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.:	**131-8087**
SRP Section:	**11.05 - Process and Effluent Radiological Monitoring Instrumentation and Sampling System**
Application Section:	**11.05**
Date of RAI Issue:	**08/07/2015**

Question No. 11.05-1

11.5 - SRP 11.5.2.2, Description of the PERMSS

Gaseous PERMSS

Information contained in DCD section 11.5.2.2 does not include the level of detail SRP section 11.5 describes for the description for the PERMSS. The description of monitors in DCD section 11.5.2.2 for the Gaseous PERMSS, and the detectors functions are not completely described in Table 11.5-1. There are several instances where a detector will have the function and remark of ″Alarm (MCR)” but have no clarifying detail to describe these functions in DCD section 11.5.2.2.

Upon inspection of Tier 1 Section 2.7.6.4 NRC staff observes that there are indications not described in Section 11.5 that are seen in Tier 1 Table 2.7.6.4-1. Tier 1 Table 2.7.6.4-1 has a column to describe any Display/Alarm at MCR/ or RSR indication. Each detector in this TIER 1 table has a "Yes" marked for all three indications, however DCD Section 11.5 does not include a full description of all indications in either the text or DCD Tables 11.5-1.

As a result NRC staff request that the applicant provide the following information:

- Each monitor should contain a description of its functions and safety related requirements in meeting redundancy or independence (where applicable)
- Each monitor should contain a discussion on radiation detection ranges
- Each monitor should contain a discussion on the process configuration of the detector
- Each monitor should contain a discussion on its location
- Discussions of applicable regulatory guides should be referenced
- Provide a discussion on the alarms and interlocks established for each detector.

- Each monitor should contain information on the sampling stations if applicable, especially effluent monitors.
- Provisions for purging of sample lines and minimizing process and effluent volumes
- Each monitor should contain a discussion of the safety classification associated with the monitor
- There should be a discussion on the calibration and quality assurance for each detector

Please address these items and provide a mark up for the proposed DCD changes. This information exchange may require an audit.

Response - (Rev. 1)

- Each monitor should contain a description of its functions and safety related requirements in meeting redundancy or independence (where applicable)

  Each monitor function will be included in a revised “Function and Remark” column of Tier 2 Table 11.5-1. All safety related radiation monitors are classified as Safety Class 3 conforming to ANSI/ANS-15.1 and Electrical Class A/B/C/D per Class 1E separation division as identified in “Class” column of Tier 2 Table 11.5-1.These monitors are designed to meet the requirements of redundancy and independence in accordance with IEEE603 and IEEE 308 as described in the Tier 2 Section 3.2.3 “Safety Class”.

  Subsection 11.5.2.2.5 will be added to describe the function of each monitor and the redundancy of the safety related monitor.

- Each monitor should contain a discussion on radiation detection ranges

  The engineering unit(Bq/cc) provided as a radiation range will be changed to μCi/cc and the updated detection ranges of each monitors will be provided in the Table 11.5-1.

  In the newly added Subsection 11.5.2.2.5 a pointer is provided to state that the measuring range of each monitor is specified in Table 11.5-1.

- Each monitor should contain a discussion on the process configuration of the detector

  The gaseous PERMS local unit extracts, transports and retains a representative sample of the monitored process medium with minimum loss or sample distortion. The gaseous sample nozzle assembly and transport system are designed in accordance with ANSI/HPS N13.1. Each local unit consists of in-line or off-line samplers, a local skid, and a local panel. The local skid contains detector sensors, sample pump or blower, and associated piping/tubing and valves. Each sampler is designed to be a lead shielded stainless steel chamber of sufficient volume to allow monitoring of the minimum detectable concentration of the gaseous isotope. Integral particulate and iodine samplers are installed vertically in stainless steel containers to hold filters or cartridges for collecting particulate and iodine isotopes. The flow regulating system is provided with mass flow sensors on the pump input and a vacuum relief valve on the pump suction. The local panel contains local microprocessors, local operator controls and displays, and a local audible/visual alarm. Each local unit is designed to have stand-alone operation capability.

All connections ahead of the sample filter provide a smooth transition between system components. Horizontal runs of particulate sample transport tubing to the filter are minimized. All bends upstream of the filters have radii designed in accordance with ANSI/HPS N13.1. Transport tubing is insulated to prevent thermal shock and condensation.

For the monitors, which may incur condensation, a moisture separator with drain and heat tracing is provided for piping, tubing, and skid equipment to maintain the sample path at a temperature above the dew point to prevent condensation.

For purging provision, please refer to discussion below.

Subsection 11.5.2.2.1 and Figure 11.5-3A will be added to describe the process configuration of the gaseous PERMSS.

- Each monitor should contain a discussion on its location

The locations of each monitor are described in Subsection 11.5.2.2 and the physical locations are shown in the Figure 11.5-2.

The gaseous PERMSS monitors listed in Table 11.5-1 have been thoroughly reviewed to correct the discrepancies and omissions of the monitor location.

Figures 11.5-2 will be revised to show the correct location of the radiation detectors (RE) and the monitor electronics/displays (RT). In the figures, RE/RT means that the detector and electronic/display are installed together adjacent to each other. The location of some RE and RT have been changed to the correct location. Subsection 11.5.2.2.5 will be added to describe that the location of each monitor is shown in Figures 11.5-2.

- Discussions of applicable regulatory guides should be referenced

The applicable regulatory guides in Section 11.5 are described in Subsection 11.5.6 “References” as follows: RG 1.97 classification and related requirements are discussed and referenced in 11.5.2.1.

- Regulatory Guide 1.21, “Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste,” U.S. Nuclear Regulatory Commission, June 2009 (Reference 5).

- Regulatory Guide 1.45, “Reactor Coolant Pressure Boundary Leakage Detection Systems,” Rev. 1, U.S. Nuclear Regulatory Commission, May 2008 (Reference 7).

- Regulatory Guide 1.97, “Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident,” Rev. 4, U.S. Nuclear Regulatory Commission, June 2006 (Reference 8).

- Regulatory Guide 1.143, “Design Guide for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants,” Rev. 2, U.S. Nuclear Regulatory Commission, November 2001(Reference 12).

- Regulatory Guide 1.33, “Quality Assurance Program Requirements (Operation),” U.S. Nuclear Regulatory Commission, February 1978(Reference 25).

- Regulatory Guide 4.15, “Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License Termination) - Effluent Streams and the environment,” Rev. 2, U.S. Nuclear Regulatory Commission, July 2007(Reference 26).

