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April 29, 1999

MEMORANDUM TO: Singh S. Bajwa, Section Chief
Project Directorate I
Division of Licensing Project Management

FROM: George T. Hubbard, Section Chief /s/
Balance of Plant and Containment Systems Section
Plant Systems Branch
Division of Systems Safety and Analysis

SUBJECT: SAFETY EVALUATION FOR PROPOSED TECHNICAL
SPECIFICATION CHANGES RELATED TO ULTIMATE HEAT SINK
AVERAGE TEMPERATURE (TAC NOS. MA0342 AND MA0343)

Plant Name: Susquehanna Steam Electric Station, Unit 1 and Unit 2
Docket Nos.: 50-387 and 50-388
Licensee: Pennsylvania Power and Light Company
Review Status: Complete

By letter dated June 1, 1998, the licensee (Pennsylvania Power and Light Company) requested an amendment to Operating License Nos. NPF-14 and NPF-22 for Susquehanna Steam Electric Station (SSES) Units 1 and 2, respectively. The amendment which proposed changes to the Technical Specifications (TS) of both units would replace the current ultimate heat sink (UHS) average water temperature limit of 88°F for all combinations of plant operations with a set of more restrictive values of 85°F, 87°F or 88°F depending on whether either unit has been in Mode 3 less than 12 hours, at least 12 hours but less than 24 hours, or at least 24 hours, respectively, with the other unit in Mode 1 or 2.

The Plant Systems Branch (SPLB) has prepared the attached Safety Evaluation after having reviewed the applicable areas of the licensee's submittals (including its responses dated October 30, 1998 and March 29, 1999 to the staff's Request for Additional Information dated September 8, 1998) for which the SPLB has the primary review responsibility. We consider our efforts on TAC Nos. MA0342 and MA0343 complete.

Docket Nos.: 50-387 and 50-388

Attachment: As stated

Contact: D. Shum: 301-415-2860

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**SAFETY EVALUATION FOR PROPOSED TECHNICAL SPECIFICATION CHANGES
RELATED TO ULTIMATE HEAT SINK AVERAGE TEMPERATURE
SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2
DOCKET NOS. 50-387 AND 50-388**

1.0 INTRODUCTION

By letter dated June 1, 1998, the licensee (Pennsylvania Power and Light Company) requested an amendment to Operating License Nos. NPF-14 and NPF-22 for Susquehanna Steam Electric Station (SSES) Units 1 and 2, respectively. The amendment which proposed changes to the Technical Specifications (TS) of both units would replace the current ultimate heat sink (UHS) average water temperature limit of 88°F for all combinations of plant operations with a set of more restrictive values of 85°F, 87°F or 88°F depending on whether either unit has been in Mode 3 less than 12 hours, at least 12 hours but less than 24 hours, or at least 24 hours, respectively, with the other unit in Mode 1 or 2.

2.0 BACKGROUND

The UHS at SSES is a Seismic Category I concrete lined spray pond which is shared between Unit 1 and Unit 2. It is designed to provide sufficient cooling water to the emergency service water (ESW) system and the residual heat removal service water (RHRSW) system at a maximum average UHS water temperature of 97°F without make-up for 30 days following a designed basis loss-of-coolant accident (LOCA) in one unit and simultaneous shutdown of the other unit. In order to limit the average UHS water temperature at or below 97°F following a LOCA, the current plant TS Section SR 3.7.1.2 requires the average UHS water temperature be maintained at less than or equal to 88°F during plant operations in Modes 1, 2, or 3.

In June 1997, during an engineering review, the licensee identified an error in the decay heat values used to establish the UHS water temperature limit during plant operations in Modes 1, 2, or 3. Results of subsequent UHS water temperature analyses incorporating the corrected decay heat values show that there was a need to lower the maximum acceptable UHS water temperature from 88°F to 85°F during plant operations in Modes 1, 2, or 3 in order to limit the average UHS water temperature at or below 97°F following a LOCA.

