



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 7, 2017

Mr. Brad Berryman
Site Vice President
Susquehanna Nuclear, LLC
769 Salem Boulevard
NUCSB3
Berwick, PA 18603-0467

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2 – REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST TO REVISE DIESEL GENERATOR SURVEILLANCE REQUIREMENTS WITH NEW STEADY STATE VOLTAGE AND FREQUENCY LIMITS (CAC NOS. MF9131 AND MF9132)

Dear Mr. Berryman:

By letter dated January 25, 2017,¹ as supplemented by letter dated March 21, 2017,² Susquehanna Nuclear, LLC (the licensee) submitted a license amendment request for Susquehanna Steam Electric Station, Units 1 and 2. The proposed amendments requested changes to certain surveillance requirements in Technical Specification 3.8.1, "AC [Alternating Current] Sources – Operating." The requests are for changes in the use of steady state voltage and frequency acceptance criteria for the onsite standby power source of the diesel generators, allowing for the use of new and more conservative design analysis.

To complete its review, the U.S. Nuclear Regulatory Commission staff requests responses to the enclosed Request for Additional Information. The draft questions were sent to Ms. Melisa Krick of your staff to ensure that they were understandable, the regulatory basis for the questions was clear, and to determine if the information was previously docketed. Please respond within 30 days of the date of this letter.

If you have any questions, please contact me at (301) 415-1387 or Tanya.Hood@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "Tanya E. Hood".

Tanya E. Hood, Project Manager
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

Enclosure:
Request for Additional Information

cc w/enclosure: Distribution via Listserv

¹ Agencywide Documents Access and Management System (ADAMS) Accession No. ML17044A149

² ADAMS Accession No. ML17080A405

REQUEST FOR ADDITIONAL INFORMATION
LICENSE AMENDMENT REQUEST REGARDING
DIESEL GENERATOR SURVEILLANCE REQUIREMENTS
WITH NEW STEADY STATE VOLTAGE AND FREQUENCY LIMITS
SUSQUEHANNA NUCLEAR, LLC
SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2
DOCKET NOS. 50-387 AND 50-388

By letter dated January 25, 2017,¹ as supplemented by letter dated March 21, 2017,² Susquehanna Nuclear, LLC (the licensee) submitted a license amendment request (LAR) for Susquehanna Steam Electric Station, Units 1 and 2. The proposed amendments requested changes to certain surveillance requirements (SRs) in Technical Specification (TS) 3.8.1, "AC [Alternating Current] Sources – Operating." The requests are for changes in the use of steady state voltage and frequency acceptance criteria for the onsite standby power source of the diesel generators (DGs), allowing for the use of new and more conservative design analysis.

The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the information submitted by the licensee and determined that additional information is required to complete its review. The specific request for additional information (RAI) is addressed below.

RAI-1

The analysis of record (AOR) in the Final Safety Analysis Report indicates that the limiting case of the loss-of-coolant accident (LOCA) is the double-ended guillotine break of the recirculation suction line concurrent with a loss of offsite power, assuming a single low pressure core injection valve failure. The proposed TS related to the voltage and frequency limits for DG SRs may result in flow rates of the emergency core cooling system lower than that assumed in the LOCA analysis.

Show that for the proposed TS conditions, the non-limiting LOCA cases will not become the limiting case and the LOCA AOR remains unchanged.

RAI-2

When the DG is operating at a steady state frequency of 60.5 hertz (Hz), the pump flow rate increases and the pump suction side pressure losses increase. This will decrease the available net positive suction head (NPSH). Additionally, the required NPSH for the pump increases as the flow rate increases.

Discuss the change in NPSH margin for each pump affected by the LAR when the DG operates at a steady state frequency of 60.5 Hz.

¹ Agencywide Documents Access and Management System (ADAMS) Accession No. ML17044A149

² ADAMS Accession No. ML17080A405

RAI-3

In Section 4.3.2, "DG Jacket Water," of the LAR, it states:

Under normal operation, the engine-driven jacket water pump pressure for DG A and E is 30 psig [pounds per square inch gauge], and its low-pressure alarm is 12 psig and 10 psig for DGs A and E, respectively.

Provide the engine-driven jacket water pump pressures and low-pressure alarm settings for DG B through D.

RAI-4

Discuss whether or not any relief valves on the pumps' discharge piping will lift due to the higher discharge pressure when the DG is operating at 60.5 Hz.

