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U.S. Nuclear Regulatory Commission  
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**SUSQUEHANNA STEAM ELECTRIC STATION  
RESPONSE TO THE FOLLOW-UP TO THE REQUEST  
FOR ADDITIONAL INFORMATION REGARDING GENERIC  
LETTER 92-08 ISSUED PURSUANT TO 10CFR50.54(f)  
PLA-4236**

**FILE R41-2**

Docket Nos. 50-387/NPF-14  
and 50-388/NPF-22

Dear Sir:

This letter is provided in response to your request for additional information regarding Generic Letter 92-08, "Thermo-Lag 330-1 Fire Barriers" dated September 23, 1994. This letter supplements the information provided to you in our previous response, PLA-4089, dated February 3, 1994. Where the information in this letter changes the information provided in PLA-4089, the revised information is provided. Where the response does not change, a reference to the appropriate section of PLA-4089 is provided.

**Introduction:**

Since our initial submittal responding to your request for information on Thermo-Lag fire barriers, additional information has become available and numerous changes have occurred. Some of the information and changes are the result of activities at the industry level, while others are a result of SSES plant unique actions.

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At the Industry level, the following has occurred:

- Phase 2 of the NEI sponsored Industry Test Program has been completed.
- The NEI Industry Applications Guide has been issued, reviewed by NRC and Industry, revised and reissued for use.
- The NRC Staff has informed the Commissioners, in SECY-94-127, of four options, including a recommended option, for resolving the technical issues related to Thermo-Lag Fire Barriers.
- The NRC Commissioners have provided direction to the NRC Staff, in the form of a Staff Requirements Memorandum, endorsing the Staff's recommended approach for resolving this issue.
- The NEI Fire Protection Working Group has finalized their Comprehensive Resolution Strategy for resolving the Thermo-Lag Fire Barrier Issue.
- The use of the NEI Industry Applications Guide has been demonstrated to the NRC and the Industry by four Pilot Utilities. Feedback on these demonstrations is currently being compiled.
- The quality of the Thermo-Lag 330-1 material supplied by Thermal Sciences Inc. over the course of time has come under question.

At the SSES Plant Unique level, the following has occurred:

- An Appendix R Design Basis Document has been prepared and issued for internal review.
- The SSES IPEEE Analysis, including the Fire Analysis, has been completed and submitted.
- Phase 1 Thermo-Lag Walkdowns, consisting of visual examinations and construction vintage determinations for Thermo-Lag Installations, has been completed.
- An assessment of our ability to eliminate the need for certain Thermo-Lag Fire barriers by revising our Appendix R Safe Shutdown Analysis is being finalized.
- An assessment of our ability to qualify installed Thermo-Lag Fire Barriers based on industry testing is being finalized.

- Presentations demonstrating the use of the NEI Industry Applications Guide for some representative SSES Installations have been prepared and given to the NRC and Utility Representatives.

The culmination of our evaluation of this set of information is a revised strategy, focused primarily on the elimination of unnecessary Thermo-Lag fire barriers, and a revised implementation schedule. The revised strategy relies heavily on a revision to our Appendix R Safe Shutdown Analysis. In general, we have determined that there is a high degree of conservatism built into our current safe shutdown analysis and that this extra conservatism has driven us to a heavy reliance on the use of raceway fire barriers, specifically Thermo-Lag (i.e. approximately 15,000 linear feet) at the station. Specifically, our analysis conservatively relies upon a very limited set of equipment to achieve and maintain safe shutdown. All other equipment is assumed lost. Large fire areas were assumed and the fire was assumed to spread throughout the fire area of origin. Also, a simultaneous loss of offsite power was assumed for all fire scenarios including those using normal plant systems operated from the main control room. Finally, no repairs were relied upon to reach and maintain cold shutdown.

This information, coupled with the Thermo-Lag material quality questions and the detailed information from our Phase I Walkdowns which highlight the difficulties associated with accessing and modifying our current installations, has lead us to the conclusion that Thermo-Lag elimination through reanalysis is the only realistic approach to resolving this issue.

Based upon our previous reanalysis experience during the 1985-1989 time frame, it is clear to us that the reanalysis effort to resolve the Thermo-Lag will ultimately extend the time needed to resolve this issue. Therefore a change to our previously committed schedule is submitted herewith in response to your Request VI.

**PP&L Responses to NRC Requests:**

The format of our response follows that provided in our previous submittal, PLA-4089, dated February 3, 1994. We have reiterated your requests and then followed the specific request with our response. Where our response is not changed from our initial response, we have provided a reference to that response. Where our response has changed, the revised information has been provided.

