

THERMO-LAG ACTION PLAN

FIFTH QUARTERLY UPDATE

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Office of Nuclear Reactor Regulation
Plant Systems Branch
Special Projects Section

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THERMO-LAG ACTION PLAN

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EXECUTIVE SUMMARY

The Thermo-Lag Action Plan addresses the technical and programmatic issues related to the use of Thermo-Lag fire barriers by nuclear reactor licensees to satisfy U.S. Nuclear Regulatory Commission (NRC) requirements. This is the fifth quarterly update of the Thermo-Lag Action Plan.

SIGNIFICANT NRC STAFF ACTIONS DURING THE PAST QUARTER

- Finalized the staff position on fire test acceptance criteria, Generic Letter 86-10, Supplement 1 (Action Plan Part I).
- Observed NUMARC Phase 1 fire tests (Part I).
- Discussed with NUMARC the results of Phase 1 tests, plans for Phase 2 tests, and the industry application guidance (Part I).
- Initiated periodic NRC/NUMARC senior management meetings (Part I).
- Observed construction of NUMARC Phase 2 test specimens (Part I).
- Issued requests for additional information pursuant to 10 CFR 50.54(f) to licensees relying on the NUMARC test program (Part I).
- Briefed the Commission on the status of Thermo-Lag (Part V).
- Assessed and adjusted the current course of action (Part V).
- Briefed the Advisory Committee on Reactor Safeguards on the NUMARC test program (Part V).
- Completed a survey of fire protection requirements at foreign reactors (Part V).
- Briefed Congressional staff on the status of Thermo-Lag (Part V).

PLANNED ACTIONS

- Issue Generic Letter 86-10, Supplement 1 (Part I).
- Review licensee responses to the 50.54(f) letter (Part I).
- Continue the review of NUMARC test program which includes Phase 1 test reports, Phase 2 construction and fire endurance tests, and implementation guidance (Part I).
- Finalize the fire barrier inspection guidance and conduct fire barrier inspections (Part III).
- Reassess course of action at appropriate points and revise as needed to ensure timely resolution of the issues.

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INTRODUCTION

The Thermo-Lag Action Plan addresses resolving the technical and programmatic issues relating to Thermo-Lag 330 fire barrier systems supplied to the nuclear industry by Thermal Science, Incorporated. Many of the issues related to these systems were documented in the "Final Report of the Special Review Team for the Review of Thermo-Lag Fire Barrier Performance," of February 11, 1992, and April 1992. In its report of April 1992, the special review team concluded that:

- (1) The fire-resistive ratings and the ampacity derating factors for the Thermo-Lag 330-1 fire barrier system are indeterminate.
- (2) Some licensees have not adequately reviewed and evaluated the fire endurance test results and the ampacity derating test results used as the licensing basis for their Thermo-Lag fire barriers to determine the validity of the tests and the applicability of the test results to their plant designs.
- (3) Some licensees have not adequately reviewed the Thermo-Lag fire barriers installed in their plants to ensure that they meet NRC requirements and guidance, such as that provided in Generic Letter 86-10, "Implementation of Fire Protection Requirements," April 24, 1986.
- (4) Some licensees used inadequate or incomplete installation procedures during the construction of their Thermo-Lag fire barriers.

In addition, the Office of Inspector General (OIG), in its Inspection Report entitled, "Adequacy of NRC Staff's Acceptance and Review of Thermo-Lag 330-1 Fire Barrier Material," of August 12, 1992, found that the NRC staff did not conduct an adequate review of fire endurance and ampacity derating information concerning the ability of Thermo-Lag fire barrier material. The staff incorporated in the Thermo-Lag Action Plan tasks to address the following matters raised by the Commission in a memorandum of August 17, 1992:

- (1) The initial review process did not identify problems with Thermo-Lag 330-1, and deficiencies in the staff's response to later indications of problems existed.
- (2) Problems identified with respect to the initial review and the lack of follow-up to later indications of problems may represent a systematic weakness with the staff's review and response programs.

