AP1000DCDFileNPEm Resource

From: Loza, Paul G. [lozapg@westinghouse.com]
Sent: Monday, March 30, 2009 6:56 PM
To: David Jaffe; Christopher Proctor
Cc: Perry Buckberg; Rhonda Butler; Seelman, Robert J.
Subject: Acknowledgement of 11 Chapter 8 RAIs
Attachments: CH 8 RAI, Rev 17.doc

David,

I acknowledge receipt for Westinghouse of RAIs RAI-SRP8.3.1-EEB-04, and RAI-SRP8.3.2-EEB-01 through -10. I will contact you for an initial call between the Westinghouse SME and your reviewer.

Thanks,

Paul Loza

From: David Jaffe [mailto:David.Jaffe@nrc.gov]
Sent: Friday, March 27, 2009 11:21 AM
To: Loza, Paul G.
Subject: Revised RAI for Chapter 8

Please acknowledge receipt of this RAI and inform the staff if you need to discuss.

Hearing Identifier: AP1000_DCD_Review
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From: Loza, Paul G.

Created By: lozapg@westinghouse.com

Recipients:
"Perry Buckberg" <Perry.Buckberg@nrc.gov>
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REQUEST FOR ADDITIONAL INFORMATION
AP1000 DCD REVISION 17

RAI - SRP 8.3.1 - EEB-01

DCD Section 8.3.1.4.2 states, “Each diesel generator is tested to verify the capability to provide 4000 kW while maintaining the output voltage and frequency within the design tolerances of 6900±10% Vac and 60±5% Hz. The 4000 kW capacity is sufficient to meet the loads listed in table 8.3.1-1 and 8.3.1-2.” However, the sum of the total loads (automatic and manual) listed in each revised table exceeds the continuous rating of each diesel generator. Update the information in this section and justify why it is acceptable to exceed the continuous rating of the diesel generator at this stage of the design. Also, provide the provisions included in your design that will prevent overloading of the diesel generators when manual loads are powered from the diesel generator.

RAI - SRP 8.3.2 - EEB-01

In AP 1000 design, the system voltage for the operation of Class 1E dc loads has been changed from 125 V dc to 250 V dc. In this regard provide a discussion as to how this voltage change would impact motors, cables, protective devices, switchboard, and other equipment as applicable. Also, describe how motor sizing, cable sizing would still be compatible with valve loads.

RAI - SRP 8.3.2 - EEB-02

DCD Section 8.3.2.1 indicates that the operating voltage range of the Class 1E batteries is 210 to 280 Vdc and the maximum equalizing charge voltage for the Class 1E batteries is 280 Vdc. Confirm that the connected dc equipment is designed to operate up to the maximum voltage 280 Vdc.

RAI - SRP 8.3.2 - EEB-03

Provide the load profiles (duty cycle) from one minute to 24/72 hours for each of the 24-hour and the 72-hour Class 1E 250Vdc batteries. Also, discuss battery margins (aging margin, design margin, temperature correction factor, margin associated with float current for 100% state of charge) and potential for thermal runaway and the expected service life of these batteries.

RAI - SRP 8.3.2 - EEB-04

Describe how the 24-hour and the 72-hour 250 Vdc batteries would be qualified for service life. If safety-related batteries will be qualified using the recommendations of IEEE 535, “Standard for Qualification of Class 1E Lead Storage Batteries for Nuclear Power Generating Stations”, the NRC staff notes that this standard was written under the assumption of an 8-hour duty cycle. Since passive plant duty cycles are significantly longer than 8 hour duty cycle and IEEE-Std-535 does not apply to duty cycles longer than 8 hours, describe how these batteries will be qualified for extended duty cycles of

24-hours and 72-hours. Also, discuss the failure mode(s) for both the 24-hours and 72-hour duty cycles batteries.

RAI - SRP 8.3.2 - EEB-05

In order for staff to assess the adequacy of the dc power systems, provide the results of 250 Vdc battery and battery charger sizing calculations, battery terminal voltage calculations, short circuit calculations, and voltage drop calculations and the associated assumptions used.

RAI - SRP 8.3.2 - EEB-06

DCD Section 8.3.2.1.1.1 for 72-hour 250 Vdc batteries states, “Each switchboard connected with a 72-hour battery bank supplies power to an inverter. No load shedding or load manage program is needed to maintain power during the required 24-hour safety actuation period.” The NRC staff’s understanding is that no operator actions are required for 72 hour in AP1000 design. Clarify if manual actions would be necessary to maintain power during the required 72 hours and describe the loads that will be shed after 24 hours.

RAI - SRP 8.3.2 - EEB-07

DCD Section 8.3.2.1 indicates that the operating voltage range of the Class 1E batteries is 210 to 280 Vdc. Explain how battery room temperature will be maintained during loss of ac power? Battery performance is dependent on battery temperature. Provide assurance that the battery will perform its intended function without ac power to the battery room ventilation and air conditioning systems.

RAI - SRP 8.3.2 - EEB-08

DCD Section 8.3.2.1.1.1 indicates that the operating voltage range of the Class 1E dc system has been changed from 125 vdc to 250 Vdc. Figure 2.6.1-1 of the Tier 1 DCD shows that the MCCs that feed the safety-related 250 Vdc battery chargers are fed from 480 V load center. Provide detailed drawing of the 480 V load centers, the MCC that feed the battery chargers and the dc motor control center showing typical loads powered from these buses. Also, describe how the 480 V load centers are protected from degraded voltage and frequency conditions. In addition, provide the following information:

a. Provide the results of an analysis of the onsite power distribution system to demonstrate that adequate voltages at terminal of the battery chargers are optimized for the maximum and minimum voltage variations of the offsite power for events, such as a unit trip, loss-of-coolant accident, startup or shutdown.

b. Provide a description of the analytical techniques, methodology, and assumptions used in performing the analyses. Also, provide the results of these analyses for each level of onsite electrical power distribution.

c. Identify the analytical software (and its version) used for performing these studies and make available to the NRC staff an electronic copy of the

electrical distribution system model that form the basis of the analytical studies.

RAI - SRP 8.3.2 - EEB-9

The AP1000 is designed to sustain a load rejection from 100 percent power with the turbine generator continuing stable operation while supplying the plant house loads. The staff is concerned about the transient conditions where a significant voltage spike during islanding could cause high dc voltage conditions on the output side of the battery chargers. The operating experience (see Information Notice 2006-18) reveals that the voltage spike either due to malfunction of the main generator exciter or during islanding could go as high as 130% which could go undetected by normally provided relaying and could cause damage to the safety-related equipment or miss-operation. In this regard, describe how the protective features of the inverter and the new battery chargers would be coordinated so that any voltage transient will not result in inadvertent loss of the inverters or the batteries.

RAI - SRP 8.3.2 - EEB-10

The staff notes proposed changes to Tables 8.3.2-2 and -3 of the DCD. In this regard Note 8 of Figure 8.3.1-4 (Sheets 1 and 2) of the DCD indicate that the diesel generators include DC pre-lube oil pumps and keep-warm lube oil heaters. These loads are not included on Tables 8.3.2-2 and -3 of the DCD. Additionally, the same tables do not include DC power requirements to close and recharge the springs of the circuit breakers, nor do they include the DC power requirements for diesel generator field flashing and starting. Please indicate that the battery sizing will include these loads or provide a reference to where these loads are powered from.