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U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

10 CFR 50.90

**SUSQUEHANNA STEAM ELECTRIC STATION
RESPONSE TO NRC REQUEST FOR SUPPLEMENTAL
INFORMATION FOR LICENSE AMENDMENT REQUEST
TO REVISE DIESEL GENERATOR SURVEILLANCE
REQUIREMENTS WITH NEW STEADY STATE VOLTAGE
AND FREQUENCY LIMITS
PLA-7583**

**Docket No. 50-387
50-388**

References:

1. *NRC Letter to Brad Berryman, "Susquehanna Steam Electric Station, Units 1 and 2- Supplemental Information Needed for Acceptance of Requested Licensing Action RE: License Amendment Request to Revise Diesel Generator Surveillance Requirements with New Steady State Voltage and Frequency Limits (CAC NOS. MF9131 and MF9132)," dated March 6, 2017.*
2. *SSES Letter to NRC (PLA-7471), "Susquehanna Steam Electric Station Proposed License Amendments to Revise Diesel Generator Surveillance Requirements with New Steady State Voltage and Frequency Limits," dated January 25, 2017.*

Within the letter provided under Reference 1, the NRC has documented a request for supplemental information to enable the staff to make an independent assessment regarding the acceptability of the proposed license amendment request submitted under Reference 2. The proposed amendment requests revision to the Susquehanna Steam Electric Station (SSES) Units 1 and 2, Operating Licenses NPF-14 and NPF-22 Surveillance Requirements in Technical Specification (TS) 3.8.1, "AC [Alternating Current] Sources - Operating."

The Attachment to this letter provides the SSES response to the supplemental information requested in Reference 1.

This letter contains no new regulatory commitments.

If you have any questions or require additional information, please contact Mr. Jason Jennings, Manager of Nuclear Regulatory Affairs, at (570) 542-3155.

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

Executed on: March 21, 2017



Brad Berryman

Attachment: SSES Response to NRC Supplemental Information Request for License
Amendment Request to Revise Diesel Generator Surveillance Requirements
with New Steady State Voltage and Frequency Limits

Copy: NRC Region I
Ms. T. E. Hood, NRC Project Manager
Ms. L. H. Micewski, NRC Sr. Resident Inspector
Mr. M. Shields, PA DEP/BRP

Attachment to PLA-7583

**SSES Response to NRC Supplemental Information
Request for License Amendment Request to Revise
Diesel Generator Surveillance Requirements with
New Steady State Voltage and Frequency Limits**

NRC Question 1:

The NRC staff has determined that clarification is needed with regard to the referencing of topical report (TR) WCAP-17308, "Treatment of Diesel Generator (DG) Technical Specification Frequency and Voltage Tolerances." WCAP-17308 is still under NRC staff review and is not an approved TR. Therefore, the NRC staff is requesting clarity of the licensee's use of this unapproved TR referenced in Attachment 3 of the LAR. This information will enable the NRC staff to complete its detailed review and make an independent assessment regarding the acceptability of the proposed amendment in terms of regulatory requirements and the protection of public health and safety and the environment.

SSES Response to Question 1:

As stated in the License Amendment Request submittal (PLA-7471), the information provided in Attachment 3 is "For Information Only." This attachment is provided to the NRC to help review the License Amendment Request by providing details on the analysis already performed and accepted for use as design basis related information at the station. The specific use of the reference to the WCAP in the attachment is not requiring nor warranting any NRC review associated with its limited use in the calculation. The reference to the WCAP within calculation EC-024-1035 provided in Attachment 3 is provided only as an identifier for the derivation of the mathematical formula for the net effect of voltage and frequency variations on motor steady state speed (Equation 8 of the calculation). The respective formula is derived from standard equations that relate voltage, torque, and frequency of a motor. This is not specific to the use of the WCAP or to the requested licensing action of our submittal. It is not the intention of Susquehanna Nuclear to utilize the WCAP in verification of the formula or its results as presented within the WCAP report. It is also not the intention of the Licensee to either demonstrate endorsement of the WCAP or request the NRC endorsement or review of the WCAP, or its contents, with respect to the License Amendment Request submitted under our letter, PLA-7471.

