KHNPDCDRAIsPEm Resource

From:	Ciocco, Jeff
Sent:	Thursday, August 20, 2015 10:07 AM
To:	apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; Steven Mannon
Cc:	Som, Swagata; Wunder, George; Lee, Samuel
Subject:	APR1400 Design Certification Application RAI 163-8178 (08.03.02 - DC Power Systems (Onsite))
Attachments:	APR1400 DC RAI 163 EEB 8178.pdf

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 45 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,

Jeff Ciocco
New Nuclear Reactor Licensing
301.415.6391
jeff.ciocco@nrc.gov

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Hearing Identifier: KHNP_APR1400_DCD_RAI_Public
Email Number: 198

Mail Envelope Properties (334e2fa01b10467e98c3b98bb1d72cf9)

Subject: APR1400 Design Certification Application RAI 163-8178 (08.03.02 - DC Power Systems (Onsite))
Sent Date: 8/20/2015 10:06:49 AM
Received Date: 8/20/2015 10:06:52 AM
From: Ciocco, Jeff

Created By: Jeff.Ciocco@nrc.gov

Recipients:
"Som, Swagata" <Swagata.Som@nrc.gov>
Tracking Status: None
"Wunder, George" <George.Wunder@nrc.gov>
Tracking Status: None
"Lee, Samuel" <Samuel.Lee@nrc.gov>
Tracking Status: None
"apr1400rai@khnp.co.kr" <apr1400rai@khnp.co.kr>
Tracking Status: None
"KHNPDCDRAIsPEm Resource" <KHNPDCDRAIsPEm.Resource@nrc.gov>
Tracking Status: None
"Harry (Hyun Seung) Chang" <hyunseung.chang@gmail.com>
Tracking Status: None
"Andy Jiyong Oh" <jiyong.oh5@gmail.com>
Tracking Status: None
"Steven Mannon" <steven.mannon@aecom.com>
Tracking Status: None

Post Office: HQPWMSMRS08.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	607	8/20/2015 10:06:52 AM
APR1400 DC RAI 163 EEB 8178.pdf	165956	
image001.jpg	5040	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

REQUEST FOR ADDITIONAL INFORMATION 163-8178

Issue Date: 08/20/2015
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 08.03.02 - DC Power Systems (Onsite)
Application Section: 8.3.2

QUESTIONS

08.03.02-1

Question 1:

DCD, Tier 2, Table 8.3.2-4 (Page 1), shows 116 cells for a 125 Vdc battery, and 116 cells for 250 Vdc battery. Typically, 125 Vdc batteries have around 60 cells. Please clarify the apparent discrepancy.

Question 2:
DCD, Tier 2, Table 8.3.2-4 (Page 1, Non- Class 1E DC and I&C, component data), shows that Division I battery and charger capacity are different than that of Division II battery and charger capacity as below. Please explain the differences, and explain whether a divisional pair of larger capacity can be replaced by the other pair of lower capacity, without any impact to operation of the DC/UPS systems. Explain if any load shedding is involved in the design.

Division I battery Chargers output current rating is 1800 Amp, whereas Division II battery chargers are 1600 Amp.
Division I battery capacity is 4,000 Amp-Hour, whereas Division II battery capacity is 3600 Amp-Hour

Question 3:
DCD, Tier 2, Table 8.3.2-1 (4 sheets), shows that the duty cycle is 8 hours long for Train A and 16 hours for Train C (Notes 5 and 8). Similarly for Train B (8 Hours) & D (16 Hours). Please explain the reason for such difference in duty cycle. Considering the duty cycle diagram for APR1400 design for each battery train, discuss how the most critical time was determined and how the section of the duty cycle was identified that controls battery size (Momentary, random and continuous). Provide the controlling portion of the duty cycle time in minutes as per guidance in Figure 1 of IEEE Std. 485 (Diagram of a duty cycle) for random loads, representative of the two different duty cycles.

Question 4:
DCD, Tier 2, Table 8.3.2-4 (Page 1), provides electrical equipment rating. Provide the inverter efficiency factor assumed, when determining Class 1E battery loads.

Question 5:
DCD, Tier 2, Table 8.3.2-4 (Page 2), indicates that the Class 1E 125 Vdc battery capacity is 8800 AH for Trains C&D.

(a) Discuss how this capacity is determined. Provide a summary of the calculation results with assumptions, and acceptance criteria.
(b) Discuss whether large capacity battery will impact the short circuit capacity of the distribution system and connected equipment.
(c) Provide the time to recharge the battery from a fully discharged state, based on the worst-case duty cycle, to approximately 95 percent capacity during operating conditions.
(d) Confirm that the acceptance criteria for selecting the DC system equipment (batteries, battery chargers, inverters, DC switchgear, panels, and connecting cables) are such that the equipment ratings are

sufficient to start and operate required loads during normal and off-normal plant conditions including DBA [Design Basis Accident].

08.03.02-2

Question 1:
DCD, Tier 2, Section 8.3.2.3.5, states that "The power quality limits are analyzed by methods that are similar to onsite ac power system".

Discuss the important considerations that affect the design life of batteries and chargers in DC/UPS system, and how power quality will be maintained.

Question 2:
DCD, Tier 2, Section 8.3.2.2, Analysis, Regulatory Guide 1.53, states that "If one safety-related power division is inoperable because of a single failure, the other division can accomplish the intended safety function". Please explain how the transfer of divisional loads from the inoperable division to the redundant/standby division is achieved, both manually and automatically.

Demonstrate the online DC/UPS power distribution system capability to maintain safety function in the event of a single failure by providing a failure mode and effects analysis (FMEA).

Question 3:
DCD Tier 2, Section 8.3.2 provides design aspects of DC Onsite Power System. The staff has the following questions:

- In Section 8.3.2.1.2.2, Class 1E 120 Vac Instrumentation and Control Power System, it is stated that "The Class 1E 120 Vac I&C power system, located in a seismic Category I structure". Where are the 4 trains of this system and it's various panel boards located? Are these locations all Seismic Category I?

- In Section 8.3.2.1.2.2, Class 1E 120 Vac Instrumentation and Control Power System, it is stated that "The four trains are separated…….independence is provided between safety trains and non-safety equipment". Please explain how independence between safety trains and non-safety equipment is achieved.

- Section 8.3.2.1.2.1 discusses C lass 1E 125 Vdc Power System. Does this Class 1E system provides power to any non-safety equipment? If yes, how the independence between safety trains and non-safety equipment is achieved.

- Section 8.3.1.1.4, Electrical Equipment Layout, states that "Piping containing fluids is excluded from the Class 1E electrical distribution equipment rooms". Is this design aspect followed for DC/UPS system equipment? Are these DC/UPS equipment separated from the high energy lines?

REQUEST FOR ADDITIONAL INFORMATION 163-8178

Question 4:

DCD, Tier 2, Section 8.3.2, Regulatory Guide 1.129, states that "The onsite dc power system of the APR 1400 is designed to meet the requirements of GDC's 1, 17, 18, and Criterion III of Appendix B of 10CFR Part 50."

RG 1.129, in addition to the above applicable regulations, also included Criterion XI, "Test Control," in Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50. Provide a discussion regarding conformance to this regulation for Test Program and Test Procedures for installation, preoperational tests, and operational tests.


U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment