

## **KHNPDCDRAIsPEm Resource**

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**Sent:** Thursday, December 17, 2015 11:15 AM  
**To:** apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; Erin Wisler  
**Cc:** Otto, Ngola; Ray, Sheila; Zimmerman, Jacob; Wunder, George; Lee, Samuel  
**Subject:** APR1400 Design Certification Application RAI 338-8426 (08.01 - Electric Power - Introduction)  
**Attachments:** APR1400 DC RAI 338 EEB 8426.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, 60 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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United States Nuclear Regulatory Commission

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# REQUEST FOR ADDITIONAL INFORMATION 338-8426

Issue Date: 12/17/2015  
Application Title: APR1400 Design Certification Review – 52-046  
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.  
Docket No. 52-046  
Review Section: 08.01 - Electric Power - Introduction  
Application Section: 8.01

## QUESTIONS

### 08.01-14

In RAI 7915, Question 08.01-1 (ADAMS Accession ML15142A611), the staff stated in part that the proposed design of the APR1400 power distribution system did not meet the 10 CFR Part 50, GDC 17 requirement and the guidance provided in SRP 8.3 and SECY-91-078. The staff also noted that in SECY 91-078 the Commission requires at least one offsite circuit to each redundant safety division that is supplied directly from an offsite power source with no intervening non-safety buses.

In response to RAI 7915, Question 08.01-1 dated June 22, 2015 (ADAMS Accession ML15173A092), the applicant (KHNP) stated in part the following:

- The APR1400 offsite power system is designed in accordance with IEEE Std. 765, which provides detail design guidance and design criteria to properly meet GDC 17. In particular, the APR1400 adopts the enhanced preferred power supply (PPS) design mentioned in Subsection 4.5.c of IEEE Std. 765.
- Since each PPS circuit connects directly to redundant 4.16 kV Class 1E buses, failure of a non-Class 1E bus does not prevent the PPS circuit from supplying the offsite power to the Class 1E buses, provided the failure is properly isolated by the protective devices.
- The Class 1E buses are not subject to potential failure due to a failure of the non-Class 1E buses since the non-Class 1E electrical equipment is designed to preclude adverse effects on Class 1E electrical equipment due to its failure during normal, accident, or post accident modes of plant operation and each Class 1E and non-Class 1E buses are protected by properly coordinated Class 1E and non-Class 1E protection devices as described in DCD Tier 2 Chapter 8, Subsection 8.1.3.2.j and Subsection 8.3.1.3.4.
- KHNP recognizes that in case of a specific failure, e.g. fail-to-open of the bus incoming breaker upon the fault at a non-Class 1E MV bus, the fault effect could propagate to the Class 1E buses which are fed from the same SAT or UAT as the faulted non-Class 1E bus.
- KHNP plans to implement design enhancement to the incoming breakers at the non-Class 1E MV buses to address potential risk associated with fault at non-Class 1E MV bus affecting Class 1E MV bus.

The applicant proposed to enhance the design by providing two independent circuit breakers, connected in series, and used as incoming breakers for all non-Class 1E 13.8 kV and 4.16 kV switchgears. The applicant explained that the design enhancement would significantly reduce the probability of failure of the non-Class 1E incoming breakers in case of a bus fault. The applicant also explained that only one of the two independent circuit breakers will be used for switching operation and protection, while the other breaker will be used only for protection. They also explained that to avoid a common cause failure of the two circuit breakers, each circuit breaker will be independent from the other, both physically and functionally, and will have its own protective relaying provisions.

The staff has reviewed the applicant's responses and determined that in accordance with SECY-91-078, the Commission requires evolutionary advance light water reactor (ALWR) design such as APR 1400 should include an alternate power source to the non-safety loads unless the design can demonstrate that the design margins in the evolutionary ALWR will result in transients for a loss of non-safety power event that is less severe than those associated with the turbine trip only event in current existing plant designs. SECY-91-078 also states that the staff's position is that at least one offsite circuit to each redundant safety division should be supplied directly from one of the offsite power sources with no intervening non-safety buses, in such a manner that the offsite source can power the safety buses upon failure of any non-safety bus.

The applicant states that the APR1400 offsite power system is designed in accordance with IEEE Std. 765, which provides detail design guidance and design criteria to properly meet GDC 17. However, the NRC staff has not endorsed IEEE Std. 765 in applicable RGs (RG 1.32, RG 1.75). IEEE Std. 308-2001 guidance as endorsed by RG 1.32, states that the non-Class 1E circuits shall meet the independence and isolation requirements as established in IEEE Std. 384-1992. IEEE Std. 384-1992 guidance as endorsed by RG 1.75 states that the applicant should follow the guidance in IEEE Std. 384 to address independence and isolation of Class 1E and non-Class 1E circuits. The staff believes that the new proposed enhanced design still does not meet the intent of the GDC 17 and the Commission direction in SRM-SECY-91-078, and that further explanation is needed.

## **REQUEST FOR ADDITIONAL INFORMATION 338-8426**

The applicant is requested to provide explanation as to how the proposed design meets GDC 17 requirement, and guidance in SRP 8.3, SECY-91-078, RG 1.32, RG 1.75, and applicable industry standards or provide analysis to demonstrate that the design margins will result in transients from a loss of non-safety power event that is less severe than those associated with the turbine trip only event in current existing plant designs. The applicant is requested to discuss how the electrical system provides a direct connection with no intervening non-safety buses from the offsite power source to the onsite Class 1E system.