- (3) Corrective actions may be necessary to rectify deficiencies identified with respect to the review and response processes.

The Thermo-Lag Action Plan is divided into the following five parts:

- Part I Review and evaluate technical issues with industry coordination (as appropriate) and evaluate industry actions to resolve the fire barrier issues.
- Part II Sponsor small-scale fire tests to assess concerns with combustibility and fire performance.
- Part III Prepare inspection guidance and conduct inspections to evaluate the adequacy of in-plant fire barrier configurations. Resolve plant-specific issues.
- Part IV Assess the NRC programmatic review and inspection processes regarding various aspects of the NRC fire protection program.
- Part V Oversee action plan implementation, prepare status reports, respond to 10 CFR 2.206 petitions, respond to Congressional requests, and brief management.

A personal computer-based project management program is used to track and manage the Thermo-Lag Action Plan. The program tracks task details, schedules, milestones, and completion dates. The attachment to this action plan is a Gantt chart that identifies each task with its schedule and status. The Thermo-Lag Action Plan is revised as needed to add tasks that arise during the review, and to account for changing resources, work assignments, and priorities. Completion of the Thermo-Lag Action Plan within the stated schedules is dependent on the availability of resources.

A reassessment of the NRR reactor fire protection program was performed under Part IV of the Thermo-Lag Action Plan in response to the programmatic concerns raised during the initial review of Thermo-Lag fire barriers. The results of the reassessment were provided in the "Report on the Reassessment of the NRC Fire Protection Program" of February 27, 1993. This action completed Part IV of the action plan. The reassessment report contained a number of recommendations. Implementation of the recommendations is addressed in the Fire Protection Task Action Plan (FP-TAP) and the Equipment Qualification Task Action Plan (EQ-TAP).

PART I TECHNICAL ISSUES

Objective: To coordinate resolution of technical issues with the industry, to monitor and review industry actions, and to ensure that these actions adequately resolve the technical issues associated with the performance of Thermo-Lag fire barriers.

Scope: Resolve the technical issues identified by the special review team, by the OIG, and that arise during the course of

the review. Coordinate with the Nuclear Management and Resources Council (NUMARC) and individual licensees to resolve issues and resolve fire testing methodology and acceptance criteria through meetings, reviewing submittals, and observing fire endurance and ampacity derating tests.

Issue Generic Letter 92-08, "Thermo-Lag 330-1 Fire Barriers."

Prepare a staff position on fire endurance test acceptance criteria. Issue the position with Supplement 1 to Generic Letter 86-10, "Implementation of Fire Protection Requirements."

Issue Bulletins, Information Notices, other generic communications, and plant-specific communications as appropriate.

Review licensee responses to the generic and plant-specific communications.

Staff effort: 4.0 staff years.

Completion date: November 1994 (WITS 9200188).

Status: Started. Completion date and resources are unchanged.

During the past quarter, the staff continued its review of the industry Thermo-Lag test program proposed by NUMARC. The staff witnessed Phase 1 fire endurance tests, met with NUMARC to discuss the results of Phase 1 tests and plans for Phase 2 tests, audited construction of Phase 2 test specimens, initiated periodic senior management meetings with NUMARC, and met with the Advisory Committee on Reactor Safeguards (ACRS) to review the technical differences between the NRC staff and NUMARC on fire test methodology and acceptance criteria. ACRS played an important role in the NUMARC decision to install thermocouples in accordance with NRC staff recommendations. Questions about the plant-specific applicability of NUMARC test results are still under review. The staff also initiated a review of the NUMARC industry guide entitled, "Thermo-Lag 330-1 Combustibility Evaluation Methodology Plant Screening Guide," of October 12, 1993, as revised December 27, 1993. NIST is providing technical assistance.

