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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.:** 219-8199  
**SRP Section:** 11.03 - Gaseous Waste Management System  
**Application Section:** 11.3  
**Date of RAI Issue:** 09/21/2015

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### **Question No. 11.03-6**

Staff review of DCD Tier 1, Revision 2, Section 2.7.6.2 and Table 2.7.6.2-1 found that information on ITAAC for the GWMS to demonstrate compliance with 10 CFR 52.47(b)(1) and to provide reasonable assurance that a plant that incorporates the APR 1400 design certification and operates in accordance with the design certification will meet the provisions of the Atomic Energy Act and NRC regulations was not fully described. Without confirming the initial introduction of the proper types and amounts of charcoal media and desiccants, and delay time, the GWMS would fail to meet the design criteria in the DCD Tier 2, Revision 2, Section 11.3.1.2. As a result, gaseous releases could exceed 10 CFR 20, Appendix B, Table 1, effluent concentration and dose limits, and 10 CFR 50, Appendix I dose objectives. The staff requests the applicant to address the following:

1. Describe in DCD Tier 1, Section 2.7.6.2.1, how the GWMS is designed to process gaseous waste prior to release and ensure compliance with 10 CFR 20, Appendix B, Table 1 effluent concentration and dose limits, and 10 CFR 50, Appendix I dose objectives for gaseous effluents when the plant is operational.
2. Describe in DCD Tier 1, Section 2.7.6.2.1, the process design of the GWMS subsystems and how the initial loading of the subsystem demineralizers and vessels includes the proper types and amounts of charcoal media and desiccant, and delay time that will meet or exceed the system design descriptions and parameters listed in DCD Tier 2, Revision 2, Tables 11.3-1 and 11.3-2. Provide in DCD Tier 1, Table 2.7.6.2-1, the assigned ITAAC to confirm the charcoal quantity.
3. Provide in DCD Tier 1, Table 2.7.6.2-1, the assigned ITAAC to confirm the radiation monitor at the discharge side of the adsorbers which sends a signal to close the GWMS discharge valves upon detection of radiation levels above the setpoint monitor, source test of the radiation monitor, alarms, indications, and automatic initiation functions as described in DCD Tier 1, Revision 2, Section 2.7.6.2.1 and DCD Tier 2, Revision 2, Sections 11.3.2.1.6 and 11.5.2.4.1.

Please revise the DCD to include this information and provide a markup.

## **Response**

1. The GRS is designed to process gaseous radioactive waste with the charcoal delay beds having adequate charcoal mass and the waste gas dryer and charcoal guard beds protecting the charcoal delay beds from the potential moisture entrained with the process gas, in order to meet 10CFR 20, Appendix B effluent concentration and dose limits, and 10 CFR 50, Appendix I dose objectives for gaseous effluents.

DCD Tier 1 subsection 2.7.6.2.1 includes the GWMS design description for the gaseous waste treatment method, the sampling, the radiation monitoring and isolation provisions for gaseous effluent control and DCD Tier 1 Table 2.7.6-2-3 lists the GWMS components in conjunction with DCD Tier 2 Section 11.3, in order to provide the design feature for ensuring compliance with 10CFR 20, Appendix B effluent concentration and dose limits, and 10 CFR 50, Appendix I dose objectives for gaseous effluents when the plant is operational. In addition, DCD Tier 1 Section 2.7.6.2 also includes the ITAACs to confirm the aforementioned design features.

The description in DCD Tier 1 Section 2.7.6.2 will be updated to add the GRS design features about the waste gas dryer and charcoal guard beds, which protect the charcoal delay bed from the from the potential moisture entrained with the process gas, and clarifying the requirement of effluent concentration limits applied in GWMS,.

2. The ITAAC item 2 in DCD Tier 1, Table 2.7.6.2-4 provides how the charcoal delay beds contain the appropriate type, size, and mass of charcoal to ensure that the gaseous releases are within the regulatory limits.

The appropriate mass and adsorption efficiency (or dynamic adsorption coefficient) of charcoal for the charcoal delay bed have been determined based on the NUREG-0017 methodology to have sufficient delay time for complying with the regulatory limits for gaseous release. The design basis information of the delay time, charcoal mass, and charcoal adsorption efficiency is listed in DCD Tier 2, Table 11.3-3 and 4.

The gaseous radwaste treatment subsystem with waste gas dryers, charcoal guard beds and charcoal delay beds is to be designed, procured and manufactured from a supplier having supplying and operating experiences in nuclear power plants and to be installed, in order to have the design basis delay time, adsorption coefficient and mass of charcoal meet or exceed the values listed in DCD Tier 2, Table 11.3-3 and 4.

Since the adsorption coefficient and the delay time is dependent on the system operating conditions including flow rate, temperature, and moisture contents of process gas as indicated in NUREG-0017 and the type of charcoal to be provided by the supplier, the appropriate type, size and adsorption efficiency are selected and specified by the supplier based on operating experiences or performance results of the system in nuclear power plants, and/or the charcoal test results, under the system design condition and the design basis delay time and mass of the charcoal to be loaded in the delay beds.

