REVISED 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.:	**223-8204**
SRP Section:	**11.05 – Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems**
Application Section:	**11.5**
Date of RAI Issue:	**09/23/2015**

Question No. 11.05-4

Section 11.5.2.2.h identifies the Main Control Room air intake monitors (RE-071A, 072B, 073B, and 074B) are safety related.

1. The conformance to applicable requirements of IEEE Std. 603-1991 is required by 10 CFR Part 50.55a(h)(3) which should be stipulated for these Monitors and any other portions of this system which are safety related.

2. The Final Safety Analysis Report should discuss how such equipment meets the requirements outlined in IEEE Std. 603-1991.

Please address this item and provide a markup for the proposed DCD changes.

Response - (Rev.1)

Details of the compliance to IEEE Std. 603-1991 for Main Control Room air intake monitors (RE-071A, 072B, 073B, and 074B) and Containment air monitors (RE-039A and 040B) will be described in Subsections 11.5.2.2.5.e and 11.5.2.2.5.h.

Impact on DCD

DCD Tier 2, Subsections 11.5.2.2.5.e and 11.5.2.2.5.h will be revised.

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.

These monitors do not perform any plant protective function. Therefore, discussion of compliance to IEEE Std. 603 (Reference 33) is not needed.

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The monitors transmit the radiation signals to the licensing entity via emergency response data system (ERDS) link.

The monitors are located in Auxiliary building as shown in Figure 11.5-2F.

f. Fuel handling area HVAC effluent monitor (RE-043)

The sample line inlet of RE-043 is located at the common duct at the outlet of the fuel handling area normal and emergency exhaust ACUs.

The monitor detects particulate, iodine, and noble gas activities of the fuel handling area before it is released to the environment. The monitor has measuring range specified in Table 11.5-1 and provides indication and alarm to the MCR, RSR, and local RMS skid. High radiation signal initiated by the monitor starts the fuel handling area emergency exhaust ACU and isolates the isolation dampers installed upstream of the normal supply AHU and downstream of the normal exhaust ACU in the fuel handling area.

The monitor is designed to provide alarm to operator not to exceed the dose limits in 10 CFR 50, Appendix I and the effluent concentration limits in 10 CFR 20, Appendix B.

The monitor is located in Auxiliary building as shown in Figure 11.5-2F.

g. Condenser vacuum pump vent effluent monitor (RE-063)

The sample line inlet of RE-063 is located at the condenser vacuum pump vent effluent. RE-063 has particulate and iodine sampler and detects noble gas activities. The monitor sends the radiation signal to RMS computer to analyze the radiation data.

The monitor has measuring range specified in Table 11.5-1 and provides indication and alarm to the MCR, RSR, and local RMS skid.

High radiation signal from the monitor automatically stops the condenser overboard pump and diverts condensate flow to the condensate overflow storage sump by the modulating condenser overflow valve. The deaerator vent gas diverts from atmosphere to condenser by closing atmosphere valve and opening condenser valve simultaneously. Then, the condenser exhaust atmosphere valve closes and the containment isolation valve opens simultaneously. Also, the exhausted gases from condenser vacuum pump discharge are diverted to the reactor containment building drain sump by the booster fan start simultaneously.

The monitor transmits the radiation signal to the licensing entity via ERDS link.

The monitor is designed to provide alarm to operator not to exceed the dose limits in 10 CFR 50, Appendix I and the effluent concentration limits in 10 CFR 20, Appendix B.

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The monitor is located in Turbine Generator Building as shown in Figure 11.5-2Z.

h. MCR air intake monitors (RE-071A, 072B, 073A, and 074B)

Two monitors per division (a total of four monitors) are provided with gas channels to monitor each of the intakes. The sample line inlet of two monitors are located in the air intake duct of each safety division as close to the intake point as practicable. The monitors detect noble gas activities.

The monitor has measuring range specified in Table 11.5-1 and provides indication and alarm to the MCR, RSR, and local RMS skid. Upon detection of high radiation, control room emergency ventilation actuation signal (CREVAS) is generated. The AHU inlet isolation dampers, which are open for normal operation, automatically close and the outside air is routed through the control room emergency makeup ACU.

The monitors are located in Auxiliary Building as shown in Figure 11.5-2P (RE-073A, 074B) and Figure 11.5-2Q (RE-071A, 072B).

i. Gaseous radwaste system exhaust monitor (RE-080)

The sample line inlet of RE-080 is located at waste gas exhaust line in the gaseous radwaste system. The monitor detects noble gas activities.

The monitor has measuring range specified in Table 11.5-1 and provides indication and alarm to the MCR, RSR, and local RMS skid. Upon detection of high radiation, the waste gas exhaust line in the gaseous radwaste system is isolated with an automatic closure of isolation valve.

The monitor is designed to provide alarm to operator not to exceed the dose limits in 10 CFR 50, Appendix I and the effluent concentration limits in 10 CFR 20, Appendix B.

