:DORS	D:DORS
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Originator: Jeff Holmes