RAIO-0917-56306

September 29, 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. 124 (eRAI No. 8981) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 124 (eRAI No. 8981)," dated August 04, 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. 8981:

- 03.04.02-1
- 03.04.02-2
- 03.04.02-3
- 03.04.02-4

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

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Enclosure 1: NuScale Response to NRC Request for Addtional Information eRAI No. 8981

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 8981

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

eRAI No.: 8981
Date of RAI Issue: 08/04/2017

NRC Question No.: 03.04.02-1

10 CFR 50, Appendix, GDC 2 requires, in part, that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as floods, tsunami, and seiches without loss of capability to perform their safety functions.

a. The staff requests the applicant to provide the analysis procedures utilized to transform the static and dynamic effects of the highest flood and groundwater levels into effective loads applied to seismic Category I structures.

b. In DCD Section 3.4.2 “Protection of Structures against Flood from External Sources,” the applicant describes that the lateral hydrostatic pressures on the structures from the design flood, in conjunction with ground water and soil pressure, are factored into the structural design as discussed in Sections 3.7.1 and 3.8.4 of the DCD. The staff did not find the lateral hydrostatic pressures due to the design flood level in the DCD Section 3.7.1. Therefore, the staff requests the applicant to describe where this information is located in the DCD or supplement the DCD to include the lateral hydrostatic pressures due to the design flood level.

NuScale Response:

Responses pertaining to FSAR Tier 2, Section 3.4.2, Protection of Structures Against Flood from External Sources, are provided as follows:

a. Hydrostatic groundwater pressure was included in lateral soil pressure calculations as an earth pressure load as described in FSAR Tier 2, Section 3.8.4.3.3. The total horizontal pressure is calculated as the sum of the hydrostatic pressure and lateral effective soil pressure, considering the buoyany effects. Because the water provides a buoyant effect, the effective pressure is calculated using the difference between the soil density and water density. The total lateral soil pressure value was increased to represent a conservative uniform loading condition to be applied to Seismic Category I structures. For the dynamic analysis, the groundwater table is analyzed at grade for the standard design. A saturated soil condition is included in the development of the generic soil

profiles described in FSAR Tier 2, Section 3.7.1.3.1. These saturated soil profiles are used in the soil-structure interaction (SSI) analyses to develop the design loads.

b. FSAR Tier 2, Section 3.7.1 is for seismic analysis and only describes static analysis with stiffness modifiers. “High groundwater” is mentioned for generic soil profiles as a conservative approach, but hydrostatic pressure is not discussed in this section. FSAR Tier 2, Section 3.4.2.1 is revised to remove the reference to Section 3.7.1. All lateral hydrostatic pressures on the structures from the design flood, in conjunction with the ground water and soil pressure, are factored into the structural design as discussed in Section 3.8.4.

Impact on DCA:

FSAR Tier 2, Section 3.4.2.1 has 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.: 8981
Date of RAI Issue: 08/04/2017

NRC Question No.: 03.04.02-2

10 CFR 50, Appendix, GDC 2 requires, in part, that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as floods, tsunami, and seiches without loss of capability to perform their safety functions.

In DCD Section 3.4.2 “Protection of Structures against Flood from External Sources,” the applicant describes that the below grade portions of the Seismic Category I structures provide protection for the safety-related and risk-significant SSCs from groundwater intrusion by utilizing waterstops, waterproofing, damp proofing, and watertight seals.

The staff requests the applicant to provide the specified design life for waterstops, waterproofing, damp proofing, and watertight seals. If the design life is less than the operating life of the plant, the applicant should describe how continued protection will be ensured.

NuScale Response:

FSAR Tier 2, Section 3.4.2, COL Item 3.4-5 states, "A COL applicant that references the NuScale Power Plant design certification will determine the extent of waterproofing and dampproofing needed for the underground portion of the Reactor Building and Control Building based on site-specific conditions." Therefore, COL Item 3.4-5 is revised to add that a COL applicant will provide the specified design life for waterstops, waterproofing, damp proofing, and watertight seals. If the design life is less than the operating life of the plant, the COL applicant should describe how continued protection will be ensured.

Impact on DCA:

FSAR Tier 2, Table 1.8-2 and Section 3.4.2.1 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.: 8981
Date of RAI Issue: 08/04/2017

NRC Question No.: 03.04.02-3

10 CFR 50, Appendix, GDC 2 requires, in part, that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as floods, tsunami, and seiches without loss of capability to perform their safety functions.

