KHNPDCDRAIsPEm Resource

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Sent:	Monday, July 06, 2015 1:31 PM
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Cc:	Som, Swagata; Steckel, James; Lee, Samuel
Subject:	APR1400 Design Certification Application RAI 61-7984 (08.03.01 - AC Power Systems (Onsite))
Attachments:	APR1400 DC RAI 61 EEB 7984.pdf; image001.jpg

KHNP

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs. However, KHNP requests, and we grant, 60 days to respond to this RAI. We may adjust the schedule accordingly.

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

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REQUEST FOR ADDITIONAL INFORMATION 61-7984

Issue Date: 07/06/2015
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 08.03.01 - AC Power Systems (Onsite)
Application Section: 8.3.1

QUESTIONS

08.03.01-5

In Section 8.3.1.1, page 8.3.1-1, of the DCD Tier 2, the applicant states that “The COL applicant is to provide and to design a mobile generator and its support equipment (COL 8.3.1).” The staff notes that approximate sizing information of certain major equipment is provided. It appears that the sizing criteria for the mobile generator equipment and determining the design details are left for the Combined Operating License (COL) applicants to decide based on site specific information. However, the applicant has not provided any design aspects, including physical location, connection configuration, the method of transferring the source to safety buses, specification of the equipment, details of support equipment, and the methodology to determine the capacity of the mobile generator for its intended function during loss of all AC power in the scenario of a beyond design basis external event.

Provide a summary of the design aspects of the mobile generator, including anticipated physical location, connection configuration, the method of transferring the source to safety buses, specification of the equipment, details of support equipment.

Please discuss the methodology to determine the capacity of the mobile generator to show it can complete its intended function during loss of all AC power in the scenario of a beyond design basis external event.

08.03.01-6
Loss of Voltage and Degraded Voltage Relay Protection :

1. DCD Section 8.3.1.1.3.12, Protective Relaying System, states that “Class 1E buses are provided with separate bus voltage monitoring and protection schemes for degraded and loss of voltage conditions.” Also this section states that “There are four first-level undervoltage (UV) relays to detect loss of voltage, and four second-level UV relays to detect degraded voltage on each of the four Class 1E buses.”

In describing the schemes, the applicant further states that the dropout for the second-level UV relays for the Class 1E distribution system is set at a level above the minimum voltage that allows proper operation of safety loads with the worst-case line-up and minimum switchyard voltage.

a. Explain what constitutes the safety loads with worst-case line-up, and how the minimum switchyard voltage is determined. Also, clarify whether the statement “the minimum voltage that allows proper operation of safety loads” means providing the minimum required voltages for important to safety loads for starting and running large motors or the limiting load that is required to meet its intended function during design basis events and accidents.

b. Provide sufficient basis for staff to understand the proposed scheme, and explain the analytical limit for voltage and time delay chosen for the degraded voltage relay protection (DVR) scheme and the bases as per BTP 8-6 Position 1a, which states that “The selection of UV and time delay setpoints should be determined from an analysis of the voltage requirements of the Class 1E loads at all onsite system distribution level.”

c. In Regulatory Issue Summary RIS-2011-12, Rev 1, the staff provided a position regarding degraded voltage protection for nuclear power plants after the events at Millstone and Arkansas. For DVR Setting Design Calculations, this RIS states that voltage calculations should provide the basis for their DVR settings, ensuring safety-related equipment is supplied with adequate voltage, based on bounding conditions for the most limiting safety-related load in the plant. Provide a basis of the voltage studies, ensuring that no improper voltage protection logic can cause adverse effects on the Class 1E systems and equipment due to degraded voltage conditions.

2. Provide a detailed discussion of the loss of voltage protection (LOV) scheme including the analytical limit for voltage and time delay as well as their basis.

3. DCD Section 8.3.1.1.3.12 states that "These relays [LOV and DVR] consists of a two-out-of-four coincidence logic in the component control system (CCS)". Explain the function of the CCS and describe what is meant by two-out-of-four coincidence logic. Discuss how the EDG Actuation functions for Degraded Grid Voltage, Loss of Voltage, and Safety Injection System (SIS) Actuation are implemented in the CCS.