In December, the staff issued a request for additional information pursuant to 10 CFR 50.54(f) to each licensee awaiting the results of the NUMARC test program. The letter requires additional information on the configurations and the amounts of Thermo-Lag installed in the plant, how the NUMARC test results will be applied, how configurations particular to the plant will be addressed, what alternatives

are available for configurations that may not demonstrate satisfactory performance by test or cannot be upgraded, and plans and schedules for resolving the technical issues identified in GL 92-08. Licensees are required to respond within 45 days of the date of the letter. The staff expects to complete its review and evaluation of the data and information submitted in response to the letters within 60 days of receipt of the licensees' responses. The staff will then reassess the Thermo-Lag Action Plan and will consider all practical alternatives that originate from the licensee responses and this reassessment. This action was discussed in detail in SECY-93-362, December 30, 1993.

The staff also (1) resolved the public comments received in response to its proposed position on fire endurance test acceptance criteria, (2) finalized the staff position, which will be issued with GL 86-10, Supplement 1 during the next quarter, and (3) conducted full-scale fire endurance and ampacity derating tests at Underwriters Laboratories, Inc. The staff plans to issue the results of these tests during the first quarter of 1994 in an information notice.

Several Part I tasks have been delayed, such as the NUMARC test program. However, as of yet, the delays have not impacted the overall Part I completion date of November 1994.

PART II NRC TESTING

Objective: To determine the combustibility of and assess the fire endurance performance of Thermo-Lag 330-1 fire barrier materials by conducting small-scale tests.

Scope: Develop, conduct, and document the results of the NRC test program

Staff effort: 0.8 staff year.

Completion date: September 1993 (WITS 9200189).

Status: Complete. (This completed WITS 9200189.)

The staff conducted combustibility tests of Thermo-Lag material and issued the results to industry by Information Notice 92-82. Further review of Thermo-Lag combustibility is included in the NUMARC test program (Part I). The staff will provide its final position on Thermo-Lag combustibility in GL 92-08, Supplement 1 (Part I).

The staff completed the small-scale Thermo-Lag fire test program at the National Institute of Standards and Technology (NIST). The results were published in Report of

Technology (NIST). The results were published in Report of Test FR 3991, "Pilot-scale Fire Endurance Tests of Subliming Fire Barrier Panels," January 6, 1993.

The review of fire barrier materials other than Thermo-Lag, is tracked in the FP-TAP.

PART III INSPECTION PROGRAM AND PLANT SPECIFIC ISSUES

Objective: To inspect in-plant fire barriers for compliance with NRC fire protection requirements and guidance and to resolve the plant specific issues identified by the NRR special review team and by the staff during its ongoing review of Thermo-Lag fire barriers.

Scope: Develop and issue a Temporary Instruction (TI) for fire barrier inspections.

Conduct inspection workshops for the regions.

Conduct fire barrier inspections (NRC regions) and assist the regions (NRR), as necessary, in resolving issues found during the inspections.

Coordinate with the regions and track plant-specific issues identified in the special review team final report of February 11, 1992, and other sources.

Staff effort: 8 staff years¹ as follows:

0.3 staff years by NRR to develop the TI.

7.0 staff years by the regions to conduct and document the fire barrier inspections.

0.7 staff years by NRR to assist in resolving inspections findings.

Completion date: December 1996 (WITS 9200190).

Status: Started. Completion date revised. Resources unchanged.

The TI was drafted and is currently undergoing internal NRR review. Several plant-specific actions, such as an evaluation of the use of Thermo-Lag for electrical separation at South Texas, were completed. In addition,

¹ Plant-specific issues and tasks are identified in Part III of the Thermo-Lag Action Plan to facilitate overall task management. Staff resources (NRR and regional) expended on these issues and tasks are charged to plant-specific TAC Numbers and inspection report numbers, but are not included in the action plan resources.

several plant-specific issues, such as the review of the TVA fire test program for Watts Bar and the review of Region IV questions concerning Cooper, were started.