The licensee further revised the UHS water temperature analyses with the decay heat values which take credit for the lower reactor decay heat rate 12 hours or more after shutdown and 24 hours or more after shutdown, compared to the reactor decay heat rate during the first 12 hours following shutdown. Results of the revised analyses indicate that the maximum UHS water temperatures which are allowed during plant operations in Modes 1, 2, or 3 vary from 85°F to 88°F depending upon the length of time one unit has been in Mode 3 while the other unit is in Modes 1 or 2. Therefore, the licensee proposed changes to the TS for both units to reflect the results of the revised UHS water temperature analyses by replacing the current ultimate heat sink (UHS) average water temperature limit of 88°F with a set of more restrictive values of 85°F, 87°F or 88°F.

The following evaluation covers the applicable areas of the licensee's submittals (including its responses dated October 30, 1998, and March 29, 1999, to the staff's Request for Additional Information dated September 8, 1998) for which the Plant Systems Branch has the primary review responsibility.

3.0 EVALUATION

3.1 Surveillance Requirements (SR) Regarding Average UHS Temperature LIMITS During Plant Operation

Current TS

TS Section SR 3.7.1.2 requires that:

Verify the average water temperature of the UHS is $\leq 88^{\circ}\text{F}$ once per 24 hours.

Proposed TS

The licensee proposed to replace the above current TS Section SR 3.7.1.2 with the following three subsections:

a. SR 3.7.1.2.a

When both units are in MODE 1 or 2, or either unit has been in MODE 3 for less than twelve (12) hours, verify the average water temperature in the UHS is $\leq 85^{\circ}\text{F}$ once per 24¹ hours.

b. SR 3.7.1.2.b

When either unit has been in MODE 3 for at least twelve (12) hours but not more than twenty-four (24) hours, verify the average water temperature in the UHS is $\leq 87^{\circ}\text{F}$ once per 24² hours.

¹ In the response (dated October 30, 1998) to the staff's request for additional information (RAI), the licensee stated that seven resistance temperature detectors (RTDs) are used to monitor spray pond temperature. Four of these RTDs are in the spray network areas and provide only surface temperatures. The remaining three RTDs are in a vertical array just outside the ESWS pump house and provide surface, middle and bottom temperature inputs to the average temperature calculation. Spray pond temperatures from the latter three RTDs are recorded four times a day in the shiftly surveillance log (This is more restricted than the TS requirement of once per 24 hours). An individual reading is recorded for each of the 3 levels, and an average value is calculated manually.

² Same as Footnote 1.

c. SR 3.7.1.2.c

When either unit has been in MODE 3 for at least twenty-four (24) hours, verify the average water temperature in the UHS is $\leq 88^{\circ}\text{F}$ once per 24³ hours.

The licensee stated that the revised decay heat values used in the UHS water temperature analyses were calculated in accordance with the guidance described in NRC Branch Technical Position ASB 9-2 and took credit for the lower decay heat generated in reactor 12 hours or more after shutdown and 24 hours or more after shutdown, compared to the reactor decay heat generated in reactor during the first 12 hours following shutdown. The UHS water temperature analyses were re-performed in accordance with the guidance described in Regulatory Guide 1.27 and with conservative inputs to establish the proposed TS UHS water temperature limits. The licensee identified the conservatisms considered in the analyses. The following are the more significant conservatisms:

- a. A worst case initial spray pond level (the highest pond level) is assumed to reduce the distance that spray droplets travel through air from the nozzles back to the pond. Thus, heat removed from the spray droplets will be minimized.
- b. No heat loss from the spray pond to the environment through the concrete basin is assumed.
- c. No credit is taken for heat loss from ESW/RHRSW system components and piping to the environment.
- d. All pump energy is assumed to be deposited into the working fluid.

In addition, a measurement error allowance of 0.5°F is included (by increasing the initial UHS water temperature from 85°F to 85.5°F) in the calculation.

In response to the staff's concerns, the licensee performed an additional analysis using less conservative (more realistic) assumptions to calculate the average UHS water temperatures to demonstrate that adequate margins exist in the above proposed TS temperature limits for UHS. The licensee revised the above cited conservative assumptions in the following manner:

- a. An average spray pond water level is assumed based on a calculated water level decrease of 6" during the first 44 hours following a LOCA. The effect of this revised assumption is an increase in the heat removal from the UHS compared to the previous calculation by increasing the effective distance that spray droplets travel through air from the nozzles back to the pond surface.
- b. The heat transferred from the UHS water to the sediment, concrete basin and supporting soil as the UHS water temperature rises is included.