- Regulatory Guide 8.8, “Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be as Low as Is Reasonably Achievable,” Rev. 3, U.S. Nuclear Regulatory Commission, June 1978 (Reference 28).

- 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 (Reference 29).

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

- Provide a discussion on the alarms and interlocks established for each detector.

  The updated information of the alarms are provided in the Table 11.5-1. The interlock function can be divided into isolation and diversion function. These are tabulated in the Table 11.5-1. Two functions for each detector are described in note 4 of the same Table as applicable.

  Subsection 11.5.2.2.5 will be added to describe the alarms and interlocks of each monitor.

- Each monitor should contain information on the sampling stations if applicable, especially effluent monitors.

  Subsections 11.5.2.2.3, 11.5.2.2.3.1, and 11.5.2.2.3.2 will be added to describe the equipment and instrument for the gaseous effluent monitoring and process monitoring.

- Provisions for purging of sample lines and minimizing process and effluent volumes

  Each local skid has a provision for purging the sample line with the service air for gaseous monitors. The pressure regulator and air filter are provided on the inlet line of the air purge. For purging the sampler with service air, a two-way solenoid valve is installed at the sampler inlet to facilitate background checking. The valve is designed to be operable locally from the local unit or remotely from the Operator Interface Unit (OIU) keyboard. A local manual purge valve is also provided.

  Service air used in purging the sample line will be sent through the Air Cleaning Unit (ACU) before being discharged to the environment. This minimizes the amount of radioactive contaminants.

  Subsection 11.5.2.2.2 will be added to describe the purging of sample lines.

- Each monitor should contain a discussion of the safety classification associated with the Monitor

The safety classification in accordance with ANSI/ANS-51.1-1983(Reference 32) is provided in the “Class” column of Table 11.5-1 and the details of each classification is given in note 1 at the end of the table.

Subsection 11.5.2.2.5 will be added to describe the safety classification of each monitor.

- There should be a discussion on the calibration and quality assurance for each detector

  The calibration procedures are developed in accordance with NRC RG 1.33 (Reference 25) and NRC RG 4.15 (Reference 26) (COL 11.5 (6)) as described in the Subsection 11.5.1.2 “Design Criteria”. The methodology to determine the calibration methods and frequency of the PERMSS and ARMS is provided by the offsite dose calculation manual (ODCM) based on plant procedures as described in the Subsection 12.3.4.1.7 “Calibration Methods and Frequency”

  The quality assurance (QA) program for the design, installation, procurement, and fabrication of PERMSS components conforms to Regulatory Position C.7 of NRC RG 1.143 (Reference 12) as described in the Subsection 11.5.1.2 “Design Criteria”.

  Post-accident radiation monitors conform to NRC RG 1.97 including equipment qualification, quality assurance testing, and calibration as described in the Subsection 11.5.2.1 “Monitor Design and Configuration”.

Impact on DCD

DCD Tier 1, Table 2.7.6.4-1 will be revised.

DCD Tier 2, Subsections 11.5.2.2, 11.5.2.3, 11.5.3, 11.5.4 and Table 11.5-1, Figures 11.5-2E, 11.5-2F, 11.5-2G, 11.5-2H, 11.5-2I, 11.5-2J, 11.5-2K, 11.5-2L, 11.5-2M, 11.5-2O, 11.5-2P, 11.5-2Q, 11.5-2U, 11.5-2V, 11.5-2W, 11.5-2Z, and 11.5-2BB will be revised.

Since the markup of Figures 11.5-2K, 11.5-2L, 11.5-2M, 11.5-2O, 11.5-2U, and 11.5-2BB have already been submitted in the response to RAI 376-8496 Question 12.03-49, the markups for these figures are not attached to this response.

Figure 11.5-3A will be added.

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

RAI 116-8054_Question 14.03.08-5

RAI 131-8087_Question 11.05-1_Rev.1

Format changed and safety class information added

Table 2.7.6.4-1 (2 of 5)

Range information

Display & Alarm at MCR/RSR/Local

RE-037N01
RE-037N02

No/No/No

Description	Tag No [1]	Monitor Type [3]	Location	Class [4]			Range (μCi/cc) [5]				~~Display/ Alarm at MCR/RSR~~
				S	SE	E	Particulate Gross β	I-131 γ	Gas Gross β	Liquid Gross γ	
Aux BLDG Controlled Area II Emergency Exhaust ACU Effluent	PR-RE-020	Sampler (P,I)	Auxiliary Building	N	II	N	Sampler	Sampler	N/A	N/A	~~Yes/Yes/Yes~~
Containment Purge Effluent	~~PR-RE-037~~	P, I, G	Auxiliary Building	N	II	N	1.0×10^{-11} to 1.0×10^{2}	1.0×10^{-11} to 1.0×10^{2}	1.0×10^{-6} to 1.0×10^{5}	N/A	Yes/Yes/Yes
Containment Air	PR-RE-039A	P, I, G	Auxiliary Building	3	I	B	1.0×10^{-9} to 1.0×10^{-3}	1.0×10^{-9} to 1.0×10^{-3}	1.0×10^{-6} to 1.0×10^{1}	N/A	Yes/Yes/Yes
Containment Air	PR-RE-040B	P, I, G	Auxiliary Building	3	I	B	1.0×10^{-9} to 1.0×10^{-3}	1.0×10^{-9} to 1.0×10^{-3}	1.0×10^{-6} to 1.0×10^{1}	N/A	Yes/Yes/Yes
Fuel Handling Area HVAC Effluent	PR-RE-043	P, I, G	Auxiliary Building	N	II	N	1.0×10^{-11} to 1.0×10^{-5}	1.0×10^{-11} to 1.0×10^{-5}	1.0×10^{-6} to 1.0×10^{3}	N/A	Yes/Yes/Yes
Condenser Vacuum Vent Effluent	PR-RE-063	Gas & Sampler (P, I)	Turbine Building	N	III	N	Sampler	Sampler	1.0×10^{-6} to 1.0×10^{-1}	N/A	Yes/Yes/Yes
Main Control Room Air Intake	PR-RE-071A	Gas	Auxiliary Building	3	I	A	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	N/A	Yes/Yes/Yes
Main Control Room Air Intake	PR-RE-072B	Gas	Auxiliary Building	3	I	B	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	N/A	Yes/Yes/Yes
Main Control Room Air Intake	PR-RE-073A	Gas	Auxiliary Building	3	I	A	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	N/A	Yes/Yes/Yes
Main Control Room Air Intake	PR-RE-074B	Gas	Auxiliary Building	3	I	B	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	N/A	Yes/Yes/Yes

The RMS has provisions at the monitor/sampler skid for maintenance and repair. The RMS subcomponents are designed to be quickly and easily dismantled for corrective or routine maintenance such as cleaning. The sample chamber is designed so that a cleaning solution may be introduced into it and be drained.

