RAIO-1117-57171

November 13, 2017

Docket No. 52-048

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 222 (eRAI No. 9116) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 222 (eRAI No. 9116)," dated September 12, 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 Questions from NRC eRAI No. 9116:

- 09.02.07-4
- 09.02.07-5

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. 9116

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9116

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NuScale Power™

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

eRAI No.: 9116
Date of RAI Issue: 09/12/2017

NRC Question No.: 09.02.07-4

10 CFR 52.47(c)(2) requires that a standard design certification of "a nuclear power reactor design that … uses simplified, inherent, passive, or other innovative means to accomplish its safety functions must provide an essentially complete nuclear power reactor design except for site-specific elements such as the service water intake structure and the ultimate heat sink, and must meet the requirements of 10 CFR 50.43(e)."

FSAR Tier 2, Section 1.2 states that the scope of the certified design and site-specific design is shown in Figure 1.2-2. FSAR Tier 2, Section 9.2.7 provides information regarding the design of the site cooling water system (SCWS). The staff could not verify whether the entire SCWS, including the structure, is within the scope of the design certification because it is not shown on Figure 1.2-2, nor described in FSAR Tier 2, Section 1.2.1. In addition, FSAR Tier 2, Section 9.2.7.2.1 makes conclusions regarding missile generation from the cooling tower fan based on location and site arrangement of the cooling tower.

The applicant is requested to provide in the FSAR a description of which portions of the SCWS are part of the design certification and which are considered site-specific or conceptual design information, and appropriately identify the site cooling water tower and pump structure in Figure 1.2-2.

NuScale Response:

The entire Site Cooling Water System (SCWS) is conceptual design information (CDI). The NuScale design requires a system to cool nonsafety-related equipment (described in Tier 2, Section 9.2.7); however, the COL applicant is responsible for final design. The SCWS is an asset-protection system. The NuScale SCWS does not provide essential cooling to safety-related SSCs and is not considered safety-related or important to safety as assumed by SRP 9.2.1.

FSAR Section 1.2.1 has been revised to list the SCWS as CDI. FSAR Figure 1.2-2 has been revised to show the proposed location of the SCWS pumps and cooling tower. In addition,

FSAR Table 3.2-1 has been revised to show that the location for the SCWS components is “various” instead of “yard.” The location of the SCWS letdown line radiation monitor is still the yard.

Impact on DCA:

FSAR Section 1.2.1, Table 3.2-1, and Figure 1.2-2 have been revised as described in the response above and as shown in the markup provided in this response.

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

eRAI No.: 9116
Date of RAI Issue: 09/12/2017

NRC Question No.: 09.02.07-5

GDC 2 requires that structures, systems, and components (SSCs) important to safety be designed to withstand the effects of postulated natural phenomena, such as earthquakes and tornadoes without loss of the capability to perform their safety functions.

FSAR Tier 2, Section 9.2.7.1 states “consistent with GDC 2, the site cooling water system (SCWS) complies with the requirements of Regulatory Guide 1.29, Position C.2,” which indicates that those portions of SSCs of which continued function is not required but of which failure could reduce the functioning of safety-related SSCs (identified in Position C.1, items 1.a through 1.q) to an unacceptable safety level or could result in incapacitating injury to occupants of the control room should be designed and constructed so that the safe-shutdown earthquake (SSE) would not cause such failure. Thus, FSAR Tier 2, Section 9.2.7.1 indicates that portions of the SCWS could be assigned as seismic category II.

FSAR Tier 2, Section 9.2.7.3 states the SCWS is located sufficiently far from any Seismic Category I or II structures, or safety-related components; in addition, FSAR Tier 2, Table 3.2-1 states the SCWS is located in the yard. These statements contradict the system design which, in part, provides supply and return cooling water to reactor component cooling water system, reactor pool cooling system, spent fuel pool cooling system. Also, FSAR Tier 2, Figure 9.2.7-1 illustrates the SCWS as providing cooling water to the Reactor Building.