In DCD Section 3.8.4.1.1 “Reactor Building,” the applicant describes that there is a tunnel provided between the RXB and the CRB, this tunnel is part of the CRB. In DCD Section 3.8.4.1.2 “Control Building,” the applicant describes a 6” expansion gap between the end of the tunnel and the corresponding connecting walls on the RXB.

The staff requests the applicant to provide a discussion of how this expansion gap between the end of the tunnel and the corresponding connecting walls on the RXB is prevented from the groundwater intrusion. In addition, the staff requests the applicant to identify whether there are other Seismic Category I buried tunnels, pipes, conduits or duct banks within the scope of the NuScale design certification, and located below the PMF or ground water elevations. The applicant should list these items and describe any measures taken to protect them from the effects of PMF or groundwater.

NuScale Response:

COL Item 3.4-7 will be added to FSAR Tier 2, Section 3.4.2.1 to require the COL applicant to determine the extent of waterproofing and dampproofing needed to prevent groundwater and foreign material intrusion into the expansion gap between the end of the control building (CRB) tunnel and the corresponding connecting walls on the reactor building (RXB). The recommendation for the expansion joint sections exposed to the interior of the tunnel and to the atmosphere are to include an embedded seismic expansion joint seal with a cover plate designed for heavy traffic load conditions, which will prevent groundwater and foreign material from entering the structure.

There are no buried Seismic Category I pipes, conduits, or duct banks included in the NuScale design.

Impact on DCA:

FSAR Tier 2, Table 1.8-2 and Section 3.4.2.1 have been revised as described in the response above and as shown in the markup provided in this response.

RAI 02.04.13-1, RAI 03.04.02-1, RAI 03.04.02-2, RAI 03.04.02-3, RAI 03.05.01.04-1, RAI 03.05.02-2, RAI-03.06.02-15, RAI 03.07.01-2, RAI 03.07.01-3, RAI 03.07.02-8, RAI 03.07.02-12, RAI 03.09.02-15, RAI 03.09.06-6, RAI 03.11-8, RAI 03.11-14, RAI 10.02-1, RAI 10.02-2, RAI 10.04.10-2, RAI 13.01.01-1, RAI 13.01.01-1S1, RAI 13.02.02-1, RAI 13.03-4, RAI 13.05.02.01-2, RAI 13.05.02.01-2S1, RAI 13.05.02.01-3, RAI 13.05.02.01-3S1, RAI 13.05.02.01-4, RAI 13.05.02.01-4S1

Table 1.8-2: Combined License Information Items

Item No.	Description of COL Information Item	Section
COL Item 1.1-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will identify the site-specific plant location.	1.1
COL Item 1.1-2:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will provide the schedules for completion of construction and commercial operation of each power module.	1.1
COL Item 1.4-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will identify the prime agents or contractors for the construction and operation of the nuclear power plant.	1.4
COL Item 1.7-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will provide site-specific diagrams and legends, as applicable.	1.7
COL Item 1.7-2:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will list additional site-specific P&IDs and legends as applicable.	1.7
COL Item 1.8-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will provide a list of departures from the certified design.	1.8
COL Item 1.9-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will review and address the conformance with regulatory criteria in effect six months before the docket date of the COL application for the site-specific portions and operational aspects of the facility design.	1.9
COL Item 1.10-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will evaluate the potential hazards resulting from construction activities of the new NuScale facility to the safety-related and risk significant structures, systems, and components of existing operating unit(s) and newly constructed operating unit(s) at the co-located site per 10 CFR 52.79(a)(31). The evaluation will include identification of any management and administrative controls necessary to eliminate or mitigate the consequences of potential hazards and demonstration that the limiting conditions for operation of an operating unit would not be exceeded. This COL item is not applicable for construction activities (build-out of the facility) at an individual NuScale Power Plant with operating NuScale Power Modules.	1.10
COL Item 2.0-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will demonstrate that site-specific characteristics are bounded by the design parameters specified in Table 2.0-1. If site-specific values are not bounded by the values in Table 2.0-1, the COL applicant will demonstrate the acceptability of the site-specific values in the appropriate sections of its combined license application.	2.0
COL Item 2.1-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will describe the site geographic and demographic characteristics.	2.1
COL Item 2.2-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will describe nearby industrial, transportation, and military facilities. The COL applicant will demonstrate that the design is acceptable for each potential accident, or provide site-specific design alternatives.	2.2
COL Item 2.3-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will describe the site-specific meteorological characteristics for Section 2.3.1 through Section 2.3.5, as applicable.	2.3
COL Item 2.4-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will investigate and describe the site-specific hydrologic characteristics for Section 2.4.1 through Section 2.4.14, as applicable.	2.4
COL Item 2.5-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will describe the site-specific geology, seismology, and geotechnical characteristics for Section 2.5.1 through Section 2.5.5, below.	2.5

