

### UNITED STATES NUCLEAR REGULATORY COMMISSION WASHINGTON, D.C. 20055

August 21, 1992

MEMORANDUM FOR:

James M. Taylor Executive Director for Operations

FROM:

Thomas E. Murley, Director Office of Nuclear Reactor Regulation

SUBJECT:

PLANNED ACTIONS TO ADDRESS THE ISSUES FROM THE OFFICE OF INSPECTOR GENERAL'S REPORT ON THE MRC STAFF'S REVIEW AND ACCEPTANCE OF THERMO-LAG 330-1 FIRE BARPIER MATERIAL

In the August 17, 1992, memorandum to you, the Commission stated their belief that the staff should address the following issues raised in the subject report:

- the reasons the initial review process did not identify the problems with Thermo-Lag 330-1 and the causes of deficiencies in our response to later indications of problems that were brought to the Agency's attention
- whether the problems identified with respect to the initial review and the lack of follow-up to later indications of problems represent a systematic weakness with our review and response programs
- what corrective actions are necessary to rectify the deficiencies identified with respect to the review and response processes

The staff agrees with the Commission's determination and the need to address these issues. The staff will assess weaknesses in the initial review process and in the follow-up to later indications of problems. An assessment of these concerns related to the NRR Fire Protection Program is part of the action plan discussed below. It will be expanded to address the lessons learned from the Fire Protection Program review to other NRR programs and will include corrective actions for programmatic improvements where necessary. The assessment will utilize both headquarters and regional staff in the review of the programs, resources and expertise applied to fire protection. The implications for other programs will be addressed in a second phase. As a part of this activity, NRR management will receive periodic briefings on the progress of the assessment and on strengths and weaknesses identified to date. NRR expects to complete this assessment and identify any necessary corrective actions by Spring 1993. We will revise the action plan within the next 2 months to develop a more detailed plan and schedule for this assessment which specifically addresses the above three issues.

9209250288 920825 PDR COMMS NRCC CORRESPONDENCE PDR The staff reviewed the Inspector General's report and based on its preliminary assessment agrees with the Inspector General's technical and programmatic findings. From our perspective the following two broad areas need to be addressed:

Technical issues associated with the performance of the material as a tire barrier and the cable ampacity derating resulting from the use of this material on electrical raceway

Programmatic issues which indicate shallow reviews associated with these fire barrier systems, poor followup by the staff on past indication of inadequate Thermo-Lag fire barrier performance, and weakness of management involvement in the fire protection area.

Prior to receiving the Inspector Seneral's report, the staff developed a plan to resolve issues associated with qualification testing, design, and installation of Thermo-Lag fire barrier systems and to address programmatic shortcomings associated with prior staff reviews. Enclosure 1 is a copy of this Action Plan for your information. The plan's objective is the identification, tracking, and resolution of the issues associated with Thermo-Lag fire barrier systems and NRR's fire protection program. The plan is a living document which will be revised, as necessary, to incorporate additional issues that the staff may find in evaluating and reviewing the above issues and that may arise from testing. The staff will revise the plan in the next two months to incorporate the results of our in-depth review of the Inspector General's Report. Enclosure 2 is an overview of the plan, including an outline of the objectives and the scope of the assessment of the NRC's fire protection program and the implementation of the program.

The staff is taking actions in accordance with Agency procedures to issue the proposed Generic Letter (GL) 92-XX, "Thermo-Lag Fire Barriers" (Enclosure 3), which was issued for public comments. In this generic letter, the staff will require that licensees identify the fire endurance qualification criteria used for qualifying their Thermo-Lag applications, confirm that their Thermo-Lag fire barrier systems were constructed in accordance with the procedures used to construct the qualification test articles, and confirm that the ampacity derating factors used are consistent with the results of representative ampacity derating tests. We expect to complete Committee to Review Generic Requirements review and issue the proposed generic letter in the near future.

The staff has taken and continues to take steps to evaluate the adequacy of Thermo-Lag and to require utilities to evaluate the use of the material and take compensatory actions where appropriate. Such actions are our highest priority. The staff finds that the "defense-in-depth" aspects of the fire protection program, with the appropriate compensatory measures in place to compensate for the weaknesses found with the ability of certain Thermo-Lag fire barriers to endure fire, provide an adequate level of fire safety until the issues associated with these barriers can be resolved.

### August 21, 1992

The staff considers the relacive safety significance of other applications of Thermo-Lag for fire barriers (i.e., other than those addressed by Bulletin 92-Ol) to be low. The staff's basis for this determination is that the design and administrative controls of the defense-in-depth approach to fire protertion limit the combustibility and fire loadings within the plant. In an actual fire, the fire resistance of a barrier depends on the expected severity of the fire to which it may be exposed. Typical nuclear power plant fire loads associated with plant areas important to safe shutdown are considered low. During an actual fire, the temperature would rise more slowly than the rate specified in a fire endurance test. Althoug: the fire resistive ratings of certain Thermo-Lag fire barrier systems are considered indeterminate, the staff has evidence that the barriers will provide some level of fire protection. Most plant areas have other passive and active fire protection features installed as part of defense-in-depth to rapidly detect and suppress a fire if one were to occur.

The staff will first examine the specific actions identified by the Commission in the context of the fire protection program on the schedule for that activity detailed in the attached NRR action plan. After completing this effort, NRR will assess the broader aspects of the deficiencies in the review and response from a global perspective. This approach allows the staff to focus on specific deficiencies found in reviewing the fire protection program and allows for managers to participate appropriately in determining the broader programmatic needs.

Please contact me if you have any questions about our actions to resolve the technical issues or address the concerns discussed in the Inspector General's Report.

