RAIO-1217-57887

December 21, 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. 237 (eRAI No. 9002) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 237 (eRAI No. 9002)," dated September 25, 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. 9002:

- 14.03.02-1

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 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. 9002

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9002

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NuScale Power™

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

eRAI No.: 9002
Date of RAI Issue: 09/25/2017

NRC Question No.: 14.03.02-1

10 CFR 52.47(b)(1), requires that a DC application contain the proposed inspections, tests, analyses, and acceptance criteria (ITAAC) that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC's regulations. SRP Section 14.3, and in particular, Sections 14.3.2 and Appendix C provide guidance in developing design descriptions, figures, and ITAAC for structural related items. SRP acceptance criterion 14.3.2.II.2 states that the design description, figures (including key dimensions), and ITAAC should be developed and grouped by systems and building structures. The staff requests the applicant to supplement the DCD Tier 1 information for building structures as follows:

a. In DCD Tier 1, Sections 3.11, 3.12, and 3.13, the applicant included ITAAC descriptions of the Reactor Building (RXB), Radioactive Waste Building (RWB) and Control Building (CRB) but did not provide figures and key dimensions of these structures. Therefore, the staff requests the applicant supplement DCD Tier 1, Section 3 for the RXB, RWB, and CRB with figures including key dimensions.

b. The staff noted that the RXB and RWB Table 3.11-1 and Table 3.12-1 are titled “Shield Wall Geometry.” Because the applicant did not describe the shield wall in DCD Tier 1, Section 3.0, the staff requests that the applicant supplement the DCD with information on the shield wall. Additionally, the reactor pool, refueling pool (RFP), spent fuel pool (SFP), and associated pool liners are located in the RXB. The staff noted that the applicant did not provide in DCD Tier 1, Section 3, design descriptions and figures including key dimensions or ITAAC for these structures. Therefore, the applicant is requested to provide the design description, figures including key dimensions, and ITAAC for the reactor pool, RFP, SFP, and associated pool liners.

c. In DCD Tier 1, Section 3.13, the design description for the CRB includes an underground tunnel that connects to the RXB, but the staff did not find any ITAAC associated with this tunnel. Therefore, the staff requests the applicant provide design descriptions, figures including key dimensions and ITAAC for the underground tunnel.

NuScale Response:

Question a. response

RAI question a. requests NuScale to supplement Tier 1, Section 3 for the Reactor Building (RXB), Radioactive Waste Building (RWB), and Control Building (CRB) with figures including key dimensions.

The design description and ITAAC for the RXB, RWB, and CRB are in the following Tier 1 sections:

- Tier 1 Section 3.11- RXB
- Tier 1 Section 3.12- RWB
- Tier 1 Section 3.13- CRB

Each of the above Tier 1 sections contain ITAAC for the associated building to verify the structural integrity of the building under design basis loads. The structural ITAAC conform to the NRC standardized ITAAC provided to NuScale by letter and attachment from Frank Akstulewicz (NRC) to Thomas Bergman (NuScale) dated April 8, 2016 (ML16096A121, attachment ML16097A123).

Tier 1, Table 3.11-2, item No. 6, contains structural ITAAC 03.11.06 for the Seismic Category I RXB.

No.	Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
6	The RXB is Seismic Category I and maintains its structural integrity under the design basis loads.	i. An inspection and analysis will be performed of the as-built RXB. ii. An inspection will be performed of the as- built RXB.	i. A design report exists and concludes that the deviations between the drawings used for construction and the as-built RXB have been reconciled, and the RXB maintains its structural integrity under the design basis loads. ii. The dimensions of the RXB critical sections conform to the approved design.

Tier 1, Table 3.13-1, item No. 4, contains structural ITAAC 03.13.04 for the Seismic Category I CRB.

No.	Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
4	The CRB at Elevation 120'-0"(except for the elevator shaft, the stairwells, and the fire protection vestibule which are Seismic Category II) and below is Seismic Category I and maintains its structural integrity under the design basis loads.	i. An inspection and analysis will be performed of the as-built CRB . ii. An inspection will be performed of the as-built CRB at Elevation 120'-0" and below. .	i. A design report exists and concludes that the deviations between the drawings used for construction and the as-built CRB have been reconciled, and the CRB at Elevation 120'-0" and below (except for the elevator shaft, the stairwells, and the fire protection vestibule) maintains its structural integrity under the design basis loads. ii. The dimensions of the CRB critical sections conform to the approved design.

Tier 1, Table 3.12-2, item No. 3 contains structural ITAAC 03.12.03 for the NuScale Category RW-IIa RWB.

