RAIO-0717-55154

August 1, 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. 66 (eRAI No. 8880) on the NuScale Design Certification Application

**REFERENCE:** U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 66 (eRAI No. 8880)," dated June 20, 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. 8880:

- 09.02.05-1

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 Marty Bryan at 541-452-7172 or at mbryan@nuscalepower.com.

Sincerely,

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

Distribution: Gregory Cranston, NRC, OWFN-8G9A
Samuel Lee, NRC, OWFN-8G9A
Anthony Markley, NRC, OWFN-8G9A

Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 8880

**Enclosure 1:**

NuScale Response to NRC Request for Additional Information eRAI No. 8880

NuScale Power, LLC
1100 NE Circle Blvd., Suite 200 Corvalis, Oregon 97330, Office: 541.360.0500, Fax: 541.207.3928
www.nuscalepower.com

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

**eRAI No.:** 8880
**Date of RAI Issue:** 06/20/2017

**NRC Question No.:** 09.02.05-1

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.

FSAR Tier 2, Table 3.2-1, "Classification of Structures, Systems, and Components," identifies the ultimate heat sink (UHS) pool under SSC classification to be "A1", which is safety-related and risk-significant. However, in the same table it is listed as "N/A" under "Quality Group" and "Seismic Classification". The staff finds the determination of quality group and seismic classification inconsistent with the SSC classification. In addition, in FSAR Tier 2, Section 9.2.5, "Ultimate Heat Sink," there is no discussion about the seismic qualification of the UHS pool structure.

The applicant is requested to (1) clarify the inconsistency in Table 3.2-1, (2) provide appropriate information or a clear pointer in Section 9.2.5 to clarify the seismic categorization of the UHS pool structure, and (3) revise FSAR Tier 2 as necessary.

**NuScale Response:**

FSAR Table 3.2-1 summarizes the classifications of structures, systems, and components (SSC) for the NuScale Plant including the ultimate heat sink (UHS). This table has been revised as shown in the attached markups to clarify the entry for the ultimate heat sink (UHS) system and for components related to the UHS, but not in the UHS system.

The revision for the entry, "UHS, Ultimate Heat Sink" system, shows that the row for the "UHS Pool" refers to just the water in the UHS. The components which hold the water in place in the reactor building are related to the UHS and are addressed below. For the UHS pool water, this row of FSAR Table 3.2-1 is intended to recognize that the water itself is considered a safety-related component because it performs the function of removing decay heat that is transferred to it. A Quality Group designation from Regulatory Guide 1.26 is not applicable (N/A) to the

water as these designations are applied to water and steam containing components (that is, pressure vessels, storage tanks, piping, pumps, and valves). Similarly, a seismic category is not assigned to water as a component and the classification is also shown as N/A.

The revision for the “UHS Pool” row also advises the reader to see the information on the entries for the reactor building (RXB) and the reactor building components (RBCM), which are addressed later in the table. Both the RXB and RBCM are related to the UHS as follows and shown in the attached markups.

The entry for the “Reactor Building” under the row for “RXB, Reactor Building” has been revised to clarify that the classifications in this row apply to the interior walls and floor of the RXB forming the UHS pool, as well as the external walls, floor, roof, etc. These interior RXB structures support the UHS pool liner which holds the UHS pool (water). The RXB structure including the interior walls and floor are classified as Seismic Category I. The RXB interior walls and floor are related to the UHS but not part of the UHS system.

Likewise, the entry for the “Pool Liner” under the row for “RBCM, Reactor Building Components” has been revised to “UHS Pool Liner and Dry Dock Liner” to identify that the classifications in this row apply to both the liner for the UHS pool, which is formed by the reactor pool, refueling pool, and spent fuel pool, and to the liner for the dry dock, which is not credited as being part of the UHS pool but communicates with it when the dry dock gate is open. The UHS pool liner holds the UHS pool (water). The UHS pool liner is classified as Seismic Category I and is related to the UHS but not part of the UHS system.

FSAR Section 9.2.5.2.1 has been revised as shown in the attached markups to clarify that FSAR Table 3.2-1 identifies the components included in the UHS system and provides their safety, seismic, and quality group classifications. The revisions also clarify that the structural components forming the UHS pools are not part of the UHS system. This section was also revised to describe that the RXB, including the concrete forming the UHS pools, and UHS pool liner meet Seismic Category I requirements.

**Impact on DCA:**

FSAR Table 3.2-1 and Section 9.2.5.2.1 have been revised as described in the response above and as shown in the markup provided in this response.