Table 1.8-2: Combined License Information Items (Continued)

Item No.	Description of COL Information Item	Section
COL Item 3.2-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will update Table 3.2-1 to identify the classification of site-specific SSC.	3.2
COL Item 3.3-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design will confirm that nearby structures exposed to severe and extreme (tornado and hurricane) wind loads will not collapse and adversely affect the RXB or Seismic Category I portion of the CRB.	3.3
COL Item 3.4-1:	A COL ~~Applicant~~applicant that references the NuScale Power plant design certification will confirm the final location of structures, systems, and components subject to flood protection and final routing of piping.	3.4
COL Item 3.4-2:	A COL ~~Applicant~~applicant that references the NuScale Power plant design certification will identify the selected mitigation strategy for each room containing structures, systems, and components subject to flood protection.	3.4
COL Item 3.4-3:	A COL ~~Applicant~~applicant that references the NuScale Power plant design certification will develop an inspection and maintenance program to ensure that each water-tight door, penetration seal, or other "degradable" measure remains capable of performing its intended function.	3.4
COL Item 3.4-4:	A COL ~~Applicant~~applicant that references the NuScale Power plant design certification will confirm that site-specific tanks or water sources are placed in locations where they cannot cause flooding in the Reactor Building or Control Building.	3.4
COL Item 3.4-5:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will determine the extent of waterproofing and dampproofing needed for the underground portion of the Reactor Building and Control Building based on site-specific conditions. Additionally, a COL applicant will provide the specified design life for waterstops, waterproofing, damp proofing, and watertight seals. If the design life is less than the operating life of the plant, the COL applicant should describe how continued protection will be ensured.	3.4
COL Item 3.4-6:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will confirm that nearby structures exposed to external flooding will not collapse and adversely affect the RXB or Seismic Category I portion of the CRB.	3.4
COL Item 3.4-7:	A COL applicant that references the NuScale Power Plant design certification will determine the extent of waterproofing and dampproofing needed to prevent groundwater and foreign material intrusion into the expansion gap between the end of the tunnel between the RXB and the CRB, and the corresponding RXB connecting walls.	3.4
COL Item 3.5-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant certified design will provide a missile analysis for the turbine generator which demonstrates that the probability of a turbine generator producing a low trajectory turbine missile is less than 10-5.	3.5
COL Item 3.5-2:	A COL ~~Applicant~~applicant that references the NuScale Power Plant certified design will address the effect of turbine missiles from nearby or co-located facilities.	3.5
COL Item 3.5-3:	A COL applicant that references the NuScale Power Plant certified design will confirm that automobile missiles cannot be generated within a 0.5 mile radius of safety-related SSC and risk-significant SSC requiring missile protection, that would lead to impact higher than 30 feet above plant grade. Additionally, if automobile missiles impact at higher than 30 feet above plant grade, the COL applicant will evaluate and show that the missiles will not compromise safety-related and risk-significant SSC.	3.5
COL Item 3.5-4:	A COL applicant that references the NuScale Power Plant design certification will evaluate site-specific hazards for external events that may produce more energetic missiles than the design basis missiles defined in FSAR Tier 2, Section 3.5.1.4.	3.5
COL Item 3.6-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will ~~determine if a high-energy line break or moderate energy line break outside of the Reactor Building, Control Building, or Radioactive Waste Building could affect site-specific essential equipment (or result in a transient or other off-normal event in a second module), and install protection~~complete the routing of piping systems outside of the reactor pool bay, identify the location of high- and moderate-energy lines, and update Table 3.6-1 as necessary.	3.6

3.4.2.1 Probable Maximum Flood

The design is the equivalent of a "Dry Site" as defined in Regulatory Guide 1.102, "Flood Protection for Nuclear Power Plants," Rev. 1. The Seismic Category I structures are protected from external floods and groundwater by establishing the following design parameters:

- The probable maximum flood elevation (including wave action) of the design is one foot below the baseline plant elevation (100'-0).
- The maximum groundwater elevation for the design is two feet below the baseline plant elevation.
- The finished grade for all building structures, except at a truck ramp on the west side of the Radwaste Building and CRB tunnel, is approximately six inches below the baseline plant elevation. The yard is graded with a minimum slope of 1.5% away from these structures.

