# 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.:** **244-8326**

**SRP Section:** **09.03.03 – Equipment and Floor Drainage Systems**

**Application Section:** **9.3.3**

**Date of RAI Issue:** **10/14/2015**

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## Question No. 09.03.03-3

GDC 60 requires, in part, a power unit design to "include means to control suitably the release of radioactive materials in liquid effluents … produced during normal reactor operation, including anticipated operating occurrences." 10 CFR 52.6 requires, in part, that information provided to the Commission under Part 52 shall be complete and accurate in all material respects.

As stipulated in item III.2 of SRP Section 9.3.3, "Equipment and Floor Drainage System," the EFDS performance requirements are reviewed for whether they describe component allowable operational degradation. The SRP continues and states that the drawings and descriptions are reviewed for whether safety-related EFDS portions are identified correctly and can be isolated from non safety-related portions.

DCD Tier 2, Figure 9.3.3, "Equipment and Floor Drainage System," depicts the EFDS including the radioactive subsystem in the auxiliary building. However, this figure only shows certain portions of the EFDS, specifically the radioactive portions in the auxiliary and compound buildings. This figure is missing information depicting the reactor containment building subsystems, the turbine generator building subsystems, and the identification of the safety-related and non safety-related portions of the EFDS. In addition, the figure does not show the interconnection of the turbine generating building sump pump discharge between the liquid waste management system (LWMS) and the waste water treatment facility (WWTF).

The applicant is requested to provide the above information in DCD Tier 2, Table 3.2-1, Figure 9.3.3, and Section 9.3.3, in order for the staff to adequately review the EFDS design against GDC 60.

## Response

The reactor containment building drains subsystem is depicted in DCD Tier 2, Figure 9.3.3-1 Radioactive Drain System Flow (1 of 7). Figures of the radioactive drain system show the

safety-related portion by means of the seismic category and quality class in accordance with DCD Tier 2, Table 3.2-1 (Item No. 24, DE).

The turbine generator building drain system consists of the condenser pit sumps (north/south) and a condensate polishing area sump. The figure 1 shows the interconnection of the turbine generator building sump pumps between the LWMS and the WWTF.

All sump pumps discharge into the WWTF when radioactivity of fluid is below a predetermined setpoint. The discharge from the condensate polishing area sump is monitored for process radiation. When contamination level is detected at or exceeding a predetermined setpoint, the operating sump pump is stopped automatically by the RMS signal. The discharge valve to the WWTF is closed and the discharge valve to the LWMS is opened. Then, the sump pump is manually started. The flow is then diverted to the LWMS.

The discharges from the condenser pit sumps are monitored for process radiation. When contamination level is detected at or exceeding a predetermined setpoint, the operating sump pumps are stopped automatically by the RMS signal. The discharge valve to the WWTF is closed and the discharge valve to the condensate polishing area sump is opened. Then, the sump pump is manually started. The flow is then diverted to the condensate polishing area sump and finally to the LWMS.

The DCD will be revised to state that the COL applicant is to provide the classification of structures, systems, and components and the flow diagram for turbine generator building drain system.

Figure 1. Turbine Generator Building Drain System

**Impact on DCD**

DCD Tier 2, Table 1.8-2 (2 & 15 of 29), Table 3.2-1 (84 of 86), Section 3.2.5, Section 9.3.3.2.1 and Section 9.3.5 will be revised as indicated 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.