In addition, FSAR Tier 2, Section 9.2.7.1 states the portions of the SCWS whose structural failure could adversely affect the function of Seismic Category I structure, systems, and components (SSC) are Seismic Category II. However, FSAR Tier 2, Table 3.2-1 indicates the entire SCWS is seismic Category III. Because the SCWS diagram provided in Figure 9.2.7-1 is not detailed enough to determine SCWS pipe routing and seismic classification, it is not clear to the staff which portions of the SCWS are seismic Category II.

The applicant is requested to:

a. Revise the information in FSAR Tier 2, Section 9.2.7.3, and FSAR Tier 2, Table 3.2-1 to ensure they accurately reflect the design of the SCWS and its location(s).
b. Clearly identify in the FSAR how the SCWS is routed in the Reactor Building, and

which portions of the SCWS are classified as seismic Category II.

NuScale Response:

Response to part a):

FSAR Figure 1.2-2 has been revised to show the proposed location of the site cooling water system (SCWS) pumps and cooling tower. In addition, FSAR Table 3.2-1 has been revised to show that the location for the SCWS components is “various” instead of “yard.” The location of the SCWS letdown line radiation monitor is still the yard.

Response to part b):

In the response to RAI No. 8866, Question 09.02.02-1, transmitted by letter RAIO-0817-55425 on August 14, 2017 (ADAMS Accession No. ML17226A370), NuScale provided an update to FSAR Tier 2 Table 3.2-1, "Classification of Structures, Systems and Components." The update to Table 3.2-1 provided Note 5 which applies to the Seismic Classification of SSCs, including the SCWS. Note 5 states, "*Where SSC (or portions thereof) as determined in the as-built plant which are identified as Seismic Category III in this table could, as the result of a seismic event, adversely affect Seismic Category I SSC or result in incapacitating injury to occupants of the control room, they are categorized as Seismic Category II consistent with Section 3.2.1.2 and analyzed as described in Section 3.7.3.8.*"

The sentence in FSAR Tier 2, Section 9.2.7.1, “Design Bases,” which reads, “The portions of the SCWS whose structural failure could adversely affect the function of Seismic Category I structure, systems, and components (SSC) are Seismic Category II” is meant to be consistent with FSAR Tier 2, Table 3.2-1, Note 5. This note addresses the NRC RAI question, since SCWS components that could affect Seismic Category I SSCs, including the portion routed in the Reactor Building, will be designed to Seismic Category II standards.

Impact on DCA:

FSAR Section 1.2.1, Table 3.2-1, and Figure 1.2-2 have been revised as described in the response above and as shown in the markup provided in this response.

The following structures are included in the NuScale certified design (Figure 1.2-1 and Figure 1.2-2):

1) Reactor Building (RXB): located above and below grade, houses the following facilities (among others that are not specifically discussed in this section):

   - ultimate heat sink (reactor pool, refuel pool, and spent fuel pool)
   - fuel handling areas
   - remote shutdown station
   - primary systems

   Additional details of the RXB are provided in Section 1.2.2.1.

2) Control Building (CRB): located above and below grade, adjacent to the RXB, provides space for the following facilities:

   - main control room (MCR): located below grade, houses the equipment, controls, and indications for operation of the NPMs
   - technical support center-located above the MCR, outside the radiological controlled area, provides space to support emergency operations and personnel

   Additional details of the CRB are provided in Section 1.2.2.2.

3) Radioactive Waste Building (RWB): located above and below grade, provides space for heating ventilating and air conditioning (HVAC) equipment; and radioactive waste treatment and storage equipment. Additional details of the RWB are provided in Section 1.2.2.3.

The following structures are discussed as CDI (Figure 1.2-1 and Figure 1.2-2):

1) Turbine Generator Buildings (TGBs): house the turbine generators and associated equipment. Additional details of the TGBs are provided in Section 1.2.2.5.1.

2) Annex Building (ANB): controls access into the radiologically controlled area (RCA) and provides space for health physics facilities, servicing potentially radioactive and non-radioactive tooling, fixtures, and instrumentation, security services, and various personnel services. Additional details of the ANB are provided in Section 1.2.2.5.2.

3) Security Buildings (SCBs): provide for controlled access into the SOCA and the PA of the plant. Additional details of the SCBs are provided in Section 1.2.2.5.3.

