

## KHNPDCDRAIsPEm Resource

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**From:** Ciocco, Jeff  
**Sent:** Thursday, August 13, 2015 10:47 AM  
**To:** KHNPDCDRAIsPEm Resource  
**Subject:** FW: APR1400 Design Certification Application RAI 148-8104 (08.03.01 - AC Power Systems (Onsite))  
**Attachments:** APR1400 DC RAI 148 EEB 8104.pdf

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**From:** Ciocco, Jeff  
**Sent:** Monday, August 10, 2015 1:16 PM  
**To:** apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource <KHNPDCDRAIsPEm.Resource@nrc.gov>; Harry (Hyun Seung) Chang <hyunseung.chang@gmail.com>; Yunho Kim <yshh8226@gmail.com>; Steven Mannon <steven.mannon@aecom.com>  
**Cc:** Som, Swagata <Swagata.Som@nrc.gov>; Wunder, George <George.Wunder@nrc.gov>; Lee, Samuel <Samuel.Lee@nrc.gov>  
**Subject:** APR1400 Design Certification Application RAI 148-8104 (08.03.01 - AC Power Systems (Onsite))

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, 45, 30, 45, and 45 days to respond to the RAI questions. We may adjust the schedule accordingly.

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

Thank you,

Jeff Ciocco  
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**Hearing Identifier:** KHNP\_APR1400\_DCD\_RAI\_Public  
**Email Number:** 175

**Mail Envelope Properties** (9787ba8e1f8b406e99c73e16a00deac1)

**Subject:** FW: APR1400 Design Certification Application RAI 148-8104 (08.03.01 - AC Power Systems (Onsite))  
**Sent Date:** 8/13/2015 10:46:47 AM  
**Received Date:** 8/13/2015 10:46:48 AM  
**From:** Ciocco, Jeff

**Created By:** Jeff.Ciocco@nrc.gov

**Recipients:**  
"KHNPDCDRAIsPEm Resource" <KHNPDCDRAIsPEm.Resource@nrc.gov>  
Tracking Status: None

**Post Office:** HQPWMSMRS08.nrc.gov

<b>Files</b>	<b>Size</b>	<b>Date &amp; Time</b>
MESSAGE	1145	8/13/2015 10:46:48 AM
APR1400 DC RAI 148 EEB 8104.pdf		99266
image001.jpg	5040	

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

# REQUEST FOR ADDITIONAL INFORMATION 148-8104

Issue Date: 08/10/2015  
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

08.03.01-13

DCD Tier 2, Section 8.3.1.3, “Electrical Power System Calculations and Distribution System Studies for AC System”, stated:

“The analysis of load flow, voltage regulation, and short-circuit studies is performed by using ETAP, version 12.0.0N, which is qualified for nuclear power plants in accordance with 10 CFR Part 21, 10 CFR Part 50, Appendix B, and ASME NQA-1”.

Provide a summary of the results of 1 to 4 below, providing Grid/Utility parameters and all other equipment parameters including transformers (LV and MV), medium voltage motors, motor operated valves, main generator, diesel generator, cable assumptions, static loads, LV and MV bus ratings, LV and MV circuit breaker ratings, etc. :

1. Load flow/voltage regulation and under/overvoltage protection studies that demonstrate system capability to provide minimum required voltage to safety-related equipment terminals and assumptions used for the analysis.
2. EDG load requirements, acceptance criteria and assumptions used.
3. Minimum voltage requirements for safety-related equipment, demonstration of electrical distribution system capability and assumptions used.
4. Class 1E inverter sizing and assumptions used

In addition, discuss the worst case load-flow scenarios for normal operation, start-up, and bus transfer. Provide the acceptance criteria to demonstrate minimum voltages are maintained to safety-related equipment during available plant configurations and various plant operations.

Discuss diversity factor as applied to components/loads for equipment sizing.

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08.03.01-14

DCD Tier 2, Section 8.3.1.3.3, “Equipment Sizing Studies”, stated that the electrical equipment sizing of the distribution system is performed using the spreadsheet load list. Please discuss how these equipment sizes/ratings are verified using the ETAP load flow/Voltage regulation and short circuit analysis results. Provide the assumptions applied, the acceptance criteria, and a summary of the results from equipment sizing studies.

## REQUEST FOR ADDITIONAL INFORMATION 148-8104

08.03.01-15

RG 1.206, Sections C.I.8.3.1.3 and C.I.8.3.2.3 identify a list of electrical system calculations (or studies) necessary for the onsite ac and dc distribution systems. In this RAI, the summary of the calculations (i.e. load flow, short circuit, equipment sizing) were requested in a separate question with results, assumptions and acceptance criteria/conclusions.

Please provide a similar summary of calculations or studies and assumptions used to demonstrate adequacy for insulation coordination (surge and lightning protection) (item 5 of C.I.8.3.1.3) and power quality limits (harmonic distortion-item 6) as cited in the above RG 1.206.

DCD Section 8.3.3, COL items, includes insulation coordination of surge and lightning protection. Additionally, DCD Tier 2, Section 8.3.1.3.6 indicates that an analysis will be performed so that total harmonic distortion (THD) is less than or equal to 5% according to IEEE Std. 519. Please indicate if the power quality analyses will be performed in accordance with RG 1.206 and be included as a COL item.

08.03.01-16

DCD Tier 2, Section 8.3.1.1.3.1, "Starting Initiating Circuits", item (a) indicates Figure 7.3-4 for Automatic through load Sequencer Logic. However, in Section 7 of the DCD Tier 2, this figure is found as 7.3-21. Please confirm the correct Figure and revise the DCD.

08.03.01-17

GDC 17 requires that each plant onsite electrical distribution system is supplied by at least two physically independent circuits designed and located to minimize, to the extent practical, the likelihood of their simultaneous failure during operating and postulated accident and environmental conditions. SRP 8.3.1, Part III (Review Procedures), Section 4.(A) provides criteria for review to verify the requirements of GDC 17 have been made. It describes requirements to minimize diesel generator failure and to start on demand and to ensure that diesel generator reliability and operation will not be degraded.

In DCD, Tier 2, Section 8.3.1 and 8.3.2, the applicant described that the onsite power complies with GDC 17, but did not provide any Failure Mode Effects Analysis (FMEA) for the onsite ac and dc/ups power system based on the design configuration. The staff requests additional information regarding the conformance to GDC 17 to specifically show that no single event will simultaneously fail the redundant power circuits. In the additional information, the applicant should include component identification, their functions, failure modes (loss of cooling, bus failure, loss of voltage, breaker failure, transformer failure etc.), failure mechanism (including fault location), effect/impact on any safety-related function, detection (alarm/trip), and actions to mitigate the failed status of the system/equipment.



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