Safety-related monitors are powered from a Class 1E 120 Vac distribution panel in the instrument power system. Information on instrumentation and control power is provided in Subsection 8.3.2.

Replaced with "A"

~~11.5.2.2 Gaseous PERMSS~~

~~In accordance with ANSI/HPS N13.1, sample tubing for gaseous monitors is installed and routed to minimize interference with sample integrity.~~

~~The following paragraphs contain descriptions of the monitors in the gaseous process and effluent radiation monitoring system. Each monitor is listed along with associated parameters (also see Table 11.5-1).~~

~~a. High-energy line break area HVAC effluent monitors (RE-006, 007)~~

~~A monitor at the exhaust air cleaning unit (ACU) inlet in the auxiliary building detects particulate, iodine and noble gas activities, and the other monitor at the outlet of the exhaust ACU has a particulate and iodine sampler.~~

~~b. Auxiliary building controlled area I, II HVAC normal/emergency exhaust ACU inlet effluent monitors (RE-013, 014, 017, and 018)~~

~~Four monitors with particulate, gas, and iodine channels are provided to monitor HVAC effluent from the auxiliary building.~~

~~c. Auxiliary building controlled area HVAC normal/emergency exhaust effluent monitors (RE-015, 016, 019, and 020)~~

~~Four samplers for particulate and iodine are provided to monitor HVAC effluent from the auxiliary building controlled area HVAC filter discharge.~~

d. Containment purge effluent monitor (RE-037)

A monitor with air particulate, gas, and iodine channels is provided to monitor containment purge effluent.

e. Containment air monitors (RE-039A and 040B)

Two monitors with air particulate, gas, and iodine channels are provided to monitor the radiation level in the containment. The wet parts of the detectors maintain pressure boundary integrity during normal conditions. The containment air monitors continuously measure, indicate, and record the radioactivity of particulate, iodine, and noble gas in a sample of air extracted from the containment. The sample lines of these offline monitors are provided with heat tracing to prevent dew condensation and are purged before sampling to provide reasonable assurance that samples are representative. The purge gas is routed back to the containment atmosphere.

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

A monitor with air particulate, gas, and iodine channels is provided to monitor the fuel handling area HVAC effluent.

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

A monitor with a gas channel, air particulate, and iodine sampler is provided to monitor the condenser vacuum system effluent.

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

Two monitors per division (a total of four monitors) are provided with gas channels to monitor each of the intakes. The monitors are interlocked with the makeup air cleaning unit and MCR air intake dampers. On a high-radiation emergency signal, the outside air intake damper, which is open for normal operation, automatically closes and the air is routed through the makeup air-cleaning unit. The channels used for monitoring are Class 1E.

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

~~A monitor with gas channels is provided to monitor the radiation level of gaseous radwaste system exhaust to the compound building vent stack.~~

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

~~One monitor with air particulate and iodine sampler is provided to monitor compound building HVAC effluent.~~

~~k. Compound building exhaust ACU inlet monitor (RE-083)~~

~~A monitor with air particulate, iodine, and gas channels is provided to monitor the compound building plant area.~~

~~l. Compound building hot machine shop monitor (RE-084)~~

~~One monitor with air particulate, iodine, and gas channels is provided to monitor the compound building hot machine shop.~~

m. Main steam line area and N-16 radiation monitors (RE-217, 218, 219, and 220)

These monitors are located near the main steam safety valves and main steam atmospheric dump valves. Alarms are provided in the MCR to alert the operator when these monitors detect the PTS leakage due to a steam generator leakage. The method of detecting the SG leak rate is described in Appendix 11B.

~~The RMS for the release point in the high-energy line break (HELB) area, auxiliary building, and compound building is described in Subsection 9.4.~~

11.5.2.3 Liquid PERMSS

Each liquid process and effluent monitor is described in the following paragraphs. A list of each monitor and associated parameters is given in Table 11.5-2.

A

11.5.2.2 Gaseous PERMSS

11.5.2.2.1 Process configuration

The gaseous PERMSS local unit extracts, transports and retains a representative sample of the monitored process medium with minimum loss or sample distortion. The gaseous sample nozzle assembly and transport system are designed in accordance with ANSI/HPS N13.1. Each local unit consists of in-line or off-line samplers, a local skid, and a local panel. The local skid contains detector sensors, sample pump or blower, and associated piping/tubing and valves. Each sampler is designed to be a lead shielded stainless steel chamber of sufficient volume to allow monitoring of the minimum detectable concentration of the gaseous isotope. Integral particulate and iodine samplers are installed vertically in stainless steel containers to hold filters or cartridges for collecting particulate and iodine isotopes. The flow regulating system is provided with mass flow sensors on the pump input and a vacuum relief valve on the pump suction. The local panel contains local microprocessors, local operator controls and displays, and a local audible/visual alarm. Each local unit is designed to have stand-alone operation capability.

All connections ahead of the sample filter provide a smooth transition between system components. Horizontal runs of particulate sample transport tubing to the filter are minimized. All bends upstream of the filters have radii designed in accordance with ANSI/HPS N13.1. Transport tubing is insulated to prevent thermal shock and condensation.

For the monitors, which may incur condensation, a moisture separator with drain and heat tracing is provided for piping, tubing, and skid equipment to maintain the sample path at a temperature above the dew point to prevent condensation.

Generic process configuration for the gaseous PERMSS is shown in Figure 11.5-3A.

11.5.2.2.2 Purging of sample lines

Each local skid has a provision for purging the sample line with the service air for gaseous monitors. The pressure regulator and air filter are provided on the inlet line of the air purge. For purging the sampler with service air, a two-way solenoid valve is installed at the sampler inlet to facilitate background checking. The valve is designed to be operable locally from the local unit or remotely from the Operator Interface Unit (OIU) keyboard. A local manual purge valve is also provided.

Service air used in purging the sample line will be sent through the Air Cleaning Unit (ACU) before being discharged to the environment. This minimizes the amount of radioactive contaminants.

11.5.2.2.3 Monitoring of gaseous effluent discharge and process stream

In accordance with ANSI/HPS N13.1, sample tubing for gaseous monitors is installed and routed to minimize interference with sample integrity. The sample lines for gaseous PERMSS are sloped down toward the monitor skid, and the use of sample line fittings such as unions, elbows, and tees are avoided to the extent practical. Design details are provided belows.

