# RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**APR1400 Design Certification**

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

**Docket No. 52-046**

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| **RAI No.:** | **203-8214** |
| **SRP Section:** | **08.03.01 – AC Power Systems (Onsite)** |
| **Application Section:** | **8.3.1** |
| **Date of RAI Issue:** | **09/08/2015** |

## Question No. 08.03.01-19

In DCD Tier 2, Section 8.3.1.1.2.3, “System Independence”, it is stated that “Non-Class 1E loads are connected to the Class 1E bus by Class 1E isolation devices”, in discussion related to conformance to RG 1.75 for separation and independence. However, RG 1.75 as endorsed by IEEE Std. 384-1992 requires that the isolation devices be properly coordinated and periodically tested to ensure the overall protection coordination remains. The DCD has not addressed that the isolation devices used will be periodically tested.

Please discuss how periodic testing of isolation devices (e.g., visual inspection of fuses and fuse holders) during every refueling outage is performed to demonstrate that the overall coordination scheme under multiple faults of non-safety-related loads provides protection for the safety-related loads, in accordance with RG 1.75.

Please include this in the DCD as appropriate.

## Response

In a power circuit, an isolation device is applied so that the maximum credible voltage or current transient applied to the non-Class 1E side of the device does not degrade the operation of the circuit on the other side of that device below an acceptable level. The breaker or fuse that is automatically opened by fault current may be used as an isolation device.

In the APR1400 design, the isolation devices are selected and coordinated such that their time-overcurrent trip characteristics for all circuit faults cause the nearest isolation device to interrupt the fault current prior to initiation of a trip of any upstream interrupting device.

During every refueling outage, periodic testing of the electrical isolation devices is to be performed so that the overall coordination scheme is demonstrated to remain within the limits specified in the design criteria, in accordance with RG 1.75. DCD Tier 2, Subsection 8.3.1.1.2.3

will be revised to incorporate the description on the periodic testing of electrical isolation devices.

Below is a summary of typical periodic equipment tests for representative isolation devices.

Periodic equipment tests

| Component | Required inspection and testing | Frequency |
|---|---|---|
| 4.16 kV vacuum circuit breaker (VCB) | • Circuit breaker insulation and contact resistance measurement<br>• Visual inspection of circuit breaker disconnecting switch part<br>• Main operational part check<br>• Inside of circuit breaker box and current transformer (CT), zero-phase-sequence current transformer (ZCT) check<br>• Circuit breaker operability test | Every 18 months (overhaul) |
| 480V air circuit breaker (ACB) | • Circuit breaker check<br>• Lubrication and terminal tightness check<br>• Circuit breaker operability test | |
| 480V molded case circuit breaker (MCCB) | • Resistance measurement of bus and space heater<br>• Motor control panel check<br>• Circuit breaker operability test<br>• Electronic contactor check | |
| Switchgear potential transformer | • Visual inspection of fuses and fuse holders | |

**Impact on DCD**

DCD Tier 2, Subsection 8.3.1.1.2.3 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 Environment Report.

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Periodic testing of the isolation devices (e.g., visual inspection of fuses and fuse holders, circuit breaker operability tests, etc.) is performed during every refueling outage to demonstrate that the overall coordination scheme under multiple faults of non-safety related loads remains within the limits specified in the design criteria.

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Following a LOOP, the associated Class 1E EDGs are started and the safety buses are isolated from offsite sources and fed solely from the associated EDG. The four load sequencers (one for each Class 1E bus) used for bus load shedding and load sequencing are independent from one another. The Class 1E 4.16 kV bus degraded voltage relay scheme is designed to meet the requirements of Branch Technical Position (BTP) 8-6 (Reference 8). The protective relay scheme is described in detail in Subsection 8.3.1.1.3.12.

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The isolation devices meet Regulatory Position (1) of RG 1.75.

Non-Class 1E loads are connected to the Class 1E bus by Class 1E isolation devices. Pressurizer heater backup groups are provided power from the Class 1E 4.16 kV bus in accordance with 10 CFR 50.34 (Reference 9). Emergency ac lighting is powered from the Class 1E 480V MCC buses. Emergency lighting is described in Subsection 9.5.3.

The physical separation between the redundant equipment, including cables and raceways, is designed in accordance with IEEE Std. 384 as endorsed by NRC RG 1.75. The design criteria for the cable designs are described in Subsection 8.3.1.1.10. The identification of onsite power system components, including cables and raceways, is described in Subsection 8.3.1.1.10.

8.3.1.1.2.4 System Capacity and Capability

The Class 1E onsite power system has four independent trains. Each train is connected to one EDG. The selected two EDGs (trains A and C or trains B and D) are sufficient to meet the emergency load requirements for a safe shutdown during a LOOP concurrent with LOCA conditions.

The Class 1E EDG rating shown in Tables 8.3.1-2 and 8.3.1-3 is based on the characteristics of each load and the combined bus load demand connected to each diesel generator during the worst-case operating condition. Trains A and B EDGs are rated at 9,100 kW continuous rating and 10,010 kW short-time rating (2 hours), and trains C and D EDGs are rated at 7,500 kW continuous rating and 8,250 kW short-time rating.

Each EDG is designed to attain a rated voltage and frequency within 17 seconds after receipt of a start signal, supply power to its Class 1E 4.16 kV bus within 19 seconds, and begin to accept sequenced loads to meet the response times assumed in Chapter 15 analyses. The loading sequence and bases are shown in Tables 8.3.1-2 and 8.3.1-3.