RAIO-0518-60098

May 21, 2018

Docket No. 52-048

U.S. Nuclear Regulatory Commission
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11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 397 (eRAI No. 9238) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 397 (eRAI No. 9238)," dated March 21, 2018

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) response to the referenced NRC Request for Additional Information (RAI).

The Enclosure to this letter contains NuScale's response to the following RAI Question from NRC eRAI No. 9238:

- 11.05-2

This letter and the enclosed response make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Steven Mirsky at 240-833-3001 or at smirsky@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9238

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9238

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Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 9238
Date of RAI Issue: 03/21/2018

NRC Question No.: 11.05-2

Clarification of Type E variables for Control room HVAC

Regulatory Basis: 10 CFR Part 50 Appendix A, GDC 19; RG 1.97

GDC 19 requires operating reactor licensees to provide a control room from which (1) actions can be taken to maintain the nuclear power unit in a safe condition under accident conditions, and (2) operators shall be provided adequate protection such that radiation exposures shall not exceed 5 rem TEDE as defined in §50.2 for the duration of the accident. Consistent with this criterion, the staff finds the application does not contain sufficient information about the control room monitors (i.e., specifically for how airborne radioactivity conditions will be monitored in the control room) and staff is unable to determine that the NuScale design would have the monitoring required to ensure dose limits are not exceeded.

Background:

In DCA Tier 2, Section 6.4.3.2, NuScale credits the control room HVAC radiation monitors for performing automatic actions taken by the control room habitability system. The upstream monitors change the airflow through the control room ventilation system to pass the airflow through the supplemental air filtration unit if radiation levels exceed specified limits. The downstream monitors are there to isolate the control room ventilation system if the air supply remains radioactive after passing through the filtration system. According to DCA section 6.4.3.2, on a high radiation signal, this downstream monitor is responsible for the isolation of the control room, and for opening of the bottled air supply to provide the control room with an emergency air supply.

In DCA Tier 2, Table 1.9-2, the applicant committed to follow RG 1.97 Rev. 4, which endorses the IEEE 497-2002's Type E standard that states that a Type E variable will "monitor radiation levels and radioactivity in the control room and selected plant areas where access may be required for plant recovery." The staff's review of DCA Table 1.9-2 showed that the applicant deviated from the IEEE 497-2002 Type E variable definition and has not accounted for how airborne radioactivity conditions (i.e., beta energies associated with particulates, radioiodines, and noble gasses) will be monitored in the control room. These beta energies have significant safety implications as they are the major contributors to the 5 rem TEDE dose limit specified in GDC 19 for control room operators. The staff's review also identified that in DCA section 7.1.1.2.2, the definition for Type E variables provided by the applicant omitted the language of "the control room and" from the variable selection criteria.

Upon examination, the staff's review of the radiation monitors in the control room identified that there is an area monitor provided in the control room design which is specified as a Type E variable. However, according to DCA Section 12.3, Table 12.3-10, this fixed area radiation monitor measures only gamma radiation and would not detect beta emitting radionuclides. To satisfy the type E variable monitor definition, the staff has determined that the applicant needs to have the ability to detect both beta and gamma energies associated with particulates, radioiodines, and noble gases in the control room as credited in DCA Tier 2, Table 1.9-2, in which NuScale commits to RG 1.97, Rev. 4.

Key Issue:

The staff has determined that the application does not adequately describe control room monitors that are capable of appropriately characterizing the radioactivity conditions in the control room (e.g., a way to monitor the beta energies associated with particulates, radioiodines, and noble gasses which are the major contributors to the 5 rem TEDE dose limit specified in GDC 19). As a result the staff determined the application deviates from the committed guidance contained in RG 1.97 and may not meet the requirements of GDC 19.

Questions:

1. The staff requests that the applicant provide a monitor that characterizes the control room radiation and radioactivity levels, ensuring it monitors beta and gamma radiations, or requests the applicant justify why the currently existing monitor in the design would meet the guidance specified in RG 1.97 which endorses the IEEE 497- 2002's Type E variable standard.

2. The staff requests that the applicant provide changes to DCA section 7.1.1.2.2 to correct the stated definition of the Type E variables, which omits "the control room and," to be in conformity with IEEE 497-2002.

The staff requests that the necessary updates to the DCA be provided as markups in response to this RAI.

