
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.: 214-8250
SRP Section: 09.04.05 - Engineered Safety Feature Ventilation System
Application Section: 09.04.05
Date of RAI Issue: 09/14/2015

Question No. 09.04.05-1

Emergency Diesel Generator Area HVAC System:

General Design Criteria (GDC) 17, "Electric power systems," requires the proper functioning of the essential power systems. Standard Review Plan (SRP) Section 9.4.5 is used by the staff to review Emergency Diesel Generator Area HVAC System. Section II of this SRP "Acceptance Criteria", Item 4 under Technical Rationale, provides the following guidance to demonstrate compliance with GDC 17:

With regard to the ESFVS, the plant design should ensure that electrical contacts and relays in diesel generator rooms are protected from dust, dirt, and grit.

The above guidance is also mentioned in NUREG/CR-0660, "Enhancement of Onsite Emergency Diesel Generator Reliability," item 2 under Subsection A, Recommendations. DCD Tier 2, Table 8.1-2, "Criteria and Guidelines for Electric Power Systems," shows that essential electrical equipment conform to the guidelines of NUREG/CR-0660. However, there is no specific information in the DCD that describes how the Emergency Diesel Generator Area HVAC System removes dust, dirt, and grit from the diesel generator rooms. Please describe in the DCD how the above guidance is met, or alternatively, to provide justification why the above guidance does not need to be met.

Response

DCD Tier 2, Section 9.4.5.1.1 describes that "The EDG area HVAC system conforms with 10 CFR Part 50 Appendix A, GDC 17, by protecting electric contacts and relays from dust and dirt in the EDG rooms, which is accomplished by taking filtered air from a height of at least 7 m (20 ft) above ground level.". The EDG area HVAC system has air intakes located at least 7 m (20 ft) above ground level to prevent taking dust and dirt from the ground and each EDG room normal supply air handling unit (AHU) of the EDG area HVAC system has a prefilter as

described in Section 9.4.5.2.1.1 and shown in Figure 9.4.5-1 to provide filtered air to the EDG rooms.

Impact on DCD

There is no impact on the DCD.

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 Reports.

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Question No. 09.04.05-2

Auxiliary Building Controlled Area HVAC System:

1. According to DCD Tier 2, Section 9.4.5.1.3, the design and construction of air cleanup units (ACUs) (AU01A, AU01B, AU01C, AU01D, AU03, AU04, AU05, AU06, AU07, and AU08) conform to ASME AG-1-2009, "Code on Nuclear Air and Gas Treatment." AG-1 specifies that ACU heating coils should be inspected and tested per AG-1, CA-5400. However, DCD Tier 2, Sections 9.4.5.4.3 does not address the inspection and testing requirements of heating coils. Please provide the heating coil inspection and testing requirements in the DCD or provide justification for why it is not needed.
2. Regulatory Position C.3.2 of Regulatory Guide 1.140, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants," states that to ensure reliable in-place testing, the volumetric air-flow rate of a single cleanup unit should be limited to approximately 849.51 m³/min (30,000 cfm). If a total system air flow in excess of this rate is necessary, multiple units should be used.. The staff reviewed DCD Tier 2, Section 9.4.5.2.3.1, and found that the exhaust air flow rate through AU05 and AU07 is 38,000 cfm. Also, the exhaust air flow rate through AU06 and AU08 is 36,150 cfm. The applicant did not indicate whether multiple-units for AU05, AU07, AU06 and AU08 would be used. Therefore, to conform to the guidance in RG 1.140, Regulatory Position C.3.2, please modify the DCD to limit a single ACU to 30,000 cfm or less or provide justification for ensuring reliable in-place testing with higher flowrates.

Response

1. DCD Tier 2, Section 9.4.5.4.3 will be revised to clarify that the heating coils of ACUs in the auxiliary building controlled area HVAC system are inspected and tested in accordance with section CA-5400 of ASME AG-1.

