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RAIO-1118-62463

November 06, 2018

Docket No. 52-048

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

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 261 (eRAI No. 9063) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 261 (eRAI No. 9063)," dated October 13, 2017

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. 9063:

- 09.01.03-1

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 Carrie Fosaaen at 541-452-7126 or at cfosaaen@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9063

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9063

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

eRAI No.: 9063

Date of RAI Issue: 10/14/2017

NRC Question No.: 09.01.03-1

10 CFR 52.47(a)(2) requires that a standard design certification applicant provide a description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefor, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished.

10 CFR 50, Appendix A, General Design Criterion (GDC) 61 requires, in part, the fuel storage and handling, radioactive waste, and other systems which may contain radioactivity shall be designed to assure adequate safety under normal and postulated accident condition. These systems shall be designed with a residual heat removal capability having reliability and testability that reflects the importance to safety of decay heat and other residual heat removal.

SRP 9.1.3.III.B states that the cooling loop may be constructed to nonseismic Category I requirements, provided the spent fuel pool water makeup system and the building ventilation and filtration system are:

1) designed to Quality Group C and seismic Category I requirements;

2) are protected from the effects of tornadoes; and

3) meet the single-failure requirements.

Where this alternative is selected, the ventilation system provides the capability to vent steam/moisture to the atmosphere to protect safety-related components from the effects of boiling in the SFP.

In FSAR Tier 2, Section 9.2.5.2.3, the applicant discusses the operation of the ultimate heat sink (UHS) during abnormal and accident conditions. The FSAR states that a passive vent path (reactor building exhaust ventilation system (RBVS)) is credited to prevent pressurization of the reactor building (RXB). The RXB is classifieds as a safety-related, seismic Category I structure.

On the other hand, the description of the RBVS in FSAR Tier 2, Section 9.4.2, states that the system serves no safety-related function and is not credited for mitigation of design basis accidents. Components of the RBVS whose structural failure could affect the operability of safety-related SSCs are designed as Seismic Category II; the remainder of the RBVS is Seismic Category III.

The staff finds that the RBVS, as described in FSAR Tier 2, Section 9.4.2, is inconsistent with the assumptions of FSAR 9.2.5, that the system will be available during accident scenarios to release the steam generated in the UHS area.

Therefore, the staff requests the applicant to upgrade the design of the passive vent path on the RBVS to Quality Group C and seismic Category I requirements, or to credit another Quality Group C and seismic Category I system to vent the steam in the RXB area and to prevent pressurization of the RXB., and to update the FSAR accordingly.

NuScale Response:

To prevent over-pressurization in the ultimate heat sink (UHS) area of the RXB, credit is taken for a vent path included in the RXB system. This vent path allows pressure to be released externally from the RXB by way of a safety-related, Seismic Category I over-pressurization vent (OPV) that includes a rupture disk. The rupture disk is pre-set to limit pressure in the RXB pool area during abnormal and accident conditions. In addition, there is a second identical vent path included for redundancy. Each vent path is capable of independently maintaining RXB pool area pressure within the design limits of the RXB.

Markups of FSAR Chapter 9 and sections of Chapter 3 that describe this change are attached. Additional associated DCA changes to the tables and figures listed below will be provided separately.

- Table 3.9-16: Valve Inservice Test Requirements per ASME OM Code
- Table 7.1-7: Summary of Type A, B, C, D, and E Variables
- Figure 7.1-2: Post-Accident Monitoring General Arrangement Drawing

- Table 12.3-10: Fixed Area and Airborne Radiation Monitors Post-Accident Monitoring Variables
- Table 12.3-11: Fixed Airborne Radiation Monitors
- Tier 1 Table 3.14-1: Mechanical and Electrical/Instrumentation and Controls Shared Equipment

Impact on DCA:

FSAR Sections 3.8.4, 9.2.5, 9.4.2, and Table 3.2-1: Classification of Structures, Systems, and Components have been revised as described in the response above and as shown in the markup provided in this response.