11.5.2.2.3.1 Effluent Monitoring

Effluent monitoring instruments are provided for monitoring the containment atmosphere, spaces containing components for recirculation of loss-of-coolant accident (LOCA) fluids, effluent discharge paths, and the plant environs for radioactivity that may be released from normal operations, including AOOs and from postulated accidents, as shown in Tables 11.5-1 and 11.5-2.

Periodic sampling is performed to supplement the function of the process and effluent radiation monitors. The sampling programs conform with NRC RG 1.21 and the sampling requirements defined in the Technical Specifications.

Special provisions are made for post-accident sampling of effluent pathways in accordance with the guidelines of NUREG-0737, 10 CFR 50, Appendix I, and NRC RG 1.97. Subsection 9.3.2 describes additional post-accident sampling details.

Sampling locations conform with NRC RG 1.21 and NUREG-0800. Post-accident sampling points and equipment conform with NUREG-0737 and NRC RG 1.97.

The containment atmosphere and the vapor space of the liquid radioactive waste tanks are sampled prior to release to the environment. An analysis is performed to determine constituent radionuclides in the liquid radioactive waste tanks, to set the proper release rates and isolation setpoints in accordance with 10 CFR 20 limits. The containment purge isolation setpoint is determined so that there is reasonable assurance that 10 CFR 20 limits will be met.

Sampling equipment is designed to prevent the spread of contaminants and radiation exposure to operating personnel while taking grab samples and to include provisions for a rapid change-out of filter elements to limit possible radiation exposure to operating personnel. Sampling equipment is modularized to the maximum extent possible for quick component change-out and calibration.

Compliance to design requirements for the ALARA provisions of NRC RG 8.8 and 8.10 provide reasonable assurance of conformance with the occupational dose limits of 10 CFR 20.1201, 10 CFR 20.1202, and the occupational limits (ALI and DAC) in Table 1 of Appendix B to 10 CFR 20. Sufficient shielding is provided to all equipment of the PERMSS, and any equipment that requires frequent maintenance, inspections, testing, and calibration is designed so that radiation exposures to operating and maintenance personnel are maintained ALARA. In addition, instrument locations provide sufficient space for easy access, operation, inspections, testing, and

maintenance to maintain personnel exposures ALARA. High-radiation alarms and interlock signals are provided to operating and maintenance personnel to meet ALARA requirements.

11.5.2.2.3.2 Process Monitoring

Process monitoring instruments include the means to control the release of radioactive materials to meet the requirements of 10 CFR 50, Appendix A, GDC 60 during normal operation and AOOs. Automatic isolation functions are also implemented to conform with 10 CFR 50, Appendix A, GDC 60.

Radiological monitoring instruments for fuel and waste storage are provided to detect conditions that may result in the loss of residual heat removal capability and excessive radiation levels and to initiate appropriate safety actions. These are to meet the requirements of 10 CFR 50, Appendix A, GDC 63.

11.5.2.2.4 Calibration

Calibration procedure is described in Subsection 11.5.1.2.m.

11.5.2.2.5 Gaseous PERMSS monitor component description

Gaseous PERMSS are classifies as non-safety-related except Containment air monitors and MCR air intake monitors, which are Safety Class 3. Setpoints for safety-related monitors are described in Subsections 12.3.4.1.6.

Table 11.5-1 lists the measuring range, safety class, seismic category, quality class, electrical class, and other associated design information for each monitor.

a. High-energy line break area effluent monitors (RE-006 and 007)

   The sample line inlet of RE-006 is located at High-energy line break area HVAC effluent. The monitor has particulate and iodine sampler and sends the radiation signal to RMS computer to analyze the radiation data. There is no indication, alarm, and automatic actuation generated from RE-006.

   The sample line inlet of RE-007 is located at High-energy line break area exhaust ACU inlet. The monitor is used to detect particulate, iodine, and 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. There is no automatic action initiated by RE-007.

   These monitors are located in Auxiliary Building as shown in Figure 11.5-2E.

b. Auxiliary Building controlled area I, II HVAC normal/emergency exhaust ACU inlet monitors (RE-013, 014, 017, and 018)

The sample line inlet of RE-013 is located at Auxiliary Building controlled area I HVAC normal exhaust ACU inlet. The monitor is used to detect particulate, iodine, and 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. There is no automatic action initiated by RE-013. The monitor is located in Auxiliary building as shown in Figure 11.5-2F.

The sample line inlet of RE-014 is located at Auxiliary building controlled area II HVAC normal exhaust ACU inlet. The monitor is used to detect particulate, iodine, and 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. There is no automatic action initiated by RE-014. The monitor is located in Auxiliary Building as shown in Figure 11.5-2G.

The sample line inlet of RE-017 is located at Auxiliary building controlled area I HVAC emergency exhaust ACU inlet. The monitor is used to detect particulate, iodine, and 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. There is no automatic action initiated by RE-017. The monitor is located in Auxiliary Building as shown in Figure 11.5-2H.

The sample line inlet of RE-018 is located at Auxiliary building controlled area II HVAC emergency exhaust ACU inlet. The monitor is used to detect particulate, iodine, and 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. There is no automatic action initiated by RE-018. The monitor is located in Auxiliary Building as shown in Figure 11.5-2H.

These monitors are 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.

c. Auxiliary building controlled area HVAC normal/emergency exhaust ACU effluent monitors (RE-015, 016, 019, and 020)

The sample line inlet of RE-015 is located at Auxiliary building controlled area I HVAC normal exhaust ACU effluent. The sample line inlet of RE-016 is located at Auxiliary building controlled area II HVAC normal exhaust ACU effluent. The sample line inlet of RE-019 is located at Auxiliary building controlled area I HVAC emergency exhaust ACU effluent. The sample line inlet of RE-020 is located at Auxiliary building controlled area II HVAC emergency exhaust ACU effluent.

These monitors have particulate and iodine sampler and send 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 these monitors 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.

The monitors are located in Auxiliary building as shown in Figure 11.5-2G (RE-015), Figure 11.5-2M (RE-016), Figure 11.5-2I (RE-019), and Figure 11.5-2J (RE-020).

d. Containment purge effluent monitors (RE-037N01 and 037N02)

These monitors detect particulate, iodine, and noble gas activities from the containment before they are released to the environment.

The monitors have measuring range specified in Table 11.5-1 and provide indication and alarm to the MCR, RSR, and local RMS skid. High radiation signal initiated by these monitors stops the high volume purge exhaust ACUs or low volume purge exhaust ACU automatically.