**NRC Request I.B.1**

Describe the Thermo-Lag 330-1 barriers installed in the plant to

- a. meet 10 CFR 50.48 or Appendix R to 10 CFR 50,
- b. support an exemption from Appendix R,
- c. achieve physical independence of electrical systems,
- d. meet a condition of the plant operating license.
- e. satisfy licensing commitments

The descriptions should include the following information: the intended purpose and fire rating of the barrier (for example, 3-hour fire barrier, 1-hour fire barrier, radiant energy heat shield), and the type and dimension of the barrier (for example, 8-ft by 10-ft wall, 4-ft by 3-ft by 2-ft equipment enclosure, 36-inch-wide cable tray, or 3-inch-diameter conduit).

**PP&L's Response:**

PP&L's response to NRC Request I.B.1 is the same as that provided in PLA-4089 dated February 3, 1994.

**NRC Request I.B.2**

For the total population of Thermo-Lag fire barriers described under Item I.B.1, submit an approximation of:

- a. For cable tray barriers: the total linear feet and square feet of 1-hour barriers and the total linear feet and square feet of 3-hour barriers.
- b. For conduit barriers: the total linear feet of 1-hour barriers and the total linear feet of 3-hour barriers.
- c. For all other barriers: the total square feet of 1-hour barriers and the total square feet of 3-hour barriers.
- d. For all other barriers and radiant energy heat shields: the total linear feet or square feet of 1-hour barriers and the total linear feet or square feet of 3-hour barriers, as appropriate for the barrier configuration or type.

**PP&L's Response:**

PP&L's response to NRC Request I.B.2 is the same as that provided in PLA-4089 dated February 3, 1994.

**NRC Request II.B.1.**

State whether you have obtained and verified each of the aforementioned parameters for each Thermo-Lag barrier installed in the plant. If not, discuss the parameters you have not obtained or verified. Retain detailed information on site for NRC audit where the aforementioned parameters are known.

**PP&L's Response:**

Destructive examinations have been performed on three straight-run sections of cable tray. External visual examinations have been performed on all accessible barriers. PP&L, however, has not verified each parameter for each Thermo-Lag barrier installed at Susquehanna SES.

As stated in the introduction to this letter; Thermo-Lag elimination through safe shutdown reanalysis is the primary focus of our resolution strategy. As a result of this, comprehensive destructive examinations will not be conducted until the Thermo-Lag elimination efforts have been completed and the final population of required fire barriers is determined.

At that time, destructive examinations will be performed on a sample of installations representative of the types of Thermo-Lag installations that exist in the population of required barriers. The examinations will consist of a determination of those parameters required to use the NEI Industry Applications Guide and any supporting engineering analysis in justifying the acceptability of the barriers.

**NRC Request II.B.2.**

For any parameter that is not known or has not been verified, describe how you will evaluate the in-plant barrier for acceptability.

**PP&L's Response:**

As discussed in II.B.1 above, destructive examinations will be performed on a sample of barriers representative of installed barriers. The intent of this examination will be to determine the construction details associated with the types of installations used in the population of required barriers. To the extent possible, the destructive examination sample will be selected from the population of barriers that the revised safe shutdown analysis has determined to be no longer required.

The information obtained from these destructive examinations will be combined with the results of documentation searches, review of engineering requirements and installer work practices supported by testimony, where appropriate, to determine all of those parameters that are not known and must be verified.

This information will be used in conjunction with the testing referenced in the NEI Industry Applications Guide and supporting engineering analysis to evaluate the acceptability of the required barriers.

**NRC Request II.B.3.**

To evaluate NUMARC's application guidance, an understanding of the types and extent of the unknown parameters is needed. Describe the type and the extent of the unknown parameters at plant in this context.

**PP&L's Response:**

As discussed in II.B.1 above, external visual examinations of accessible barriers has been performed. In addition, some limited destructive examinations have been performed on straight-run cable tray. The inspections performed to date have not examined the internal details of construction for any raceway type other than straight-run cable tray. Therefore, the internal details of construction for raceway other than straight-run cable tray are not known.

Based on the installation criteria specified for barriers at Susquehanna SES, however, we have a reasonable idea as to the expected details of construction. As discussed in II.B.1 and II.B.2 above, however, destructive examinations will be required to verify these details.

**NRC Request III.B.1.**

Describe the barriers discussed under item I.B.1 that you have determined will not be bounded by the NUMARC test program.

