
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.: 421-8500
SRP Section: 08.03.01 – AC Power Systems (Onsite)
Application Section: 8.3.1
Date of RAI Issue: 03/01/2016

Question No. 08.03.01-23

By letter dated September 17, 2015, the applicant provided a response to RAI 8017, Question 08.03.01-9 regarding Containment Electrical penetration Assembly (EPA).

In the response, the applicant confirms that the protection devices are capable of being tested, calibrated and inspected. In the inspection/test details provided by the applicant, the staff noted that the inspection/functional test period indicated by the applicant is “once per 60 months” for all circuit breakers for EPA conductors. Also for the overcurrent relay for medium voltage circuit breaker for EPA conductors, the applicant stated that the inspection/functional test period is provided as “at every overhaul.”

10 CFR 50, GDC 18 requires that electric power system important to safety shall be designed to permit appropriate periodic inspection and testing of important areas and features, such as wiring, insulation, connections, and switchboards, to assess the continuity of the systems and the conditions of their compositions. Please provide a discussion as how the above intervals are determined. Also, provide the expected interval in days/months for the next overhaul typical schedule for the overcurrent relay for the medium voltage circuit breaker for containment electrical penetration conductor. The staff is concerned that the periodic inspection and testing intervals provided in this response is not explained adequately. Provide an explanation how the inspection/test period is determined so that the equipment and component are not impacted from gradual undetected degradation.

Since the DCD Section 8.3.1.1.9 did not address the periodic inspection and testing of the Containment EPA, the proposed revision of the DCD Section 8.3.1.1.9 should provide reference of the periodic inspection and testing program and the details of the specific inspection/test as provided in the RAI 08.03.01-9 response, in compliance with GDC 18 and GDC 50.

Response

The testing/inspection intervals are determined considering an overhaul capability of 18 months which corresponds to the APR1400 refueling cycle. The required testing/inspection interval for the protection devices for the EPA conductor is 60 months. All protection devices for the EPA conductors are divided into three groups: the first group is tested and inspected at the first overhaul, the second group is tested and inspected at the second overhaul and the third group is tested and inspected at the third overhaul. Eventually, every protection devices for the EPA conductors will be tested and inspected within 60 months. Overcurrent relays for 10% of each type of low voltage circuit breakers for the EPA conductors are to be tested and inspected every 18 months which corresponds to every overhaul (i.e., refueling) cycle. At the next overhaul, another 10% (excluding the tested ones in the previous overhaul) will be tested and inspected in the same manner. All overcurrent relays for medium voltage circuit breakers for the EPA conductors are to be tested and inspected every 18 months. The established frequencies are based on vendor recommendation and operating experience of the current Korean operating fleet and are consistent with that of the reference plant, Shin Kori Nuclear Units 3 & 4.

The following description for periodic inspection and testing of the containment EPAs will be provided on DCD section 8.3.1.1.9.

The COL applicant is to conduct periodic inspection and testing of the protection devices for the EPA conductors. All circuit breakers for the EPA conductors shall be inspected and tested within 60 months, low voltage circuit breaker overcurrent protection devices for the EPA conductors shall be inspected and tested once per 18 months for 10% of each type of circuit breakers and overcurrent relays for medium voltage circuit breakers for the EPA conductors shall be inspected and tested once per 18 months (COL 8.3 (9)).

Impact on DCD

The DCD Tier 2, Table 1.8-2 and Subsection 8.3.1.1.9 and 8.3.3 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.

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Table 1.8-2 (11 of 29)

Item No.	Description
COL 8.3(1)	The COL applicant is to provide and to design a mobile generator and its support equipment.
COL 8.3(2)	The COL applicant is to describe and provide detailed ground grid and lightning protection.
COL 8.3(3)	The COL applicant is to provide testing, inspection, and monitoring programs for detecting insulation degradation of underground and inaccessible power cables within the scope of 10 CFR 50.65.
COL 8.3(4)	The COL applicant is to provide protective device coordination.
COL 8.3(5)	The COL applicant is to provide insulation coordination of surge and lightning protection.
COL 8.3(6)	The COL applicant is to develop the maintenance program to optimize the life and performance of the batteries.
COL 8.3(7)	The COL applicant is to provide short circuit analysis of onsite dc power system with actual data.
COL 8.3(8)	The COL applicant is to describe any special features of the design that would permit online replacement of an individual cell, group of cells, or entire battery.
COL 8.4(1)	The COL applicant is to identify local power sources and transmission paths that could be made available to resupply power to the plant following the loss of a grid or the SBO.
COL 8.4(2)	The COL applicant is to develop detailed procedures for manually aligning the alternate AC power supply when two (Trains A and B) of the four diesel generators are unavailable during a loss of offsite power event.
COL 9.1(1)	The COL applicant is to provide operational procedures and maintenance program as related to leak detection and contamination control.
COL 9.1(2)	The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations.
COL 9.1(3)	The COL applicant is to address the load-handling procedures. Load-handling procedures are established for component handling procedures and plant operating procedures in accordance with ASME B30.2. ASME B30.2 requires establishing component handling procedures that include (1) a safe load path for lifting heavy loads to perform special handling component inspections, (2) acceptance criteria prior to lift, and (3) use of steps and proper sequence in handling the load. ASME B30.2 requires plant operating procedure guidelines that include appropriate crane operator training and crane inspections. ASME B30.2 also requires that the load-handling procedures include preparing operating procedures for preoperational load testing and checkouts of interlocks, brakes, hoisting cables, control circuitry, and lubrication of OHLHS equipment.
COL 8.3 (14)	The COL applicant is to conduct periodic inspection and testing of the protection devices for the EPA conductors. All circuit breakers for the EPA conductors shall be inspected and tested in 60 months, low voltage circuit breaker overcurrent protection devices for the EPA conductors shall be inspected and tested once per 18 months for 10 % of each type of circuit breakers, and overcurrent relay for medium voltage circuit breakers for the EPA conductors shall be inspected and tested once per 18 months.

