June 10, 1996

Mr. Robert G. Byram
Senior Vice President-Nuclear
Pennsylvania Power and Light
Company
2 North Ninth Street
Allentown, PA 18101

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION ON IPEEE SUBMITTAL, SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2 (TAC NOS M74478 AND M74479)

Dear Mr. Byram:

Based on our ongoing review of the Susquehanna Individual Plant Examination of External Events (IPEEE) submittal dated June 27, 1994, and its associated documentation, we have developed the enclosed request for additional information (RAI). The RAI is related to the external event analyses in the IPEEE, including the seismic analysis, the fire analysis, and the analyses on effects of high winds, floods, and others. The RAI was developed by our contractor, Energy Research, Inc., and reviewed by the Senior Review Board (SRB). The SRB is comprised of the Office of Research (RES), Office of Nuclear Reactor Regulation staff and RES consultants (Sandia National Laboratory) with probabilistic risk assessment expertise for external events.

We request that you provide a response within 60 days in conformance with our review schedule. If you have any questions concerning our review, please contact me on (301) 415-1402.

Sincerely,
Original signed by:
Chester Poslusny, Senior Project Manager
Project Directorate I-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket Nos. 50-387/388

Enclosure: RAI

cc w/encl: See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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Mr. Robert G. Byram
Pennsylvania Power & Light Company

Susquehanna Steam Electric Station,
Units 1 & 2

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REQUEST FOR ADDITIONAL INFORMATION

SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2

INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS (IPEEE)

I. SEISMIC

1. The discussion of containment performance in the seismic IPEEE submittal reveals that seismic effects on containment safeguard systems may not have been adequately addressed. Please identify the items of equipment, excluding those which are already part of the safe shutdown equipment list (SSEL), that are required to successfully avert early seismic-related containment failure. Please describe the walkdown evaluation and findings pertaining to these items of equipment. Please provide discussions of the effects of relay chatter on containment isolation, of the potential for seismic-related bypass, and of other containment performance issues as identified in Section 3.2.6 of NUREG-1407.

Please also describe the systems and elements selection walkdown undertaken to ensure completeness of both the SSEL and the containment systems equipment list.

2. It is not clear what screening process was applied, with respect to non-seismic failures and human actions, when developing success paths. Please list all potential shutdown path-related non-seismic failures and human actions, together with their failure rates, noting any lack of redundancies. Please provide a discussion concerning the anticipated effects of the seismic margin earthquake on rates of operator errors which may impact the integrity of the preferred and alternate success paths. Please identify the locations at which operator actions must take place.

3. The approaches to screening and to performing evaluations of block walls and of atmospheric storage tanks need to be clarified. Please address the following related items:

(a) Please describe the basis for concluding that the high confidence of low probability of failure (HCLPF) capacities of block walls meet the 0.3g review level earthquake (RLE). Provide capacity calculations and results, including completed walkdown work sheets, for a block wall that may cause an SSEL component to fail. Please select a bounding case (i.e., block wall with lowest expected capacity) for illustration of the analysis.

(b) Please provide a detailed description of SSEL storage tanks and the basis for screening out such tanks (especially flat-bottomed/atmospheric storage tanks) in the seismic margin assessment.

4. The submittal provides a brief summary of low ruggedness relays found at Susquehanna. Please describe, in detail, the procedure that was used to develop the list (and locations) of low-ruggedness relays. Please describe the role of the plant walkdown in the relay evaluation.

5. NUREG-1407 requests an evaluation of seismic-fire interactions to consider: (i) seismic-induced fires, (ii) seismic actuation of fire suppression systems, and (iii) seismic degradation of fire suppression systems. Examples of items found in past studies include (but are not limited to):

- Unanchored CO_2 tanks or bottles
- Sprinkler standoffs penetrating suspended ceilings
- Fire pumps unanchored or on vibration isolation mounts
- Mercury or "bad actors" relays in fire protection system (FPS) actuation circuitry
- Weak or unanchored 480V or 600V (non-safety related) electrical cabinets in close proximity to essential safety equipment (i.e., as potential fire sources)
- Use of cast iron fire mains to provide fire water to fire pumps

NUREG-1407 suggests a walkdown as a means of identifying any such items.

Please provide the related results of your seismic-fire interaction study. Provide guidelines given to walkdown personnel for evaluating these issues (if they exist).