These monitors are 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 monitors are located in Auxiliary building as shown in Figure 11.5-2O.

e. Containment air monitors (RE-039A and 040B)

Two monitors with air particulate, gas, and iodine channels are provided to monitor the radiation level in the containment. The wet parts of the detectors maintain pressure boundary integrity during normal conditions. The containment air monitors continuously measure, indicate, alarm, and record the radioactivity of particulate, iodine, and noble gas in a sample of air extracted from the containment. The sample lines of these offline monitors are provided with heat tracing to prevent condensation and are purged before sampling to provide reasonable assurance that samples are representative. In order to obtain a representative sample of containment air, the sample line inlet is located on the operating level between two reactor containment fan cooler air intakes. The purge gas is routed back to the containment atmosphere.

The monitors have measuring range specified in Table 11.5-1 and provide indication and alarm to the MCR, RSR, and local RMS skid. There is no automatic action initiated by these monitors. The particulate detector serves as reactor coolant pressure boundary leak detection in accordance with NRC RG 1.45. These monitors are isolated by a containment isolation actuation signal (CIAS).

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.

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.

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

k. Compound building exhaust ACU inlet monitor (RE-083)

The sample line inlet of RE-083 is located at the compound building exhaust ACU duct at the inlet. The monitor detects particulate, iodine, and 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 gaseous radwaste exhaust line in the gaseous radwaste system is isolated with an automatic closure of isolation valve. High radiation also diverts normal ventilation to emergency ventilation by starting the carbon adsorber exhaust ACUs and stopping the HEPA filter exhaust ACUs automatically.

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 11.5-2W.

l. Compound building hot machine shop monitor (RE-084)

The sample line inlet of RE-084 is located at the compound building hot machine shop ACU outlet duct. The monitor detects particulate, iodine, and 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. There is no automatic action initiated by the monitor.

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

the discharge flow is automatically diverted to the LWMS prior to release to the environment, and the high-radiation alarm is provided to the operator. This monitor is also used to detect gross gamma activity at the outlet of the condenser pit sumps.

g. Miscellaneous process liquid monitors (RE-204 and 265)

Two monitors are provided to continuously monitor the radiation levels of the letdown and gas stripper outlets in the CVCS. Detailed information for these monitors is presented in Subsection 9.3.4.5.5.

h. Essential service water pump discharge header monitors (RE-113 and 114)

Two monitors for essential service water discharge header are installed. The essential service water is sampled downstream of the component cooling water heat exchangers and is continuously monitored by a gamma scintillation detector mounted in a shielded liquid sampler. After passing through the monitor, the sample is returned to the essential service water system. Activity detected above background is indicative of a leak into the essential service water system from the ultimate heat sink basins or one of the other systems containing radioactive fluids.

~~The sample lines for gaseous PERMSS are sloped down toward the monitor skid, and the use of sample line fittings such as unions, elbows, and tees are avoided to the extent practical. Setpoints, the calibration method, and the frequency for safety-related monitors are described in Subsections 12.3.4.1.6 and 12.3.4.1.1.~~ 7

11.5.2.4 Design Features for Minimization of Contamination

The APR1400 is designed with specific features to meet the requirements of 10 CFR 20.1406 and Regulatory Guide 4.21. The basic principles of RG 4.21, and the methods of control suggested in the regulations, are specifically delineated in four design objectives and two operational objectives described in Subsection 12.4.2 of this DCD. The following evaluation summarizes the primary features to address the design and operational objectives for the RMS.

Site Radiological Environmental Monitoring

The RMS is designed to provide data for plant operation. The RMS components do not process or generate wastes that can impact contamination of facility and the environment. The RMS is designed to provide data for plant operation and the data can be used to support the radiological environmental monitoring program. The program is included as a COL information item (COL 11.5 (9)).

~~11.5.3 Effluent Monitoring and Sampling~~

~~Effluent monitoring and sampling instruments are provided for monitoring the containment atmosphere, spaces containing components for recirculation of loss-of-coolant accident (LOCA) fluids, effluent discharge paths, and the plant environs for radioactivity that may be released from normal operations, including AOOs and from postulated accidents, as shown in Tables 11.5-1 and 11.5-2.~~

~~Periodic sampling is performed to supplement the function of the process and effluent radiation monitors. The sampling programs conform with NRC RG 1.21 and the sampling requirements defined in the Technical Specifications.~~

~~Special provisions are made for post-accident sampling of effluent pathways in accordance with the guidelines of NUREG-0737, 10 CFR 50, Appendix I, and NRC RG 1.97. See Subsection 9.3.2 for additional post-accident sampling details.~~

~~Sampling locations conform with NRC RG 1.21 and NUREG-0800. Post-accident sampling points and equipment conform with NUREG-0737 and NRC RG 1.97.~~

~~The containment atmosphere and the liquid radioactive waste tanks are sampled prior to release to the environment. An analysis is performed to determine constituent radionuclides in the liquid radioactive waste tanks, to set the proper release rates and isolation setpoints in accordance with 10 CFR 20 limits. The containment purge isolation setpoint is determined so that there is reasonable assurance that 10 CFR 20 limits will be met.~~

Sampling equipment is designed to prevent the spread of contaminants and radiation exposure to operating personnel while taking grab samples and to include provisions for a rapid change-out of filter elements to limit possible radiation exposure to operating personnel. Sampling equipment is modularized to the maximum extent possible for quick component change-out and calibration.

Design requirements regarding the ALARA provisions of NRC RG 8.8 and 8.10 provide reasonable assurance of conformance with the occupational dose limits of 10 CFR 20.1201, 10 CFR 20.1202, and the occupational limits (ALI and DAC) in Table 1 of Appendix B to 10 CFR 20. Sufficient shielding is provided to all equipment of the PERMSS, and any equipment that requires frequent maintenance, inspections, testing, and calibration is designed so that radiation exposures to operating and maintenance personnel are maintained ALARA. In addition, instrument locations provide sufficient space for easy access, operation, inspections, testing, and maintenance to maintain personnel exposures ALARA. High radiation alarms and interlock signals are provided to operating and maintenance personnel to meet ALARA requirements.

11.5.4 Process Monitoring and Sampling

Process and effluent monitoring and sampling instruments include the means to control the release of radioactive materials to meet the requirements of 10 CFR 50, Appendix A, GDC 60 during normal operation and AOOs. Automatic isolation functions are also implemented to conform with 10 CFR 50, Appendix A, GDC 60.