NuScale Response:

The fixed area radiation monitor in the main control room (MCR) provides the MCR area radiation Type E post-accident monitor (PAM) variable, as indicated in FSAR Table 7.1-7, Table 12.3-10, and Table 12.3-11. Because the CRVS radiation monitor downstream of the HVAC filters is isolated from the MCR atmosphere after the control room habitability system actuates, an additional airborne radiation monitor is added inside the MCR to monitor both beta and gamma radiation in the atmosphere within the control room envelope. This new airborne radiation monitor provides two new Type E variables: MCR noble gas activity and MCR particulates and halogens, consistent with the guidance of IEEE 497-2002. FSAR Figure 7.1-2, Table 7.1-7, Table 12.3-10 and Table 12.3-11 have been revised to include this additional airborne radiation monitor and these additional Type E variables.

The Type E variable criteria list provided in FSAR Section 7.1.1.2.2 has also been revised to include the control room, consistent with IEEE 497-2002.

Impact on DCA:

FSAR Section 7.1.1.2.2, Table 7.1-7, Table 12.3-10, Table 12.3-11, and Figure 7.1-2 have been revised as described in the response above and as shown in the markup provided in this response.

radiation monitor is the primary method used to assess the extent of the fuel cladding breach and to identify fuel cladding breaches where the core is not damaged due to inadequate core cooling.

Reactor Coolant System Fission Product Barrier Variables

The primary variables used to assess the status of the reactor coolant system fission product barrier are the RPV riser level and RCS pressure. RPV riser level can show a loss of boundary through a loss of inventory, resulting in a reduction in level. Wide range RCS pressure is used to assess challenges to the barrier from overpressure and as an alternate variable to RPV riser level for primary assessment.

Containment Fission Product Barrier Variables

Containment is both a critical safety function (Maintain Containment Integrity) and a fission product barrier which serves to control effluent releases. The same variables identified for the containment integrity critical safety function are also used to support the containment fission product barrier monitoring: wide range containment pressure, containment isolation valve position, containment water level, and inside bioshield area radiation monitor.

Type D Variables

The Type D variables listed in Table 7.1-7 are those variables that are required in procedures and licensing basis documentation to perform the following:

- indicate the performance of those safety systems and auxiliary supporting features necessary for the mitigation of design-basis events.
- indicate the performance of other systems necessary to achieve and maintain a safe shutdown condition.
- verify safety system status.

The Type D variables identified and listed in Table 7.1-7 are based upon the plant accident analysis licensing basis and those necessary to implement the plant abnormal operating procedures, emergency operating procedures and functional restoration procedures.

Type E Variables

Type E variables identified and listed in Table 7.1-7 are used in determining the magnitude of the release of radioactive materials and continually assessing such releases. The variable identification was made on the following criteria:

- Variables identified and related to pathways for release of radioactive material.
- Variables identified and related to environmental conditions that are used to determine the impact of radiological releases.

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- Variables identified and related to the control room and plant areas where access may be required for plant recovery.

Table 7.1-7: Summary of Type A, B, C, D, and E Variables (Continued)

Variable	Range	System	Type A	Type B	Type C	Type D	Type E
CRHS Air Supply Isolation Valve Position	Open	PPS				X	
CRHS Pressure Relief Isolation Valve Position	Closed	PPS				X	
CRVS Supply Air Damper Position	Open/Closed	PPS				X	
CRVS Smoke Purge Exhaust Damper Position	Open/Closed	PPS				X	
CRVS General Exhaust Damper Position	Open/Closed	PPS				X	
CRVS Return Air Damper Position	Open/Closed	PPS				X	
Reactor Building Plant Exhaust Stack - Flowrate	0-110% flow rate	RBVS					X
Reactor Building Plant Exhaust Stack - Noble Gas Activity	Note 2	RBVS					X
Reactor Building Plant Exhaust Stack - Particulates And Halogens	Note 2	RBVS					X
Hot Lab - Area Radioactivity	Note 3	RMS					X
Primary Sampling System Equipment - Area Radioactivity	Note 3	RMS					X
Containment Sampling System Equipment -Area Radioactivity	Note 3	RMS					X
EDSS Switchgear Rooms - Area Radioactivity	Note 3	RMS					X
Safety Instrument Rooms - Area Radioactivity	Note 3	RMS					X
Reactor Building Access Tunnel - Area Radioactivity	Note 3	RMS					X
Technical Support Center - Control Support Area Radiation Level	Note 3	RMS					X
Condenser Air Removal Vacuum Pump Exhaust - Flowrate	0-110% flow rate	CARS					X
Condenser Air Removal Vacuum Pump Exhaust - Noble Gases	Note 2	CARS					X
Meteorological And Environmental Monitoring System - Site Specific	N/A	N/A					X
Plant Specific Environs Radiation and Radioactivity	N/A	N/A					X
MCR Area Radiation	Note 3	RMS					X
MCR Noble Gas Activity	Note 3	RMS					X
MCR Particulates and Halogens	Note 3	RMS					X