4) Central Utility Building (CUB): houses various equipment for the chilled water system and other ancillary equipment for balance of plant systems. Additional details of the CUB are provided in Section 1.2.2.5.4.

5) [[Diesel Generator Buildings (DGBs): house the backup diesel generators and associated equipment.]] Additional details of the DGBs are provided in Section 1.2.2.5.5.

RAI 09.02.07-4. RAI 09.02.07-5

6) [[Site Cooling Water System (SCWS): provides cooling water to plant auxiliary systems.]] Additional details of the SCWS are provided in Section 1.2.1.6.

1.2.1.1 Facility Description

Process Overview

The reactor core is located in a core support assembly, which is seated in the lower RPV assembly. A central hot leg riser is connected to the top of the core support assembly. The reactor core transfers heat into the reactor coolant and the heated reactor coolant flows upward through the core and lower and upper riser assemblies. The heated coolant exits the upper riser assembly and is redirected downwards into the SG region between the vessel wall and the upper riser assembly. As the reactor coolant transfers heat to the SGs, it cools and becomes denser, which drives the natural circulation flow. The coolant returns to the bottom of the vessel through the downcomer and back into the reactor core, where the cycle begins again (Figure 1.2-7).

On the secondary side, preheated feedwater is pumped into the tube side of the SGs where it boils. As the steam flows upward in the tubes, it is continually heated to produce superheated steam before exiting the top of the SGs.

The superheated steam is directed to a dedicated steam turbine. A generator, driven by the turbine, creates electric power that is delivered to the utility grid through a step-up transformer. A turbine bypass line provides up to 100% of the rated main steam flow directly from the associated steam generators to the main condenser in a controlled manner to remove heat from the reactor following a load reduction or loss of electrical load.

Steam that exits or bypasses the turbine is directed to the condenser. A shared circulating water loop removes heat and condenses the steam for up to 6 condensers. The condensate is pumped through condensate polishing equipment to the inlet of the variable speed feedwater pumps. A small amount of steam is extracted from turbine stages to preheat the feedwater and increase plant efficiency. Feedwater regulating valves control feed flow into the SGs.

[[Heat from the circulating water loop from up to 6 condensers is rejected to atmosphere by a set of evaporative mechanical-draft cooling towers. Two sets of cooling towers are provided for 12 NPMs.]]