Radiological monitoring and sampling instruments for fuel and waste storage are provided to detect conditions that may result in the loss of residual heat removal capability and excessive radiation levels and to initiate appropriate safety actions. These are to meet the requirements of 10 CFR 50, Appendix A, GDC 63.

11.5.5 Combined License Information

COL 11.5(1) The COL applicant is to determine the WARN and ALARM setpoints of the PERMSS based on the site-specific conditions and operational requirements.

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Table 11.5-1 (1 of 3)

Gaseous Process and Effluent Radiation Monitors

Location	Tag No.	Class[1]				Range (~~Bq/cc~~)[2]					Function and Remarks[4]
		S	SE	Q	E	Particulate Gross β	I-131 γ	Gas Gross β	Liquid Gross γ	Area	~~Function and Remarks~~
High-energy line break area HVAC effluent (offline)	RE-006	N	III	A	N	Sampler	Sampler	N/A	N/A	N/A	Analysis
High-energy line break area exhaust ACU inlet (offline)	RE-007	N	III	A	N	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-2} to 3.7×10^{7}~~	N/A	N/A	~~Alarm (MCR)~~
Auxiliary building controlled area (I, II) HVAC normal/emergency exhaust ACU inlet (offline)	RE-013 RE-014 RE-017 RE-018	N	II	A	N	~~3.7×10^{-7} to 3.7×10^{6}~~	~~3.7×10^{-7} to 3.7×10^{6}~~	~~3.7×10^{-2} to 3.7×10^{7}~~	N/A	N/A	~~Alarm (MCR)~~
Auxiliary building controlled area (I, II) HVAC normal/emergency exhaust ACU effluent (offline)	RE-015 RE-016 RE-019 RE-020	N	II	A	N	Sampler	Sampler	N/A	N/A	N/A	Analysis
Containment purge effluent (offline)	RE-037	N	II	A	N	~~3.7×10^{-7} to 3.7×10^{6}~~	~~3.7×10^{-7} to 3.7×10^{6}~~	~~3.7×10^{-2} to 3.7×10^{9}~~	N/A	N/A	~~Alarm (MCR),~~ containment building purge stop

1.0×10^{-11} to 1.0×10^{-5}

μCi/cc

Function and Remarks [4]

Display & Alarm at MCR/RSR/Local

No/No/No

Yes/Yes/Yes

1.0×10^{-6} to 1.0×10^{3}

1.0×10^{-11} to 1.0×10^{2}

No/No/No

Yes/Yes/Yes

1.0×10^{-6} to 1.0×10^{5}

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Table 11.5-1 (1 of 3)

Gaseous Process and Effluent Radiation Monitors

Location	Tag No.	Class(1)				Range (~~Bq/cc~~)(2)					Function and Remarks (4)
		S	SE	Q	E	Particulate Gross β	I-131 γ	Gas Gross β	Liquid Gross γ	Area	~~Function and Remarks~~
High-energy line break area HVAC effluent (offline)	RE-006	N	III	A	N	Sampler	Sampler	N/A	N/A	N/A	Analysis
High-energy line break area exhaust ACU inlet (offline)	RE-007	N	III	A	N	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-2} to 3.7×10^{7}~~	N/A	N/A	~~Alarm (MCR)~~
Auxiliary building controlled area (I, II) HVAC normal/emergency exhaust ACU inlet (offline)	RE-013 RE-014 RE-017 RE-018	N	II	A	N	~~3.7×10^{-7} to 3.7×10^{6}~~	~~3.7×10^{-7} to 3.7×10^{6}~~	~~3.7×10^{-2} to 3.7×10^{7}~~	N/A	N/A	~~Alarm (MCR)~~
Auxiliary building controlled area (I, II) HVAC normal/emergency exhaust ACU effluent (offline)	RE-015 RE-016 RE-019 RE-020	N	II	A	N	Sampler	Sampler	N/A	N/A	N/A	Analysis
Containment purge effluent (offline)	~~RE-037~~	N	II	A	N	~~3.7×10^{-7} to 3.7×10^{6}~~	~~3.7×10^{-7} to 3.7×10^{6}~~	~~3.7×10^{-2} to 3.7×10^{9}~~	N/A	N/A	~~Alarm (MCR),~~ containment building purge stop

1.0×10^{-11} to 1.0×10^{-5}

μCi/cc

Display & Alarm at MCR/RSR/Local

No/No/No

Yes/Yes/Yes

1.0×10^{-6} to 1.0×10^{3}

1.0×10^{-11} to 1.0×10^{2}

No/No/No

1.0×10^{-6} to 1.0×10^{5}

Yes/Yes/Yes

RE-037N01
RE-037N02

Delete from the table

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Table 11.5-1 (2 of 3)

Location	Tag No.	Class(1)				Range (~~Bq/cc~~)(2)					Function and Remarks (4)
		S	SE	Q	E	Particulate Gross β	I-131 γ	Gas Gross β	Liquid Gross γ	Area	~~Function and Remarks~~
Containment air (offline)	RE-039A RE-040B	3	I	Q	~~B~~	~~3.7×10^{-5} to 3.7×10^{1}~~	~~3.7×10^{-5} to 3.7×10^{1}~~	~~3.7×10^{-2} to 3.7×10^{5}~~	N/A	N/A	~~Alarm (MCR),~~ leak detection
Fuel handling area HVAC effluent (offline)	RE-043	N	II	A	N	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-2} to 3.7×10^{7}~~	N/A	N/A	~~Alarm (MCR)~~ isolation interlock diversion interlock
Condenser vacuum pump vent effluent (offline)	RE-063	N	III	A	N	Sampler	Sampler	~~3.7×10^{-2} to 3.7×10^{3}~~	N/A	N/A	~~Alarm (MCR),~~ diversion interlock analysis
MCR air intake (inline)	RE-071A RE-072B RE-073A RE-074B	3	I	Q	A B A B	N/A	N/A	~~3.7×10^{-2} to 3.7×10^{3}~~	N/A	N/A	~~Alarm (MCR),~~ CREVAS
Gaseous radwaste system exhaust (offline)	RE-080	N	III	A	N	N/A	N/A	~~3.7×10^{1} to 3.7×10^{6}~~	N/A	N/A	~~Alarm (MCR)~~ isolation interlock
Compound building HVAC effluent (offline)	RE-082	N	III	A	N	Sampler	Sampler	N/A	N/A	N/A	Analysis
Main steam line	RE-217 RE-218 RE-219 RE-220	N	II	~~T~~	N	N/A	N/A	N/A	N/A	~~10^{-4} ~ 10^{2}~~ (Note 3)	~~Alarm (MCR, Local)~~