2. As indicated in DCD Tier 2, Table 9.4.5-1, the auxiliary building controlled area normal exhaust ACUs in Div. I (AU05 and AU07) consist of two 100% capacity redundant units and each unit has 38,000 CFM air-flow rate and the auxiliary building controlled area normal exhaust ACUs in Div. II (AU06 and AU08) consist of two 100% capacity redundant units and each unit has 36,150 CFM air-flow rate.

DOE HDBK-1169-2003, section 4.4.11 describes that a nominal system capacity of 30,000 CFM has been recommended by DOE and U.S. NRC for any filter or adsorber bank. It describes that for larger systems, this limit requires the system to be segmented into two or more smaller subsystems, each contained in an individual housing and having an installed capacity of 30,000 CFM or less. The purpose of this requirement was to facilitate maintenance and in-place testing, and to enhance the reliability of the total system. A 30,000 CFM bank using 1,000 CFM HEPA filters with a filter layout of 3 HEPA filters high and 10 HEPA filters wide was considered the largest that can be tested in-place conveniently.

DOE HDBK-1169-2003, section 4.4.11 also describes that the development of higher-flow aerosol generators and manifold in-place test systems has allowed larger filter banks than the recommended 30 filters and the use of 1,500 CFM HEPA filters. This allows for higher-capacity systems without increasing the physical size of the bank and the in-place testing and maintenance are the determining factors.

In the APR1400 standard design, the auxiliary building controlled area HVAC system uses 1,500~2,000 CFM HEPA filters and the auxiliary building controlled area normal exhaust ACUs can allow at least 45,000 CFM air-flow rate without increasing the physical size and changing the filter layout of 3 HEPA filters high and 10 HEPA filters wide. And in-place test equipment such as aerosol generators for in-place testing has been developed and it currently has the capability to perform reliable in-place testing for ACUs up to 65,000 CFM. Therefore, the auxiliary building controlled area normal exhaust ACUs, which have 38,000 CFM or 36,150 CFM air-flow rate per single ACU can ensure convenient maintenance and reliable in-place testing and the auxiliary building controlled area HVAC system would not need to limit the air-flow rate of a single ACU to 30,000 CFM.

Impact on DCD

DCD Tier 2, Subsection 9.4.5.4.3 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 Reports.

APR1400 DCD TIER 2

interlocks, and safety devices on the system are functionally checked, adjusted, and tested to provide reasonable assurance of the proper sequence of operation.

Preoperational testing of the ESF HVAC systems are performed as described in Section 14.2 to demonstrate that systems and components operate in accordance with applicable test programs and specifications.

Air handling units are factory inspected and tested in accordance with AMCA standards (References 11 and 12). Filters are inspected and tested in accordance with ASHRAE standards (Reference 10). Cooling coils are hydrostatically tested in accordance with ASME AG-1. The cooling coil performance rating is developed in accordance with AHRI standards (References 13, 14, and 15).

Leak testing of system ductwork is performed in accordance with ASME AG-1 and ASME N511.

9.4.5.4.1 Emergency Diesel Generator Area HVAC System

The general inspection and test requirements in Subsection 9.4.5.4 are applied.

9.4.5.4.2 Electrical and I&C Equipment Areas HVAC System

The general inspection and test requirements in Subsection 9.4.5.4 are applied.

9.4.5.4.3 Auxiliary Building Controlled Area HVAC System

ACUs are factory inspected and tested for housing leakage, filter bypass leakage, and airflow performance. Periodically and subsequent to each filter or carbon adsorber replacement, the unit is inspected and tested in-place in accordance with the requirements of ASME N511, ASME AG-1, and NRC RG 1.52 for safety-related ACUs or NRC RG 1.140 for non-safety-related ACUs. The HEPA filters are checked periodically and carbon adsorber samples are tested for efficiency in an independent laboratory in accordance with NRC RGs 1.52, 1.140, and ASTM D 3803.

ADD

The safety-related isolation dampers are inspected periodically and tested in accordance with ASME AG-1 and the damper seats are replaced when it is required.

The electric heating coils of ACUs are inspected and tested in accordance with article CA-5400 of ASME AG-1.