RAI 03.02.01-2, RAI 03.02.01-3, RAI 03.02.02-2, RAI 03.02.02-6, RAI 03.08.02-14, RAI 03.09.02-64, RAI 05.04.02.01-6, RAI 06.02.04-2, RAI 09.01.03-1, RAI 09.02.02-1, RAI 09.02.04-1, RAI 09.02.04-1S1, RAI 09.02.05-1, RAI 09.02.06-1, RAI 09.02.07-4, RAI 09.02.07-5, RAI 09.02.09-2, RAI 09.03.04-5, RAI 09.04.02-1, RAI 09.04.02-1S1, RAI 10.04.07-2, RAI 11.02-1, RAI 15-17, RAI 19-14

Table 3.2-1: Classification of Structures, Systems, and Components

SSC (Note 1)	Location	SSC Classification (A1, A2, B1, B2)	RTNSS Category (A,B,C,D,E)	QA Program Applicability (Note 2)	Augmented Design Requirements (Note 3)	Quality Group / Safety Classification (Ref RG 1.26 or RG 1.143) (Note 4)	Seismic Classification (Ref. RG 1.29 or RG 1.143) (Note 5)
CNTS, Containment System							
All components (except as listed below)	RXB	A1	N/A	Q	None	B	I
• CVC Injection Check Valve • CVC Discharge Excess Flow Check Valve • CVC PZR Spray Check Valve	RXB	B2	None	AQ-S	None	C	I
• CVC Injection & Discharge Nozzles • CVC PZR Spray Nozzle • CVC PZR Spray CIV • CVC RPV High Point Degasification Nozzle • CVC RPV High Point Degasification CIV • RVV & RRV Trip/Reset # 1 & 2 Nozzles • RVV Trip 1 & 2/Reset #3 Nozzles • CVC Injection & Discharge CIVs	RXB	A1	N/A	Q	None	A	I
• NPM Lifting Lugs • Top Support Structure • Top Support Structure Diagonal Lifting Braces	RXB	B1	None	AQ-S	• ANSI/ANS 57.1-1992 • ASME NOG-1 • NUREG-0554	N/A	I
• CNV Fasteners • Hydraulic skid • CNV Seismic Shear Lug • CNV CRDM Support Frame • Containment Pressure Transducer (Narrow Range) • Containment Water Level Sensors (Radar Transceiver) • SG 1 & 2 Steam Temperature Sensors (RTD)	RXB	A1	N/A	Q	None	N/A	I
CNTS CFDS Piping in containment	RXB	B2	None	AQ-S	None	B	II
Piping from (CES, CFDS, FWS, MSS, and RCCWS) CIVs to disconnect flange (outside containment)	RXB	B2	None	AQ-S	None	D	I
CVCS Piping from CIVs to disconnect flange (outside containment)	RXB	B2	None	AQ-S	None	C	I
CIV Close and Open Position Sensors: • CES, Inboard and Outboard • CFDS, Inboard and Outboard • CVCS, Inboard and Outboard PZR Spray Line • CVCS, Inboard and Outboard RCS Discharge • CVCS, Inboard and Outboard RCS Injection • CVCS, Inboard and Outboard RPV High-Point Degasification • FWS, Supply to SGs and DHR HXs FWIV • RCCWS, Inboard and Outboard Return and Supply • SGS, Steam Supply CIV/MSIVs and CIV/MSIV Bypasses	RXB	B2	None	AQ-S	IEEE 497-2002 with CORR 1	N/A	I
Containment Pressure Transducer (Wide Range)	RXB	B2	None	AQ-S	IEEE 497-2002 with CORR 1	N/A	I
• Containment Air Temperature (RTDs) • FW Temperature Transducers	RXB	B2	None	AQ-S	None	N/A	II
SGS, Steam Generator System							
• SG tubes • Feedwater plenums • Steam plenums	RXB	A1	N/A	Q	None	A	I
• SG tube supports • Upper and lower SG supports	RXB	A1	N/A	Q	None	N/A	I