A
B

1.0 x 10^{-9} to 1.0 x 10^{-3}

µCi/cc

1.0 x 10^{-6} to 1.0 x 10^{1}

Function and Remarks (4)

Display & Alarm at MCR/RSR/Local

Yes/Yes/Yes

1.0 x 10^{-11} to 1.0 x 10^{-5}

1.0 x 10^{-6} to 1.0 x 10^{3}

Yes/Yes/Yes

Isolation interlock

1.0 x 10^{-6} to 1.0 x 10^{-1}

Yes/Yes/Yes

1.0 x 10^{-3} to 1.0 x 10^{2}

Yes/Yes/Yes

Yes/Yes/Yes

No/No/No

A

2.7 x 10^{-9} to 2.7 x 10^{-3}

Leak detection
Primary to secondary
Yes/Yes/Yes

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Table 11.5-1 (2 of 3)

Location	Tag No.	Class(1) S	SE	Q	E	Range (~~Bq/cc~~)(2) Particulate Gross β	I-131 γ	Gas Gross β	Liquid Gross γ	Area	~~Function and Remarks~~
Containment air (offline)	RE-039A RE-040B	3	I	Q	~~B~~	~~3.7×10^{-5} to 3.7×10^{1}~~	~~3.7×10^{-5} to 3.7×10^{1}~~	~~3.7×10^{-2} to 3.7×10^{5}~~	N/A	N/A	~~Alarm (MCR),~~ leak detection
Fuel handling area HVAC effluent (offline)	RE-043	N	II	A	N	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-2} to 3.7×10^{7}~~	N/A	N/A	~~Alarm (MCR)~~ isolation interlock diversion interlock
Condenser vacuum pump vent effluent (offline)	RE-063	N	III	A	N	Sampler	Sampler	~~3.7×10^{-2} to 3.7×10^{3}~~	N/A	N/A	~~Alarm (MCR),~~ diversion interlock analysis
MCR air intake (inline)	RE-071A RE-072B RE-073A RE-074B	3	I	Q	A B A B	N/A	N/A	~~3.7×10^{-2} to 3.7×10^{3}~~	N/A	N/A	~~Alarm (MCR),~~ CREVAS
Gaseous radwaste system exhaust (offline)	RE-080	N	III	A	N	N/A	N/A	~~3.7×10^{1} to 3.7×10^{6}~~	N/A	N/A	~~Alarm (MCR)~~ isolation interlock
Compound building HVAC effluent (offline)	RE-082	N	III	A	N	Sampler	Sampler	N/A	N/A	N/A	Analysis
Main steam line	RE-217 RE-218 RE-219 RE-220	N	II	~~T~~	N	N/A	N/A	N/A	N/A	~~10^{-4} ~ 10^{2}~~ (Note 3)	~~Alarm (MCR, Local)~~

1.0×10^{-9} to 1.0×10^{-3}

A

B

µCi/cc

1.0×10^{-6} to 1.0×10^{1}

Function and Remarks (4)

Display & Alarm at MCR/RSR/Local

Yes/Yes/Yes

1.0×10^{-11} to 1.0×10^{-5}

1.0×10^{-6} to 1.0×10^{3}

Yes/Yes/Yes

Isolation interlock

1.0×10^{-6} to 1.0×10^{-1}

Yes/Yes/Yes

1.0×10^{-3} to 1.0×10^{2}

Yes/Yes/Yes

Yes/Yes/Yes

No/No/No

2.7×10^{-9} to 2.7×10^{-3}

Leak detection

Primary to secondary

Yes/Yes/Yes

A

Delete from the table

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Table 11.5-1 (3 of 3)

Location	Tag No.	Class(1)				Range ~~(Bq/cc)~~(2)					Function and Remarks (4)
		S	SE	Q	E	Particulate Gross β	I-131 γ	Gas Gross β	Liquid Gross γ	Area	~~Function and Remarks~~
Compound building exhaust ACU inlet (offline)	RE-083	N	III	A	N	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-2} to 3.7×10^{6}~~	N/A	N/A	~~Alarm (MCR),~~ isolation interlock, diversion interlock from normal to emergency ventilation
Compound building hot machine shop	RE-084	N	III	A	N	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-2} to 3.7×10^{3}~~	N/A	N/A	~~Alarm (MCR)~~

µCi/cc

Display & Alarm at MCR/RSR/Local

Yes/Yes/Yes

1.0×10^{-11} to 1.0×10^{-5}

1.0×10^{-6} to 1.0×10^{2}

1.0×10^{-6} to 1.0×10^{-1}

(1) S = Safety Class per ANSI/ANS 51.1 (Reference 32): 1 = SC-1, 2 = SC-2, 3 = SC-3, N = NNS
SE = Seismic Category: I, II, III
E = Electrical Class: A, B, C, D=Class 1E Separation Division, N = Non-Class 1E
Q = Quality Class: Q, A, S

(2) Detector type and calibration nuclide for each measurement:
Particulate Gross β = β scintillator with Cs-137
Gas Gross β = β scintillator with Kr-85
Liquid Gross γ = γ scintillator with Cs-137
Iodine γ = γ scintillator with Ba-133

(3) Detector type for area radiation monitor is GM tube or ionization chamber.

(4) The detector with the isolation function isolates the effluent discharge function when the discharge reaches a preset setpoint value, thus terminating the discharge. The detector with the diversion interlock function diverts the effluent discharge to a safe hold-up storage or further processing for decontamination when a setpoint is reached. Certain detectors could have both isolation and diversion interlock function depending on the application.

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μCi/cc

Function and Remarks (4)

Display & Alarm at MCR/RSR/Local

Location	Tag No.	Class(1)				Range ~~(Bq/cc)~~(2)					~~Function and Remarks~~
		S	SE	Q	E	Particulate Gross β	I-131 γ	Gas Gross β	Liquid Gross γ	Area	
Compound building exhaust ACU inlet (offline)	RE-083	N	III	A	N	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-2} to 3.7×10^{6}~~	N/A	N/A	~~Alarm (MCR),~~ isolation interlock, diversion interlock from normal to emergency ventilation
Compound building hot machine shop	RE-084	N	III	A	N	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-2} to 3.7×10^{3}~~	N/A	N/A	~~Alarm (MCR)~~

1.0×10^{-11} to 1.0×10^{-5}

1.0×10^{-6} to 1.0×10^{2}

1.0×10^{-6} to 1.0×10^{-1}

Yes/Yes/Yes

(1) S = Safety Class per ANSI/ANS 51.1 (Reference 32): 1 = SC-1, 2 = SC-2, 3 = SC-3, N = NNS
SE = Seismic Category: I, II, III
E = Electrical Class: A, B, C, D=Class 1E Separation Division, N = Non-Class 1E
~~Q = Quality Class: Q, A, S~~

Delete

Delete from the table

(2) Detector type and calibration nuclide for each measurement:
Particulate Gross β = β scintillator with Cs-137
Gas Gross β = β scintillator with Kr-85
Liquid Gross γ = γ scintillator with Cs-137
Iodine γ = γ scintillator with Ba-133

(3) Detector type for area radiation monitor is GM tube or ionization chamber.