RAI 09.02.02-1, RAI 09.02.05-1, RAI 09.02.06-1

## 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) (Note 5) |
|---|---|---|---|---|---|---|---|
| CNTS, Containment System | | | | | | | |
| All components (except as listed below) | RXB | A1 | N/A | Q | None | A | I |
| • RXM Lifting Lugs<br>• Top Auxiliary Mechanical Access Structure<br>• Top Auxiliary Mechanical Access Structure Diagonal Lifting Braces | RXB | B1 | None | AQ-S | • ANSI/ANS 57.1-1992<br>• ASME NOG-1<br>• 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:<br>• CES, Inboard and Outboard<br>• CFDS, Inboard and Outboard<br>• CVCS, Inboard and Outboard PZR Spray Line<br>• CVCS, Inboard and Outboard RCS Discharge<br>• CVCS, Inboard and Outboard RCS Injection<br>• CVCS, Inboard and Outboard RPV High-Point Degasification<br>• FWS, Supply to SGs and DHR HXs FWIV<br>• RCCWS, Inboard and Outboard Return and Supply<br>• 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)<br>• FW Temperature Transducers | RXB | B2 | None | AQ-S | None | N/A | II |
| SGS, Steam Generator System | | | | | | | |
| • SG tubes<br>• Feedwater plenums<br>• Steam plenums<br>• SG tube supports | RXB | A1 | N/A | Q | None | A | I |
| • Steam piping inside containment<br>• Feedwater piping inside containment<br>• Feedwater supply nozzles<br>• Main steam supply nozzles<br>• 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<br>• 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<br>• CRDM power cables from EDN breaker to MPS breaker<br>• CRDM power cables from MPS breaker to CRDM Cabinets | RXB | B2 | None | AQ-S | None | N/A | II |
| • CRDM Control Cabinet<br>• CRDM Power & Rod Position Indication Cables<br>• Rod Position Indication Cabinets (Train A/B) | RXB | B2 | None | AQ | None | N/A | III |

**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) (Note 5) |
|---|---|---|---|---|---|---|---|
| RPCS, Reactor Pool Cooling System | | | | | | | |
| • Sample Points<br>- SAM-0001<br>- SAM-0002<br>• Valves - Air operated<br>- AOV-0031<br>- AOV-0033<br>- AOV-0034<br>- AOV-0035<br>• Instrumentation - Position<br>- ZSC-0031 and ZSO-0031<br>- ZSC-0033 and ZSO-0033<br>- ZSC-0034 and ZSO-0034<br>- ZSC-0035 and ZSO-0035 | RXB | B2 | None | AQ | ANSI/ANS 57.2-1983 with additions, clarifications, and exceptions of RG 1.13 | D | III |
| • Heat Exchangers<br>• Reactor Pool Cooling Pumps<br>• Strainers<br>• Valves (not listed above) - Air operated, Check, Manual, Relief<br>• Instrumentation (not listed above) - Flow, Position, Pressure, Temperature<br>• Orifices | RXB | B2 | None | None | None | D | III |
| Instrumentation - Temperature (PAM D Variable) | RXB | B2 | None | AQ-S | IEEE 497-2002 with CORR 1 | N/A | I |
| PSCS, Pool Surge Control System | | | | | | | |
| • RXB Penetrations - Piping<br>• Pool Penetrations - Piping | RXB | B2 | None | AQ-S | None | D | II |
| Tank Vent RE | Yard | B2 | None | AQ | ANSI N42.18-2004 | N/A | III |
| All other components | RXB, Yard | B2 | None | None | None | D | III |
| UHS, Ultimate Heat Sink | | | | | | | |
| UHS Pool (water only; also see RXB and RBCM below) | RXB | A1 | N/A | Q | None | N/A | N/A |
| Pool Level Instruments | RXB | B2 | None | AQ-S | • IEEE 497-2002 with CORR 1<br>• NRC Order EA-12-051<br>• NEI 12-02<br>• NEI 12-06 (Order EA-12-049) | N/A | I |
| Water M/U Line | RXB | B2 | None | AQ-S | • NRC Order EA-12-051<br>• NEI 12-02 | C | I |
| PLDS, Pool Leakage Detection System | | | | | | | |
| All components | RXB | B2 | None | None | None | D | III |
| CES, Containment Evacuation System | | | | | | | |
| Vacuum Pump Suction Pressure Indicators | RXB | B2 | None | AQ-S | None | N/A | I |
| All other components (except as listed below) | RXB | B2 | None | AQ | None | D | III |
| Radiation Monitor | RXB | B2 | None | AQ | • ANSI N42.18-2004<br>• ANSI/HPS N13.1-2011<br>• Table 1 of SRP 11.5<br>• Pressure boundary components of any monitoring path outside of containment shall be designed to withstand combustion events corresponding to the capability of containment. | N/A | III |
| Sample Vessel Radiation Transmitter | RXB | B2 | None | AQ | • ANSI N42.18-2004<br>• Table 1 of SRP 11.5 | N/A | III |

