



Pennsylvania Power & Light Company

Two North Ninth Street • Allentown, PA 18101-1179 • 215/774-5151

Robert G. Byram
Senior Vice President-Nuclear
215/774-7502

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Director of Nuclear Reactor Regulation
Attention: Mr. C. L. Miller, Project Director
Project Directorate I-2
Division of Reactor Projects
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

**SUSQUEHANNA STEAM ELECTRIC STATION
INFORMATION ON LICENSING BASIS OF
SPENT FUEL POOL COOLING SYSTEM
PLA-3996 FILES A17-2/R45-1A**

Docket Nos. 50-387
and 50-388

Dear Mr. Miller:

Enclosed please find a discussion of PP&L's perspective on the licensing basis of our spent fuel pool cooling system for your information.

Very truly yours,

R. G. Byram
for R. G. Byram

Enclosure

- cc: NRC Document Control Desk (original)
- NRC Region I
- Mr. G. S. Barber, NRC Sr. Resident Inspector - SSES
- Mr. R. J. Clark, NRC Sr. Project Manager - Rockville

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DISCUSSION OF SPENT FUEL POOL COOLING LICENSING BASIS

EXECUTIVE SUMMARY

On November 27, 1992, two PP&L contract engineers filed a 10CFR21 report with the NRC, claiming that a substantial safety hazard existed in the design of the SSES spent fuel pool cooling system. Significant to their claim was that the SSES design could not adequately respond to a loss of spent fuel pool cooling as a direct result of a LOCA or a LOCA/LOOP, and further that the regulations/licensing basis required this design capability. This paper provides PP&L's evaluation of the Susquehanna licensing basis as it relates to this issue. Based on this evaluation, PP&L has concluded that:

1. The licensing basis of Susquehanna SES does not consider loss of spent fuel pool cooling to be initiated from other than seismic events.
2. This licensing basis is acceptable, given the probability and consequences of a loss of spent fuel pool cooling from LOCA or LOCA/LOOP initiating events, since ensuring stored fuel coverage with water is a long term action that will be dealt with by plant operators.
3. Prior NRC decisions indicate that coupling a LOCA or LOCA/LOOP with a loss of spent fuel pool cooling (and subsequently to pool boiling) is indeed beyond what is required by the regulations, and have established that regulatory changes are not required due to a lack of safety significance.
4. PP&L has evaluated both the licensing basis and the postulated events beyond it, and has determined that all scenarios can be successfully mitigated.
5. Based on the concerns being beyond the licensing basis and not having sufficient safety significance, PP&L determined this issue not to be reportable. A voluntary report was submitted due to the nature of the issue and its potential generic implications.

LICENSING BASIS EVALUATION

PSAR/FSAR

The PSAR documented the reclassification of the spent fuel pool cooling system to Quality Group D, Seismic Category II prior to actual licensing. The NRC approved this change based on PP&L supplying Seismic Category I makeup (ESW) to the pool if a seismic event occurred. Furthermore, dose calculations were required to be performed since makeup alone would not prohibit pool boiling, and therefore the offsite dose consequences of the loss of spent fuel pool cooling due to a seismic event had to be evaluated for compliance with 10CFR100 limits. The design and safety analysis for the system is currently documented in FSAR Section 9.1.3 and Appendix 9A.

The FSAR was further examined to determine whether or not a loss of spent fuel pool cooling was assumed as a direct consequence of a LOCA or LOCA/LOOP event. Chapter 15 and other pertinent FSAR sections were reviewed, and these events were not coupled with a loss of spent fuel pool cooling. This was further confirmed based on the absence of any contribution from a boiling spent fuel pool in the LOCA radiological consequences evaluation in Chapter 15.

NRC SER (NUREG 0776)

In the Susquehanna SER, the NRC concluded that the spent fuel pool cooling system complied with the requirements of 10CFR50 Appendix A General Design Criterion 61, and Regulatory Guides 1.13 and 1.29. The salient excerpt from Section 9.1.3 follows:

"The dose rates resulting from pool boiling as a result of loss of the cooling systems is below the guideline values of 10 (CFR) 100 and the 1.5 Rem thyroid guideline of Regulatory Guide 1.29 'Seismic Design Classification.' Makeup from the Seismic Category I emergency service water systems would keep the fuel covered during loss of spent fuel pool cooling accidents.

In accordance with the requirements of General Design Criteria 61 "Fuel Storage and Handling and Radioactivity Control" regarding significant reduction in coolant inventory under accident conditions, all piping is arranged so that the pool cannot be inadvertently drained to uncover the fuel. This is accomplished by syphon breakers or by penetration levels above the fuel.