**PP&L's Response:**

Other than those barriers specifically itemized in our previous response, PP&L has not identified any additional barriers that will not be bounded by the NEI Test Program and the testing summarized in the NEI Industry Applications Guide.

Classification of installed barrier configurations into bounded and unbounded categories will be performed after completion of our revision to the Appendix R Safe Shutdown Analysis.

Based on the levels of conservatism identified in our current safe shutdown analysis, we expect that the reanalysis will eliminate a significant number of Thermo-Lag barriers.

For those barriers that are required, justification demonstrating acceptability will be provided.

This justification will be based upon fire test results supplemented with engineering evaluations of the differences between the installed and tested configurations, as well as, in some cases, the actual hazard to which the barrier will be exposed, rather than strictly on type testing.

In conclusion, it is our position that the industry test program conducted by NEI combined with the testing from other test programs conducted throughout the industry provides a substantial data base to aid in the plant-specific assessment of fire barrier configurations. When this base of test information is evaluated and used in combination with accepted engineering analysis techniques, we expect that the need for additional testing for the population of barriers remaining after completion of the revised Appendix R Safe Shutdown Analysis will be limited.

**NRC Request III.B.2.**

Describe the plant-specific corrective action program you expect to use to evaluate the fire barrier configurations particular to the plant. This description should include a discussion of the evaluations and tests being considered to resolve the fire barrier issues identified in GL 92-08 and to demonstrate the adequacy of existing in-plant barriers.

**PP&L's Response:**

The first step in our corrective action program for evaluating the fire barrier configurations at Susquehanna SES will be to revise our Appendix R Safe Shutdown Analysis to eliminate unnecessary conservatisms and Thermo-Lag barriers.

Upon completion of this step, we will attempt to justify the required and remaining barriers. This step will consist of the following:

- conducting destructive examinations to aid in the determination of the actual details of construction,
- evaluating the installed configurations for acceptability based on:
  - a. the existing fire tests contained in the NEI Industry Applications Guide,
  - b. engineering analysis addressing the differences, such as increased thermal absorptivity or cable maximum insulation capability, between the installed and tested configurations,
  - c. engineering analysis addressing the actual fire hazard in the location where the barrier is installed.

- downgrading 3-hour barriers to 1-hour and either adding suppression and detection or providing deviation requests justifying why suppression is not required for the area.
- evaluating the installed configuration for acceptability based on physical separation equivalent to that required by Appendix R Section II.G.2, but not previously credited,
- evaluating the installed configuration for acceptability based on physical separation not in strict agreement with Appendix R Section III.G.2, but for which adequate justification exists for processing of a deviation request.

If it becomes clear that justification of the barrier is not feasible, effected barriers will be evaluated for upgrade or other types of modifications, such as circuit reroutes or component relocations. As a part of the modification scoping process, the most suitable alternative will be selected for each application.

The final step will include the implementation of all required modifications.

**NRC Request III.B.3.**

If a plant-specific fire endurance test program is anticipated, describe the following:

- a. Anticipated test specimens
- b. Test methodology and acceptance criteria including cable functionality.

**PP&L's Response:**

At this time PP&L does not anticipate a plant-specific fire endurance test program.

Should PP&L find it necessary to do any further testing on a plant-specific basis, a test plan will be developed and made available to the NRC.

**NRC Request IV.B.1.**

For the barriers described under Item I.B.1, describe those that you have determined will fall within the scope of the NUMARC program for ampacity derating, those that will not be bounded by the NUMARC program, and those for which ampacity derating does not apply.

**PP&L's Response:**

A detailed response to the requests made by the NRC relative to the ampacity issue cannot be provided until the technical issues between the NRC and the Industry related to ampacity derating factors are resolved.

The general position of PP&L with respect to the ampacity issue is as follows:

Ampacity derating applies only to cable raceway containing power cables. The issue of concern is the long term life of the cable. PP&L has performed an evaluation of the Unit 1 and 2 fire protected raceway to determine the calculated maximum allowable ampacity derating for the cables contained in those raceway protected with Thermo-Lag 330-1. The results of this evaluation are provided below:

Maximum allowable ampacity derating factor for power cables:

Unit	Raceway Type	Max. Allow. Derating (%)
1	cable tray	38.5
2	cable tray	36.9
1	conduit	28.9
2	conduit	31.8

Based on the maximum allowable ampacity values calculated, PP&L expects that the actual test values will be less than our calculated allowables and no additional actions will be required.

