Jeff Ciocco

From: Jeff Ciocco
Sent: Tuesday, June 10, 2008 4:50 PM
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Cc: Om Chopra; Allen Howe; Stephen Monarque; Larry Burkhart; Ngola Otto
Subject: US-APWR Design Certification Application RAI No. 8
Attachments: US-APWR DC RAI 8 EEB 343.pdf

MHI,

Attached please find the subject request for additional information (RAI). This RAI was not sent to you in draft form. The schedule we are establishing for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule. Please submit your RAI response to the NRC Document Control Desk.

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Request for Additional Information No. 8 Revision 0

6/10/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 08.03.02 - DC Power Systems (Onsite)

Application Section: 8.3.2

EEB Branch

QUESTIONS

08.03.02-2

RAI-SRP 8.3.2-EEB-01

Section 8.3.2.1.1,"Class 1E DC Power System," of the FSAR discusses the adequacy of the Class 1E DC power systems. Provide additional information in the following areas:

a. Inverter specification including voltage regulation, frequency variation, and total Harmonic distortion (THD)

b. Regulating transformer specifications including voltage regulation

c. UPS protective scheme against faults (e.g., overcurrent, fault current, undervoltage, underfrequency)

08.03.02-3

RAI-SRP 8.3.2-EEB-02

It is stated in Section 8.3.2.1.1 of the FSAR that each Class 1E battery charger has the capacity to recharge its battery from the design minimum charge to a 95% charged condition within 24 hours and simultaneously supply the normal dc loads of the associated 125V dc switchboard bus. However, the staff notes that the each non-Class 1E battery charger has the capacity to recharge its battery from the design minimum charge to fully charged condition within 24 hours and simultaneously supply the normal dc loads of the associated 125V dc switchboard bus. Provide your justification for not providing the Class 1E battery chargers enough capacity to recharge their batteries from the design minimum charge to fully charged condition rather than to a 95% charged condition.

08.03.02-4

RAI-SRP 8.3.2-EEB-03

It is stated in Section 8.3.2.1.1 of the FSAR that there are four Class 1E safety battery chargers: one for each train, connected to the Class 1E 125V dc switchboard bus. In addition, there are two installed non-Class 1E spare battery chargers, one spare battery charger AB for trains A and B, and another spare battery charger CD for trains C and D. The spare battery charger AB can be used to temporarily replace any one of the Class 1E battery chargers A or B. Similarly, the spare battery charger CD can be used to temporarily replace any one of the Class 1E battery chargers C or D. The non-Class 1E spare battery charger is placed in service to temporarily replace any one of the four inoperable Class 1E chargers. Provide your justification for replacing Class 1E battery chargers with non-Class 1E chargers when Class 1E chargers are inoperable during power operation. In addition, describe the periodic surveillances that will be performed on the non-Class 1E battery chargers.

08.03.02-5

RAI-SRP 8.3.2-EEB-05

It is stated in Section 8.3.2.1.1 of the FSAR that the Class 1E switchboards employ molded case circuit breakers and/or fusible disconnect switches as input and output circuit protection devices. Confirm whether it is going to be molded circuit breakers or fusible disconnect switches as input and output circuit protection devices. If molded circuit breakers are used, describe how the molded case circuit breakers will be coordinated with the downstream protective devices. In addition, provide results of the coordination studies performed on the dc system.

08.03.02-6

RAI-SRP 8.3.2-EEB-06

It is stated in Section 8.3.1.1.6 of the FSAR that in case of failure of the UPS unit or if the UPS
unit is out on maintenance, buses A, B, C and D are switched to the 50kVA, 480V/120V ac bypass transformer associated with the same train. Switching between each UPS unit and the bypass transformer is done automatically by an undervoltage signal. Describe in detail how this circuitry works and where the undervoltage signal is derived from.

08.03.02-7

RAI-SRP 8.3.2-EEB-07

Figure 8.1-1 of the FSAR shows that the A MOV MCC1, A MOV MCC2, B MOV MCC, C MOV MCC, D MOV MCC1 and D MOV MCC2 are fed from the corresponding train of

the MOV inverter each of which is backed up by the pertinent Class 1E 125V dc bus. Confirm that the batteries and battery chargers have sufficient capacity to provide backup power for the additional inverter load while carrying its own design basis loads.

08.03.02-8

RAI-SRP 8.3.2-EEB-08

The staff notes that the battery sizing includes only 10 percent design margin. IEEE std. 485 recommends a design margin of 10-15% capacity margin to allow for unforeseen additions to the dc system and less-than-optimum operating conditions of the battery due to improper maintenance, recent discharge, or ambient temperature lower than anticipated or a combination of these factors. Since the battery chargers are sized to carry the normal dc system load and simultaneously recharge a design basis discharged battery to 95 % of full rated capacity, the staff is concerned that when battery is declared operable at 95 % of the full rated capacity it will have only 5% margin available for load growth. Justify that 10% instead of 15% margin for load growth is adequate in your design when battery is supplying power at 95 % of the full rated capacity.

08.03.02-9

RAI-SRP 8.3.2-EEB-09

It is stated in Section 8.3.2.1.1 of the FSAR that the instrumentation and control (I&C) power supply system inverters are designed to supply 120 V ac power with dc input less than 140V and more than 108 V. I&C power supply system inverters are powered from dc switchboard and are capable of operating at the battery minimum terminal voltage of 108 V. Since, there will be some voltage drop from the battery terminal to the inverter terminal, explain how the voltage will be maintained more than 108V at the inverter terminal.

08.03.02-10

RAI-SRP 8.3.2-EEB-10

It is stated in Section 8.3.2.1.1 of the FSAR that the battery rooms are ventilated to the outside air to preclude a hydrogen concentration of more than 2%. A safety-related ventilation system is not directly required when the batteries perform their safety function. Clarify why operability of the safety-related ventilation system is not required when the batteries perform their safety function.

08.03.02-11

RAI-SRP 8.3.2-EEB-11

Table 8.3.2-1,"125 V DC Class 1E Load Current Requirement," of the FSAR provides current requirement of 438 amps for a UPS unit in all columns of the table. Since the battery voltage decreases after one minute and reduces to 108V after two hours, shouldn't the dc input current for the UPS increase as the battery input voltage to the UPS decreases?

08.03.02-12

RAI-SRP 8.3.2-EEB-12

Table 8.3.2-1 of the FSAR shows current requirement of 1 amp for Class 1E 480V Load Center. This appears to be too low. Provide your basis for providing 1 amp for Class 1E 480V Load Center. In addition, the staff finds that this table does not include current requirements for loads such as load sequencer, dc solenoids, ground detector, auxiliary relays, indicating lights etc. Confirm that all the loads listed above are included in battery load calculations.

08.03.02-13

RAI-SRP 8.3.2-EEB-13

Table 8.3.2-1 of the FSAR shows the current requirement of 10 amps for emergency lighting. Confirm that the above current value includes emergency lighting for the main control room as well as the remote shutdown console.

08.03.02-14

RAI-SRP 8.3.2-EEB-14

In order for staff to assess the adequacy of the safety related dc power systems, provide the results of battery sizing calculations, battery terminal voltage calculations, short circuit calculations, and voltage drop calculations for staff review.