Based on our review as described above we conclude that the spent fuel pool cooling and cleanup system meets the guidelines of Regulatory Guide 1.13 regarding makeup to the spent fuel pool and the guidelines of Regulatory Guide 1.29 regarding design of nonseismic Category I systems and that the system design is in compliance with General Design Criterion 61 with regards to prevention of uncovering the spent fuel. We, therefore, conclude that the spent fuel pool cooling and cleanup system is acceptable."

The NRC does not evaluate the performance of the spent fuel pool cooling system in response to other than seismic events (LOCA, LOCA/LOOP) in other sections of the SER or its supplements.

Other Applicable Regulatory Guidance

The only NRC regulation directly relevant to the design of the spent fuel pool cooling system (other than 10CFR100) is contained in GDC 61, which states:

"The fuel storage and handling, radioactive waste, and other systems which may contain radioactivity shall be designed to assure adequate safety under normal and postulated accident conditions. These systems shall be designed ...(4) with a residual heat removal capability having reliability and testability that reflects the importance to safety of decay heat and other residual heat removal, and (5) to prevent significant reduction in fuel storage coolant inventory under accident conditions."



GDC 61 does not identify a particular accident or accidents for which a spent fuel pool cooling system must be designed. Instead, one must look to the NRC guidance and how it was applied to Susquehanna.

The NRC SER was based on the Standard Review Plan (SRP, NUREG-0800). SRP Section 9.1.3 directs the staff "to assure that essential portions of the (spent fuel pool cooling) system will function following design basis accidents" and for purposes of ensuring compliance with GDC 61, to consider the system's "capability to prevent reduction in fuel storage coolant inventory under accident conditions in accordance with the guidelines of position C.6 of Regulatory Guide 1.13." Although Section 9.1.3 refers to "design basis accidents" and "accident conditions," there is no specific guidance provided regarding the type of design basis accident or nature of the accident condition that must be considered for spent fuel pool cooling systems.

Regulatory Guide 1.13, "Spent Fuel Storage Facility Design Basis," Rev. 1 (Dec. 1975), Position C.6 includes the following relevant statement:

"Systems for maintaining water quality and quantity should be designed so that any maloperation or failure of such systems (including failures resulting from the Safe Shutdown Earthquake) will not cause fuel to be uncovered."

Although this statement does not limit potential scenarios, it does not list what other types of failures must be considered. With respect to the specific licensing basis evaluation of Susquehanna, what we do know is that the NRC found Susquehanna to be in compliance with R.G. 1.13. This implies that the licensing basis for Susquehanna for loss of spent fuel pool cooling is limited to seismic events.

With regard to LOCA or LOCA/LOOP events, the regulations (10CFR50.46, 10CFR50 Appendices A, J, and K, and 10CFR100.11) do not specifically address what assumptions and consequences must be considered for the scenario of concern. In each case, the NRC found PP&L in compliance with the specific regulation.

Regulatory Guide 1.3, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss-of-Coolant Accident for Boiling Water Reactors," Rev. 2, (June 1974) does not provide any guidance on the possible plant consequences from a postulated LOCA, nor does it direct one to consider potential sources of fission products from areas other than the fuel in the reactor and leakage from the containment.

Generic Issue 82, "Beyond Design Basis Accidents in Spent Fuel Pools," specifically considered the probability and consequences of a loss of spent fuel pool cooling stemming from a beyond design basis seismic event, component failures, operator errors, and times for repair and/or alignment of make-up systems. In addition, it considered the possibility of a long-duration power loss as an unlikely LOCA initiator relying on a 1988 study (NUREG/CR-5032, "Modeling Time to Recovery and Initiating Event Frequency for Loss of Off-Site Power Incidents at Nuclear Power Plants") which reported that the longest power outage was approximately 9 hours. Notably absent from GI 82 was any discussion of a LOCA induced loss of spent fuel pool cooling.

Finally, a number of licensing decisions, (see Att. A) have considered contentions based upon a postulated LOCA coupled with loss of spent fuel pool cooling. In each case, it appears that facility design changes were not required by the Licensing Boards because the utility could demonstrate by way of analysis that the consequences of a particular scenario were acceptable.

PP&L Perspective

Based on our evaluation, PP&L believes that the concern presented to the NRC in the Part 21 report is outside the licensing basis of Susquehanna Steam Electric Station. The scenario of concern, loss of spent fuel pool cooling due to other than a seismic event was not required to be analyzed. Spent fuel pool boiling was evaluated not as a result of a severe accident, but to provide a bounding offsite dose evaluation for a non-seismic system and determine its compliance with 10CFR100.

The spent fuel pool cooling system was neither loaded onto emergency power nor designed to be safety grade because it can be restored post-accident, not unlike other systems that are initially unavailable, but are later available to be used at the discretion of plant operators. Mitigation of fuel pool heatup post LOCA is a long term action. Our review of the Susquehanna IPE indicates that power can be restored prior to the onset of boiling, and that procedures exist to support this.

