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## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

### APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.: 39-7937  
SRP Section: 08.02 – Offsite Power System  
Application Section: 08.02  
Date of RAI Issued: 06/18/2015

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#### **Question No. 08.02-3**

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 8.2, Part III (Review Procedures), Section 1 C provides criterion for review to verify the requirements of GDC 17 have been met. It requires that the electrical schematics of the switchyard breaker control system, its power supply configuration and breaker arrangement should be examined for possibility of simultaneous failure of both circuits from single events such as breaker not operating during fault conditions, spurious relay trip, loss of a control circuit power supply or a fault in a switchyard bus or transformer. Therefore, in order to determine that no single event will simultaneously fail both offsite power circuits, the failure mode and effects analysis (FMEA) of the switchyard is necessary for the staff's review.

In the DCD Section 8.2, the applicant described that the offsite power complies with GDC 17, but did not provide any FMEA since COL item 8.2 (6) states that the "the COL applicant is to provide an FMEA for switchyard components." However, the staff requests additional information regarding the conformance to GDC 17 to specifically show that no single event will simultaneously fail both offsite power circuits. The additional information should include the electrical schematics and discussion of the switchyard breaker control system, its power supply configuration and breaker arrangement to demonstrate that there would be no simultaneous failure of both offsite power circuits.

**Response**

The two circuits of the offsite preferred power supplies for the APR1400 are designed in accordance with GDC 17 so that a failure of one offsite preferred power supply does not affect the capacity and capability of the other offsite preferred power supply.

In the RAI question, the staff requested additional information to verify that the switchyard design complies with GDC 17 requirements by showing that there would be no simultaneous failure of both offsite power circuits. The additional information regarding the switchyard design, such as the electrical schematics of the switchyard breaker control system, its power supply configuration, and breaker arrangement, depends on or is affected by specific conditions of each site, along with specific requirements of the transmission system provider/operator and their design practice.

For this reason, the plant switchyard design is defined as site-specific in Subsection 8.2.1.2 and a COL applicant that references the APR1400 design certification is to provide the site-specific design information which includes the electrical schematics of the switchyard breaker control system, its power supply configuration and breaker arrangement, as well as a failure modes and effects analysis (FMEA) of the switchyard as described in DCD Subsection 8.2.1.2.

KHNP recognizes that descriptions of the COL Items, COL 8.2(5) and COL 8.2(6), need to be revised as shown in the attachment to clarify the responsibility of a COL applicant.

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**Impact on DCD**

DCD Tier 2, Table 1.8-2, Subsection 8.2.1.2, and Subsection 8.2.3 will be revised as shown in the attachment.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical Specifications**

There is no impact on the Technical Specifications.

**Impact on Technical/Topical/Environmental Reports**

There is no impact on any Technical, Topical, or Environmental Report.

APR1400 DCD TIER 2

design for the switchyard equipment, including breaker arrangement, electrical schematics of breaker control system, protective devices and their settings, and auxiliary power supplies (ac and dc) for control and protection.

Table 1.8-2 (10 of 29)

Item No.	Description
COL 8.2(1)	The COL applicant is to identify the circuits from the transmission network to the onsite electrical distribution system that are supplied by two physically independent circuits.
COL 8.2(2)	The COL applicant is to provide information on the location of rights-of-way, transmission towers, voltage level, and length of each transmission line from the site to the first major substation that connects the line to the transmission network.
COL 8.2(3)	The COL applicant is to describe the switchyard voltage related to the transmission system provider/operator (TSP/TSO) and the formal agreement between the nuclear power plant and the TSP/TSO. The COL applicant is to describe the capability and the analysis tool of the TSP. The COL applicant is also to describe the protocols for the plant to remain cognizant of grid vulnerabilities.
COL 8.2(4)	The COL applicant is to describe and provide layout drawings of the circuits connecting the onsite distribution system to the preferred power supply.
COL 8.2(5)	<del>The COL applicant is to describe site-specific information for the protective devices, ac power, and dc power that control the switchyard equipment.</del>
COL 8.2(6)	<del>The COL applicant is to provide an FMEA for switchyard components.</del> In addition, the COL applicant is to provide the results of grid stability analyses to demonstrate that the offsite power system does not degrade the normal and alternate preferred power sources to a level where the preferred power sources do not have the capacity or capability to support the onsite Class 1E electrical distribution system in performing its intended safety function.
COL 8.2(7)	The COL applicant is to design the offsite power system to detect, alarm, and automatically clear a single-phase open circuit condition.
COL 8.2(8)	The COL applicant is to describe how testing is performed on the offsite power system components.
COL 8.2(9)	The COL applicant is to provide the required number of immediate access circuits from the transmission network.