Add

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protect the EPAs from damage due to short-circuit current or overload, primary and backup protections are provided. For MCCs, backup protection is provided with two thermal-magnetic breakers in series. For 480V load centers and 13.8 kV medium-voltage switchgears for the reactor coolant pump, backup protection is provided by the main breaker and overcurrent relays coordinated with the feeder breaker to protect the electrical penetration assemblies.

Add →

8.3.1.1.10 Cable and Raceway Design Criteria

The power cables are designed, fabricated, and tested in accordance with NEMA WC 74 (Reference 33) and NEMA WC 70 (Reference 34). The control cables are designed, fabricated, and tested in accordance with NEMA WC 57 (Reference 35). The instrumentation cables are designed, fabricated, and tested in accordance with NEMA WC 57. Safety-related cables are qualified for the design life of the plant in accordance with IEEE Std. 323.

Cable conductor size selection for medium and low-voltage power and control cables is based on cable ampacity and voltage drop considerations. In addition, the conductors of all medium- and low-voltage power cables are sized to withstand the maximum available fault current. The cable ampacity is based on the maximum cable ambient temperature, the rated cable insulation temperature of 90 °C (194 °F), the cable raceway design, and cable routing paths. IEEE Std. 835 (Reference 36) and NEMA WC 51/ICEA P-54-440 (Reference 37) are used for cable conductor size selections.

NRC RG 1.218 (Reference 38) requires that the plant have monitoring techniques for electric cables. Cable monitoring programs include cable tests to measure and trend the condition of the cable. Tests that can be used for detecting insulation degradation in underground cable include partial discharge testing, time-domain reflectometry, dissipation factor testing, and very-low-frequency ac testing.

The COL applicant is to provide testing, inspection, and monitoring programs for detecting insulation degradation of underground and inaccessible power cables within the scope of 10 CFR 50.65 (COL 8.3(3)) (Reference 39).

The COL applicant is to conduct periodic inspection and testing of the protection devices for the EPA conductors. All circuit breakers for the EPA conductors shall be inspected and tested in 60 months, low voltage circuit breaker overcurrent protection devices for the EPA conductors shall be inspected and tested once per 18 months for 10 % of each type of circuit breakers, and overcurrent relay for medium voltage circuit breakers for the EPA conductors shall be inspected and tested once per 18 months (COL 8.3 (14)).

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The ground detector has an alarm in the MCR to monitor constant grounding and recording. The ground detector has high sensitivity.

8.3.3 Combined License Information

COL 8.3(1) The COL applicant is to provide and to design a mobile generator and its support equipment.

COL 8.3(2) The COL applicant is to describe and provide detailed ground grid and lightning protection.

COL 8.3(3) The COL applicant is to provide testing, inspection, and monitoring programs for detecting insulation degradation of underground and inaccessible power cables within the scope of 10 CFR 50.65.

COL 8.3(4) The COL applicant is to provide protective device coordination.

COL 8.3(5) The COL applicant is to provide insulation coordination of surge and lightning protection.

COL 8.3(6) The COL applicant is to develop the maintenance program to optimize the life and performance of the batteries.

COL 8.3(7) The COL applicant is to provide a short-circuit analysis of the onsite dc power system with actual data.

COL 8.3 (8) The COL applicant is to describe any special features of the design that would permit online replacement of an individual cell, group of cells, or entire battery.

Add A in next page. →

8.3.4 References

1. IEEE Std. 141-1993, "IEEE Recommended Practice for Electric Power Distribution for Industrial Plants," Institute of Electrical and Electronics Engineers, 1993.

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COL 8.3 (14) The COL applicant is to conduct periodic inspection and testing of the protection devices for the EPA conductors. All circuit breakers for the EPA conductors shall be inspected and tested in 60 months, low voltage circuit breaker overcurrent protection devices for the EPA conductors shall be inspected and tested once per 18 months for 10 % of each type of circuit breakers, and overcurrent relay for medium voltage circuit breakers for the EPA conductors shall be inspected and tested once per 18 months.