Final completion of the Thermo-Lag Action Plan is driven by the completion of Part III. The Part III completion date is changed from May 1995 to December 1996. During the briefing on October 29, 1993, the staff informed the Commission that several factors, such as delays in the NUMARC test program, had delayed the previously reported completion schedule of May 1995. The revised schedule to resolve concerns with Thermo-Lag fire barriers or to propose alternative fire protection measures to be implemented to bring the plants into compliance with existing NRC fire protection requirements is March 31, 1994. Licensees should start plant modifications during refueling outages after March 1994, with the expectation that barriers will be upgraded by March 1996. Assuming that the NRC initiate fire barrier inspection at the plants after the licensees declare the barriers operable, as currently specified in Part III of the action plan, and that the inspections are conducted as each plant completes its barrier upgrades, the inspections could start as early as fall 1994 and be completed by 1996. Therefore, the revised overall completion schedule is December 1996. The staff reflected this revised schedule in Part III of the Thermo-Lag Action Plan.

As part of its continuing assessment of the Thermo-Lag Action Plan, the staff will conduct a series of inspections at a sampling of plants to assess licensee efforts to resolve the fire barrier issues. The results of these inspections would be used to determine whether or not each reactor unit should be inspected. This revised inspection approach could shorten the completion schedule without impairing plant safety.

PART IV ASSESSMENT OF NRC'S FIRE PROTECTION PROGRAM

Objective: To address the issues identified by the Commission and NRR during its review of the OIG report of August 12, 1992, and the programmatic issues identified in the Thermo-Lag Action Plan revision of July 1, 1992.

Staff effort: 0.5 staff year.

Status: Completed February 27, 1993, by report entitled "Reassessment of the NRC Fire Protection Program." Staff actions to assess and implement the report recommendation are documented in the FP-TAP.

PART V MANAGEMENT/OVERSIGHT

Objective: To keep NRC management informed of current issues, progress, and the status of resolving technical issues. To disseminate information to the industry and the public. To track, manage, and resolve miscellaneous tasks.

Scope: Track the resolution of tasks in the action plan, add new tasks as appropriate, and update status as necessary.

Update the Thermo-Lag Action Plan quarterly and provide to the Commission.

Respond to issues identified in 10 CFR 2.206 petitions and other correspondence from the public regarding Thermo-Lag fire barriers.

Prepare information and responses to Congress regarding Thermo-Lag and fire protection issues.

Prepare presentations and briefings as needed.

Staff effort: 4.5 staff years.

Completion date: December 1996.

Status: Started. Completion date revised. Resources unchanged.

During this quarter, the staff briefed the Commission, the Office of Public Affairs, and the Advisory Committee on Reactor Safeguards. The staff also performed a survey of fire protection requirements at foreign reactors in response to a Commission request.

As discussed under Part III, above, the staff has revised the completion dates for Part III to reflect the pace of work and expected progress. The completion of Part V is driven by the final completion of the action plan. Therefore, the completion date for Part V is also changed from May 1995 to December 1996.

STAFF RESOURCE REQUIREMENTS

The staff estimates that 17.8 staff years will be required to complete the Thermo-Lag Action Plan, which will consist of the following:

NRR Resources:	10.8 staff years
Part I	4.0 staff years
Part II	0.8 staff year
Part III	1.0 staff year
Part IV	0.5 staff year
Part V	4.5 staff years

Region Resources:	7.0 staff years
Region I	1.8 staff years
Region II	1.8 staff years
Region III	1.8 staff years
Region IV	0.8 staff year
Region V	0.8 staff year

Note: 0.2 staff year was transferred from Part II of this action plan to Part I of the FP-TAP for the review of fire barriers other than Thermo-Lag.