Table 3.2-1: Classification of Structures, Systems, and Components (Continued)

SSC (Note 1)	Location	SSC Classification (A1, A2, B1, B2)	RTNSS Category (A,B,C,D,E)	QA Program Applicability (Note 2)	Augmented Design Requirements (Note 3)	Quality Group / Safety Classification (Ref RG 1.26 or RG 1.143) (Note 4)	Seismic Classification (Ref. RG 1.29 or RG 1.143) (Note 5)
Division I and Division II: • CTB Communication Module • Enable Nonsafety Control Switch • Hard-Wired Module • Scheduling and Bypass Modules • Safety Function Modules for CRV Post-filter Radiation Sensor • Safety Function Module for CRV Post-filter Radiation Sensor Trip/Bypass Switches	CRB	B2	None	AQ-S	RG 1.78	N/A	I
Division I and Division II: • CRV Outside Air Isolation Damper Equipment Interface Module • Manual Outside Air Isolation Actuation Switch • Safety Function Module for CRV Toxic Gas Sensor • Safety Function Module for CRV Toxic Gas Sensor Trip/Bypass Switch	CRB	B2	None	AQ-S	RG 1.78	N/A	I
Division I and Division II Maintenance Workstations	CRB	B2	None	AQ-S	None	N/A	II
RMS, Radiation Monitoring System							
RM system that monitors PAM B & C variables	RXB	B2	None	AQ-S	IEEE 497-2002 with CORR 1	N/A	I
Radiation monitors that monitors Type E variables	RXB, TGB	B2	None	AQ	IEEE 497-2002 with CORR 1	N/A	III
Area airborne radiation monitors that monitors Type E Variable	CRB, RXB	B2	None	AQ	• IEEE 497-2002 with CORR 1 • ANSI/HPS N13.1-2011	N/A	III
Area airborne radiation monitors in: • Annex Building • Radioactive Waste Building • Reactor Building	ANB, RWB, RXB	B2	None	AQ	ANSI/HPS N13.1-2011	N/A	III
Radiation monitors in: • Annex Building • Control Building • Radioactive Waste Building • Reactor Building • Turbine Buildings	ANB, CRB, RWB, RXB, TGB	B2	None	AQ	None	N/A	III
RXB, Reactor Building							
Reactor Building (includes interior walls and floor forming UHS pool)	Yard	A1	N/A	Q	None	N/A	I
RBC, Reactor Building Cranes							
Reactor Building Crane	RXB	B1	None	AQ-S	ASME NOG-1	N/A	I
Module Lifting Adapter	RXB	B1	None	AQ-S	ANSI N14.6	N/A	I
Traveling Jib Crane	RXB	B2	None	N/A	None	N/A	II
Wet Hoist	RXB	B2	None	AQ	ASME NOG-1	N/A	III
RBCM, Reactor Building Components							
Over-pressurization Vent (OPV)	RXB	A2	None	Q	None	Quality Group 1.26 C (d)	I
• UHS Pool Liner and Dry Dock Liner Dry Dock Gate support stainless steel plates at plate-to-liner weld locations	RXB	B2	None	AQ-S	ANSI/ANS 57.2-1983 with additions, clarifications, and exceptions of RG 1.13	N/A	I
Bioshield	RXB	B2	None	AQ-S	EQ requirements to GDC 4 and 23	N/A	II
Reactor Building Equipment Door	RXB	B2	None	AQ-S	None	N/A	II
Dry Dock Gate	RXB	B2	None	AQ-S	None	N/A	II
• Dry Dock Gate Closure instrumentation • Reactor Building Equipment Door Condition Instrumentation	RXB	B2	None	None	None	N/A	III
[[TGB, Turbine Generator Building]]							
Turbine Generator Building	Yard	B2	None	None	None	N/A	III
[[TBC, Turbine Building Cranes]]							
Turbine Building Cranes	TGB	B2	None	None	None	N/A	III
RWB, Radioactive Waste Building							
Radioactive Waste Building	Yard	B2	None	AQ	None	RW-IIa	II, RW-IIa

elevation. The liner is included as a dead weight in the analysis of the RXB. There is a pool leakage detection system embedded in the concrete beneath the pool. The pool leakage detection system is discussed in Section 9.1.3.2.5.

