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Report Title: Operating Experience Feedback Report Assessment of Spent Fuel Cooling

Prepared by: Office for Analysis and Evaluation of Operational Data

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EXECUTIVE SUMMARY

As directed by the Executive Director for Operations, the Office for Analysis and Evaluation of Operational Data (AEOD) performed an independent assessment of the likelihood and consequences of an extended loss of spent-fuel-pool (SFP) cooling. The overall conclusions are that the typical plant may need improvements in SFP instrumentation, operator procedures and training, and configuration control.

The AEOD staff conducted six site visits to gain an understanding of each licensee's SFP physical configuration, practices, and operating procedures. During these visits, they found great variation among the designs and capabilities of SFPs and systems at the nuclear plants on these sites.

In November 1992, Mr. Donald Prevatte and Mr. David Lochbaum submitted a defects and noncompliance report on the Susquehanna SFP to the U.S. Nuclear Regulatory Commission (NRC). The AEOD staff interviewed Mr. Prevatte and Mr. Lochbaum to better understand their concerns. Their report, which has potential generic implications, provided the impetus for the NRC and the nuclear industry to take a closer look at SFPs.

AEOD reviewed the applicable SFP regulations, the applicable acceptance criteria in the NRC Standard Review Plan, and the applicable Regulatory Guides. Because the criteria evolved and each reactor was licensed over time, the criteria varies for evaluating these SFP designs.

The AEOD staff performed independent assessments of the electrical systems, instrumentation, heat loads, and radiation from which they determined the typical SFP configurations and potential problems.

Utilizing a previous Susquehanna risk analysis, Idaho National Engineering Laboratory (INEL) performed model refinements that resulted in better estimates of near boiling frequency (NBF). Although INEL performed no quantitative estimates of core damage, the analysis provided qualitative insights for identifying improvements to SFPs that may lessen the risks of events.

Findings from these assessments are as follows:

- From reviewing more than 12 years of operating experience, the staff determined that loss of SFP coolant inventory greater than 1 foot occurred at a rate of about 1 event per 100 reactor years. Loss of SFP cooling with a temperature increase greater than 20 °F occurred at a rate of approximately 3 events per 1000 reactor years. The consequences of these actual events were not severe. However, these events resulted in loss of several feet of SFP coolant level, some of the events have lasted longer than 24 hours. The primary cause of these events was human error.

- During review of existing SFP risk assessments, the staff found that after correction for several problems in the analyses, the relative risk produced by loss of spent fuel cooling is low when compared with the risk of events not involving SFP. The likelihood and consequences of loss of SFP cooling events are highly dependent on human performance and individual plant design features.

- The staff determined that utilities' efforts to reduce outage duration have resulted in full core off-loads occurring earlier in outages. This increased fuel pool heat load reduces the time available to recover from a loss-of-SFP-cooling event early in the outage.

Actions recommended by AEOD based on these assessments are as follows:

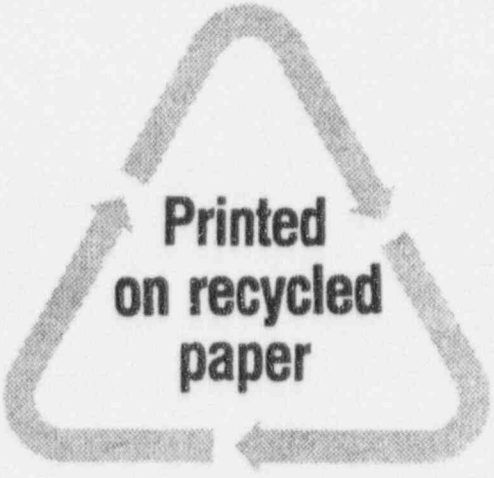
- The need for corrective actions at each plant where failures of reactor cavity seal or gate seals, or ineffective antisiphon devices could potentially cause loss of SFP coolant inventory sufficient to uncover the fuel or endanger makeup capability, should be evaluated.

- The need for improvement to configuration controls related to the SFP to prevent or mitigate SFP loss-of-inventory events and loss-of-cooling events should be evaluated on a plant-specific basis.

- The need for plant modifications at some multiunit sites to account for the potential effects of SFP boiling conditions on safe shutdown equipment for the operating unit, particularly during full core off-loads, should be evaluated on a plant-specific basis.

- The need for improved procedures and training for control room operators to respond to SFP loss-of-inventory and SFP loss-of-cooling events, consistent with the time frames over which events can proceed and recognizing the heat load and the possibility of loss of inventory, should be evaluated on a plant-specific basis.

- The need for improvements to instrumentation and power supplies to the SFP equipment to aid correct operator response to SFP events should be evaluated on a plant-specific basis.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