W.T. fursel for

Thomas E. Murley, Director Office of Nuclear Reactor Regulation

Enclosures:

- Action Plan, Resolution of Technical Issues Thermo-Lag Fire Barrier Designs and Installations, Revision 2, July 1, 1992
- 2. Overview of NRR Action Plan
- Draft Generic Letter 92-XX, "Thermo-Lag Fire Barriers," February 11, 1992

Enclosure 1

### REV. 2 (7/1/92)

### OFFICE OF NUCLEAR REACTOR REGULATION DIVISION OF SYSTEMS TECHNOLOGY RESOLUTION OF TECHNICAL ISSUES THERMO-LAG FIRE BARRIER DESIGNS AND INSTALLATIONS ACTION PLAN

### SCOPE:

This action plan will focus on resolving the technical issues relating to Thermal Science, Inc., Thermo-Lag 330 fire Earrier systems. The major part of the issues related to these systems were identified in the NRR Special Review Team Final Report, "The Review of Thermo-Lag Fire Barrier Performance," dated April 1992. In the review team's report, the following major technical findings associated with Thermo-Lag and it's acequacy to perform as a fire resistive barrier providing fire separation between safe shutdown trains were identified:

- The fire resistive ratings and the ampacity derating factors for the Thermo-Lag 330-1 fire barrier system are indeterminate;
- 2. Licensees may not have adequately reviewed and evaluated the fire endurance test results and the ampacity derating test results used in the licensing basis for their Thermo-Lag fire barrier applications to determine the validity and the applicability of these tests to their plant designs;
- 3. Licensees may not have adequately reviewed Thermo-Lag fire barrier applications installed in their plants to ensure that these installed configurations meat the NRC requirements and guidance (i.e., 10 CFR 50 Appendix R, Section III.G, Fire Protection of Safe Shutdown Capability, Generic Letter 86-10, Implementation of Fire Protection Requirements, April 24, 1986); and
- Licensees may have used inadequate or incomplete installation procedures during the construction of their Thermo-Lag fire barrier designs.

The implementation of this action plan will be performed in four parts. Part I will be a review and evaluation of the technical issues identified in the Special Review Team's Report. The technical issues will be coordinated with industry for resolution. In addition, during this part the NRC will evaluate and monitor industry's actions to resolve the fire barrier issues. NRC small and large scale fire testing of Thermo-Lag will be conducted during Part II. During Part III, Inspection Guidance will be developed. This guidance will assist the Regions in evaluating the adequacy of in-plant Thermo-Lag fire barrier configurations. In Part IV, the staff will evaluate the past NRC programmatic review and inspection process with regard to all aspects of the NRC fire protection program. The Deputy Director of DST has been directed to assess the past implementation practices and to determine how fire protection regulatory performance can be improved.

Attachment 1 to this Action Plan provides the current status of the technical issues identified in the NRR Special Review Team's February 11, 1992, and April 21, 1992, Final Reports, "The Review of Thermo-Lag Fire Barrier Performance." Throughout the implementation of the action plan, the NRC will issue Information Notices and/or Bulletins in response to new information developed in the review and testing process.

### SCHEDULE :

The various parts of this action plan will be performed concurrently. The following summarizes tentative milestone schedule dates associated with NRR's efforts to resolve the Thermo-Lag issues:

- Identification and coordination of the Thermo-Lag issues with industry (NUMARC) is anticipated to be completed by September 25, 1992.
- Resolution of these issues through coordination with NUMARC. If follow-up with industry fire testing is required, it is anticipated to be completed by March 26, 1993.
- Issuance of inspection guidance to the Regions for implementation is anticipated to be completed by November 27, 1992.
- Regional implementation of the fire barrier inspection guidance should be completed by August 28, 1993.
- Resolution of the issues identified by the inspection process will be handled on a schedule consistent with the issues level of safety significance.
- NRC small scale fire test (NIST contractor) is anticipated to be completed by September 4, 1992.
- NRC independent fire test program (contractor Sandia National Labs) completion date is projected for March 8, 1993.
- DST general assessment of NRC's approach towards assuring fire protection of safe shutdown capability at operating reactors is anticipated to be completed by December 31, 1992.

### RESOURCE 'JTILIZATION:

Currently, it is anticipated that it will take 7.0 NRC staff years to resolve the technical issues associated with Thermo-Lag. The following is a breakdown of the projected NRC resources required to obtain timely corrective actions:

Regional Resources - 3.0 staff years (Phase III) Inspection/documentation/enforcement

Keylon		0.8	starr	years	
Region	II	0.8	staff	years	
Region	111	0.8	staff	years	
Region	IV	0.3	staff	years	
Region	٧	0.3	staff	years	

DST Resources - 4.0 staff years

Problem identification and coordination with industry groups to obtain technical issue resolution - 0.5 staff year (Part I).

Evaluation of industry's resolution of Thermo-Lag fire barrier technical issues - 1.7 staff year (Part I).

Development and issuance of generic communication to the industry (e.g., Generic Letters, Bulletins, additional Information Notices) - 0.3 staff year (Part I).

Fire (large and small scale test) and ampacity derating test plan development, contract management program coordination, and technical oversight - 0.5 staff year (Fart II).

Develument, coordination, and issuance of fire barrier inspection guidance (temporary instruction) to the region -0.3 staff year (Part III).

Assistance to the Regions, resolving inspection issues, and providing enforcement guidance - 0.5 staff year (Part III).

Coordination and assistance to OI and OIG on additional technical issues - 0.6 staff year.

Project update briefings to NRC management, management planning, and management oversight - 0.2 staff year.

General assessment of NRC fire protection inspection/review program - 0.3 staff years (Part IV).