RAI 09.01.03-1, RAI 09.04.02-1S1

To prevent over-pressurization in the ultimate heat sink (UHS) area of the RXB, credit is taken for a vent path included in the RXB system. This vent path allows pressure to be released externally from the RXB by way of a safety-related, Seismic Category I over-pressurization vent (OPV) that includes a rupture disk. The rupture disk is pre-set to limit pressure in the RXB pool area during abnormal and accident conditions. In addition, there is a second identical vent path included for redundancy. Each vent path is capable of independently maintaining RXB pool area pressure within the design limits of the RXB.

3.8.4.1.8 Platforms and Miscellaneous Structures

Platforms and miscellaneous structures (e.g., ladders, guard rails, stairs) are utilized in the RXB and CRB. These components are constructed of steel beams, angles, channels, tubing, and grating. Platforms and miscellaneous structures may be Seismic Category I, II, or III depending on their safety function and potential interaction with Seismic Category I SSC. These SSC are included in the seismic analysis of the structure as part of the standard floor load.

3.8.4.1.9 Buried Conduit and Duct Banks

The design does not include any buried safety related pipes or pipe ducts.

3.8.4.1.10 Buried Pipe and Pipe Ducts

The design does not include any buried safety related pipes or pipe ducts.

3.8.4.1.11 Masonry Walls

Masonry walls are not used in the Reactor Building or in the Control Building.

3.8.4.1.12 Modular Construction

The design of the Seismic Category I RXB and CRB structural walls does not include steel-concrete (SC) modular subsystems. Modular construction techniques (including sacrificial steel) that do not alter the design, normal construction techniques, or analysis may be employed.

3.8.4.1.13 Reactor Building Crane

RAI 03.07.03-5

The Reactor Building crane (RBC) is a bridge crane that rides on rails anchored to the RXB at EL 145' 6". The RBC is part of the Overhead Heavy Load Handling System via the UHS water. For an abnormal condition where one NPM is cooled in this manner, the UHS pool water temperature would initially increase above the normal operating temperature shown in Table 9.2.5-1. With AC power available, the active pool cooling systems operate to return the water temperature to the normal operating value.

During an event where loss of electric power occurs, the volume of water already in the pool provides the inventory for the necessary heat removal. Upon loss of power, the reactor pool cooling and SFP cooling systems shut down. The UHS water expands as it heats and eventually begins to boil. Heat continues to be removed from the pool through boiling and evaporation, removing enough heat to maintain the spent fuel and fuel in the NPMs sufficiently cool to prevent fuel damage. The design is such that UHS water boil-off will continue to remove heat from the power modules and spent fuel for greater than 30 days without the need for operator action, makeup water, or electric power.

RAI 09.02.05-2

Section 9.2.5.4 describes the evaluation of the capability of the UHS to cool the NPMs and the spent fuel following an accident or transient, including a loss-of-coolant accident (LOCA) in an NPM. As shown in the evaluation, without electrical power to supply normal pool cooling and makeup systems, the large UHS water volume provides sufficient time for actions to restore UHS water level using defense-in-depth design provisions. These defense-in-depth design provisions include: the makeup water connection and associated piping that provides a pathway for makeup water, and connection capability to the fire protection system.

The level of water over the spent fuel is monitored and in the event that level continues to drop, the qualified makeup line is used to add water to the pool. The qualified makeup line provides a connection outside the RXB for a source of water to fill the SFP area and the UHS pool. The weir assures that water is available to cover the spent fuel first, before adding water to the rest of the pool complex.