Table 1.8-2 (2 of 29)

| Item No. | Description |
|---|---|
| COL 2.5(1) | The COL applicant is to provide the site-specific information on geology, seismology, and geotechnical engineering as required in NRC RG 1.206. |
| COL 2.5(2) | The COL applicant is to confirm that the foundation input response spectra (FIRS) of the nuclear island are completely enveloped by the CSDRS-compatible free-field response motions at the bottom elevation of the nuclear island for a site with the low-strain shear wave velocity greater than 304.8 m/s (1,000 ft/s) at the finished grade in the free field. Alternately, the COL applicant is to confirm that FIRS of the nuclear island are completely enveloped by the CSDRS for a hard rock site with a low-strain shear wave velocity of supporting medium for the nuclear island greater than 2,804 m/s (9,200 ft/s). |
| COL 2.5(3) | The COL applicant is to confirm that the lower bound of the site-specific strain-compatible soil profile for a soil site is greater than the lower bound of the generic strain-compatible soil profiles used in the APR1400 seismic analyses. |
| COL 2.5(4) | The COL applicant is to confirm that the site-specific GMRS determined at the finished grade are completely enveloped by the hard rock high frequency (HRHF) response spectra for a site with a low-strain shear wave velocity of supporting medium for the nuclear island higher than 1,494 m/s (4,900 ft/s) overlaying a hard rock with a low-strain shear wave velocity greater than 2,804 m/s (9,200 ft/s). |
| COL 2.5(5) | The COL applicant is to perform a site-specific seismic analysis to generate in-structure response spectra at key locations using the procedure described in Appendix 3.7A if COL 2.5(2) and COL 2.5(3) above are not met. In addition, the COL applicant is to confirm that the site-specific in-structure response spectra so generated are enveloped by the corresponding in-structure response spectra provided in Appendix 3.7A. |
| COL 2.5(6) | The COL applicant is to perform a site-specific seismic response analysis using the procedure described in Appendix 3.7B and the EPRI White Paper, "Seismic Screening of Components Sensitive to High Frequency Vibratory Motions," if COL 2.5(4) is not met. |
| COL 2.5(7) | The COL applicant is to perform an evaluation of the subsurface conditions within the standard plant structure footprint based on the geologic investigation in accordance with NRC RG 1.132. |
| COL 2.5(8) | The COL applicant is to confirm that the dynamic properties of structural fill granular to be used in construction of the APR1400 seismic Category I structures satisfy the requirements of structural fill granular provided in Table 2.0-1. |
| COL 3.2(1) | The COL applicant is to identify the seismic classification of site-specific SSCs that should be designed to withstand the effects of the SSE. |
| COL 3.2(2) | The COL applicant is to identify the quality group classification of site-specific systems and components and their applicable codes and standards. |
| COL 3.3(1) | The COL applicant is to demonstrate that the site-specific design wind speed is bounded by the design wind speed of 64.8 m/s (145 mph). |
| COL 3.3(2) | The COL applicant is to demonstrate that the site-specific seismic Category II structures adjacent to the seismic Category I structures are designed to meet the provisions described in Subsection 3.3.1.2. |
| COL 3.3(3) | The COL applicant is to provide reasonable assurance that site-specific structures and components not designed for the extreme wind loads do not impact either the function or integrity of adjacent seismic Category I SSCs. |

COL 3.2(3) The COL applicant is to provide the classification of structures, systems, and components for turbine generator building drain system.

Table 1.8-2 (15 of 29)

| Item No. | Description |
|---|---|
| COL 9.3(2) | The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations. |
| COL 9.3(3) | The COL applicant is to prepare the site radiological environmental monitoring program. |
| COL 9.3(4) | The COL applicant is to provide the supply systems of the nitrogen gas subsystem, the hydrogen subsystem, the carbon dioxide subsystem, and the breathing air systems. |
| COL 9.4(1) | The COL applicant is to provide the capacities of heating coils in the safety-related air handling units and cooling and heating coils in the non safety-related air handling units affected by site-specific conditions. |
| COL 9.4(2) | The COL applicant is to provide the capacities of heating coils of electric duct heaters affected by site-specific conditions. |
| COL 9.4(3) | The COL applicant is to provide the system design information of ESW building and CCW heat exchanger building HVAC system including flow diagram, if the ESW building and CCW heat exchanger building require the HVAC system. |
| COL 9.4(4) | The COL applicant is to establish operational procedures and maintenance programs as related to leak detection and contamination control. |
| COL 9.5(1) | The COL applicant is to establish a fire protection program, including organization, training, and qualification of personnel, administrative controls of combustibles and ignition sources, firefighting procedures, and quality assurance. |
| COL 9.5(2) | The COL applicant is to address the design and fire protection aspects of the facilities, buildings and equipment, and a fire protection water supply system, which are site specific and/or are not a standard feature of the APR1400. |
| COL 9.5(3) | The COL applicant is to describe the provided apparatus for plant personnel and fire brigades such as portable fire extinguishers, self-contained breathing apparatus, and radio communication systems. |
| COL 9.5(4) | The COL applicant is to address the final FHA and FSSA based on the final plant design, including a detailed post-fire safe-shutdown circuit analysis. |
| COL 9.5(5) | The COL applicant is to provide a reliable starting method for the AAC GTG. |
| COL 9.5(6) | The COL applicant is to provide details of emergency response facilities and associated communication capabilities. |