NRC Question 2:

Section 4.3.9, Appendix K Analysis, of the LAR states that “[t]here is no need to account for the impacts of uncertainties in site-specific Emergency Core Cooling System (ECCS) flow-rates, induced by a $\leq 2\%$ reduction in diesel speed in the [Loss-of-Coolant-Accident] LOCA analysis.” Section 50.46 of Title 10 of the Code of Federal Regulations governs LOCA analyses for individual nuclear plants. The results of the limiting cases of the LOCA analyses performed using the ECCS model are often referred to as the “analysis of record” (AOR). The AOR is used to establish core operating limits for each cycle according to the licensee’s approved reload methodology. The proposed changes in the DG voltage limits and frequency limits may affect the ECCS flow. Provide the method and assumptions used in the estimation, and the results of the ECCS flow change resulting from the DG voltage and frequency limits changes on the AOR. Demonstrate that the change in the calculated peak clad temperature (PCT) is small and the existing margin to the PCT limit of 2,200 degree Fahrenheit is not adversely impacted.

SSES Response to Question 2:

The two Emergency Core Cooling Systems (ECCS) that are impacted by the proposed Technical Specification (TS) change to Diesel Generator (DG) voltage and frequency limits are Core Spray (CS) and the Residual Heat Removal (RHR) system operated in the low pressure coolant injection (LPCI) mode of operation. The current Loss of Coolant Accident (LOCA) Analysis of Record (AOR) uses a reduced flow rate with respect to the required TS flow rates specified in TS Surveillance Requirement (SR) 3.5.1.7. To determine if the AOR was impacted, an estimate was performed to determine if the expected flow rates at the new DG voltage and frequency limit bounds the current flow rates used in the AOR.

The estimate analysis first determined the expected decrease in pump speed due to the change in DG frequency and voltage. The following formula was used to determine the change in pump speed:

$$\Delta S = [(V_1 f_2 / V_2 f_1)^2 - 1](S_{\text{synch}} - S_1) + S_1(1 - (f_2 / f_1))$$

Where S = pump speed (rpm)

f = DG frequency (Hz)

V = voltage (V)

The pump affinity laws were then used to determine the change in pump flow and head for the values in TS SR 3.5.1.7 based on the change in pump speed. These newly calculated TS flow rates at reduced DG voltage and frequency were then compared to the values used in the AOR. Note that an additional step in calculating the change in RHR flow rate was needed. As part of the RHR LPCI design basis, the assumption is made that the minimum flow bypass valve fails open. To determine the flow split between the minimum flow bypass line to the suppression pool and the vessel, a flow model was developed and the results of the flow model are used for the analysis.

The results demonstrated that the ECCS flow rates used in the LOCA analysis are not impacted:

- 1) The Core Spray flow rates at the reduced DG frequency and voltage are bounded by the flow rates used in the LOCA analysis at all differential pressures
- 2) The RHR flow rates at the reduced DG frequency and voltage are bounded by the flow rates used in the LOCA analysis at pressures below approximately 200 psid. Peak Clad Temperature (PCT) occurs at approximately 118 seconds when vessel pressure is 25 psig. The integrated RHR flow rate at reduced DG frequency and voltage is bounded by the LOCA analysis. The following table provides RHR pump flow rates for the degraded pump curve and the values used for the LOCA analysis.

Differential Pressure (psid)	RHR Flow Rate @ <u>reduced</u> frequency and voltage (gpm)	Differential Pressure (psid)	RHR Flow Rate in LOCA Analysis (gpm)
0	12,071	0	11,347
177	6,591	177	6,420
237	2,743	237	2,971
261.9	4.4	270	0

Based on the above discussion, the ECCS flow rates used in the LOCA AOR are not impacted by adjusted flow rates at reduced DG frequency and voltage for the proposed change.