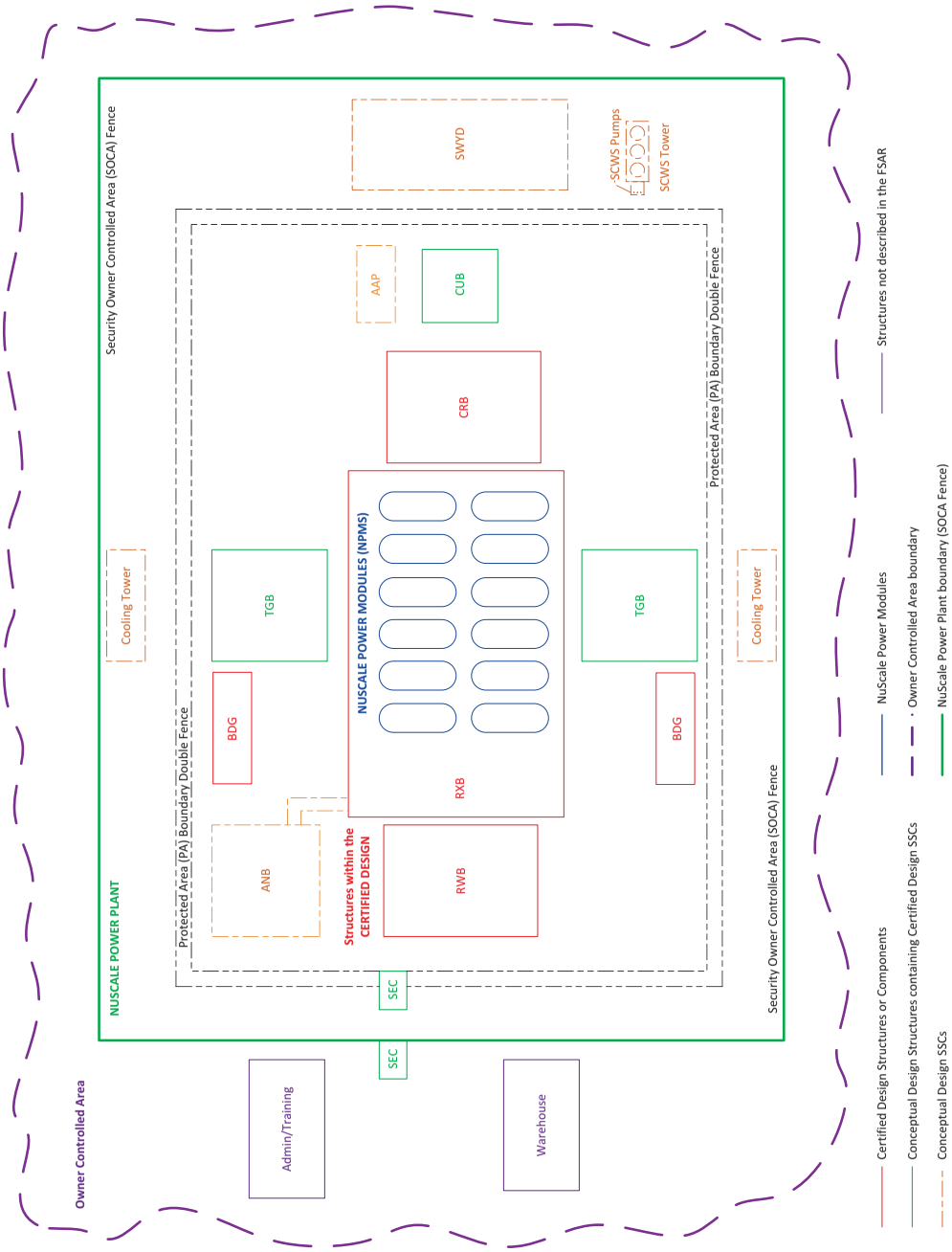
1.2.1.1.1 Principal Design Criteria

The design provides a simple, safe reactor and provides the following:

- reliable, passive safety systems that are simple in design and operation, and are not reliant on electrical power to fulfill their safety functions
- safety features that assure a core damage frequency significantly lower than the current light water reactor fleet
- the absence of RPV or containment penetrations below the top of the reactor core

RAI 09.02.07-4, RAI 09.02.07-4S1, RAI 09.02.07-5, RAI 09.02.07-5S1

Figure 1.2-2: NuScale Functional Boundaries



RAI 03.02.01-2, RAI 03.02.01-3, RAI 03.02.02-2, RAI 03.02.02-6, RAI 06.02.04-2, RAI 09.02.02-1, RAI 09.02.04-1, 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 11.02-1, 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 1.189 or~~ RG 1.29 or RG 1.143) (Note 5)
CNTS, Containment System							
All components (except as listed below)	RXB	A1	N/A	Q	None	A	I
• RXM Lifting Lugs • Top Auxiliary Mechanical Access Structure • Top Auxiliary Mechanical Access Structure Diagonal Lifting Braces	RXB	B1	None	AQ-S	• ANSI/ANS 57.1-1992 • ASME NOG-1 • NUREG-0554	N/A	I
CFDS Piping in containment	RXB	B2	None	AQ-S	None	B	II
Piping from (CES, CFDS, CVCS, FWS, MSS, and RCCWS) CIVs to disconnect flange (outside containment)	RXB	B2	None	AQ-S	None	D	I
~~Hydraulic Skid for valve reset~~	~~RXB~~	~~B2~~	~~None~~	~~None~~	~~None~~	~~D~~	~~III~~
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	II
• 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 • ~~SG tube supports~~	RXB	A1	N/A	Q	None	A	I
• SG tube supports	RXB	A1	N/A	Q	None	N/A	I
• Steam piping inside containment • Feedwater piping inside containment • Feedwater supply nozzles • Main steam supply nozzles • Thermal relief valves	RXB	A2	N/A	Q	None	B	I
Flow restrictors	RXB	A2	N/A	Q	None	N/A	I
RXC, Reactor Core System							
Fuel assembly (RXF)	RXB	A1	N/A	Q	None	N/A	I
Fuel Assembly Guide Tube	RXB	A2	N/A	Q	None	N/A	I
Incore Instrument Tube	RXB	B2	None	AQ-S	None	N/A	I
CRDS, Control Rod Drive System							
• Control Rod Drive Shafts • Control Rod Drive Latch Mechanism	RXB	A1	N/A	Q	None	N/A	I
CRDM Pressure Boundary (Latch Housing, Rod Travel Housing, Rod Travel Housing Plug)	RXB	A2	N/A	Q	None	A	I
CRDS Cooling Water Piping and Pressure Relief Valve	RXB	B2	None	AQ-S	None	B	II
Rod Position Indication (RPI) Coils	RXB	B2	None	AQ-S	None	N/A	I
• Control Rod Drive Coils • CRDM power cables from EDN breaker to MPS breaker • CRDM power cables from MPS breaker to CRDM Cabinets	RXB	B2	None	AQ-S	None	N/A	II

