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U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop OP1-17
Washington, DC 20555

SUSQUEHANNA STEAM ELECTRIC STATION (SSES)
REQUEST FOR ADDITIONAL INFORMATION
GENERIC LETTER 2008-01
"MANAGING GAS ACCUMULATION IN EMERGENCY CORE COOLING, DECAY HEAT REMOVAL, AND CONTAINMENT SPRAY SYSTEMS"
PLA-6680

Docket Nos. 50-387 and 50-388

References: 1) NRC Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," dated January 11, 2008.

2) PLA-6439, Mr. B. T. McKinney (PPL) to Document Control Desk (USNRC), "Nine-Month Response to NRC Generic Letter 2008-01," dated October 14, 2008.

3) Letter from Mr. B. K. Vaidya (USNRC) to Mr. T. S. Rausch (PPL), Request for Additional Information (RAI) - Susquehanna Steam Electric Station, Units 1 and 2 (SSES 1 and 2) - Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," dated December 2, 2010.

The Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2008-01 (Reference 1) to request that each licensee evaluate the licensing basis, design, testing, and corrective action programs for the Emergency Core Cooling Systems (ECCS), Decay Heat Removal system, and Containment Spray system, to ensure that gas accumulation is maintained less than the amount that challenges operability of these systems, and that appropriate action is taken when conditions adverse to quality are identified.

Reference 2 provided PPL's response to GL 2008-01.

Reference 3 is an NRC request for additional information (RAI) to determine that SSES has acceptably demonstrated that the GL 2008-01 systems are in compliance with the current licensing bases, design bases, and applicable regulatory requirements; and that suitable design, operational, and testing control measures are in place for maintaining this compliance.

The PPL response to Reference 3 is provided in the enclosure to this letter.

Please direct any questions regarding this RAI response to Mr. Duane L. Filchner at (610) 774-7819.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: 1/6/11

T. S. Rausch

Enclosure: PPL Responses to NRC Request for Additional Information (RAI)

Copy: NRC Region I
Mr. P. W. Finney, NRC Sr. Resident Inspector
Mr. R. R. Janati, DEP/BRP
Mr. B. K. Vaidya, NRC Project Manager

Enclosure to PLA-6680
PPL Responses to NRC
Request for Additional Information (RAI)

NRC RAI (1):

Please address any discrepancies between the systems evaluated in the Boiling Water Reactor Owners Group (BWROG) Report and those at SSES and any discrepancies between the pump suction void criteria in the BWROG Report and NRC Inspection Guidance, Rev. 9.

PPL Response:

There were no discrepancies between systems discussed in the BWROG report and the SSES systems. SSES suction piping void acceptance criteria has been established for the Emergency Core Cooling systems (ECCS), which include RHR, Core Spray and High Pressure Coolant Injection, consistent with the current NRC inspection guidance, Rev. 9 referenced above.

Reference 2 provided the PPL submittal of the SSES response to GL 2008-01. At the time of this submittal, the only gas void acceptance criteria guidance that was available was in the BWROG report "BWR Owners' Group Technical Report ECCS Pumps Suction Void Fraction Study," dated August 2008, as discussed in Reference 2. Formal suction piping void acceptance criteria calculations were not performed at that time.

Subsequent to submitting Reference 2, SSES established gas void acceptance criteria for the ECCS suction piping in accordance with the NEI guidance document titled "Industry Guidance for Evaluation of Unexpected Voids or Gas Identified in Plant ECCS and Other Systems." This guidance document was transmitted from James H. Riley, NEI, to Mr. William H. Ruland, NRC, on June 18, 2009.

In order to ensure conservative results, acceptable suction piping void volume calculations were based on the minimum flow at which voids could be transported to the pump suction. (See discussion in response to NRC RAI (3) below). The suction piping acceptance criteria was used for subsequent ECCS suction piping inspections performed by PPL to support system operability in the event air/gas was found in the suction piping. As expected, there was no significant air/gas found in the SSES ECCS suction piping during these inspections.