### TECHNICAL ASSISTANCE SUPPORT

Estimated costs associated with contractor assistance - Total \$950K

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- Additional \$100k (NIST assistance with the development of the NRC's testing program and assistance with the analysis of industry's fire testing program and results)
- \$850K Sandia coordinate and conduct of the NRC's testing program (3 - large scale fire endurance and 1 - ampacity test).

PART I IDENTIFICATION OF THERMO-LAG FIRE BARRIER ISSUES, COORDINATION, AND RESOLUTION OF TECHNICAL ISSUES WITH INDUSTRY

1. Objective

The objective of this part is to coordinate the issues identified in Attachment 2 with industry (NUMARC), monitor and review industry's actions, and assure that these actions adequately resolve the technical issues associated with Thermo-Lag fire barrier performance.

2. Staff Resources

Estimated staff resources to complete Part I - 2.5 staff years.

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3. Completion Schedule

Anticipated completion of Part I activities are currently scheduled for March 26, 1993.

4. Technical Assistance

Estimated costs associated with contractor assistance - arditional \$50k (NIST assistance with the analysis of Industry's fire testing program).

 Overview of Part ! Activities (See Attachment 4 - Timeline Schedule)

> Advise industry of the staff's concerns regarding Thermo-Lag fire barriers through a public meeting with the Nuclear Utilities Management and Resources Council (NUMARC). Encourage NUMARC to coordinate a response that verifies the fire resistance rating of the Thermo-Lag fire barrier configurations installed by the licensees to meet the NRC's requirements and the ampacity derating factors for those configurations.

Issue the Generic Letter that discusses the concerns and requires the licensees to provide assurances that they are in compliance with 10 CFR 50.48, GDC 3, and GDC 17.

As required, disseminate additional information pertaining to the resolution of major Thermo-Lag fire barrier issues through the issuance of Informatica Notices to the industry.

Coordinate with NUMARC on the resolution of the technical issues identified in Attachment 2. (Note - In order to resolve some of the technical issues involved with plant Thermo-Lag fire barrier configurations additional fire andurance testing by injustry is likely to be required. NRC's offorts associated with industry fire testing will be performed as a part of this effort).

Perform the necessary review and oversight of NUMARC activities associated with the resolution of Thermo-Lag technical issues.

If new tests are needed to verify the fire ratings and the ampacity derating factors, provide staff oversight of the industry's test program and review the NUMARC's corrective action plans for esolving the fire barrier design, evaluation, and installation issues.

Review licensee's responses to the Generic Letter.

### PART II NRC TESTING OF THERMO-LAG 330-1 FIRE BARRIER MATERIAL

1. Objective

The objective of this part is to determine the fire endurance performance and the cable ampacity derating associated with Thermo-Lag 330 by conducting small and large scale fire exposure and ampacity experiments. Through the information and data gained by these experiments, insights should be gained to assist in the closure of the technical issue. identified in Attachment 3.

Staff Resources

Part II staff resources required - 0.5 staff year.

3. Completion Schedule

Anticipated completion of Part II activities is currently scheduled for March 8, 1993.

4. Technical Assistance

Estimated costs associated with contractor assistance -

\$850K Sandia - coordinate and conduct of the NRC's testing program (3 - large scale fire endurance and 1 - ampacity test).

\$50K additional to NIST to assist the staff in the development of the test program which will support the NRC'r investigative and technical needs.

 Ov rview of Part II Activities (see Attachment 4 - Timeline Schedule)

> Develop, conduct, and document the results of a small and large scale fire endurance test program. The small scale test program will evaluate the thermal/fire endurance performance of Thermo-Lag 1 and 3 hour panel material. The large scale testing program will duplicate general installation configurations and conditions bounded by previous indeterminate fire test results. This test program will test three configurations. These configurations will be fabricated by qualified/trained installers using the vendor's recommended installation procedure (TSI Technical Note 20684, Revision V, November 1985). The ability of these configurations, when subjected to an ASTM E-11S fire test, to maintain the cabling free from fire damage will be assessed.

Devency, conduct, and document a test program to determine the ampacity derating caused by installing Thermo-Lag material on electrical raceway.

Formally advise other government agencies and foreign nuclear industries of the staff's findings.

# PART III DEVELOPMENT AND IMPLEMENTATION OF A COMPREHENSIVE FIRE BARRIER INSPECTION PROGRAM

1. Objective

The objective of this part of the action plan is to develop Thermo-Lag fire barrier system inspection guidance which verifies that licensees are taking the appropriate actions to assure compliance with the regulation and, through the Regions, implement this guidance.

### 2. Staff Resources

DST resources to develop the Temporary Instruction (TI)- 0.3 staff year (TI development to incorporate staff input from all regions).

Regional resources to implement and document the TI - 3.0 staff years.

DST resources required to assist in the resolution of the technical issues identified through the implementation of the TI - 0.5 staff year.

4. Completion Schedule

Anticipated completion of Part III activities is currently scheduled for November 26, 1993.

 Overview of Part III Activities (see Attachment 4 - Timeline Schedule)

Develop and issue a Temporary Instruction (TI) to the Regions for implementation.

Regions, using resources having a background in fire protection and fire endurance testing methods, implement the TI.

Through the implementation of the TI the Regions will take the appropriate actions to resolve the issues identified (e.g., enforcement, request technical assistance from NRR).

The staff will assist the Regions, as necessary, with the resolution of the issues identified through the implementation of the proposed TI. In addition, the staff will provide technical guidance to the Region with regard to enforcement issues identified during the implementation of the TI.