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 1.189 or~~ RG 1.29 or RG 1.143) (Note 5)
All components	TGB	B2	None	None	• NEI 97-06 • EPRI PWR Secondary Water Chemistry Guidelines, Rev 7	D	III
HVDS, (Feedwater) Heater Vents and Drains System							
All components	TGB	B2	None	None	None	D	III
CHWS, Chilled Water System							
All components	Various	B2	None	None	None	N/A	III
ABS, Auxiliary Boiler System							
High Pressure and Low Pressure Aux Boiler skids	TGB	B2	None	None	No	D	III
Radioactivity Instruments	Various	B2	None	AQ	ANSI N42.18-2004	N/A	III
CARS, Condenser Air Removal System							
All components (except as listed below)	TGB	B2	None	None	None	D	III
• Effluent Radiation Element • Effluent Radiation Transmitter • Discharge Flow Transmitter	TGB	B2	None	AQ	IEEE 497-2002 with CORR 1	N/A	III
TGS, Turbine Generator System							
All components (except as listed below)	TGB	B2	None	None	None	N/A	III
TG Gland Seal Exhauster Radiation Monitor	TGB	B2	None	AQ	ANSI N42.18-2004	N/A	III
TLOSS, Turbine Lube Oil Storage System							
All components	TGB	B2	None	None	None	N/A	III
CPS, Cathodic Protection System							
Cathodic Protection System	Various	B2	None	None	None	N/A	III
CWS, Circulating Water System							
All components	TGB, Yard	B2	None	None	None	D	III
SCWS, Site Cooling Water System							
All components (except as listed below)	Various~~Yard~~	B2	None	None	None	D	III
Letdown line rad monitor	Yard	B2	None	AQ	ANSI N42.18-2004	N/A	III
PWS, Potable Water System							
All components (except as listed below)	Various	B2	None	None	None	N/A	III
Supply and return piping from the CRE penetration (includes only the isolation devices and the piping between the isolation devices and the outer wall of the CRE)	CRB	B2	None	None	None	N/A	II
UWS, Utility Water System							
All components (except as listed below)	Various	B2	None	None	None	N/A	III
Wastewater effluent discharge portion of UWS	Various	B2	None	None	None	D	III
Letdown Line Rad Monitor	RWB	B2	None	AQ	ANSI N42.18-2004	N/A	III
DWS, Demineralized Water System							
All components (except as listed below)	Various	B2	None	None	None	D	III
• DWS potentially radioactive loop • Grab sample isolation valves • Grab sample ports • DWS headers - radiation indication instruments	Various	B2	None	AQ	None	D	III
NDS, Nitrogen Distribution System							
All components	Yard, RWB	B2	None	None	None	N/A	III
SAS, Service Air System							
All components	Various	B2	None	None	None	N/A	III
IAS, Instrument and Control Air System							
All components	Various	B2	None	None	None	N/A	III
TBVS, Turbine Building HVAC System							
All components	TGB	B2	None	None	None	N/A	III