No.	Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
3	The RWB is an RW-IIa structure and maintains its structural integrity under the design basis loads.	An inspection and analysis will be performed of the as-built RW-IIa RWB.	i. A design report exists and concludes that the deviations between the drawings used for construction and the as-built RW-IIa RWB have been reconciled and that the as-built RW-IIa RWB maintains its structural integrity under the design basis loads.

The structural ITAAC for the RXB, CRB and RWB are similar in that acceptance criteria i. of each ITAAC require an as-built reconciliation between the drawings used for construction and the dimensions of the as-built structure. The completion of the as-built reconciliation does not require that building dimensions or building drawings be included in the Tier 1 design description of the building.

The structural ITAAC for the RXB and CRB are similar in that acceptance criteria ii. of each ITAAC require an inspection to verify the building's as-built critical dimensions conform to design. The identification of the critical dimensions of the RXB and CRB are necessary to complete each structural ITAAC.

Tier 2, Table 14.3-2 contains a discussion of each Tier 1 ITAAC. The discussion of RXB structural ITAAC 03.11.06 points to Appendix 3B, new Table 3B-54 for the dimensions of the RXB critical sections. The discussion of CRB structural ITAAC 03.13.04 points to Appendix 3B, new Table 3B-55 for the dimensions of the CRB critical sections. The markup of Tier 2, Table 14.3-2 is attached.

Appendix 3B, Table 3B-54 and Table 3B-55 were added to clarify the location, figure reference, and critical dimension for each critical section. The markup of Appendix 3B and addition of the tables to Appendix 3B are attached.

Question b. response

RAI question b. requests NuScale to supplement the DCD with information on the shield wall.

Tier 1, Table 3.11-1 contains the dimensions of the RXB walls used for shielding. The only reference to this table is in the acceptance criteria for ITAAC No. 4, Table 3.11-2, which states "The thickness of RXB radiation shielding barriers is greater than or equal to the required thickness specified in Table 3.11-1."

Tier 1, Table 3.12-1 contains the dimensions of the RWB walls used for shielding. The only reference to this table is in the acceptance criteria for ITAAC No. 1, Table 3.12-2, which states "The thickness of RWB radiation shielding barriers is greater than or equal to the required thickness specified in Table 3.12-1."

The only mention in Tier 1 of "shield walls" are Tables 3.11-1 and 3.12-1, which contain shield wall dimensions. The only Tier 1 reference to these tables are the ITAAC No. 4, Table 3.11-2 and ITAAC No. 1, Table 3.12-2, acceptance criteria that refers the reader to the tables for radiation shielding barrier thicknesses. Thus, NuScale concludes that no additional description of "shield walls" is necessary.

RAI question b. also requests NuScale to provide the design description, figures including key dimensions, and ITAAC for the reactor pool, RFP, SFP, and associated pool liners.

Tier 1, Section 3.11.1 contains a description of the RXB and the RXB components. The description of the RXB components includes the pool liners. ITAAC 03.14.01 verifies that the pool liner withstands design basis loads without loss of its function during and after a safe shutdown earthquake.

The RFP and the SFP are part of the ultimate heat sink (UHS), which is water. The RXB does not contain the UHS. However, one of the RXB functions listed in Section 3.11.1 is that the RXB supports the UHS by "housing and providing structural support" of the UHS.

Thus, a revision to Tier 1 Section 3.11.1 RXB design description is not necessary. Similarly, figures, key dimensions and ITAAC for the reactor pool, RFP, SFP and associated liners are not required in Section 3.11.1.

Question c. response

RAI question c. requests NuScale to provide design descriptions, figures including key dimensions and ITAAC for the underground tunnel.

The underground tunnel is a part of the CRB, so the structural ITAAC No. 4, Table 3.13-1, for the Seismic Category I CRB applies to the tunnel.

No.	Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
4	The CRB at Elevation 120'-0"(except for the elevator shaft, the stairwells, and the fire protection vestibule which are Seismic Category II) and below is Seismic Category I and maintains its structural integrity under the design basis loads.	i. An inspection and analysis will be performed of the as-built CRB . ii. An inspection will be performed of the as-built CRB at Elevation 120'-0" and below.	i. A design report exists and concludes that the deviations between the drawings used for construction and the as-built CRB have been reconciled, and the CRB at Elevation 120'-0" and below (except for the elevator shaft, the stairwells, and the fire protection vestibule) maintains its structural integrity under the design basis loads. ii. The dimensions of the CRB critical sections conform to the approved design.

Since the CRB underground tunnel contains no critical sections, ITAAC No. 4, Table 3.13-1 acceptance criteria ii. does not apply to the tunnel. Acceptance criteria i. applies, but the completion of the as-built reconciliation does not require that building dimensions or building drawings be included in the Tier 1 design description of the building. Thus, no revisions to Tier 1 are required.