08.03.01-7

DCD Tier 2, Section 8.3.1.1.3, Class 1E Emergency Diesel Generator (EDG), provides the descriptions the EDG and related information. Since GDC 17 relates to the safety related onsite power system's capacity and capability, the staff has the following questions to evaluate that the EDG system meets the requirements:

1. Target Reliability Factor: DCD Tier 2, Section 8.3.1.1.3, states that the EDG units have the minimum target reliability factor of 0.95 in accordance with NRC RG 1.9. Since the reliability factor is dependent on all other factors (redundancy of EDGs, frequency of LOOP, and probable time needed to restore offsite power), a higher reliability of the EDGs will result in a lower probability of a station blackout with a corresponding decrease in coping duration for certain plant. Since this is a site specific item to verify the reliability during the operation of the plant, the staff considers this should be a COL item and should be added in the DCD Section 8.3.1 and Chapter 1. A COL applicant that references the APR1400 design certification will establish procedures to monitor and maintain EDG reliability during plant operations to verify the selected reliability level target is being achieved as intended in RG 1.155. Also please discuss the methodology and relevant attributes of the reliability program.

2. Generator information: Provide a description of the generator type and pertinent characteristics (including cooling type, Brushless, Seismic category, etc). Please include these EDG details in Table 8.3.1-6, Electrical Equipment Ratings and Component Data. Discuss the generator's supporting systems or provide reference where these are discussed elsewhere in the DCD.

3. Loading Sequence Time: DCD Tier 2, Section 8.3.1.1.3.6, states that the EDGs are started on an engineered safety features actuation system (ESFAS) and ready for operation within 17 seconds. In Table 8.3.1-2, Class 1E Loads, load sequence time is provided for loading Class 1E equipment to the EDG, which shows loading sequence time from 5 seconds to 30 seconds. Please clarify if this loading sequence time begins after the 17 seconds as mentioned in Section 8.3.1.1.3.6.

4. Starting and Loading: Table 8.3.1-2, Class 1E Loads, shows that large induction motors are started in quick succession, from 5 to 30 seconds, and as a result, can cause a voltage reduction at the bus. This could cause a running motor to stall, or prevent a motor from starting. Explain how the EDG can adequately supply the Class 1E loads and can accept large loads in quick succession, accomplish recovery from transients without tripping or causing the EDG to overspeed. Explain how the voltage and frequency are restored to within 10% and 2% of nominal respectively with load step increase in accordance with RG 1.9.

5. Capacity Margin: RG 1.9 states that the uncertainties inherent in safety load estimates at an early stage of design are sometimes of such magnitudes that it is prudent to provide a reasonable margin in selecting the load capabilities of the EDGs. Please discuss the margins provided for EDGs, specifically for capacity, voltage, frequency, etc.

6. Tripping Devices: DCD Tier 2, Section 8.3.1.1.3.3, Tripping Devices, does not address certain mechanical and electrical trips, including Low Essential Service Water Pressure, Governor Failure, High Bearing Temperature, High Winding Temperature, Rotating Diode Failure, and Generator Field Ground. Please add these trip/alarm signals if applicable or provide justification for not including the aforementioned trips.

7. Alarm and annunciation: DCD Tier 2, Section 8.3.1.1.3.3, states that “The operating condition of each Class 1E EDG is monitored in the MCR and RSR. Trouble alarms for Class 1E EDG and devices are indicated in the MCR and RSR”. The staff finds that details of the alarm and annunciations to survey the variables are not addressed in this section. Provide a list of EDG indications and alarms for MCR, RSR and Local display. Furthermore, please confirm if the tripping devices mentioned in this section are also annunciated/displayed locally, in addition to MCR and RSR, so that EDG monitoring, trending, and in-service testing programs can be established.

8. Permissive: DCD Tier 2, Section 8.3.1.1.3.5, states that EDG operational mode selection (Local/Remote) is provided at the EDG local control panel. Please confirm if the switching to “Local” mode requires a permissive electrical interlock from the MCR.

9. EDG Support System: In DCD Tier 2, Section 8.3.1.1.3, three of the EDG subsystems are mentioned (Starting air system, Fuel Oil Storage and Transfer Systems, and EDG Cooling Systems) and a cross-reference to Section 9.5 is provided for these systems. However, other support systems, such as EDG Lubrication system, Air Intake and Exhaust system, and HVAC system are not mentioned in this section. In Section 8.3.1.1.3, please provide, for completeness, the appropriate cross reference to Chapter 9 for these other support systems.


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