Note 1: The neutron flux PAM variables are provided by the NMS-excore indications of power range linear power, intermediate range log power, source range count rate; NMS-flood provides the source range count rate indication during conditions when the containment is flooded.
Note 2: The process and effluent radiation monitoring instrumentation ranges are provided in Section 11.5, Table 11.5-1.
Note 3: The fixed area and airborne radiation monitoring instrumentation ranges are provided in Section 12.3, Table 12.3-10.

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Figure 7.1-2: Post-Accident Monitoring General Arrangement Drawing

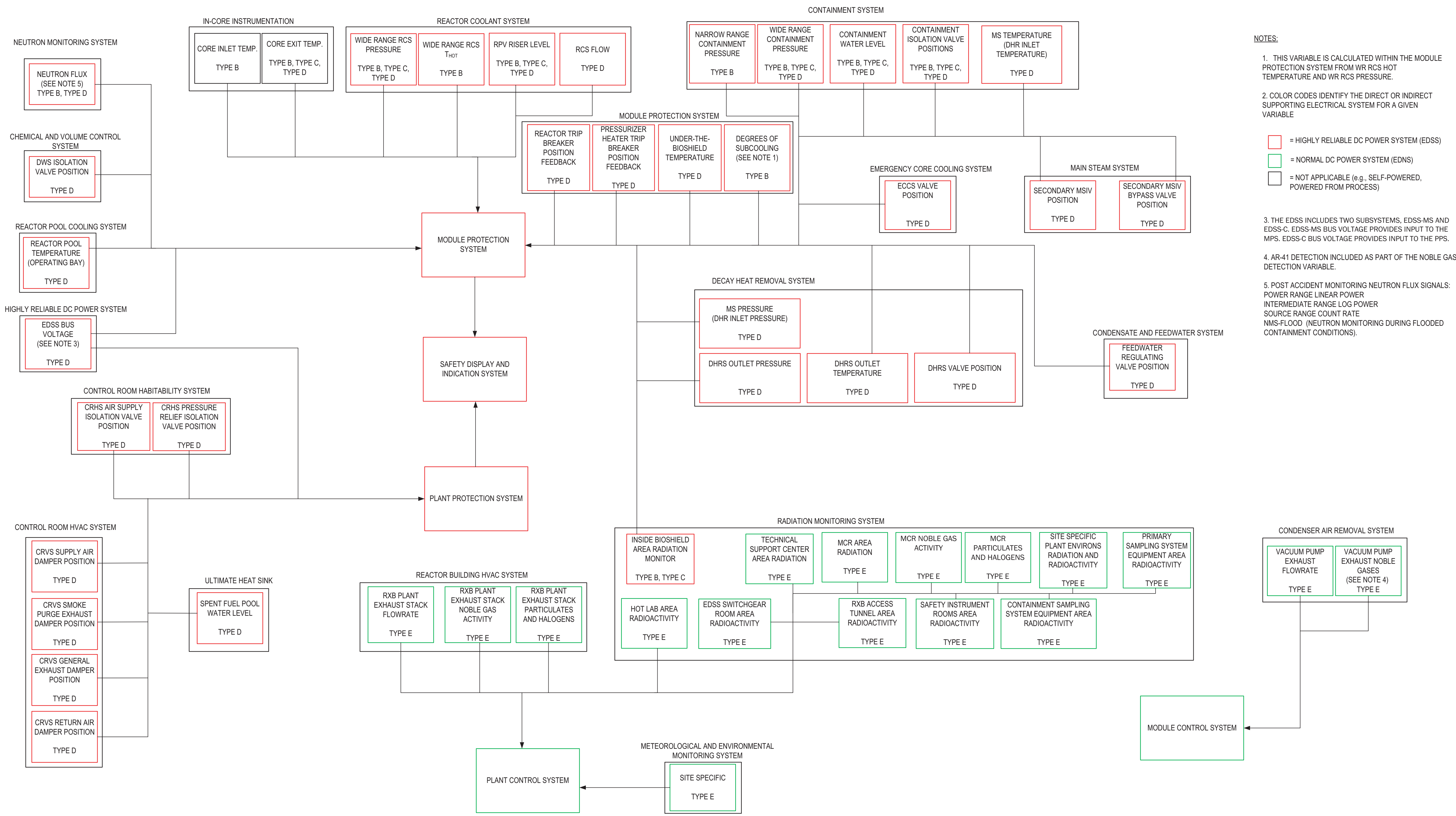

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Table 12.3-10: Fixed Area and Airborne Radiation Monitors Post-Accident Monitoring Variables