6. Please explain the process by which screened-in components were evaluated as being "adequate based on qualification test reports contained in the seismic qualification review team (SQRT) binders," as frequently indicated in Section 3.10.6 of the IPEEE submittal report.

7. For all cases where the IPEEE submittal has stated that an unscreened component was found to have a HCLPF capacity in excess of 0.3g, please briefly describe the basis for this assessment conservative deterministic failure margin (CDFM), fragility, bounding calculation, design-calculation approach, qualification approach, etc.).

8. Please provide HCLPF calculations, seismic evaluation work sheets (SEWSs), walkdown notes/checklists and photographs for the four components having HCLPF capacities less than the RLE; i.e., high pressure cooling injection (HPCI) Pump Discharge Valve, residual heat removal-suppression pool cooling mode (RHR-SPCM) suppression pool inlet valve, automatic transfer switch, and 480 V MCC.

9. EPRI NP-6041 provides examples of BWR-4 success path logic diagrams, which indicate alternate paths for decay heat removal. The Susquehanna IPEEE, however, considers only one form of decay heat removal, namely, RHR-SPCM. Please justify why an alternate path for decay heat removal was not considered and why only one division of electrical support is identified for RHR-SPCM.

10. Discuss the ability of the preferred and alternate shutdown paths to respond to medium and large loss-off-coolant-accidents (LOCAs) resulting from stuck-open safety-relief valves.

II. Fire

1. The overall core damage frequency of 1.0×10^{-9}/cycle is significantly smaller than what is typically reported for BWRs of similar vintage and design. This frequency is even smaller than the core damage frequency computed by multiplying the conditional core damage frequency, given reactor trip, with the overall frequency of plant fires leading to reactor trip. Provide a detailed justification for this low core damage frequency, including a description of the computations performed in arriving at this value.

2. It is assumed in the IPEEE submittal that a fire-induced LOCA is not possible. Since the automatic depression system (ADS) is an automatically controlled system, the possibility of spurious signals leading to system activation may exist. Given the potential for spurious ADS activation, provide detailed technical analysis demonstrating that a fire-induced LOCA is not possible or highly unlikely.

3. An assumption is made that all small motors (<50hp) do not pose a fire ignition source. However, if a pump is in close proximity to other combustibles, this assumption may not be justified. Provide a clear justification for the assumption pertaining to small motors. Alternatively, provide an assessment of the impact of including these components as ignition sources.

4. The IPE modeled components have been used in the fire IPEEE. The licensee has not addressed initiators other than reactor trip and LOCA in estimating the core damage frequency from a fire. Generally, in an IPE, causes for events such as loss of offsite power or DC power failure are not analyzed in much detail, and statistical information is used to establish the occurrence frequencies for these events. However, for fire analysis, the cables and associated control and power circuits for the initiators should be considered, to assure completeness. Provide a discussion indicating whether or not the IPE component list has been expanded to include the initiator-related components, associated circuits and cables, and whether or not the routings of these additional cables have been included in the fire analysis. If these additional components have not been included in the analysis, the fire IPEEE conclusions could be severely deficient.

5. Related to the preceding item (#4), often cable routing obtained for an Appendix R submittal is also used in the fire risk analysis. Although there is a large overlap between the safe shutdown equipment and systems considered in Appendix R, in comparison to the IPE components, there are some differences that can affect the final fire core damage frequency computations. Provide discussions indicating whether or not there are any differences between the two set of components and equipment, and describing how cable routing issues have been resolved.

6. From the screening method described in Section 4.1.1.3.2 of the submittal, it is inferred that, if a transient could not occur by postulating all equipment and cable failures in a fire zone, then that fire zone could be screened out. This is generally a non-conservative method. A reactor trip may be initiated by the plant operator. Also, since the Appendix R equipment and cables are used, no in-depth analysis is carried out on the pathways for reactor trip. There are numerous pathways that can lead, via direct and indirect influences, to a reactor trip. Provide further discussion on the method used in the "second screen," and on how the reactor trip assumption was employed.

7. One element of the screening is based on combustible loading. It is assumed that areas that contain only cables are not susceptible to fire. The NRC staff position is that administrative controls are an insufficient basis for eliminating transient combustible fires from consideration. Ignoring transient combustibles constitutes a non-conservative screening method. It fails to recognize areas with a high concentration of cables that may be critical to safe plant shutdown. This concern is particularly important to cable shafts and cable tunnels. Provide a list of fire zones that were screened-out based on the combustible loading assumption and the contents of the fire zones in terms of system trains.