³ Same as Footnote 1.

- c. The heat transferred from the ESW and RHRSW fluid through the wall of the piping to the surrounding soil as the UHS water temperature rises is accounted for.
- d. Estimated power input to the ESW and RHRSW pumps consistent with the manufacture's brake horsepower curves for the respective system pumps are used in the calculation.

Based on the calculations using the revised assumptions described above, the licensee stated that the analytical limit for the initial UHS water temperature for 2-unit operation is 87.5°F in order to limit the average UHS water temperature at or below 87°F following a LOCA. The corresponding proposed TS surveillance limit of 85°F will provide an adequate margin to this analytical limit. Similarly, for 1-unit operation with one unit shutdown at least 12 hours and for 1-unit operation with one unit shutdown at least 24 hours, the analytical limits are 89.5°F and 90.5°F, respectively. The corresponding proposed TS surveillance limits of 87°F and 88°F, respectively, will provide adequate margins to these analytical limits.

In the October 30, 1998 submittal, the licensee stated that the spray pond temperature monitoring system will provide an alarm in the control room as well as an alarm in the ESW system pump house whenever the spray pond temperature of 83°F is detected by any of the seven⁴ RTDs. Plant operating procedures require operator actions to reduce the spray pond temperature whenever a spray pond high temperature alarm is received. The 2°F margin between the spray pond alarm setpoint of 83°F and the TS temperature limit of 85°F provides sufficient time for operator response.

In the October 30, 1998 submittal, the licensee stated that a new calculation confirming spray pond temperature measurement uncertainty was performed. The calculation, which took into consideration accuracy of all loop components, repeatability, readability of indicators, calibration accuracy, and drift, as well as biased accuracy for non-independent (shared or common) components, showed an overall uncertainty of +1.97°F. Also, based on its review of the calibration records for the loops used to calculate the average UHS water temperature for the 10-year period that included the most recent (1996) calibrations, the maximum as-found loop inaccuracy had not exceeded the design accuracy of $\pm 2^\circ\text{F}$. Only twice during that period had the as-found inaccuracy for any of these loops been as much as $\pm 1.25^\circ\text{F}$. The licensee concludes that the spray pond water temperature measurement uncertainty is bounded by the margin of $\pm 2^\circ\text{F}$ design accuracy.

Based on its review of the licensee's rationale and the conservatism described above, the staff finds the above proposed TS temperature limits for the spray pond during plant operation acceptable.

⁴ See Footnote 1.

3.2 TS B 3.7.1.c Regarding An OPERABLE UHS

Current TS B 3.7.1.c defines an OPERABLE UHS as follow:

The OPERABILITY of the UHS is based on having a minimum water level of 678 feet 1 inch above mean sea level and a maximum water temperature of 88°F.

The licensee proposed to revise TS B 3.7.1.c to define an OPERABLE UHS in the following manner:

The OPERABILITY of the UHS is based on having a minimum water level at the overflow weir of 678 feet 1 inch above mean sea level and a maximum water temperature of 85°F; unless either unit is in MODE 3. If a unit enters MODE 3, the time of entrance into this condition determines the appropriate maximum UHS fluid temperature. If the earliest unit to enter MODE 3 has been in that condition for less than (12) hours, the peak temperature to maintain OPERABILITY of the UHS remains at 85°F. If the earliest unit has been in MODE 3 for more than (12) hours but less than twenty-four (24) hours, the OPERABILITY temperature of the UHS becomes 87°F. If the earliest unit has been in MODE 3 for more than twenty-four (24) hours or more, the OPERABILITY temperature of the UHS becomes 88°F.

The staff finds that the the above revised definition for UHS OPERABILITY appropriately reflects the UHS temperature limit as established in the proposed TS SR 3.7.1.2. Therefore, the staff finds it acceptable.

4.0 CONCLUSION

Based on its review of the licensee's rationale and the evaluation described above, the staff finds that the design and operation of the UHS at SSES are in accordance with the guidance described in RG 1.27. Therefore, the staff concludes that the above cited proposed TS changes acceptable.