Area	Monitor	Estimated Dynamic Detection Range	Principal Parameter measured	Basis for Dynamic Range	PAM Variable Type
Under bioshield monitors	Fixed area	1E+0 to 1E+7 rem/hr	gamma	RG 1.97, Rev. 3 Equipment Qualification Post-Accident Radiological Source Term	Type B Type C
Hot lab	Fixed area	1E-4 to 1E+4 rem/hr	gamma	RG 1.97, Rev. 3 ANSI/ANS-HPSSC-6.8.1-1981	Type E
Hot lab	Fixed airborne	3E-10 to 1E-6 µCi /cc	Cs-137: γ	RG 1.97, Rev. 3 Radiological Source Term	Type E
Radiation monitors in route to hot lab	Fixed area	1E-4 to 1E+4 rem/hr	gamma	RG 1.97, Rev. 3 ANSI/ANS-HPSSC-6.8.1-1981	Type E
Safety instrument rooms	Fixed area	1E-4 to 1E+4 rem/hr	gamma	RG 1.97, Rev. 3 ANSI/ANS-HPSSC-6.8.1-1981	Type E
EDSS switchgear rooms	Fixed area	1E-4 to 1E+4 rem/hr	gamma	RG 1.97, Rev. 3 ANSI/ANS-HPSSC-6.8.1-1981	Type E
Radiation monitors in route to safety instrumentation rooms and EDSS switchgear rooms	Fixed area	1E-4 to 1E+4 rem/hr	gamma	RG 1.97, Rev. 3 ANSI/ANS-HPSSC-6.8.1-1981	Type E
RXB access tunnel	Fixed area	1E-4 to 1E+4 rem/hr	gamma	RG 1.97, Rev. 3 ANSI/ANS-HPSSC-6.8.1-1981	Type E
MCR envelope - main control room area radiation monitor	Fixed area	1E-4 to 1E+4 rem/hr	gamma	RG 1.97, Rev. 3 ANSI/ANS-HPSSC-6.8.1-1981	Type E
MCR envelope - main control room area airborne radiation monitor	Fixed airborne	1E-7 to 1E-1 µCi/cc 1E-10 to 1E-6 µCi/cc 1E-10 to 1E-5 µCi/cc	Kr-85, Xe-133: β Cs-137: γ, β I-131: γ	RG 1.97, Rev. 3 ANSI/HPS 13.1-2011	Type E
Technical support center	Fixed area	1E-4 to 1E+4 rem/hr	gamma	RG 1.97, Rev. 3 ANSI/ANS-HPSSC-6.8.1-1981	Type E

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Table 12.3-11: Fixed Airborne Radiation Monitors

Building and Elevation	Area	Detector Quantity / Type	Principal Parameter Measured	Nominal Range	PAM / Type
Reactor Building elevation 24′	Degasifier room A	1 / Noble gas	Kr-85, Xe-133: ß	3E-4 to 1E+3 µCi / cc	No
	Degasifier room B	1 / Noble gas	Kr-85, Xe-133: ß	3E-4 to 1E+3 µCi / cc	No
Reactor Building elevation 50′	Hot lab	1 / Particulate	Cs-137: γ	3E-10 to 1E-6 µCi /cc	Yes / E
Annex Building elevation 100′	Hot shop	1 / Particulate	Cs-137: γ	3E-10 to 1E-6 µCi /cc	No
	Decontamination shop	1 / Particulate	Cs-137: γ	3E-10 to 1E-6 µCi /cc	No
Radioactive Waste Building elevation 71′	Gaseous radioactive waste process tank area	1 / Noble gas 1 / Particulate 1 / Iodine	Kr-85, Xe-133: ß Cs-137: γ I-131: γ	3E-7 to 1E-2 µCi /cc 3E-10 to 1E-6 µCi /cc 3E-10 to 5E-8 µCi /cc	No
Control Building elevation 76'-6"	Main Control Room	1/Noble Gas 1/Particulate 1/Iodine	Kr-85, Xe-133: β Cs-137: γ, β I-131: γ	1E-7 to 1E-1 µCi/cc 1E-10 to 1E-6 µCi/cc 1E-10 to 1E-5 µCi/cc	Yes / E