Impact on DCA:

FSAR Appendix 3B and new FSAR Tables 3B-54 and 3B-55, and FSAR Table 14.3-2 have been revised as described in the response above and as shown in the markup provided in this response.

- NPM support skirt
- NPM lug restraint

The following critical sections are presented for the CRB:

Walls

- Wall at grid line 3 - Interior structural wall
- Wall at grid line 4 - East exterior structural wall
- Wall at grid line A - North exterior structural wall

Slabs

- Basemat foundation
- Slab at EL. 100'-0" - Slab at grade

Pilasters

- Pilasters at grid line 1

T- Beams

- T-Beam at EL. 120'-0"

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Table 3B-54 and Table 3B-55 outline the critical sections and details for the RXB and CRB.

Section 1.2 contains architectural drawings of the RXB and CRB. Figure 1.2-10 through Figure 1.2-20 are for the RXB and Figure 1.2-21 through Figure 1.2-27 are for the CRB.

The concrete design process is organized by defining each wall, slab, pilaster, buttress and T-beam into several small zones on the structure and assigning identification names to these regions. The zone definitions are labeled according to the naming conventions below:

Wall Zone Definition Name: "A";"B";"C-D";"E-F"

where,

"A" = Building name

"B" = Grid line ID designation

"C-D" = Wall zone grid line ID range in the horizontal direction

"E-F" = Wall zone elevation range

For example a zone labeled as "RXB;1;E-D;100-120" is a RXB wall zone on grid line 1, between grid lines E and D, and located between elevations 100' and 120'.

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Table 3B-54: RXB Critical Sections

Structure Type	Location	Figure Reference	Critical Dimension*
Walls			
	Wall at grid line 1 - West outer perimeter wall at foundation level	3B-8, 3B-9	5'-0"
	Wall at grid line 3 - Interior weir wall	3B-11, 3B-12	5'-0"
	Wall at grid line 3 - Interior upper stiffener	3B-11, 3B-13	4'-0"
	Wall at grid line 4 - Interior wall of RXB	3B-15, 3B-16	5'-0"
	Wall at grid line 4 - Interior wall of RXB	3B-15, 3B-17	4'-0"
	Wall at grid line 6 - Upper stiffener wall	3B-19, 3B-20	4'-0"
	Wall at grid line 6 - Pool wall	3B-19, 3B-21	5'-0"
	Wall at grid line 6 - Pool wall	3B-19, 3B-21	7'-6"
	Wall at grid line E - South exterior wall extending upward from foundation level	3B-23, 3B-24	5'-0"
Slabs			
	Slab at EL. 100'-0" - Slab at grade	3B-29, 3B-27	3'-0"
	Slab at EL. 181'-0" - Slab at roof	3B-29, 3B-30	4'-0"
Pilasters			
	Pilasters at grid line A	3B-32, 3B-33, 3B-34, 3B-35, 3B-36	5'-0"
Beams			
	Beam at EL. 75'-0"	3B-38, 3B-39	2'-0"
Buttresses			
	Buttress at EL. 126'-0"	3B-41	5'-0"
NPM Bay			
	West wing wall	3B-43, 3B-44	5'-0"
	Pool wall	3B-46, 3B-47	5'-0"

*Dimensions shall be acceptable if found within the tolerances specified in ACI 117-06

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Table 3B-55: CRB Critical Sections

Structure Type	Location	Figure Reference	Critical Dimension*
Walls			
	Wall at grid line 3 - Interior structural wall	3B-66, 3B-67	2'-0"
	Wall at grid line 4 - East exterior structural wall	3B-69, 3B-70	3'-0"
	Wall at grid line A - North exterior structural wa	3B-72, 3B-73	3'-0"
Slabs			
	Basemat foundation	3B-75, 3B-76	5'-0"
	Slab at EL. 100'-0" - Slab at grade	3B-78, 3B-79	3'-0"
	Slab at EL. 100'-0" - Slab at grade	3B-78, 3B-79	2'-0"
Pilasters			
	Pilasters at grid line 1	3B-81, 3B-82	3'-0"
T-Beams			
	T-Beam at EL. 120'-0"	3B-84, 3B-85	3'-0"
	T-Beam at EL. 120'-0"	3B-84, 3B-85	2'-0"

*Dimensions shall be acceptable if found within the tolerances specified in ACI 117-06

RAI 09.01.04-1, RAI 09.05.01-6, RAI 14.03.02-1, RAI 14.03.02-2, RAI 14.03.03-1, RAI 14.03.03-6, RAI 14.03.03-7, RAI 14.03.09-1, RAI, 14.03.09-2, RAI 14.03.09-3, RAI 14.03.12-2, RAI 14.03.12-3

Table 14.3-2: Shared/Common Structures, Systems, and Components and Non-Structures, Systems, and components Based Design Features and Inspections, Tests, Analyses, and Acceptance Criteria Cross Reference