COL 9.3(5) The COL applicant is to provide the flow diagram for turbine generator building drain system.

Table 3.2-1 (84 of 86)

| Item No. / Principal SSCs | Location(2) | Safety Class | Quality Group | Codes and Standards | 10 CFR 50, App. B(3) | Seismic Category | Remarks |
|---|---|---|---|---|---|---|---|
| 111. WY – Radioactive Laundry | | NNS | D | API-650 - 2000<br>ASME B31.3 - 2010 | N/A | III | (4) |
| a. Detergent waste tank | CPB | NNS | D | API650 – 2007 | A | II | (3)(d) |
| b. Detergent waste tank pump | CPB | NNS | D | API610 – 2010 | N/A | III | |
| c. Detergent waste filter | CPB | NNS | D | ASME Sec. VIII - 2007 | N/A | III | |

(1) As used in this document, the term safety-related area applies to those areas containing equipment or structures required for safe shutdown (including accident mitigation).

(2) Locations are defined below:

RCB = Reactor Containment Building
CPB = Compound Building
CCWHXB = Component Cooling Water Heat Exchanger Building
CWPH=Circulating Water Pump House
MSVH = Main Steam Valve House
EOF = Emergency Operation Facility
AAC GTGB = Alternate Alternating Current Gas Turbine Generator Building
SWYD = Switchyard
AB = Auxiliary Building
TGB = Turbine Generator Building
ESWB = Essential Service Water Building
FPWTB = Fire Pump & Water/Wastewater Treatment Building
FHA = Fuel Handling Area
EDGB = Emergency Diesel Generator Building
ALL = All areas

(3) Legend:

- Yes – Compliance with the requirements of 10 CFR 50, Appendix B, is required.
- A – Augmented quality assurance requirements of Appendix B to 10 CFR 50, is applied. Augmented quality controls are applied to the following areas:
  - (a) ATWS (Anticipated Transient without Scram)
  - (b) Station Blackout
  - (c) Fire Protection
  - (d) Seismic Category II SSCs
  - (e) Risk significant non-safety related SSCs determined by design RAP

112. DT – Turbine Generator Building Drain
The COL applicant is to provide the classification of structures, systems, and components for turbine generator buildng drain system (COL 3.2(3)).

of 10 CFR Part 50, Appendix B, and are designated as such in Table 3.2-1 in the column labeled 10 CFR Part 50, Appendix B.

Piping supports and component supports are in the same safety class and have the same QA requirements as the piping and components to which they apply.

The safety classification systems described above meet the intent of NRC RG 1.26 and the requirements of 10 CFR 50.55a.

3.2.4 Classification Listings

Table 3.2-1 provides component classifications as defined in Subsections 3.2.1 through 3.2.3. Table 3.2-1 also provides the quality assurance requirements of 10 CFR Part 50, Appendix B, and the applicable codes and standards.

3.2.5 Combined License Information

COL 3.2(3) The COL applicant is to provide the classification of structures, systems, and components for turbine generator building drain system.

COL 3.2(1) The COL applicant is to identify the seismic classification of site-specific SSCs that should be designed to withstand the effects of the SSE.