Through the implementation of the TI and/or recessary regional inspection follow-up, resolution of the following technical issues should be achieved:

Site Specific Issues identified at River Bend, Comanche Peak, WNP2, Perry, Callaway, San Onofre, Waterford (Issue 6.0).

Adequacy of utility's receipt inspection of Thermo-Lag (Issue 3.6).

### PART IV DST ASSESSMENT OF NRC'S FIRE PROTECTION PROGRAM

1. Objective

The objective of this assessment is to determine if the NRC fire protection program is assuring that the program has appropriately addressed the safety issues and that licensees are maintaining compliance with the requirements. The assessment will also identify strengths and weaknesses of the program, as well as, recommendations for improvement. A addition, DST will evaluate NRC fire protection program resou ces, review process, and the

### inspection program.

2. Staff Resources

The assessment will be led by the Deputy Director, DST. Resources required to provide support responsible for assessing the NRC's fire protection program - 0.3 staff year.

Coordination and Contacts

As part of the assessment, information will be solicited from the NRC Regional Offices and from NUMARC, reactor licensees and fire protection specialists and organizations, as needed. The Region I Director of Reactor Safety has indicated his interest in supporting this effort.

Completion Schedule

Anticipated completion of Part IV activities, including a report on the assessment findings and recommendations, is January 31, 1993.

5. Over iew of Part IV Activities

The Deputy Director, DST will assess the fire protection review and inspection programs to determine if adjustments are needed.

The scope of the review will include:

- Perform a preliminary review of fire protection program to determine where problems or weaknesses exist.
- The assessment will focus on those areas where problems appear to exist.
- Determine the overall safety significance of fire protection at nuclear power plants and the most safety significant issues through discussions with fire protection experts and through a review of available information in: operating experience reports, PRA's, and previous studies.
- Determine if the NRC fire protection program has focused ts attention and resources on the most safety significant (usues.
- Determine if the <u>scope and depth of review</u> in the fire protection area are appropriate considering the relative safety significance when compared to those in other areas such as the review of ECCS. Service Water Systems, or HVAC.

- Determine if the NRC resource allocations in the fire protection area are appropriate considering the relative safety significance when compared to those in other areas such as the review of ECCS, Service Water Systems, or HVAC.
- Determine if the NRC inspection program resources in the fire protection area are appropriate considering the relative safety significance when compared to the resources allocated to other areas such as the review of ECCS, Service Water Systems, or HVAC.
- Determine it the staff and contractor experience and <u>expertise</u> in the fire protection area are appropriate considering the relative safety significance when compared to those in other areas such as the review of ECCS, Service Water Systems, or NVAC.

### ATTACHMENT 1

### THERMO-LAG FIRE BARRIER PERFORMANCE STATUS OF FINAL REPORT TECHNICAL ISSUES

The following is a summary of the status and the anticipated actions required to resolve the technical issues identified by the NRR Special Review Team's February 11 and April 21, 1992, Final Reports:

a. Ampacity Derating Testing and Factors Used (Issue 1.1)

### Anticipated Action

NRC expects NUMARC to sponsor ampacity testing of the material using a recognized testing procedure. Staff to review the test program prior to the test and will perform an analysis of the sould upon completion of industry testing.

b. Fire Test Acceptance Criteria (Issue 2.1)

### Anticipated Action

NRC to establish staff position with NUMARC regarding fire testing acceptance criteria during the review of NUMARC's fire endurance testing program. NIST to perform an analysis of UL, ANI, and ASTM fire testing standards against the guidance provided in GL 86-10. NIST will assist the staff in evaluating industry's (NUMARC) test program and the placement of thermocouples on the test specimens.

c. Extrapolation of Fire Test Results (Issue 2.4)

# Anticipated Action

NRC expects NUMARC to conduct testing of the Thermo-Lag material using various (small and large) configurations. Have NIST provide technical assistance with the extrapolation of industry test data.

d. Impact of Optional Products (e.g., Topcoat) Applied to Thermo-Lag on Fire Resistive Rating (Issue 2.6.)

### Anticipated Action

NRC expects NUMARC to coordinate fire endurance testing of configurations with these materials. The staff will interact with NUMARC to ensure optional products are incorporated into the test program.

e. Thickness of Material Actually Fire Tested (Issue 2.7)

### Anticipated Action

Determine, by testing, the impact of thickness differences using panels typical of those installed.

f. Review and Analysis of Fire Test Failures (Issue 2.8)

### Anticipated Action

Review, with NIST's assistance, industry's (NUMARC) analysis of the indeterminate fire test results associated with the ITL fire test reports. Resolution of the indeterminate fire test results can be accomplished through a comprehensive fire test program. The staff, with NIST's assistance, will coordinate with NUMARC to ensure that the fire testing issues are resolved by this program.

g. Validity and Analysis of ITL Fire Test Reports (Issue 2.9)

### Anticipated Action

Conduct testing of the material to verify the fire rating of Thermo-Lag (See Phase II, item f).

h. Deviations and Changes Installation Procedures/Methods (Issue 3.1)

### Anticipated Action

Information Notice 91-1J was issued to discuss the installation problems. The proposed generic letter will require licensees to verify their installation against the vendor recommendations and their design basis tests reports.

i. Level of Quality Control Applied During Construction (Issue 3.3)

### Anticipated Action

Conduct testing of the barriers to determine acceptable configurations (See Phase II, item f).

j. Adequacy of Thermo-Lag to be an Adequate Fire Barrier (e.g., fire wall, fire barrier equipment enclosure, penetration seal) (Issue 5.1)

### Anticipated Action

Conduct a fire test of the Thermo-Lag material. If the material fails the test, further review of this issue may be necessary.

k. Acceptability of Using of Stainless Steel Stress Skin (Issue 5.5)

### Anticipated Action

Review industry's (NUMARC) fire qualification testing program and verify that the use of stainless steel stress skin is incorporated into the program.