RAI-5

In Section 4.3.4, "DG Loading," of the LAR, it states, in part:

The non-ESF [engineered safety feature] loads are not required for mitigating the effects of a design basis event of LOCA/LOOP [[loss-of-coolant accident/loss of offsite power] on one unit and forced shutdown of the second unit, and their ultimate operation status is at plant operations discretion. The subject non-ESF loads account for more than 620 kW [kilowatts] of DG A loading beyond one hour of operation under the considered DBA [design-basis accident] scenario....

Thus, without the non-ESF loads, analysis shows that for the most severe design basis event, DGs A and E total loadings under limiting voltage and frequency variations within acceptable steady state ranges are within their respective continuous rating of 4000 kW and 5000 kW, with at least approximately 9.8% and 22.5% additional margins for DG A and E, respectively.

The NRC staff notes that the LAR does not provide sufficient information to support the conclusion for the above-mentioned analysis regarding the total loading of DG A and DG E.

Provide a discussion including a tabulated summary of the analysis that demonstrates DG A and DG E total loadings with and without non-ESF loads required for mitigating the worst case design-basis event when the DGs operate at the extremes of the proposed steady state voltage and frequency ranges.

RAI-6

In Section 4.2, "DG Steady State Frequency," of the LAR it states that the proposed minimum steady state frequency limit of 59.3 Hz produces the minimum transient frequency recommended for DG E under Regulatory Guide 1.9, Revision 2, "Selection, Design, and Qualification of Diesel-Generator Units Used as Standby (Onsite) Electric Power Systems at Nuclear Power Plants." The LAR also stated that the design of DGs A thru D conforms to Regulatory Guide 1.9, Revision 0 (Safety Guide 9), "Selection of Diesel Generator Set Capacity for Standby Power Supplies," and takes exception to the 95 percent of nominal (i.e., 57 Hz)

minimum frequency recommendation during transient periods. In addition, the LAR stated that the maximum frequency transient occurs during the start of residual heat removal (RHR) pump motor, which is the first major and the largest load applied to the DGs during a LOOP concurrent with a DBA test.

The NRC staff notes that, according to Tables 8.3.1 and 8.3.3 of the Susquehanna Updated Final Safety Analysis Report (UFSAR), Revision 67, an RHR pump motor is the first largest load applied to a DG (e.g., DG A) 13 seconds from the DBA for the unit in an accident condition, and an RHR pump is also loaded on another DG (e.g., DG D) 30 minutes later (after other loads have sequenced onto DG D) to support shutdown of the non-accident unit. DG E can be used to substitute for any of the DGs A, B, C, and D.

Since the maximum frequency transient occurs during the start of an RHR pump motor, provide the following:

- a) Discuss the impacts of the frequency and voltage deviations when the RHR pump is started after 30 minutes with the DGs loaded as postulated for all the DGs. In the discussion, specifically address how the deviations affect RHR pump and RHR train performance, considering the DGs' frequency and voltage variations during load sequencing, as specified in Regulatory Guide 1.9, Revision 0 and Revision 2, and UFSAR Section 8.1.6.1.b.6.
- b) Confirm that the voltage and frequency transient variations discussed above will not adversely impact accident mitigation loads that have been sequentially loaded prior to the RHR pump.

RAI-7

In Section 4.3.6, "Motor Impact," of the LAR it states:

Per NEMA [National Electrical Manufacturers Association] standard MG-2, a frequency allowance of up to 5% is permissible, provided the arithmetic sum of the frequency variation and the voltage frequency does not exceed 10% [of the rated values].

The NEMA MG-2 also allows a combined variation in voltage and frequency of -10 percent provided that the frequency variation is limited to -5 percent. The NRC staff notes that in the event that the DG steady state voltage and frequency are at their maximum values (i.e., 4,400V [voltage] and 60.5 Hz) simultaneously, the combined variation would exceed the NEMA MG-2 limit of +10 percent. The NRC staff also notes that if the DG steady state voltage and frequency were at their respective maximum value (4,400V) and minimum value (59.3 Hz), the combined variation would exceed the NEMA MG-2 limit of -10 percent.

Since the combination of the proposed DG voltage and frequency variations may exceed the NEMA recommended limits for motors in some cases, provide the following:

- a) A discussion regarding the net effect of the proposed voltage and frequency variations on the motors and loads that have minimum design margins between nominal rating and maximum postulated load.

- b) A discussion about the impact of the proposed DG frequency and voltage variations on the protective devices associated with the motor loads.
- c) A discussion about motor capability if the associated pump is operating under runout conditions.

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