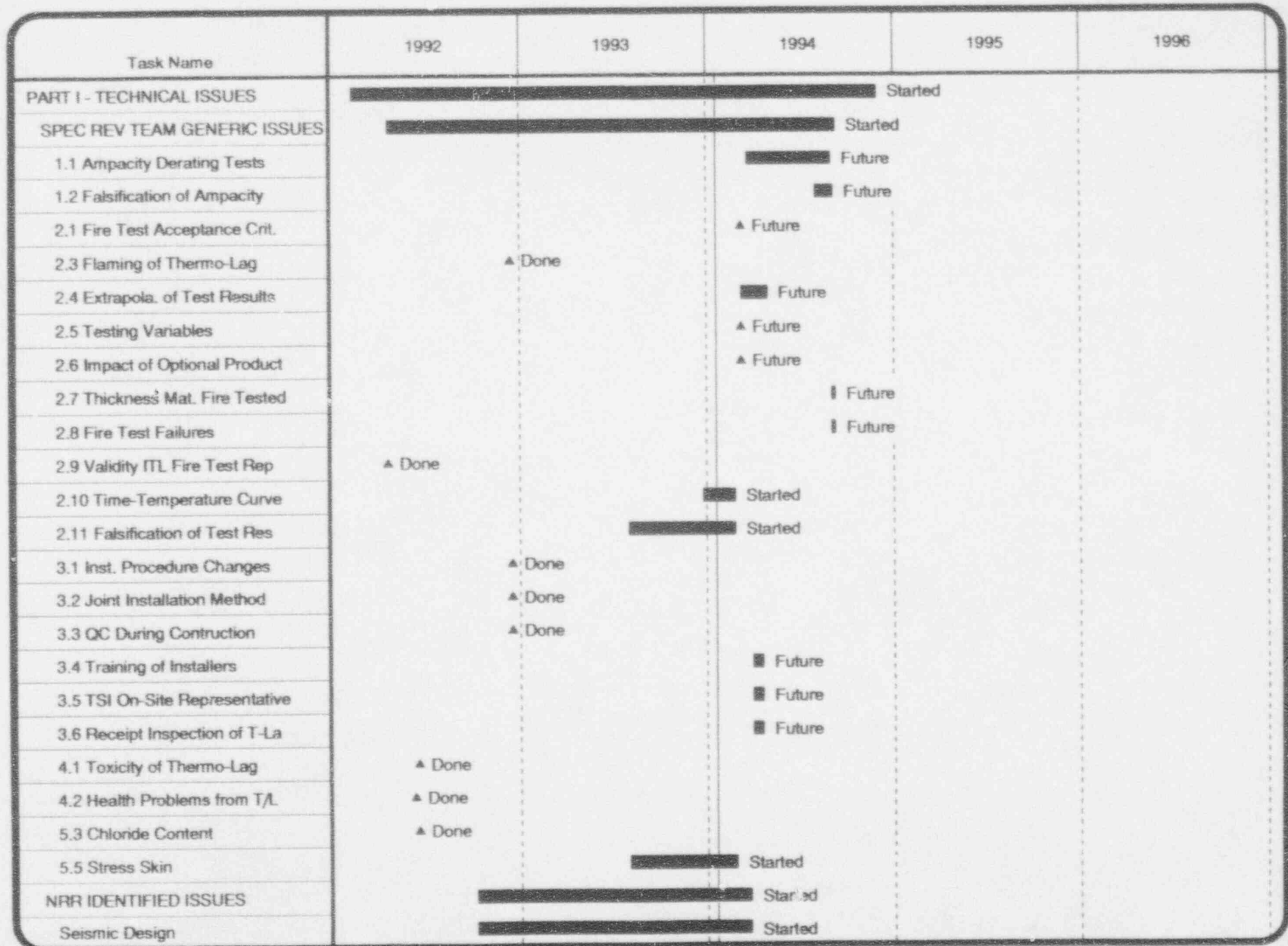
GANTT CHART

The attached Gantt chart depicts the tasks identified for resolving the issues associated with Thermo-Lag fire barriers and their status (future, started, or done). The bars indicate the scheduled duration for completing the associated task. The deltas (triangles) indicate zero duration tasks such as milestones or tasks that have not been assigned a specific duration.