1.

Impact the Use of Thermo-Lag Installation: May Have on Electrical Raceway Seismic Design Basis (Issue 5.6)

### Anticipated Action

NUMARC to coc dinate the review of TSI calculation, and several sample licensee calculations, and determine if the calculations and assumptions are valid. The staff will review NUMARC's assessment of TSI's calculations.

### ATTACHMENT 2

## THERMO-LAG FIRE BARRIER TECHNICAL ISSUES BEING COORDINATED WITH INDUSTRY

The following summarizes the Thermo-Lag issues being coordinated with Industry (NUMARC) for resolution:

Ampacity Derating Testing and Factors Used (Issue 1.1)

Fire Test Acceptance Criteria (Issue 2.1)

Extrapolation of Fire Test Results (Issue 2.4)

.mpact of Optional Products (e.g., Topcoat) Applied to Thermo-Lag on Fire Resistive Rating (Issue 2.6.)

Thickness of Material Actually Fire Tested (Issue 2.7)

Review and Analysis of Fire Test Failures (Issue 2.8)

Validity and Analysis of ITL Fire Test Reports (Issue 2.9)

Deviations and Changes Installation Procedures/Methods (Issue 3.1)

Level of Quality Control Applied During Construction (Issue 3.3)

Adequacy of the Training provided to Installers (Issue 3.4)

Adequacy of Utility's Receipt Inspection of Thermo-Lag (Issue 3.6)

Adequacy of Thermo-Lag to be an Adequate Fire Barrier (e.g., fire wall, fire barrier equipment enclosure, penetration seal) (Issue 5.1)

Acceptability of Using of Stainless Steel Stress Skin (Issue 5.5)

Impact the Use Thermo-Lag Installations May Have on Electrical Raceway Seismic Design Basis (Issue 5.6)

### ATTACHMENT 3

### THERMO-LAG FIRE BARRIER PERFORMANCE ISSUES BEING EVALUATED BY FIRE/AMPACITY EXPERIMENTS

Information gained through the implementation of the NRC's testing program will provide technical insights to the staff which will assist in the closure of the following issues:

Ampacity Derating Testing and Factors Used (Issue 1.1) Falsification of Ampacity Test Results (Issue 1.2) Fire Test Acceptance Criteria (Issue 2.1) Flaming of Thermo-Lag (Issue 2.3) Extrapolation of Tes', Results (Issue 2.4) Testing Configuration Variables (Issue 2.5) Optional Products (Issue 2.6) Thickness Tested (Issue 2.7) Fire Test Failures (Issue 2.8) ITL Test Reports (Issue 2.9) Time-Temperature Curve (Issue 2.10) Falsification of Test Results (Issue 2.11) Installation Procedure Changes (Issue 3.1) Joint Installation Method (Issue 3.2) Quality Control During Construction (Issue 3.3) Adequacy of the Training provided to Installers (Issue 3.4) CLOSED Toxicity of Off-Gases from Burning Thermo-Lag (Issue 4.1) Physical Problems with Installers (Issue 4.2) CLOSED Chloride Content (Issue 5.3)

ATTACHMENT 4 THERMO-LAG ACTION PLAN TIMELINES

# PART I - RESOLUTION OF TECHNICAL ISSUES THERMO-LAG

#### TECHNICAL ISSUES TO BE CONSIDERED WITH INDUSTRY

Ampacity Derating Testing and Factors Used (Issue 1.1)

Fire Test Acceptance Criteria (Issue 2.1)

Extrapolation of Fire Test Results (Issue 2.4)

Impact of Optional Products (e.g., Topcoal) Applied to Thermol Lag on File Resistive Rating (Issue 2.6)

Thickness of Material Actually Line Tested (Issue 2.7)

Review and Analysis of Fue Test Failures (Issue 2.8)

Validity and Analysis of (1) File Test Reports (Issue 2.9)

Deviations and Changes Installation Procedures/ Methods (Issue 3-1)

Level of Quality Control Applied During Construction (Issue 3.3)

Adequacy of the Training Provided to Installers (Issue 3.4)

Adequacy of (flighty's Receips Inspection to Thermol Lag (Issue 3.6)

Adequacy of Thermol Lag to be an Adequate Fire Barrier (e.g., i.e. well, fire barrier equipment enclosure, penetration seal) (Issue 5.1)

#/ ceptability of Using Stanless Steel Stress Skin (Issue 5.5)

Impact the Use Thermo-1 an Installations may Have on Electrical Raceway Seismic Pesign Basis (Issue 5.6)



(\*) As information becomes Available colormation Notices. Buffetins and Generic Letters May be Issued

# PART II - FIRE/AMPACITY TESTING



Note Shaded Areas" Indicate Completed Activities

#### TECHNICAL ISSUES TO BE CONSIDERED WITH INDUSTRY

Ampacity Derating Testing and Factors Used (Issue 1.1)

Falsification of Ampacity Test Results (Issue 1.2)

Fire Test Acceptance Criteria (Issue 2.1)

Harning of Thermol Lug (Issue 2.3)

Extrapolation of fire Test Results (Issue 2.4)

Testing Configuration Variables (Issue 2.5)

Optional Products (Issue 2.6)

Thickness Tested (Issue 2.7)

File Test Failures (Issue 2.8)

III five Tost Reports (Issue 2.9)

Time Temperature Curve (Issue 2.10)

Falsification of Test Results (Issue 2.11)

Installation Procedures Changes (Issue 3.1)