**NRC Request IV.B.2**

*For the barriers you have determined fall within the scope of the NUMARC program, describe what additional testing or evaluation you will need to perform to derive valid ampacity derating factors.*

**PP&L's Response:**

The response to this request is provided in our response to Request IV.B.1 above.

**NRC Request IV.B.3**

*For the barrier configurations that you have determined will not be bounded by the NUMARC test program, describe your plan for evaluating whether or not the ampacity derating tests relied upon for the ampacity derating factors used for those electrical components protected by Thermo-Lag 330-1 (for protecting the safe-shutdown capability from fire or to achieve physical independence of*

electrical systems) are correct and applicable to the plant design. Describe all corrective actions needed and submit the schedule for completing such actions.

**PP&L's Response:**

PP&L has not determined that any barrier will not be bounded by industry testing. See our response to NRC Request IV.B.1 above for additional information on ampacity.

**NRC Request IV.B.4**

In the event that the NUMARC fire barrier tests indicate the need to upgrade existing in-plant barriers or to replace existing Thermo-Lag barriers with another fire barrier system, describe the alternative actions you will take (and the schedule for performing those actions) to confirm that the ampacity derating factors were derived by valid tests and are applicable to the modified plant design.

**PP&L's Response:**

Our evaluation of any barrier being used at Susquehanna SES will include consideration of ampacity. At this time, however, PP&L does not intend to use any other barrier systems. See our response to NRC Request IV.B.1 for additional information on ampacity.

**NRC Request V.**

Describe the specific alternatives available to you for achieving compliance with the NRC fire protection requirements in plant areas that contain Thermo-Lag fire barriers. Examples of possible alternatives to Thermo-Lag based upgrades include the following:

1. Upgrade existing in-plant barriers using other materials.
2. Replace Thermo-Lag barriers with other fire barrier materials or systems.
3. Reroute cables or relocate other protected components.
4. Qualify 3-hour barriers as 1-hour barriers and install detection and suppression systems to satisfy NRC fire protection requirements.

**PP&L's Response:**

As discussed in our response to NRC Request III.B.2, the alternative selected for achieving compliance with the NRC fire protection requirements will be the most suitable alternative. Within our response, we have specifically alluded to the use of options 3 and 4 above.

Although at this time, we have no specific plans for the use of alternative materials, as suggested in options 1 and 2 above, these could be used if they are determined through our evaluation process to be technically justified.

**NRC Request VI.**

Submit an integrated schedule that addresses the overall corrective action schedule for the plant. As a minimum, the schedule should address the following aspects for the plant:

1. implementation and completion of the corrective actions and fire barrier upgrades for fire barrier configurations within the scope of the NUMARC program,
2. implementation and completion of the plant-specific analysis, testing, or alternative actions for fire barriers outside of the scope of the NUMARC program.

**PP&L's Response:**

Considering the approximately 15,000 linear feet of Thermo-Lag 330-1 material used at Susquehanna SES, the recent quality questions related to this material and our past experience with and knowledge of the complexity involved in performing Appendix R Safe Shutdown Analysis, it is clear that additional time beyond that originally envisioned will be required to resolve this issue.

Our current plan is to complete those actions identified in our corrective action plan necessary to identify the scope of required modifications by the end of the Unit 2-8RIO, scheduled to end in the 2<sup>nd</sup> quarter of 1997. At that time, we will provide a schedule for completing any required modifications. Compensatory actions to ensure safety currently in effect will remain in effect as necessary until project completion.

Delays relative to this issue related to generic areas not directly under our control could impact our schedule. Should schedule adjustments be required for this reason or as a result of unforeseen complication in our proposed resolution strategy, we will notify you.

**NRC Request VII. Sources and correctness of Information**

Describe the sources of the information provided in response to this request for information (for example, from plant drawings, quality assurance documentations, walkdowns or inspections) and how the accuracy and validity of the information was verified.

**PP&L's Response:**

The information related to quantities, dimension and details of construction provided in this letter is considered approximate and is based on the best available data. The information provided was obtained from a variety of sources; plant drawings; plant specifications; equipment databases; plant walkdowns; personal interviews. Much of the information collected from these sources was compiled in engineering studies and subjected to an engineering review. An independent review of the information provided in this letter was performed by our Nuclear Quality Assurance group. While the information provided in this letter is considered representative and accurate, it has not been verified.

Should you have any question regarding this response. please call W.W. Williams at (610) 774-5610.

Very truly yours,



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R. G. Byram

cc: NRC Region I  
Mr. C. Poslusny, Jr., NRC Sr. Project Manager - OWFN  
Ms. M. Banerjee, NRC Sr. Resident Inspector - SSES

