

## **KHNPDCDRAIsPEm Resource**

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**Sent:** Friday, May 22, 2015 10:53 AM  
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**Subject:** APR1400 Design Certification Application RAI 16-7915 (8.1 Electric Power - Introduction)  
**Attachments:** APR1400 DC RAI 16 EEB 7915.pdf

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# REQUEST FOR ADDITIONAL INFORMATION 16-7915

Issue Date: 05/22/2015

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: 08.01

## QUESTIONS

### 08.01-1

In DCD Tier 2 Section 8.1, the applicant described briefly the offsite and onsite power distribution system of the plant and referenced the Single Line Diagram Figure 8.1-1 (2 pages). These descriptions are further provided in DCD Sections 8.2 and 8.3.

The staff noted in the above descriptions and drawings that the medium voltage ac distribution system will be designed to supply power to the safety loads from the normal power source. i.e., unit auxiliary transformers (UAT), and in case of loss of power from the UAT, the safety loads will be automatically transferred to the station auxiliary transformers (SAT). The primary voltage windings of the two UATs are connected to the main generator (MG) Isophase Bus (IPB) between the generator circuit breaker (GCB) and the main transformer (MT), for obtaining auxiliary power for plant loads during normal operation. Each UAT and SAT has two secondary voltage windings, rated 13.8 kV and 4.16 kV. From Figure 8.1-1 it is noted that the 13.8 kV winding of each UAT and SAT is connected to non-Class 1E buses. The 4.16 kV winding is connected to 4.16 kV safety-related Class 1E buses, as well as permanent non-safety buses. In accordance with SECY-91-078, "EPRI's Requirements Document and Additional Evolutionary LWR Certification Issues," (NRC,1991, ADAMS ML072150592), offsite power shall be directly supplied to the Class 1E emergency power supply safety-related buses without any intervening non-Class 1E buses. SECY 91-078 states that the design should include:

- at least one offsite circuit to each redundant safety division (that) 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 if any non-safety bus should fail.
- an alternate power source to non-safety loads, unless it can be demonstrated that existing design margins will ensure that transients for loss of non-safety power events are no more severe than those associated with the turbine-trip-only event specified in current plant designs.

The staff noted that both Class 1E and non-class 1E buses are connected to the same UAT, and similarly for the SAT, rendering the emergency Class 1E buses/switchgear vulnerable to potential failure due to a failure of the non-Class 1E bus/switchgear. In addition, the safety loads could be subjected to transients caused by the non-safety loads, and adds additional failure points between the offsite power sources and the safety loads. Therefore, the staff finds that the proposed design does not meet the SECY-91-078 requirements.

Furthermore, 10 CFR Part 50, GDC 17 requires, in part, that the onsite electrical distribution system shall have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure. The proposed design does not provide capability to minimize the probability of losing electric power at the safety bus, since there is potential that the Class 1E buses are vulnerable to potential failures as a result of failures of the non-Class 1E buses. Therefore, the staff finds that the proposed design does not meet the GDC 17 requirement. Furthermore, Standard Review Plan (SRP) Chapter 8.2, Acceptance Criterion 4, and Chapter 8.3, Acceptance Criteria 4J, discuss this requirement.

Since this configuration of the power distribution system does not meet the requirement of the SECY-91-078 and GDC 17, the staff finds this power distribution arrangement unacceptable because connecting both non-safety and safety system to common transformer windings compromises the safety system reliability with no electrical separation. According to the above SECY and per GDC 17, 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 (UAT or SAT), with no intervening non-safety buses, in such a manner that the offsite source can power the safety buses upon a failure of any non-safety bus.

Based on the above discussion, please provide:

- a) A power distribution configuration that meets the requirement of SECY-91-078, and GDC 17, such that the failure of the non-safety bus/switchgear does not adversely impact the Class 1E Emergency Power Bus/Switchgear.
- b) Revised single line diagrams and descriptions in DCD chapters that reflect any changes in the power distribution systems.