Joint Installation Method (Issue 3.2)

**Quality Control During Construction (Issue 3.3)** 

Adequacy of the Training Provided to Installers (Issue 3.4)

CLOSED Toxicity of OIF. Gases from Burning Thermo-Lag (Issue 4-1)

Physical Problems with Installers (Issue 4.2)

CLOSED chloride Content (Issue 5.3)



### ENCLOSURE 2

# OVERVIEW OF THE NRR ACTION PLAN

This action plan consists of four parts:

# Part 1 IDENTIFICATION OF THERMO-LAG FIRE BARRIER ISSUES, COORDINATION AND RESOLUTION OF TECHNICAL ISSUES WITH INDUSTRY

The major goals of this part of the action plan are to:

Advise the industry of the NRC's concerns with the t $\varepsilon$ chnical issues associated with raceway fire barrier systems

Issue the generic letter and supplements, if necessary, which require licensees to submit assurances that they are in compliance with 10 CFR 50.48, GDC 3 and GDC 17

Coordinate the resolution of the raceway fire barrier technical issues with industry

Perform the necessary reviews and oversight of industry activities associated with the resolution of the raceway fire barrier technical issues.

### Part II NRC TESTING OF THERMO-LAG 330-1 FIRE BARRIER MATERIAL

The major goals of this part of the action plan are to:

Develop, conduct, and document the results of a fire endurance testing program that includes both small and large scale tests of the Thermo-Lag 330 fire barrier

Develop, conduct, and document a test program to determine typical cable ampacity derating required fc<sup>--</sup> installing Thermo-Lag material on electrical raceways

Advise other government agencies and foreign nuclear industries of the staff's findings

### Part III <u>DEVELOPMENT AND IMPLEMENTATION OF A COMPREHENSIVE FIRE BARRIER</u> INSPECTION PROGRAM

The major objectives of the part of the action plan are to:

Develop a temporary instruction (TI) for inspecting raceway fire barrier systems and issue it to the regions for implementation

Evaluate and resolve technical issues found while implementating the TI.

# PART IV ASSESSMENT OF NRC'S FIRE GARRIER REGULATORY IMPLEMENTATION

Part IV of the plan focuses on performing an assessment of the past NRC programmatic review and inspection process. This assessment is scheduled to be completed by January 31, 1993.

The major objectives of this assessment are:

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Determine if the NRC fire protection program has addressed the safety issues and if licensee are maintaining compliance with the NRC's fire protection requirements

Identification of strengths and weaknesses of the NRC's fire protection program and recommend improvements

The overall scope of this assessment will focus on the following:

Determine the overall safety significance of the fire protection program and identify the most safety significant areas

Review the NRC's fire protection program to deterrine the scope and depth of the review performed by the staff and if the group, r has focussed on safety issues;

Evaluate the level of NRC resources allocated to the fire protection program and determine if they are appropriate

Evaluate the staff and its contractors experience and expertise and determine if they are appropriate.

# DRAFT GENERIC LETTER February 11, 1992

TO: ALL HOLDERS OF OPERATING LICENSES OR CONSTRUCTION PERMITS FOR NUCLEAR POWER REACTORS. SUBJECT: THERMO-LAG FIRE BARRIERS (GENERIC LETTER 92-XX)

### Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this generic letter to require licensees to provide information to verify that Thermo-Lag 330-1 fire barrier systems manue tured by Thermal Science, Incorporated (TSI, the vendor), St. Louis, Missouri, comply with the wRC's requirements.

The NRC reviewed Thermo-Lag 330-1 fire barrier systems after receiving reports from Gulf States Utilities (GSU) that these systems had failed qualification fire tests and had installation problems. The NRC reviewed fire endurance and ampacity derating test reports, installation procedures, and as-built configurations and identified the following concerns regarding Thermo-Lag fire barriers: test results that are incomplete or indeterminate, installations that are not constructed in accordance with the vendor's installation procedures, incomplete installation procedures, and as-built fire barrier configurations that may not be qualified by a valid fire endurance test or justified by an engineering analysis. The NRC is concerned that licensees may not be meeting the requirements of Section 50.48, "Fire protection," and General Design Criterion (GDC) 17,

"Electric power systems," of Appendix A, "General Design Criteria for Nuclear Power Plants," to Part 50 of Title 10 of the Code of Federal Regulations (10 CFR Part 50). The NRC is requiring information on compliance with 10 CFR 50.48, GDC 17, and associated license conditions under the provisions of 10 CFR 50.54(f).

-2-

# Qualification Requirements for Fire Barriers

Section 50.48 requires that each operating nuclear power plant have a fire protection plan that satisfies GDC 3, "Fire protection." GDC 3 requires that 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. Systems associated with achieving and maintaining safe shutdown conditions are of major importance to safety because damage to these systems can lead to core damage.

Fire protection features required to satisfy GDC 3 include features to ensure that one train of those systems necessary to achieve and maintain hot shutdown conditions be maintained free of fire damage.<sup>1</sup> One means of complying.with this requirement is to separate one safe shutdown train from its

'See Appendix R to 10 CFR Part 50, "Fire Frotection Program for Nuclear Power Facilities Operating Prior to January 1, 1979." GENERIC LETTER 92-XX -3redundant train with fire-rated barriers. The level of fire

resistance required of the barriers depends on the other fire protection features provided in the fire area.