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of the switchyard components to assess the possibility of simultaneous failure of both circuits as a result of single events.

## APR1400 DCD TIER 2

The COL applicant is to provide information on the location of rights-of-way, transmission towers, voltage level, and length of each transmission line from the site to the first major substation that connects the line to the transmission network (COL 8.2(2)). The COL applicant is to describe the switchyard voltage related to the transmission system provider/operator (TSP/TSO) and the formal agreement between the nuclear power plant and the TSP/TSO. The COL applicant is to describe the capability and the analysis tool of the TSP. The COL applicant is also to describe the protocols for the plant to remain cognizant of grid vulnerabilities (COL 8.2(3)).

### 8.2.1.2 Switchyard

design for the switchyard equipment, including breaker arrangement, electrical schematics of breaker control system, protective devices and their settings, and auxiliary power supplies (ac and dc) for control and protection

The plant switchyard design is site-specific and not within the scope of the APR1400 design. The COL applicant is to describe and provide layout drawings of the circuits connecting the onsite distribution system to the preferred power supply (COL 8.2(4)). The layout drawings are to include switchyard arrangement (breakers and bus arrangements), transmission lines, switchyard control systems, power supplies, and cable routing. The COL applicant is to describe the site-specific ~~information for the protective devices, ac power, and dc power that control the switchyard equipment~~ (COL 8.2(5)).

At least two physically independent transmission lines connect the offsite transmission network to the high-voltage switchyard of the plant. Two physically independent transmission tie lines supply offsite electric power from the switchyard to the APR1400 for plant maintenance, startup, shutdown, and postulated accident conditions. The interface requirement is that the TSP/TSO maintains operating frequency within 5 percent and operating voltage within 10 percent on nominal value bases at the interface boundary between the transmission network and the switchyard.

The COL applicant is to provide a failure modes and effects analysis (FMEA) of the switchyard in accordance with the following items:

- a. The two preferred power circuits from the transmission network are linked to the onsite power system by passing through the switchyard. Because a switchyard can be common to both offsite circuits, the COL applicant is to provide an FMEA of the switchyard components to assess the possibility of simultaneous failure of both circuits as a result of single events (COL 8.2(6)).

## APR1400 DCD TIER 2

8.2.3 Combined License Information

COL 8.2(1) The COL applicant is to identify the circuits from the transmission network to the onsite electrical distribution system that are supplied by two physically independent circuits.

COL 8.2(2) The COL applicant is to provide information on the location of rights-of-way, transmission towers, voltage level, and length of each transmission line from the site to the first major substation that connects the line to the transmission network.

COL 8.2(3) The COL applicant is to describe the switchyard voltage related to the transmission system provider/operator (TSP/TSO) and the formal agreement between the nuclear power plant and the TSP/TSO. The COL applicant is to describe the capability and the analysis tool of the TSP. The COL applicant is also to describe the protocols for the plant to remain cognizant of grid vulnerabilities.

design for the switchyard equipment, including breaker arrangement, electrical schematics of breaker control system, protective devices and their settings, and auxiliary power supplies (ac and dc) for control and protection.

COL 8.2(4) The COL applicant is to describe and provide layout drawings of the circuits connecting the onsite distribution system to the preferred power supply.

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COL 8.2(5) The COL applicant is to describe ~~site-specific information for the protective devices, ac power, and dc power that control the switchyard equipment.~~

COL 8.2(6) The COL applicant is to provide an FMEA ~~for switchyard components.~~ In addition, the COL applicant is to provide the results of grid stability analyses to demonstrate that the offsite power system does not degrade the normal and alternate preferred power sources to a level where the preferred power sources do not have the capacity or capability to support the onsite Class 1E electrical distribution system in performing its intended safety function.

of the switchyard components to assess the possibility of simultaneous failure of both circuits as a result of single events.