It is recognized that there are differences between the NEI guidance document and the current NRC inspection guidance, "Guidance to NRC/NRR/DSS/SRXB Reviewers for Writing TI Suggestions for the Region Inspections, Revision 9," dated August 18, 2010, (ML102300053). The suction piping acceptance criteria established in accordance with the NEI guidance, in effect at that time, is considered reasonable and appropriate for the subject systems. The suction piping inspections that have been performed by PPL did not identify any significant air/gas in the piping. Therefore, based on the SSES ECCS suction

piping configuration and inspection results, no changes to the suction piping acceptance criteria are necessary.

It should also be noted that unlike some other BWR/PWR plants, air/gas voids are not expected to significantly increase in size as the voids get transported to pump suction. For the SSES ECCS systems, pressure drop calculations demonstrate that suction pressures at the pump inlets remain above atmospheric pressure under all modes of operation. Since the pump inlets remain "flooded" during system operation; the suction sources are situated well above the pump suction elevations; and all SSES ECCS suction piping is maintained above atmospheric pressure in standby conditions; no air/gas is expected to infiltrate the system through vents or valve packing leaks. In addition, unlike many PWR plants, there are no sources of air or gas connected directly to the ECCS suction piping.

NRC RAI (2):

The licensee states that pumps in the subject systems are located at the low points in the systems and are not subject to air intrusion. Did the licensee evaluate the possibility of a localized high point created within the pump and affect on pump performance?

PPL Response:

The possibility to create a localized high point within a SSES ECCS pump is determined to be not credible since all the ECCS pumps are located below the suction sources (suppression pool and condensate storage tank). The pumps are under positive pressure while in the standby condition and it is highly unlikely that a void could form in the pump body under these conditions.

Additionally, the core spray and RHR pumps are multi-stage vertical pumps with the pump impellers situated below the suction piping. This configuration is not subject to gas voiding within the pumps.

Pump vents are also installed on the ECCS pumps and are used to vent air from suction piping and the pump casings in accordance with system restoration procedures, following maintenance activities.

NRC RAI (3):

It is not clear if the licensee considered gas transport to suction piping from high points in the system at conditions other than minimum flow. Explain how the licensee has evaluated conditions other than minimum flow. For example, test flow rates may be less than that would result during a response to an event or the actual system response may involve two trains as opposed to the design basis that one train has failed. Either of these

conditions may cause gas to move whereas a minimum flow assumption may not affect the pumps because gas is not expected to move.

PPL Response:

The SSES suction piping evaluations considered all system operating conditions, where voids could be transported from high points in the system to the ECCS pumps. The range of operating conditions considered was determined in accordance with NEI guidance referenced in the response to NRC RAI (1) above.

The suction piping void acceptance criteria was established as follows:

1.) The minimum flow at which voids could be transported from high points in the system to the pump suction, was determined assuming a Froude number of 0.31 in each of the ECCS pump suction lines, consistent with the NEI guidance.

2.) The range of operating conditions (in terms of % of best efficiency point (BEP)) to apply the gas void acceptance criteria was determined. This typical range was from the minimum flow established (per the NEI guidance) to maximum pump runout conditions for each system, as determined in the evaluation.

3.) After the operating range was established, the criteria provided in Table 1 of the NEI guidance document for transient conditions was used to determine the allowable gas void fraction in the suction piping for each system. Since the minimum flow to transport voids was typically determined to be below 70% of BEP for these systems, a maximum void fraction of 5% over 5 seconds was used to determine the allowable void size in the ECCS on piping.

4.) The maximum void size was then calculated based on the minimum flow established for void transport with a void fraction of 5% over 5 seconds. These calculated allowable suction piping void volumes were used as the acceptance criteria for subsequent suction piping inspections performed by PPL.