RAI 09.01.03-1, RAI 09.02.05-2, RAI 09.04.02-1S1

~~To prevent pressurization in the UHS area of the RXB, credit is taken for a passive vent path (RXB exhaust ventilation system). The system filters and controls the release of airborne radioactive material from inside of the RXB,~~ To prevent over-pressurization in the UHS area of the RXB during abnormal conditions, credit is taken for an Over-pressurization Vent (OPV) included in the RXB system (see Section 3.8.4). Until the building pressure reaches the set point of the rupture disk, the Reactor Building HVAC system (RBVS) will filter and control the release of airborne radioactive material from inside the RXB, including from pool water evaporation for loss of normal power supply (see Section 9.4.2). Section 15.0.3 addresses the radiological consequences of the UHS pool boiling.

9.2.5.3 Refueling Operations

The NPMs are located in the reactor pool during power operations, and one is moved by the RXB crane to the RFP to perform refueling and maintenance operations. The

9.4.2 Reactor Building and Spent Fuel Pool Area Ventilation System

The Reactor Building (RXB) contains a single air volume encompassing the reactor pool, the refueling pool, spent fuel pool (SFP), dry dock, new fuel storage, the NuScale Power Modules (NPMs) and their handling equipment. The Reactor Building HVAC system (RBVS) is designed to maintain acceptable ambient conditions in the RXB to support personnel and equipment, and to control airborne radioactivity in the area during normal operation and following events that have the potential to release radioactivity in the RXB, such as a fuel handling accident.

RAI 21.0-1

The RBVS includes three subsystems: the supply subsystem, the general area exhaust subsystem, and the SFP exhaust subsystem. During normal operation, the RBVS provides conditioned and filtered outside air to the RXB, high-efficiency particulate air (HEPA)-exhaust from RXB, and HEPA-filtered exhaust from the SFP area. The two exhaust subsystems deliver air to the plant exhaust stack for discharge from the plant. In addition to air from the RXB, the RBVS general area exhaust subsystem receives and filters air from the Radioactive Waste Building HVAC system (RWBVS) and the Annex Building HVAC system (ABVS).

9.4.2.1 Design Bases

This section identifies the RBVS required or credited functions, the regulatory requirements that govern the performance of those functions, and the controlling parameters and associated values that ensure the functions are fulfilled. Together, this information represents the design bases, defined in 10 CFR 50.2, as required by 10 CFR 52.47(a) and (a)(3)(ii).

RAI 09.01.03-1, RAI 09.04.02-1, RAI 09.04.02-1S1

The RBVS serves no safety-related or risk significant function, is not credited for mitigation of design basis accidents, and has no safe shutdown function. ~~The exhaust ductwork from the spent fuel pool area is credited as a passive vent path for high energy line breaks in the Reactor Building.~~ General Design Criteria (GDC) 2, 3, and 5 were considered in the design of the RBVS. Components of the RBVS whose structural failure could adversely affect Seismic Category I SSC are designed as Seismic Category II. The remainder of the RBVS is Seismic Category III (nonseismic). Consistent with GDC 3, the RBVS is designed to limit hydrogen concentration in battery rooms in accordance with Regulatory Position 6.1.7 of Regulatory Guide (RG) 1.189 by using guidance in Section 52.3.6 of NFPA 1 (Reference 9.4.2-6). Consistent with GDC 5, the RBVS is common for the NPMs and is designed to operate during an accident on one unit without significantly affecting the capability to conduct a safe and orderly shutdown and cooldown on the remaining units. See Section 9.4.2.3 for the safety evaluation.

The RBVS is designed to remove radioactive contaminants from the exhaust streams of RXB general area, the radioactive waste building general area, and the annex building (ANB). The exhaust from the RBVS is monitored for radioactive contamination consistent with GDC 60. The RBVS includes air filtration and utilizes automatic realignment of the SFP area subsystem to limit release of airborne radioactive