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THERMO-LAG ACTION PLAN

Attachment



THERMO-LAG ACTION PLAN

Task Name	1992	1993	1994	1995	1996
OIG IDENTIFIED ISSUES		Started			
ITL Qualifications to Test			▲ Future		
10 CFR Part 21 Ampacity Issue		Started			
Notification of Other Util.		▲ Done			
CPSSES - Panel Thickness		Done			
Size of Tested Configurations			Future		
Density/Weight of Thermo-Lag		Started			
Hose Stream Test Methods		■ Done			
PROCESS OF RESOLVING ISSUES	Started				
Bulletin 92-01	■ Done				
Review Resps to Bulletin 92-01	■ Done				
Bulletin 92-01, Supplement 1	■ Done				
Review Resp. Bul. 92-01 Sup.1	■ Done				
Generic Letter 92-08	Started				
Issue Generic Letter 92-08	■ Done				
Review Responses to GL 92-08		Started			
50.54(f) Letters			■ Started		
Draft Bases for Issuing Letter			■ Done		
Draft Letter and RAI			■ Done		
Meet with CRGR			▲ Done		
Issue Letter to Licensees			Done		
Inform Commission			■ Done		
Inform Cong. Subcomm. GT 9565			■ Started		
Review Licensee Responses			■ Future		
Assess/Revise Action Plan - 2			■ Future		
Generic Letter 92-08, Supp 1			Started		

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Task Name	1992	1993	1994	1995	1996
Develop GL 92-08, Supp 1			Started		
Draft GL 92-08, Supp 1			Started		
CRGR Review				Future	
Resolve CRGR Comments				Future	
Public Comment Period				Future	
Address Public Comments				Future	
CRGR Review				Future	
Commission Paper				Future	
Commission Review				Future	
Issue GL 92-08, Supp 1				Future	
Fire Test Accept Criteria			Started		
Draft Proposed Staff Position	Done				
Internal Review & Mgt Approval	Done				
Meet with Vendors	Done				
CRGR Review		Done			
Resolve CRGR Comments		Done			
Public Comment Period		Done			
Address Public Comments		Done			
CRGR review			Started		
Commission Paper			Future		
Commission Review			Future		
Issue Criteria (GL 86-10, S1)			Future		
Ampacity Derating Issues			Started		
Review Prev. Ampacity Reports				Future	
Review UL Report				Future	
Review TSI Technical Note				Future	

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Task Name	1992	1993	1994	1995	1996
Review UL Repeat Test			■ Future		
Vendor Inspection of OPL		■ Done			
Review Ampacity Data on Cables			■ Started		
Assess Immediate Safety Issue	■ Started				
OIG Ampacity Issues		■ Started			
Review UL Ampacity Differences			■ Future		
Review Bid Document 618		■ Started			
Referral Of Ampacity Info.		■ Started			
IN 92-82, Combustibility	■ Done				
NUMARC PROGRAM		■ Started			
Combustibility Issue		■ Started			
Combustibility Tests at UL		■ Done			
Rev Combustibility Analysis		■ Started			
Phase I Fire Tests		■ Started			
Source Inspection		■ Done			
Review Test Plan		■ Done			
Test Specimen Construction		■ Done			
Fire Endurance Tests		■ Done			
Review Test Reports			■ Future		
Phase II Fire Tests			■ Started		
Review Test Plan			■ Future		
Test Specimen Construction			■ Started		
Fire Endurance Tests			■ Future		
Review Test Reports			■ Future		
Ampacity Derating Tests			■ Future		
Review Test Plan			■ Future		