(4) The detector with the isolation function isolates the effluent discharge function when the discharge reaches a preset setpoint value, thus terminating the discharge. The detector with the diversion interlock function diverts the effluent discharge to a safe hold-up storage or further processing for decontamination when a setpoint is reached. Certain detectors could have both isolation and diversion interlock function depending on the application.

Security-Related Information – Withhold Under 10 CFR 2.390

Figure 11.5-2E Location of Radiation Monitors at Plant (Auxiliary Building El. 78′-0″)

Security-Related Information – Withhold Under 10 CFR 2.390

Figure 11.5-2F Location of Radiation Monitors at Plant (Auxiliary Building El. 100′-0″)

Security-Related Information – Withhold Under 10 CFR 2.390

Figure 11.5-2G Location of Radiation Monitors at Plant (Auxiliary Building El. 120′-0″)

Security-Related Information – Withhold Under 10 CFR 2.390

Figure 11.5-2H Location of Radiation Monitors at Plant (Auxiliary Building El. 120′-0″)

Security-Related Information – Withhold Under 10 CFR 2.390

Figure 11.5-2I Location of Radiation Monitors at Plant (Auxiliary Building El. 120′-0″)

Security-Related Information – Withhold Under 10 CFR 2.390

Figure 11.5-2J Location of Radiation Monitors at Plant (Auxiliary Building El. 120′-0″)

Security-Related Information – Withhold Under 10 CFR 2.390

Figure 11.5-2P Location of Radiation Monitors at Plant (Auxiliary Building ~~El. 174'-0"~~)

El. 172'-0"

Security-Related Information – Withhold Under 10 CFR 2.390

Figure 11.5-2Q Location of Radiation Monitors at Plant (Auxiliary Building ~~El. 174′-0″~~)

El. 172'-0"

Security-Related Information – Withhold Under 10 CFR 2.390

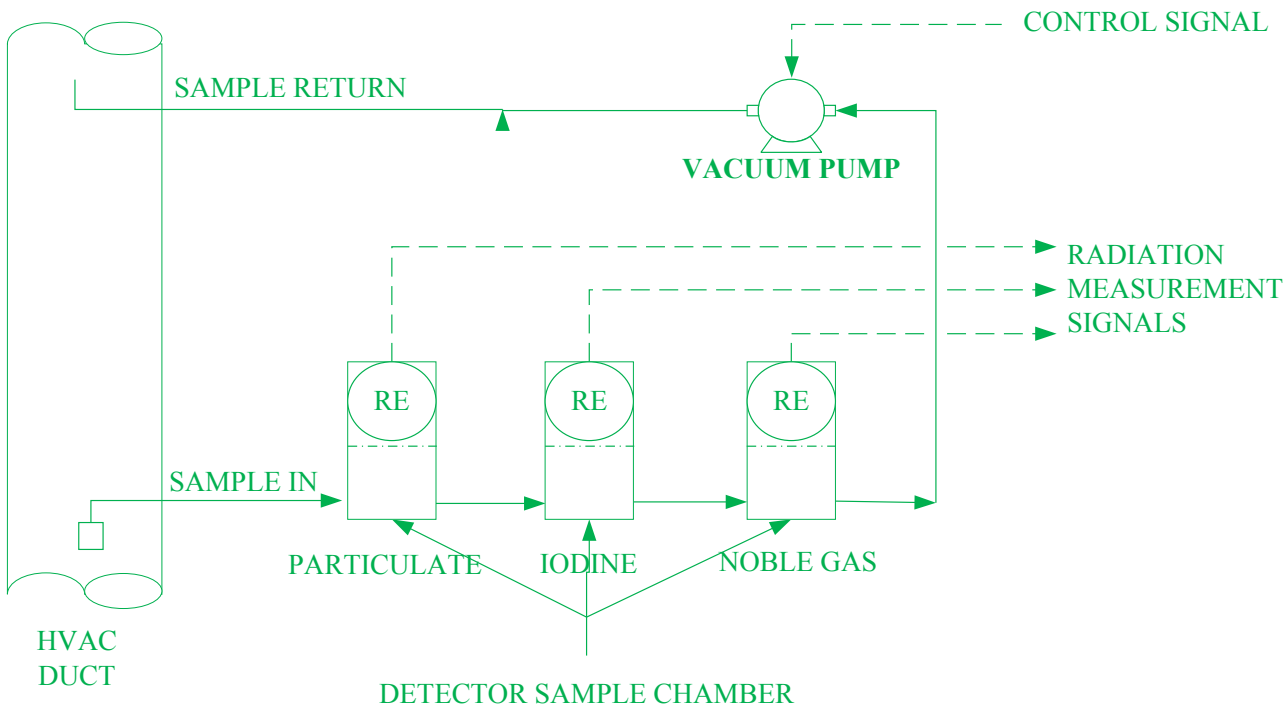
Figure 11.5-2V Location of Radiation Monitors at Plant (Compound Building El. 120′-0″)

Security-Related Information – Withhold Under 10 CFR 2.390

Figure 11.5-2W Location of Radiation Monitors at Plant (Compound Building El. 139′-6″)

Security-Related Information – Withhold Under 10 CFR 2.390

Figure 11.5-2Z Location of Radiation Monitors at Plant (Turbine Generator Building El. 170′-0″)



Notes:

1. The typical schematic block diagram shows a gaseous off-line monitor with particulate, iodine and noble gas detectors. Some monitors could contain only particulate, iodine and/or noble gas detectors, or any combination thereof.

2. Depending on the moisture content of the gaseous sample, the sample line upstream of the detector could be provided with heat tracing to prevent increased moisture content in the sample.

3. The detector local skid is typically provided with purge gas (usually service air) to prevent residual sample accumulation.

Figure 11.5-3A Typical Gaseous PIG (Particulate/Iodine/Noble Gas) Monitor

Added