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This information is to be reviewed during the procurement and detail design stages and the type, mass and quality of the charcoal are to be inspected at the construction site before the initial loading of the charcoal to charcoal delay beds.

Therefore, it is considered that the type, mass, and delay time for charcoal in the as-built charcoal beds could be confirmed by the inspection and verification of the specification data and design report showing the charcoal mass and the adsorption efficiency equal to or greater than the design basis of the charcoal delay beds, as indicated in item 2 of the ITAAC.

3. The requested information, which is related to the operation of the radiation monitor in the high radiation condition, is included in DCD Tier 1, Section 2.7.6.4. ITAAC item 3 and 4 in DCD Tier 1, Table 2.7.6.2-4 provides the information about GRS discharge valve operation and radiation alarm provisions to MCR. The GRS discharge valve is closed automatically upon detection of a high radiation signal from the radiation monitor and low or no ventilation flow condition, and the radiation high alarm is provided in the MCR.

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#### **Impact on DCD**

DCD Tier 1, Section 2.7.6.2.1 and Table 2.7.6.2-4 will be revised as indicated in the attached markup.

#### **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 1**2.7.6.2 Gaseous Waste Management System2.7.6.2.1 Design Description

The waste gas dryer and charcoal guard bed remove the moisture in the radioactive waste to protect the charcoal delay beds.

The gaseous waste management system (GWMS) consists of the gaseous radwaste system (GRS) and the building ventilation HVAC systems. The design and methods of treatment for the building ventilation subsystems are discussed in Section 9.4 of this DCD, Tier 2 and the condenser vacuum subsystem is discussed in Section 10.4 of the DCD, Tier 2. This subsection covers the design of the GRS, which handles and processes reactor offgas from the chemical and volume control system (CVCS). The GRS is non safety-related with the exception of containment penetration isolation valves and the piping. The GRS is designed to collect, store, process, sample and monitor gaseous radioactive waste generated as a result of normal operation, including anticipated operational occurrences (AOOs). The GRS ensures that gaseous waste releases comply with effluent concentration limit in 10 CFR Part 20, Appendix B, and 10 CFR Part 50, Appendix I dose objectives for gaseous effluents.

and dose

The GRS is located in the compound building. The GRS is designed to process gaseous radioactive waste with charcoal delay beds having adequate charcoal mass for adsorption of nuclides for decay in order to keep releases within regulatory limits. The GRS is designed for continuous operation. Treated effluent is continuously monitored for radioactivity levels during discharge. The radiation monitor will provide alarms in the MCR and the radwaste control room in the event that the effluent exceeds a predetermined radiation setpoint, and simultaneously close the discharge valve.

The GRS is designed as follows:

1. The functional arrangement of the GRS is as described in the Design Description of Subsection 2.7.6.2.1 and in Tables 2.7.6.2-1 and 2.7.6.2-3 and as shown in Figure 2.7.6.2-1.
2. The GRS charcoal delay beds contain the appropriate type, size, and mass of charcoal needed to facilitate adsorption of radionuclides (xenon and krypton gases) for decay to ensure that the gaseous releases are within the regulatory limits. Moisture instruments are provided for the protection of the charcoal delay beds.

## APR1400 DCD TIER 1

Table 2.7.6.2-4 (1 of 2)

Gaseous Radwaste System ITAAC

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The functional arrangement of the GRS is as described in Design Description of Subsection 2.7.6.2.1 and in Tables 2.7.6.2-1 and 2.7.6.2-3 and as shown in Figure 2.7.6.2-1.	1. Inspection of the as-built GRS will be performed.	1. The as-built GRS conforms with the functional arrangement as described in Design Description of Subsection 2.7.6.2.1 and in Tables 2.7.6.2-1 and 2.7.6.2-3 and as shown in Figure 2.7.6.2-1.
2. The GRS charcoal delay beds contain the appropriate type, size, and mass of charcoal needed to facilitate adsorption of radionuclides (xenon and krypton gases) for decay to ensure that the gaseous releases are within the regulatory limits. Moisture instruments are provided for the protection of the charcoal delay beds.	2. Inspection and verification of media in the as-built GRS charcoal beds per design specifications will be performed to verify adsorption efficiency of media.	2. A report concludes that the as-built charcoal delay beds have the adsorption efficiency equal to or greater than the design basis of the charcoal delay beds.  <div style="border: 1px solid red; padding: 2px; display: inline-block;">appropriate mass and the</div>
3. The GRS discharge valve is closed automatically upon detection of a high radiation signal from the radiation monitor at the gaseous waste discharge. The discharge valve is also automatically closed when there is insufficient or no ventilation flow.	3. Tests will be conducted for the GRS discharge valve using simulated test signal.	3. Upon receipt of a simulated GRS high radiation test signal, the as-built GRS discharge valve is closed automatically.
4. An alarm from the gaseous waste discharge radiation monitor is 2 provided in the MCR and the radwaste control room.	4. Inspection will be performed for the retrievability of the alarm from the gaseous waste discharge monitor in the as-built MCR.	4. An alarm from gaseous waste discharge radiation monitor can be retrieved in the as-built MCR and the radwaste control room.