**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) (Note 5) |
|---|---|---|---|---|---|---|---|
| Division I and Division II:<br>• CTB Communication Module<br>• Enable Nonsafety Control Switch<br>• Hard-Wired Module<br>• Scheduling and Bypass Modules<br>• Safety Function Modules for CRV Post-filter Radiation Sensor<br>• 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:<br>• CRV Outside Air Isolation Damper Equipment Interface Module<br>• Manual Outside Air Isolation Actuation Switch<br>• Safety Function Module for CRV Toxic Gas Sensor<br>• 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 | CRB, RXB, TGB | B2 | None | AQ-S | IEEE 497-2002 with CORR 1 | N/A | I |
| Radiation monitors that monitors Type E variables | CRB, 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, TGB | B2 | None | AQ | • IEEE 497-2002 with CORR 1<br>• ANSI/HPS N13.1-2011 | N/A | III |
| Area airborne radiation monitors in:<br>• Annex Building<br>• Radioactive Waste Building<br>• Reactor Building | ANB, RWB, RXB | B2 | None | AQ | ANSI/HPS N13.1-2011 | N/A | III |
| Radiation monitors in:<br>• Annex Building<br>• Control Building<br>• Radioactive Waste Building<br>• Reactor Building<br>• 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 |
| RBCM, Reactor Building Components | | | | | | | |
| • ~~Pool Liner~~UHS Pool Liner and Dry Dock Liner<br>• 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 | ES-0303-3677 | N/A | II |
| Dry Dock Gate | RXB | B2 | None | AQ-S | None | N/A | II |
| • Dry Dock Gate Closure instrumentation<br>• 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 | D | 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 |
| [[SCB, Security Buildings (Guardhouse)]] | | | | | | | |
| • Security Building<br>• Vehicle inspection sally port | Yard | B2 | None | None | None | N/A | III |

Consistent with GDC 61, the UHS is designed to ensure adequate safety under normal and postulated accident conditions and has the capability to permit appropriate periodic inspections and testing of components, provides suitable radiation shielding, provides appropriate containment, confinement and filtering capabilities, provides for the removal of residual heat of components, and provides for the prevention of a significant reduction in the pool water inventory under accident conditions.

Section 6.2.2 provides additional discussion on the containment vessel heat removal safety function.

### 9.2.5.2 System Description

#### 9.2.5.2.1 General Description

The plant design features two functional heat sinks. During normal operation, the normal heat sink is via the power conversion system where the condenser transfers heat to the circulating water system as discussed in Section 10.4.1. The remainder of this section is devoted to the safety-related heat sink, the ultimate heat sink.

The UHS includes the reactor pool, RFP, and SFP (Figure 9.2.5-1) and is located below ground within the RXB. Pool areas are open to each other with a weir wall partially separating the SFP from the RFP area. The dry dock area is not considered in this volume; it is assumed that the dry dock gate is closed and no credit is taken for the water volume.

RAI 09.02.05-1

Table 3.2-1 identifies the components included in the UHS system and provides their safety, seismic, and quality group classifications. Table 3.2-1 also provides this information for the structures related to UHS but not part of the UHS system. As described above, the UHS includes the reactor pool, RFP, and SFP, but the structural components forming these three UHS-related pools are not part of the UHS system. That is, the internal reinforced concrete walls and floors of the RXB that form the UHS pool are part of the "RXB, Reactor Building" in Table 3.2-1. The pool liner for the UHS pool in the RXB are part of "RBCM, Reactor Building Components" in Table 3.2-1. The RXB, including the concrete forming the UHS pools, and UHS pool liner meet Seismic Category I requirements to withstand the SSE without loss of UHS pool water retention capability.

The UHS will remove the decay heat from each NPM, maintaining the core temperature at low levels after a loss-of-coolant accident resulting in the initiation of the emergency core cooling system (ECCS), provide sufficient cooling to the stored spent fuel assemblies in the SFP, and maintains them covered in water under operational scenarios. The UHS will also accommodate the combined heat loads from NPMs, refueling activities, and spent fuel during normal and accident conditions assuming a single failure for at least 72 hours without operator actions or electrical power (AC or DC).

The UHS pool liner has the function to prevent potential pool inventory leakage from the SFP, reactor pool, and RFP. The pool liner design prevents inventory