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Task Name	1992	1993	1994	1995	1996
Test Specimen Construction			■ Future		
Ampacity Derating Tests			■ Future		
Review Ampacity Test Results			■ Future		
Industry Application Guide			■ Future		
Assess/Revise Action Plan - 3			■ Future		
NRC Full-Scale Tests		■ Started			
Develop Test Plan		■ Done			
Sandia Training		▲ Done			
Installer Training		▲ Done			
Construct Test Specimens		■ Done			
Conduct Tests		■ Done			
Prepare Test Report (Sandia)			■ Started		
Prepare Information Notice			■ Future		
NUMARC MEETINGS		■ Done			
NUMARC SUBMITTALS		■ Started			
Review 1st Draft Test Criteria		■ Done			
Review 2nd draft Test Criteria		■ Done			
Review Cable Functionality			■ Future		
PART II - NRC TEST PROGRAMS		■ Done			
PART III - NRC INSPECTION PROG	■ Started				
INSPECTION PROCEDURES		■ Started			
Draft Temporary Instruction		■ Started			
TI to Regions for Comments			■ Future		
Resolve Comments			■ Future		

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Task Name	1992	1993	1994	1995	1996
Issue Final TI				■ Future	
TI WORKSHOP				■ Future	
REGIONAL INSPECTIONS				■ Future	
RESOLVE INSPECTION ISSUES				■ Future	
PLANT SPECIFIC ISSUES	■ Started				
Region I	■ Started				
Susquehanna	■ Done				
Salem		■ Started			
3M Cable Tray Wrap Material		■ Started			
Region II	■ Started				
Watts Bar Nuclear	■ Started				
Test Program	■ Started				
Review TVA Test Program	■ Done				
Review TVA Criteria	■ Done				
Review TVA Test Results		■ Started			
Write SER		■ Started			
Region III	■ Started				
Callaway Plant	■ Started				
Fire Barrier Design Basis	■ Done				
Unqualified Fire Barriers		■ Started			
Installation Problems	■ Done				
Ampacity Derating	■ Done				
Vendor Information Program.		■ Started			
Perry Nuclear Power Plant	■ Started				
Fire Barrier Design Basis	■ Done				
Deviation From 18-inch Rule	■ Done				

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Task Name	1992	1993	1994	1995	1996
Receipt Inspection Procedures			Started		
Band Spacing	Done				
Split Conduit Barrier			Started		
Ampacity Derating	Done				
Fire Test Failure	▲ Done				
Region IV	Started				
Comanche Peak	Started				
Fire Barrier Design	Done				
Receipt Inspection- Panel Wgt.		▲ Done			
Installation Procedures	Done				
Installer Training			Started		
Fire Barrier Gap Widths			Started		
Unit 2 Test Program, Licensing	Started				
Review Test Program, Criteria	Done				
Review Fire Test Results	Done				
Review Ampacity Test Results			Started		
Prepare SSER 26 and 27		Done			
Prepare Safety Evaluation Rpt		Done			
Prepare Safety Evaluation			Started		
Voids and Delamination	Done				
Inspection	Done				
Cooper			Started		
TIA to Clarify Position			Started		
River Bend Station	Started				
Procurement Program Weakness	Done				
Unqualified Installations		Done			

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Task Name	1992	1993	1994	1995	1996
Fire Test Acceptance Criteria			▲ Future		
10 CFR 50.73 Reporting Reqmts	■ Done				
Installation Procedures	■ Done	■ Done			
Ampacity Derating	■ Done	■ Done			
Part 21 Reporting	▲ Done				
Unqualified 3-hour Barriers	■ Done	■ Done			
South Texas			■ Done		
Waterford	■ Done				
Region V		■ Started			
San Onofre		■ Done			
WNP2		■ Started			
Ampacity Derating	■ Done	■ Done			
Unqualified Installations		■ Done			
Receipt Inspections			■ Started		
3M/TSI Interface Test Failure	■ Done	■ Done			
Installation Problems	■ Done	■ Done			
Use of Failed Test-Susquehanna		▲ Done			
Fire Barrier Design Basis	■ Done	■ Done			
Installation Procedures	■ Done	■ Done			
PART IV - PROGRAM REASSESSMENT	■ Done				
PART V - PLAN MANAGEMENT	■ Started				
ACTION PLAN MAINTENANCE	■ Started				
ACTION PLAN TRACKING		■ Started			
Compl. Part I (WITS 9200188)				▲ Future	

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