

KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Monday, March 14, 2016 8:21 AM
To: apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Junggho Kim (jhokim082@gmail.com); Andy Jiyong Oh; Steven Mannon
Cc: Som, Swagata; Zimmerman, Jacob; Steckel, James; Wunder, George; Williams, Donna
Subject: APR1400 Design Certification Application RAI 441-8549 (08.03.02 - DC Power Systems (Onsite))
Attachments: APR1400 DC RAI 441 EEB 8549.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,

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REQUEST FOR ADDITIONAL INFORMATION 441-8549

Issue Date: 03/14/2016
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

08.03.02-3

The applicant provided response to RAI 8178, Questions 08.03.02-1 and 08.03.02-2 related to DC System. The staff is requesting response to the follow-up questions below:

- a) In response to RAI 08.03.02-1, Question 1, related to battery cell sizing, the staff requests the applicant to provide additional information as to how the number of cells was determined. Please discuss the battery sizing, specified duty cycle, and how the number of cells was determined (58 in this case) for the Class 1E batteries in the APR1400 design, demonstrating with a cell sizing sheet as per guidance provided in IEEE Std. 485.
- b) In response to RAI 08.03.02-1, Question 2, related to load difference and replacement of the Division I and Division II of the DC power distribution system, the applicant stated that the load shedding conditions are described in Table 8.3.2-2 (pages 1 and 2), but staff does not find the specific load shedding details in these pages. Please add the specific load shedding conditions with timing such as IP Inverter loads, emergency lighting loads etc., as described in the RAI response. From the Table 8.3.2-2 for non-Class 1E battery and the response of this RAI, the staff cannot determine load requirement vs. the duty cycle (8 hours) alignment. Therefore, the staff requests that these Tables of "Load classification and load currents" be supplemented with the time intervals for continuous (0 to 480 min), momentary (0 to 1 min, and 479-480 min), and Non-continuous/random (0 to 1 min) in the load currents and be aligned with the duty cycle determination. Please revise the DCD to reflect this information and provide DCD markups with your response.
- c) In response to RAI 08.03.02-1, Question 3, related to duty cycle, the applicant stated that the random loads were superimposed on the end of the controlling section of the duty cycle. Figure 1 of the duty cycle for Train A, in Attachment 1 (sheet 4), shows that the random load is superimposed as L4 at the end of the duty cycle. Please explain how the applicant determined that the most critical time to assign the random load in the duty cycle was during the last hour. The staff's concern is that the random load in Table 8.3.2-1 is found significant for Trains C and D and whether the imposition of these random loads at the end of L2 or L3 portion of the duty cycle may impact the battery size.

Also the staff requests that the description of the Class 1E Trains A/B/C/D batteries, description of the divisional pairs (A&C for Division I and B&D for Division II) including the description of the difference in the duty cycles (8 hours vs. 16 hours) be provided as part of the system description section in the DCD, as the Table 8.3.2-1 is not fully self-explanatory. Please revise the DCD to reflect this information and provide DCD markups with your response.

REQUEST FOR ADDITIONAL INFORMATION 441-8549

d) In response to RAI 08.03.02-1, Question 4, related to battery sizing, the staff requests that the inverter efficiency as 85% be added to the DCD Table 8.3.2-4 (pages 1 and 2), Electrical Equipment Ratings-Component Data, under Inverter Section. Please revise the DCD to reflect this information and provide DCD markups with your response.

e) In response to RAI 08.03.02-1, Question 5, the staff has the following questions:

(i) The staff finds that Class 1E 125Vdc loads in Table 8.3.2-1 are not tallying with the Figures of Duty Cycle Diagrams provided in the RAI response. For example, the load table for Train A (8 hour duty cycle) shows a continuous load of more than 400 Amp, whereas the duty cycle show L1 as 132.9 Amp, which is much lower. Please clarify. The staff requests that the Tables of "Load classification and load currents" for Class 1E Train A&B power system loads be supplemented with the time intervals for continuous (0 to 480 minute), momentary (0 to 1 min, and 479-480 min), and Non-continuous/random (0 to 1 min or as designed for APR1400) in the load currents and be aligned with the duty cycle determination.

Similarly, provide the Tables for battery Trains C and D for 16 hour duty cycle batteries supplemented with the time interval. Please revise the DCD to reflect this information and provide DCD markups with your response.

(ii) Battery Qualification: The APR14000 DCD, Section 8.3.2.1.2.6 states that the Class 1E batteries are qualified in accordance with IEEE Standard 535-2006, "Standard for Qualification of Class 1E Lead Storage Batteries for Nuclear Power Generating Stations." IEEE Standard 535-2006 was written under the assumption of an 8-hour duty Cycle (See ADAMS Accession No. ML13094A397, "Request for Interpretation of IEEE Standard 535-2006," dated November 17, 2008). Given that IEEE Std. 535-2006 does not apply to duty cycles longer than 8 hours, identify the methodology to be used to qualify these batteries for an extended duty cycle of 16-hours for Trains C and D batteries. Note that IEEE Standard 535-2013 does discuss qualification of duty cycles longer than 8 hours. Please revise the DCD to reflect this information and provide DCD markups with your response.

f) In Response 08.03.02-2, Question 2, the applicant provided the Failure Mode & Effects Analysis in an attached table. The staff requests that this table be included in the revised DCD Section 08.03.02.



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