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PSEG
Nuclear LLC

LR-N02-0300
LCR S02-03

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

ADDITIONAL INFORMATION
REQUEST FOR LICENSE AMENDMENT LCR S02-03
REFUELING OPERATIONS – FUEL DECAY TIME PRIOR TO COMMENCING CORE ALTERATIONS OR MOVEMENT OF IRRADIATED FUEL
SALEM GENERATING STATION, UNIT NOS. 1 AND 2
FACILITY OPERATING LICENSE DPR-70 AND DPR-75
DOCKET NOS. 50-272 AND 50-311

On July 15, 2002, PSEG Nuclear, LLC (PSEG) and the Nuclear Regulatory Commission (NRC) held a conference call to discuss additional information in support of the NRC staff's review of the request for license amendment submitted by PSEG Nuclear LLC on June 28, 2002 (LR-N02-0231). The amendment request proposes a reduction in the minimum required fuel decay time prior to commencing fuel movement for Salem Generating Station Unit Nos. 1 and 2. PSEG is providing the additional information requested in Attachment 1.

Under separate licensing action, PSEG is preparing the required documents to revise the design basis for Spent Fuel Pool (SFP) temperature. The justification will re-establish the SFP temperature design basis back to boiling and maintain the 180°F as an administrative limit related to SFP liner integrity. PSEG has constructed SFP liner leak-off valve caps and has implemented administrative controls instructing operations staff to install these caps when certain temperatures are reached in the SFP thus preventing water inventory losses due to potential liner damage. PSEG intends to operate below this administrative limit except during off-normal conditions at which time other compensatory actions, already included in plant procedures, will be taken to ensure the SFP water inventory is maintained at the required levels.

Should you have any questions regarding this response, please contact Mr. Brian Thomas at (856) 339-2022.

Sincerely,

Gabor Salamon
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ATTACHMENT 1

PSEG RESPONSE

SPENT FUEL POOL (SFP) COOLING

Each Salem SFP Cooling System consists of two non-safety related SFP pumps powered from separate Class 1E power sources backed by the Emergency Diesel Generators and one safety related SFP Heat Exchanger (SFHX). The SFHX is cooled by the safety related Component Cooling (CC) Water System, which in turn is cooled by the safety related Service Water (SW) System via the CC Heat Exchangers. Normally one pump is aligned to the SFHX to provide cooling for the SFP. The Salem SFP Cooling Systems are interconnected (cross-tied) to allow one unit's SFP to be cooled by the other unit's SFHX, in case its unit's SFHX is out of service. The cross-tie also allows for parallel SFHX operation in which one unit's SFP to be cooled by both SFHXs, in case of high heat load conditions as exist with a freshly offloaded core. Procedures currently exist to allow crosstie operation for these conditions. System operation is also discussed in UFSAR Section 9.1.3. Control Room operators monitor the SFP temperature via an alarm with a 125°F setpoint.

ADMINISTRATIVE CONTROLS

PSEG has implemented actions similar to the guidelines contained in NUMARC 96-01. The guidelines are:

1. The outage schedule should provide a DEFENSE IN DEPTH commensurate with the risk associated with loss of SFP cooling.

2. A procedure should be established for response to a loss of SFP cooling event.

For Salem Units 1 and 2, Procedure NC.OM-AP.ZZ-0001(Q), Outage Risk Assessment and Management (ORAM) contains several steps describing DEFENSE IN DEPTH precautions and measures to minimize the risk of a loss of SFP cooling event. The ORAM model takes into account the number of SFP pumps available, the opposite unit's SFP heat exchanger (as a potential heat sink), and the number of fuel handling building exhaust fans available (as a means of providing cooling through ambient losses). The model also receives a manual input identifying if a high-risk evolution is in progress effecting SFP cooling. The assumptions used in the ORAM computer model are based on our operating procedures.

Off-normal and emergency procedures have been developed to provide guidance for operations personnel in case of a Loss of SFP Cooling. In regards to the LOOP event, our abnormal operating procedure addresses the Loss of SFP Cooling and the operators are directed to the abnormal operating procedure for Loss of SFP Cooling. The spent fuel abnormal procedure will direct the

operator to load a SFP cooling pump onto the EDG, and if unsuccessful, the operator is directed to align SFP cooling from the opposite unit. The operators are trained on both of these procedures.

SPENT FUEL POOL INTEGRATED DECAY HEAT MANAGEMENT PROGRAM

The SFP Integrated Decay Heat Management program assessment begins with the design of the SFP and SFP Cooling System. It then takes the actual or conservative conditions expected for the upcoming refueling outage. The inputs include the pre-existing SFP decay heat load, the decay heat load of the fuel being offloaded, the scheduled core offload start and completion times, system flow rates and cooling water temperature. The decay heat load of the spent fuel (both pre-existing and recently off-loaded from the core) is a function of the actual exposure history. The SFP flow rate is based on one SFP pump running, which is the normal operating condition, and allows for the possibility of a pump or its vital bus being unavailable. The cooling water temperature is varied between 2 operating conditions. Currently, the calculation is performed at a conservative value of 80°F (called best estimate value), based on the highest expected SW temperature, and a bounding maximum, based on the design SW temperature of 90°F. The calculation also credits evaporative heat losses from the SFP.

The Decay Heat Management Program evaluation performed prior to the start of each refueling cycle evaluates four phases of the SFP Decay Heat evolutions. These are:

1. Normal Cooling
   For this case, the two SFP Cooling Systems are operating independently (i.e., no cross-tie), with each SFP being cooled by its own SFHX. This case provides the projected heat-up rate and peak temperature of the SFP with the offloaded core under normal operating conditions.
2. Loss of Cooling
   For the calculation, the SFP is conservatively assumed to loose all forced cooling right after the core is fully off loaded into the SFP. This case provides the time it would take the SFP to reach the administrative limit of 180°F or beyond, thus providing Operations with how long they would have to implement contingency actions to restore forced cooling.
3. Cross Tie Operation
   For this case, there is only one SFHX available. For the calculation, the "hot" SFP (i.e., the SFP with the offloaded core) is initially aligned to the opposite unit's SFHX. When the "cold" pool (i.e., non-outage unit's SFP) reaches the administrative limit of 180°F, the SFHX is aligned to that pool. When the hot pool reaches the limit, it is realigned to the SFHX, and the cycle continues as necessary. This case provides the projected heat-up rate and time it takes to reach the temperature limit for each pool, thus providing Operations and Outage Management with a planning tool. The calculation would dictate whether or not crosstie operation was feasible, and under what conditions.

4. Post Refueling
An assessment is also made after core reload is completed to support post-outage SFP related activities. This is performed for various intervals over the operating cycle. The calculation provides SFP heat-up rates and peak temperatures to be used as a planning tool for on-line maintenance.

For the upcoming refueling outage of Salem Unit (1R15), preliminary calculations performed under this program show that the conservatisms included in the design calculations are validated. A summary of the results for an offload start time of 100 hours is shown below. Note that parallel SFHX operation is not required for the Unit 1 SFP.

Unit 1 Refueling Outage 1R15, October 2002	Maximum SFP Temp. with Normal Cooling (CC T= 80°F)	Maximum SFP Temp. with Cross Tie Operation (CC T= 80°F)	Maximum SFP Temp. Loss of All Cooling
Unit 1 SFP	136°F	136°F	205°F (Note 2)
Unit 2 SFP	~86°F	173°F (Note 1)	173°F (Note 1)

Note 1: Temperature limit of 180°F in Unit 2 SFP for swapover of cooling is never reached Thus the Unit 2 SFP peak temperature effectively represents a loss of cooling for this pool The Unit 1 SFP peak temperature effectively represents normal cooling for this pool
Note 2- The estimated time to reach this temperature is approximately 9 hours after core offload is complete assuming no forced cooling is restored The time to reach 180°F is approximately 4.5 hours

ENGINEERING CALCULATIONS IN SUPPORT OF LICENSE AMENDMENT REQUEST

The calculations performed to support the amendment contain several conservatisms to provide for safety margin when evaluating fuel decay heat and the heat removal capability of the Spent Fuel Cooling System

The SFP temperatures for the most recent refueling outages for both units (1R14 and 2R12) recorded in the plant operator logs are summarized below:

Refueling Outage	Plant Operator Log Readings – Spent Fuel Pool Water Temperature			
	Prior to start of Refueling	During Core Offload	Following Core Offload (Peak) (Note 1)	After Core Reload (Temp. stable)
Unit 1 1R14 April 2001	~90°F	105°F (max)	112°F	~92°F
Unit 2 2R12 March 2002	~85°F	108°F (max)	112°F	~86°F

Note 1: The actual peak temperatures were well below the predicted values determined in the pre-outage assessment Thus the pre-outage assessment is conservative.

In addition to the assumptions included in the preliminary calculations, operations staff is able to adjust CC flow to the SFP heat exchangers to provide additional cooling capability and decay heat removal thus controlling the SFP temperatures within the guidelines provided by the Decay Heat Management Program.

The assumed SFP bulk temperatures in the calculations performed to support the amendment are 149°F with two SFP heat exchangers available. With one heat exchanger available and being swapped between the two SFPs, the temperature in both pools can be maintained below 180°F. The administrative limit of 180°F was selected as part of the SFP Liner integrity concerns. In PSEG letter to the NRC, LR-N980577 dated January 11, 1999, the seismic qualifications of the system and the installation of caps on the SFP liner drains was discussed. PSEG has completed the design of the drain caps and implemented operations procedural installation guidelines, hence, the concern regarding potential loss of water inventory from the SFP due to liner leakage caused by elevated SFP temperatures is no longer valid. The 180°F temperature limits will be observed as an administrative limit to provide Operations staff adequate time to take compensatory actions in the unlikely event of loss of SFP cooling. The margin of safety limit for the Salem Spent Fuel Pool is to prevent boiling and subsequent loss of water inventory. Administrative limits set lower provide additional margin and DEFENSE IN DEPTH to prevent temperatures from reaching this limit.

SFP SYSTEM RELIABILITY

The SFP cooling systems at Salem Units 1 and 2 are included as part of the Maintenance Rule Program. The reliability database was reviewed and found to be satisfactory. There were no instances of unplanned loss of SFP cooling. The major system components are monitored for reliability in accordance with the M-Rule program. The SFP pumps were added to the PSEG In Service Test program (IST) as documented in PSEG letter to the NRC, LR-N980577 dated January 11, 1999.

SUMMARY

The effectiveness of the Integrated Decay Heat Management Program to effectively predict SFP temperatures pre and post refueling was reviewed and found to be conservative when compared to the actual temperature trends recorded in the plant logs for the most recent refueling cycle for each unit (1R14 in April 2001 and 2R12 in April 2002).

In summary, PSEG concludes that adequate safety margin, procedural and administrative controls are in place to properly control Spent Fuel Pool temperatures and effectively respond to a Loss of Spent Fuel Pool Cooling event without exceeding the design basis limits for Spent Fuel Storage at Salem. Additional enhancements will be part of the implementation of this License Change Request that will be put in place prior to the start of the upcoming refueling outage for Unit 1 (1R15).