It appears based on Generic Issue 82 and Attachment A that the NRC has evaluated this issue previously and typically determined after analysis that facility modifications were not required. Further, it appears that no action was thought to be necessary to clarify the regulations as a result of the resolution of Generic Issue 82.

PP&L believes that the licensing basis for SSES is sufficient with respect to the Part 21 concern. Furthermore, we believe that we have demonstrated throughout the evolution of this issue that although the scenario is beyond the licensing basis for Susquehanna, we could always successfully mitigate it.

Our evaluation has identified enhancements that we are pursuing. However, these enhancements should not be viewed to imply that the current design of Susquehanna SES is unsafe. Furthermore, we do not believe that they are required to meet the licensing basis as NRC requirements.

Based on the fact that the current design of the spent fuel pool cooling system is consistent with the plant licensing basis, and that even for events beyond the licensing basis a loss of fuel pool cooling can be safely mitigated, PP&L determined this issue not to be reportable. A voluntary LER was submitted based on our desire to be sure that the NRC was aware of potential generic implications.



Attachment A: Relevant Historical NRC Decisions

- Commonwealth Edison Co. (Zion Station), LBP-80-7, 11 NRC 245 (1980)

The Licensing Board acknowledged that the spent fuel pool cooling system was not designed for or required to meet the single failure criterion following a LOCA, but nonetheless directed the parties to consider such a possibility and to evaluate the result. The Board adopted testimony by the licensee and the Staff that although boiling would occur in approximately 8 hours following such an accident scenario (i.e., LOCA plus loss of spent fuel pool cooling), access was always possible to affect manual repairs and to establish necessary alignments to provide a makeup flow of water at least equal to the boiloff rate. The Board declined to require the licensee to assess the radiological consequences associated with long-term water loss because neither a cited NRC contractor study (NUREG/CR-0649) nor the testimony of the intervenor's expert witness demonstrated "a sufficiently probable sequence of events by which boiling in the spent fuel pool could lead to a loss of water of the kind (alleged)."

- Virginia Electric and Power Co. (North Anna), ALAB-584, 11 NRC 451 (1980), LBP-79-25, 10 NRC 234 (1979)

The Appeal Board agreed with the Licensing Board that the applicant need not design the spent fuel pool cooling system for new failure scenarios (e.g., LOCA coupled with failure of the spent fuel pool cooling system). Instead, both Boards relied on licensee analyses, completed for various system configurations, which demonstrated that the pool would not boil in the event of a LOCA, even if coupled with a seismic event.

- Florida Power & Light Co. (Turkey Point), ASLBP No. 84-504-07 LA (Spent Fuel Pool Expansion) slip op. (March 25, 1987)

The conclusion here was that the licensee and NRC analyses demonstrated compliance with Part 100 and GDC 2; however, the licensee committed to upgrading its spent fuel pool cooling system to a seismic design.

- Consumers Power Co. (Big Rock Point), LBP-84-32, 20 NRC 601, 625-26 (1984)

In evaluating the need for and access to a makeup water system to mitigate a hypothetical boil-off scenario, the Board reviewed the facility against the requirements of GDC 61 and 62 and the single failure criterion (even though the facility was licensed prior to the promulgation of the GDC) and concluded that the system as designed was still reliable.

- Vermont Yankee Nuclear Power Corp. (Vermont Yankee), CLI-90-07, 32 NRC 129 (1990)

An environmental contention was submitted that would have required the applicant to evaluate the environmental effects of spent fuel pool heatup caused by a severe reactor accident (i.e., substantial fuel damage, hydrogen generation, containment failure, and increased temperature loads in the pool). Although the contention was never admitted for

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litigation because the proceeding was dismissed, the Commission clearly noted that the environmental impacts of such accidents may need to be evaluated unless, under a rule of reason, their actual probability is remote and speculative.

- Pacific Gas & Electric Co. (Diablo Canyon), LBP-87-24, 26 NRC 159, appeal dismissed, ALAB-873, 26 NRC 154 (1987)

The Board declined to admit a contention involving a potential loss of spent fuel pool cooling (which used NUREG/CR-4982 and Generic Issue 82 as its bases) because the intervenor failed to identify a specific accident initiator. The Board noted that even if an accident initiator had been identified the contention would have been rejected as being beyond the design basis of the facility. Although not confronted with the remote and speculative, the Board clearly implied such a finding would have been made.

- Public Service Electric and Gas Co. (Salem), LBP-80-27, 12 NRC 435 (1980)

This case discussed a gross loss of water from the spent fuel pool without a known causative mechanism, and concluded such events were of "very low probability".