COL 3.2(2) The COL applicant is to identify the quality group classification of site-specific systems and components and their applicable codes and standards.

3.2.6 References

1. 10 CFR Part 50, Appendix A, “General Design Criteria for Nuclear Power Plants,” U.S. Nuclear Regulatory Commission.

2. 10 CFR 100.11, “Determination of Exclusion Area, Low Population Zone, and Population Center Distance,” U.S. Nuclear Regulatory Commission.

3. 10 CFR Part 100, Appendix A, “Seismic and Geologic Siting Criteria for Nuclear Power Plants,” U.S. Nuclear Regulatory Commission

4. 10 CFR Part 50, Appendix S, “Earthquake Engineering Criteria for Nuclear Power Plants,” U.S. Nuclear Regulatory Commission.

related equipment since the non-safety-related component in safety-related areas such as reactor containment building and auxiliary building is designed as seismic Category II.

9.3.3.2 System Description

The EFDS collects radioactive and potentially radioactive liquid wastes at atmospheric pressure from drainage of the reactor containment building, the auxiliary building, the compound building, and the turbine generator building. The liquid wastes are segregated, depending upon water quality and/or building, into four groups: equipment drainage, floor drainage, chemical drainage, and detergent drainage. Such drainages are conveyed by gravity to their respective building sumps and pumped to the LWMS. Chemical wastes collected from equipment decontamination and potentially chemical contamination wastes are sent to the chemical waste tanks of LWMS.

The EFDS consists of collection sumps, sump pumps, valves, piping, and instrumentation.

9.3.3.2.1 General Description

The COL applicant is to provide the flow diagram for turbine generator building drain system. (COL 9.3(5)).

The EFDS consists of several subsystems, as described below. Areas of the plant are served by the appropriate EFDS, based on the potential source of leakage into the subject area. This allows segregation of radioactive and non-radioactive sources. The schematic diagram of radioactive drainage system (RDS) is shown in Figures 9.3.3-1.

9.3.3.2.2 Radioactive Drainage Areas

The RDS collects radioactive and potentially radioactive liquid wastes at atmospheric pressure from equipment and floor drainage of the containment building, auxiliary building, and compound building. Such drainage is conveyed by gravity to sumps and pumped from sumps to the LWMS.

Chemical wastes are collected from equipment decontamination and sent to the LWMS chemical waste tanks. Potentially radioactive wastes from personnel decontamination shower facilities are collected and pumped to the detergent waste tanks of LWMS. Potentially radioactive wastewater entering the sump located in the condensate polishing

activity. The process radiation monitor serves only as a trending device to alert the operator of possible fuel cladding failure.

9.3.4.5.6 Boronometer

The boronometer provides indication and a continuous recording in the MCR of reactor coolant boron concentration. High and low alarms warn the operator of deviations from the required boron concentration in the reactor coolant. The principle of operation is neutron absorption. The unit is provided with shielding as required to limit the maximum external radiation level from its source to a low value. All portions of the unit that contact reactor coolant are constructed of austenitic stainless steel. Refer to Subsection 7.7.1.1 for further information on the boron control system.

9.3.5 Combined License Information

COL 9.3(1) The COL applicant is to prepare operational procedures and maintenance programs as related to leak detection and contamination control.

COL 9.3(2) The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations.

COL 9.3(3) The COL applicant is to prepare the site radiological environmental monitoring program.

COL 9.3(4) The COL applicant is to provide the supply systems of the nitrogen gas subsystem, the hydrogen subsystem, the carbon dioxide subsystem, and the breathing air systems.

9.3.6 References

1. 10 CFR 50.63, “Station Blackout Rule,” U.S. Nuclear Regulatory Commission.

2. ANSI/ISA 7.0.01-1996, “Quality Standard for Instrument Air,” International Society of Automation, 1996.

COL 9.3(5) The COL applicant is to provide the flow diagram for turbine generator building drain system.