The NRC provided guidance on acceptable methods of satisfying the regulatory requirements of GDC 3 in Branch Technical Position (BTF) Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants;" Appendix A to BTP APCSB 9.5-1; BTP Chemical Engineering Branch (CMEB) 9.5-1, "Fire Protection For Nuclear Power Plants," July 1981; and Generic Letter (GL) 86-10, "Implementation of Fire Protection Requirements," April 24, 1986. In the BTPs and GL 86-10, the staff stated that the fire resistance ratings of fire barriers should be established in accordance with National Fire Protection Association (NFFA) Standard 251, "Standard Methods of Fire Tests of Buildin . Construction and Materials," by subjecting a test specimen that represents the materials, workmanship, method of assembly, dimensions, and configuration for which a fire rating is desired to a "standard fire exposure" at a nationally recognized laboratory2. In GL 86-10, the staff also provided guidance on the acceptance criteria for fire tests and on evaluations of deviations from tested configurations.

<sup>&</sup>lt;sup>2</sup> American Society for Testing and Materials (ASTM) Standard E119 was adopted by the National Fire Protection Association (NFPA) 65 NFPA Standard 251.

GDC 17 requires that onsite electric power systems be provided to permit functioning of structures, systems and components important to safety. The onsite electrical power system is required to provide sufficient capacity and capability to ensure that vital functions are maintained. The Institute of Electrical and Electronics Engineers (IEEE) Standard 279, "Criteria for Protection Systems for Nuclear Power Generating Stations," provides guidance regarding acceptable methods of satisfying GDC 17. IEEE 27.) states that the quality of the protection system components shall be achieved by specifying requirements, such as for the derating of components.

### Areas of Concern

# Fire Endurance Testing and Application of Test Results

Many fire endurance tests have been conducted on electrical raceways protected with Thermo-Lag 330-1 fire barrier systems. Although many of the test reports document results that meet the NRC's temperature acceptance critericn discussed in GL 86-10, some test assemblies have failed, such as the assembly tested in October 1989 at the Southwest Research Institute (SwRI) and discussed in NRC Information Notice (IN) 91-47, "Failure of Thermo-Lag Fire Barrier Material to Pass Fire Endurance Test."

The NRC has reviewed approximately 40 1-hour and 3-hour fire

-4-

endurance test reports involving Thermo-Lag 330-1 fire barrier systems and has found that the test assemblies met the NRC's temperature acceptance criteria when the test article protective envelope was constructed by TSI personnel using TSI's installation procedures. However, the NRC has found other Thermo-Lag 330-1 fire barrier test assemblies that failed to meet the NRC's temperature acceptance criterion. In most cases, the test assemblies that failed were either constructed by the licensee's or contractor's qualified installers, or did not follow TSI's installation procedures. In the fire endurance test conducted in October 1969 at SwRI, the test article that failed was constructed by TSI-certified licensee personnel using TSI's installation procedures.

The NRC reviewed fire test reports from various testing facilities and found that testing methods and procedures used during some of the qualification tests did not meet the NRC's guidance. NFPA 251 advises that the test conditions should be evaluated carefully because variations from the construction or conditions that are tested may substantially change the performance characteristics of the assembly. The test reports reviewed did not contain sufficient details of the construction methods used for the test article, did not contain details of the materials used, did not contain dimensioned drawings, and documented test configurations that were atypical of as-built configurations.

-5-

In GL 86-10, the NRC provided guidance on deviations from tested fire barrier configurations. While reviewing the Thermo-Lag fire barriers, the NRC staff found several instances in which licensees installed fire barrier configurations that may not have been gualified by fire endurance testing or justified by engineering analysis. For example, when the NRC conducted its review, some licensees could not justify their practice of extrapolating test results from small barrier enclosures to significantly larger enclosures, or installing barriers using procedures and materials that were different from those tested. The NRC visited site after issuing IN 91-47, and also found several licensees that had constructed fire walls, partitions, and vaults using Thermo-Lag as a component. These licensees could not provide gualification tests or engineering analyses of deviations from tested configurations to demonstrate the accoptal.lity of these fire barriers.

# Ampacity Derating Design Basis

Cables enclosed in electrical raceways protected with fire barrier materials are derated because of the insulating effect of the fire barrier material. Other factors that affect ampacity derating include cable fill, cable loading, cable type, raceway construction, and ambient temperature. The National Electrical Code, Insulated Cable Engineers Association publications, and other industry standards provide general ampacity derating

- E -

factors, but do not consider the effects of passive fire barrier systems. Although a national standard ampacity derating test method has not been established, ampacity derating factors for raceways enclosed with fire barrier material have been determined by testing.

TSI has documented a wide range of ampacity derating factors that were determined by testing. For example, ISI provided test reports to licensees that document ampacity derating factors for cable trays that range from 7 percent to 28 percent for 1-hour barriers and from 16 percent to 31 percent for 3-hour barriers. On October 2, 1986, TSI informed its customers by Mailgram that, while conducting tests in September 1986, at the Underwriter Laboratories (UL) facilities, TSI found that the ampacity derating factors for Thermo-Lag barriers were greater than previous tests indicated. However, the test procedure and test configuration differed from previous tests, and the results from the different tests may not be comparable to each other. The NRC is concerned that licensees may be using nonconservative ampacity derating factors since the tested configurations may not represent as-built configurations. The NRC learned during its roview that testing conducted at SwRI found the ampacity derating as 37 percent for a 1-hour barrier.

# Deficiencies in the Installation and Inspection Procedures

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While conducting site visits after issuing IN 91-47, the NRC staff observed a number of installations that were not in accordance with TSI's installation procedures and some installations that did not appear to be qualified by fire endurance testing or an engineering analysis. In IN 91-79, "Deficiencies in the Procedures for Installing Thermo-Lag Fire Barrier Materials," the NRC staff discu sed installation problems resulting from TSI's incomplete installation procedures, licensees' inadequate installation procedures, installer errors, incomplete or incorrect design documents, and inadequate quality control oversight. In IN 91-79, the staff listed the installation details in which it found differences.