8. The fire compartment interaction analysis (FCIA) is based on the assumption that fire barriers are effective as rated. For active fire barriers (e.g., a normally open fire door that gets closed by fusible link), the failure probability can be significantly high. Provide a list of compartments with active fire barriers, a description of the active fire barriers, and a discussion regarding screening of these (and their adjacent) compartments.

9. The study assumes that passive fire-barrier elements (e.g., walls, floors, ceilings, and penetration seals) are 100% reliable. Such an analysis is not valid unless the assumption is adequately justified and it can be demonstrated that there are no paths through the barrier for the spread of damage. Provide such justification and demonstration for high-hazard fire areas, such as: the turbine building, diesel generator rooms, cable spreading rooms, switchgear rooms, and lube oil storage areas.

10. The computer code COMPBRN IIIe is used extensively in the fire IPEEE to justify that fires would not be able to cause the critical set of damage, as identified in the fire scenarios. Based on the information provided in the submittal, the proper modelling of the fire scenario could not be verified. Provide COMPBRN input and output files for fire zones 1-2B, 0-24D, 0-27E, 0-28J, and 1-5A-S. Also provide a description of the fire scenarios modeled, the fire sources assumed, the physical input parameter values used, and the assumptions made with regards to these COMPBRN simulations.

11. There is little discussion in the fire IPEEE submittal concerning operator actions and potential failures. Provide a discussion regarding the treatment of operator actions included in the IPE model and which could have potentially been included in the fire core damage frequency computations. For fire-initiated sequences, there are performance shaping factor (PSF) issues which are unique to fire situations and would not have to be assessed in the IPE human reliability analysis. These PSF issues mostly relate to environmental stressors (e.g., the impact of smoke and suppression agents, reduced visibility, impaired communications due to the use of breathing apparatus) and psychological stressors (i.e., the occurrence of an unexpected event such as fire of sufficient severity to cause equipment failures). Provide information concerning how the human error probabilities were estimated, and the bases thereof, and how the use of the alternate shutdown panel has been incorporated into the analysis.

12. Does the fire analysis assume that those valves that need to remain in their original position to render a system available, will not move inadvertently because of fire exposure to their cables? Provide a discussion on how this issue was considered and on how associated cables were considered.

13. Control system interaction is addressed via the use of an alternate shutdown panel and isolation switches. Provide a list of equipment and instrumentation that can be controlled and monitored from the alternate shutdown panel. Provide a short discussion regarding the location and access to the isolation switch and alternate shutdown panel during a cable spreading room or control room fire, and the extent to which the instrumentation on the alternate panel is independent of the control room.

14. In Table 4.19 of the IPEEE submittal report, the fire frequency for fire zone 1-4G is taken to be zero. The NRC staff position is that administrative controls are an insufficient basis for eliminating transient combustible fires from consideration. Provide a justification for assigning zero value to this fire frequency including a detailed description of this area and a list of cables and equipment that are located in this zone.

15. Open hatchways and fire zone boundaries that are not defined by a wall cannot contain hot gas and smoke spread. Provide a list of fire zones that are not completely defined by walls or that contain open hatchways in their boundaries. Provide an analysis of the effect on fire area multi-zone screening, considering the potential for hot gas and smoke spread from the open hatchways.

16. On page 4-2 of the submittal, it is assumed that "fire originating in an electrical cabinet . . . is assumed to stay within the cabinet, or, given a full size partition, within the cabinet section of origin." This assumption is not supported by industry fire experience. Please provide an assessment of the impact on core damage frequency, if the potential for propagation from an electrical panel to other in-situ fuel or targets is considered.

17. The heat release rate data taken from NSAC-181 for wood pallets (660 BTU/s) used in the modeling of Equipment Removal Area (1-3B-W, page 4-29) is significantly below the published range for typical wood pallets. Based on the method provided in the SFPE (Society of Fire Prevention Engineers) Handbook for Fire Protection Engineering, for calculating the heat release rate from wood pallets, a 2 high pallet stack would equate to a heat release rate of approximately 1500-2000 kW (1400-1900 BTU/s). Provide a revised analysis for this area and any other area where incorrect data from NSAC-181 were utilized.

III. HFOs (high winds floods and others)

1. Please provide PP&L Calculation EC-RISK-1001.

2. Please provide PP&L Calculation EC-RISK-1024.