ITAAC No.	System	Discussion	DBA	Internal/External Hazard	Radiological	PRA & Severe Accident	FP
03.01.01	CRH	Testing is performed on the CRE in accordance with RG 1.197, "Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors," Revision 0, to demonstrate that air exfiltration from the CRE is controlled. RG 1.197 allows two options for CRE testing; either integrated testing (tracer gas testing) or component testing. Section 6.4 Control Room Habitability, describes the testing requirements for the CRE habitability program. Section 6.4 provides the maximum air exfiltration allowed from the CRE. In accordance with Table 14.2-18, a preoperational test using the tracer gas test method demonstrates that the air exfiltration from the CRE does not exceed the assumed unfiltered leakage rate provided in Table 6.4-1: Control Room Habitability System Design Parameters. Tracer gas testing in accordance with ASTM E741 will be performed to measure the unfiltered in-leakage into the CRE with the control room habitability system (CRHS) operating.			X		
03.01.02	CRH	The CRHS valves are tested by remote operation to demonstrate the capability to perform their function to transfer open and transfer closed under preoperational temperature, differential pressure, and flow conditions. In accordance with Table 14.2-18, a preoperational test demonstrates that each CRHS valve listed in Tier 1 Table 3.1-1 strokes fully open and fully closed by remote operation under preoperational test conditions. Preoperational test conditions are established that approximate design-basis temperature, differential pressure, and flow conditions to the extent practicable, consistent with preoperational test limitations.			X		

Table 14.3-2: Shared/Common Structures, Systems, and Components and Non-Structures, Systems, and components Based Design Features and Inspections, Tests, Analyses, and Acceptance Criteria Cross Reference (Continued)

ITAAC No.	System	Discussion	DBA	Internal/External Hazard	Radiological	PRA & Severe Accident	FP
		• S = Snow load. • Se = Extreme snow load. • W = Straight line wind load. • Wt = Loads due to the design basis tornado. • Wh = Loads due to the design basis hurricane. • Eo = Seismic load due to an operating basis earthquake. • Ess = Seismic load due to an SSE. • Ccr = Loads due to the RBC. • Pa = Pressure loads due to accident conditions. • Yj = Jet impingement load generated by a postulated pipe break. • Yr = Loads on the structure generated by the reaction of the broken pipe during a postulated break. • Ym = Missile impact load, or related internal moments and forces, on the structure generated by a postulated pipe break. • B = Loads due to buoyant force. Guidance for the content and structure of the design report is provided in Standard Review Plan Section 3.8.4, Appendix C as shown in Table 3.B-2. An ITAAC inspection and analysis is performed to ensure that deviations between the drawings used for construction and of the as-built RXB are reconciled and the RXB maintains its structural integrity under the design basis loads. The design report provides criteria for the reconciliation between design and as-built conditions. An ITAAC inspection is performed of the as-built RXB to verify that the dimensions of the RXB critical sections listed in Appendix B, Table 3B-54, conform to the approved design.					

Table 14.3-2: Shared/Common Structures, Systems, and Components and Non-Structures, Systems, and components Based Design Features and Inspections, Tests, Analyses, and Acceptance Criteria Cross Reference (Continued)

ITAAC No.	System	Discussion	DBA	Internal/External Hazard	Radiological	PRA & Severe Accident	FP
		Guidance for the content and structure of the design report is provided in Standard Review Plan Section 3.8.4, Appendix C as shown in Table 3.B-2. An ITAAC inspection and analysis is performed to ensure that deviations between the drawings used for construction and of the as-built CRB are reconciled. The design report provides criteria for the reconciliation between design and as-built conditions. An ITAAC inspection is performed of the as-built CRB at Elevation 120'-0" and below to verify that the dimensions of the CRB critical sections listed in Appendix B, Table 3B-55, conform to the approved design.					
03.13.05	CRB	Section 3.2.1, Seismic Classification, discusses that per RG 1.29, some SSC that perform no safety-related functions could, if they failed under seismic loading, prevent or reduce the functioning of Seismic Category I SSC. An ITAAC inspection and analysis is performed to verify that the as-built non-Seismic Category I SSC located where a potential for adverse interaction with a Seismic Category I SSC exists will not impair the ability of Seismic Category I SSC to perform their safety functions as demonstrated by one or more of the following criteria: • The collapse of the non-Seismic Category I structure will not cause the non-Seismic Category I structure to strike a Seismic Category I SSC. • The collapse of the non-Category I structure will not impair the integrity of Seismic Category I SSC, nor result in incapacitating injury to control room occupants. • The non-Category I structure will be analyzed and designed to prevent its failure under SSE conditions.	X				