The monitor is located in Compound Building as shown in Figure 11.5-2V.

j. Compound building HVAC effluent monitor (RE-082)

The sample line inlet of RE-082 is located at the compound building HVAC effluent duct. The monitor has particulate and iodine sampler and sends the radiation signal to RMS computer to analyze the radiation data to ensure that the radioactive effluent discharged to the environment does not exceed the dose limit given in 10 CFR 50, Appendix I ALARA condition and the effluent concentration limit in 10 CFR 20, Appendix B. There is no individual separate indication, alarm, and automatic action initiated by this monitor other than one combined common alarm generated by the RMS computer to alert the operator. When the common alarm is generated, the operator uses the RMS computer log to determine the details of the alarm.

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The conformance to applicable requirements of IEEE Std. 603 is as follows:

- Single-failure criterion

  Two monitors per division (a total of four monitors) are provided to meet the single-failure criterion. This arrangement is to accommodate the divisionalized air intake before merging into a common plenum which can be separated when needed. This configuration allows independence of the redundant monitor channels and precludes either a detectable or non-detectable failure impairing proper functioning of its intended safety function.

- Completion of protective action

  The four redundant radiation monitor signals are brought into the balance of plant - engineered safety features actuation system (BOP-ESFAS) coincidence logic, where the one-out-of-two logic is run twice downstream to a high radiation bistable trip circuit for each signal. The output of the coincidence logic is the CREVAS. For each redundant actuation division of HVAC equipment, the actuated equipment is grouped in two; one that cannot be manually overridden until the protective action is completed, when the radiation level subsides and falls below a preset level. The other group includes equipment that could be manually overridden depending upon the plant condition. The latter group includes equipment such as air intake supply dampers which the operator can select the intake air path that shows an acceptable radiation level. This is possible since the two air intakes are located on the far end of the Auxiliary Building separated by the building structure.

- Quality

  These monitors are safety class 3 per ANSI/ANS 51.1, seismic category I, and electrical class 1E, which means these instruments including all associated appurtenances are designed, manufactured, inspected, installed, tested, operated, and manufactured in accordance with ASME NQA-1, QA program (Reference 34). The instrumentation portion that performs safety related protective functions do not have embedded software or firmware. Therefore, the application guidance provided in IEEE Std. 7-4.3.2-2003 (Reference 35) is not applicable.

- Equipment qualification

  These monitors are seismically qualified in accordance with IEEE Std. 344 (Reference 36) and environmentally qualified per IEEE Std. 323 (Reference 37). IEEE Std. 7-4.3.2-2003 is not applicable.

- System integrity

  These monitors are designed to perform their intended safety function of protecting the main control room operators from high radiation under accident conditions expected during design basis accidents, such as LOCA or a fuel handling accident. IEEE Std. 7-4.3.2-2003 is not applicable.

- Independence

  The redundant safety related monitors are spatially and physically separated and are electrically isolated when and where cross-connects are needed (i.e., coincident logics) using a qualified isolating medium. The interconnections between the safety portions and the non-safety portions within the monitors are electrically isolated using qualified isolation medium. Locations of these monitors are carefully determined and analyzed to ensure that functional degradation of these monitors would not occur due to physical proximity or functional interaction. This is in accordance with IEEE Std. 384 (Reference 38), NRC RG 1.189 (Reference 39), and NRC RG 1.151 (Reference 40). The effect of a single failure of a non-safety portion affecting or downgrading the safety function of the safety MCR intake radiation monitors is precluded and prevented based on basic features in the design, manufacturing, inspection, installation, and testing discussed above in detail.

29. Regulatory Guide 8.10, “Operating Philosophy for Maintaining Occupational Radiation Exposures as low as Is Reasonably Achievable,” Rev. 1, U.S. Nuclear Regulatory Commission, May 1977.

30. 10 CFR 20.1406, “Minimization of Contamination,” U.S. Nuclear Regulatory Commission.

31. Regulatory Guide 4.21, “Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning,” U.S. Nuclear Regulatory Commission, June 2008.

32. ANSI/ANS 51.1, “American National Standard Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants,” American Nuclear Society, 1983.

Added

33. IEEE Std. 603-1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 1991.

34. ASME NQA-1-2008, "Quality Assurance Program Requirements for Nuclear Facilities," The American Society of Mechanical Engineers, 2008.

35. IEEE Std. 7-4.3.2-2003, "IEEE Standard Criteria for Digital Computers in Safety Systems of Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 2003.

36. IEEE Std. 344-2004, "IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 2004.

37. IEEE Std. 323-2003, "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 2003.

38. IEEE Std. 384-1992, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits," Institute of Electrical and Electronics Engineers, 1992.

39. Regulatory Guide 1.189, "Fire Protection for Nuclear Power Plants," Rev. 2, U.S. Nuclear Regulatory Commission, October 2009.

40. Regulatory Guide 1.151, "Instrument Sensing Lines," Rev. 1, U.S. Nuclear Regulatory Commission, July 2010.