-8 m

### Actions Covered by this Generic Letter

The NRC's regulations require that safe shutdown equipment be protected from fire. The NRC has found qualification test failures, test results that are indeterminate, installation problems, and differences between reported ampacity derating factors. Therefore, the licensees should confirm that Thermo-Lag 330-1 fire barrier systems have been qualified by representative fire endurance and ampacity derating testing and that these qualified barriers have been installed with appropriate quality controls to ensure that they comply with the NRC's requirements.

Reporting Requirements

All addressees are required, pirsuant to Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR Section 50.54(f), to provide a written report within 120 days from the date of this generic letter. In this written report, the licensee shall:

- (1) State that it has identified all fire barriers using TSI's Thermo-Lag 330-1 to meet 10 CFR 50.48 or that it does not use Thermo-Lag 330-1 at the facility to meet this requirement.
- (2) State that it has qualified the Thermo-Lag 330-1 fire barriers by conducting a fire endurance test in accordance with NFPA 251 or in accordance with previous licensing commitments.
- (3) State that it has constructed the as-built Thermo-Lag 330-1 fire barriers in accordance with the procedures used to assemble the qualification test article and that the asbuilt fire barrier configuration represents the materials, workmanship, method of assembly, dimensions, and configuration of the qualification test assembly configuration or that the licensee has analyzed the deviations from the tested configuration.
- (4) State that the design basis for the ampacity derating

-9-

factors used for all raceways protected by Thermo-Lag 330-1 is consistent with the as-built configuration and that representative ampacity derating test results have been reviewed for applicability.

-10-

- (5) List any necessary corrective actions and a schedule for any deficiencies identified while conducting the actions described above and describe any compensatory measures taken in accordance with technical specifications or administrative controls.
- (6) List any Thermo-Lag 330-1 fire barriers that cannot be verified in accordance with reporting requirements (1) through (5), provide a justification for continued operation until such time as the identified barriers can be verified, and provide a schedule for completing the verifications.

The licensee should retain all documentation of any reviews performed to satisfy the reporting requirements for any future NRC audit.

If the addressee cannot provide the information required or meet the reporting deadlines, it shall include in the response a justification for alternative approaches and schedules. The NRC encourages licensees to work together to develop acceptable generic solutions to the problems addressed in this generic GENERIC LETTER 92-XX letter.

The written reports required shall be addressed to the U \*. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555 under oath or affirmation. A copy of the report shall also be submitted to the appropriate regional administrator.

## Backfit Diacussion

The NRC is requiring information that will enable the NRC staff to determine if licensees are complying with 10 CFR Section 50.48. The staff is not establishing a new position regarding compliance in this generic letter. Accordingly, this generic letter does not constitute a backfit. Thus, 10 CFR 50.109 does not apply, and no backfit analysis need be prepared.

# Request for Voluntary Submittal of Impact Data

This request is covered by Office of Management and Budget Clearance Number 3150-0011, which expires May 31, 1994. The estimated average number of burden hours is 200 person-hours for each addressee's response, including the time required to assess the requirements for information, search data sources, gather and analyze the data, and prepare the required letters. This estimated average number of burden hours pertains only to the

-11-

### GENERIC LETTER 92-XX -1\_-

identified response-reluted matters and does not include the time to implement the actions required to comply with the applicable regulations, license conditions, or commitments. Comments on the accuracy of this estimate and suggestions to reduce the burden may be directed to Ronald Minsk, Office of Information and Regulatory Affairs (3150-0011), NEOB-3019, Office of Management and Budget, Washington, D.C. 20503, and to the U.S. Nuclear Regulatory Commission, Information and Records Management Branch, Division of Information Support Services, Office of Information and Resources Management, Washington, D.C. 20555.

Although not required, the following information would assist the NRC in evaluating the cost of complying with this generic letter:

- 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 required reports and documentation
- (3) the additional short-term costs incurred as a result of the inspection findings such as the costs of the corrective actions or the costs of down time
- (4) an estimate of the additional long-term costs that will be

# GENERIC LETTER 92-XX -13-

incurred in the future to implement commitments such as the estimated costs of conducting future inspections or increased maintenance

If you have any questions about this matter, please contact one of the technical contacts or the lead project manager listed below.

Sincerely,

James G. Partlow Associate Director for Projects Office of Nuclear Reactor Regulation

Enclosure:

List of Recently Issued Generic Letters

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

Ralph Architzel, NRR 301-504-2804

Lead Project Manager:



### UNITED STATES NUCLEAR REGULATORY COMMISSION WASHINGTON, D. C. 20555

EDO Principal Correspondence Control

FROM:

DUE: 08/26/92

EDO CONTLUL: 0008004 DOC DT: 08/17/92 FINAL REPLY:

MOTORARY

Chairman Selin

TO:

James M. Taylor

FOR SIGNATURE OF:

Executive Director

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ROUTING:

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CRC NO:

INSPECTOR GENERAL'S INSPECTION OF THE NRC STAFF'S Taylor ACCEFTANCE AND REVIEW OF THERMO-LAG 330-1 FIRE Sniezek BARRIER MATERIAL - PROVIDE COMM PLAN & SCHEDULE TO Thompson ADDRESS ISSUES Blana

\*\* PRT \*\*

DATE: 05/18/92

ASSIGNED TO: CONTACT: NRR Murley

SPECIAL INSTRUCTIONS OR REMARKS:

Rec'd NRR: August 18, 19902 Action: DST / Thadanc

NRR Routing: Mariey Miragliż Bartow Russell Christengrild Biblespie NEL Mailroom

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