The below grade portions of the Seismic Category I structures provide protection for the safety-related and risk-significant SSC from groundwater intrusion by utilizing the following design features:

- the portions of the buildings that are below grade consider the use of waterstops and waterproofing
- exterior below grade wall or floor penetrations have watertight seals
- waterproofing and dampproofing systems, if used, are applied per the International Building Code Section 1805 (Reference 3.4-3)
- waterproofing and dampproofing materials, if used in horizontal applications, will have a coefficient of static friction equal to or greater than the design parameter established in Table 2.0-1 for all interfaces between the basemat and soil.

The design does not use a permanent dewatering system.

RAI 03.04.02-1, RAI 03.04.02-2, RAI 03.04.02-3

COL Item 3.4-5: A COL applicant that references the NuScale Power Plant design certification will determine the extent of waterproofing and dampproofing needed for the underground portion of the Reactor Building and Control Building based on site-specific conditions. Additionally, a COL applicant will provide the specified design life for waterstops, waterproofing, damp proofing, and watertight seals. If the design life is less than the operating life of the plant, the COL applicant should describe how continued protection will be ensured.

RAI 03.04.02-1, RAI 03.04.02-2, RAI 03.04.02-3

COL Item 3.4-7: A COL applicant that references the NuScale Power Plant design certification will determine the extent of waterproofing and dampproofing needed to prevent groundwater and foreign material intrusion into the expansion gap between the end of the tunnel between the RXB and the CRB, and the corresponding RXB connecting walls.

RAI 03.04.02-1, RAI 03.04.02-3

The NuScale Power Plant design establishes a design basis flood level (including wave action) of one foot below the baseline top of concrete elevation at the ground level floor. Therefore, there are no dynamic flood loads on the RXB and CRB. The lateral hydrostatic pressures on the structures due to the design flood level, as well as ground water and soil pressure, are factored into the structural design as discussed in Section~~s 3.7.1 and~~ 3.8.4.

3.4.2.2 Probable Maximum Precipitation

The design utilizes bounding parameters for both rain and snow. The rainfall rate for roof design is 19.4 inches per hour and 6.3 inches for a 5 minute period and the design static roof load because of snow is 50 pounds per square foot. The extreme snow load is 75 pounds per square foot.

The roofs of the RXB and CRB prevent the undesirable buildup of standing water in conformance with Regulatory Guide 1.102 as described below:

- The RXB has a gabled roof, with the sloping portions to the north and south. There are no parapets on the top, flat section.
- The CRB roof is a sloped steel structure with scuppers in the parapet designed to allow rainfall to drain off the roof.

The bounding rain and snow loads are used in the structural analysis described in Section 3.8.4.

3.4.2.3 Interaction of Non-Seismic Category I Structures with Seismic Category I Structures

Nearby structures are assessed, or analyzed if necessary, to ensure that there is no credible potential for interactions that could adversely affect the Seismic Category I RXB and CRB. Figure 1.2-2 provides a site plan showing the plant layout. The non-Seismic Category I structures that are adjacent to the Seismic Category I RXB and CRB are:

- RWB (Seismic Category II) adjacent to RXB
- CRB above elevation 120' (Seismic Category II), above Seismic Category I CRB and adjacent to RXB
- [[North and south Turbine Generator Buildings (Seismic Category III), adjacent to RXB]]
- [[Central Utilities Building (Seismic Category III), adjacent to CRB]]
- [[Annex Building (Seismic Category III), adjacent to RXB]]

The Seismic Category II portion of the CRB was analyzed along with the Seismic Category I portion of the structure and shown to be capable of withstanding the effects of the probable maximum precipitation.

The RWB has been evaluated and shown to be capable of withstanding the effects of the probable maximum precipitation.

Response to Request for Additional Information
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eRAI No.: 8981
Date of RAI Issue: 08/04/2017

NRC Question No.: 03.04.02-4

10 CFR 50, Appendix, GDC 2 requires, in part, that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as floods, tsunami, and seiches without loss of capability to perform their safety functions.

SRP 3.4.2 Acceptance criteria 3 states the dynamic loads of wave action should be considered where the flood level is above the proposed plant grade, and its acceptable procedures for determining such dynamic loads.

In DCD Section 3.4.2.1 “Probable Maximum Flood,” the applicant did not provide the finished grade elevation at a truck ramp on the west side of the Radwaste Building and CRB tunnel. Because it is possible that the finished grade elevation in this area might be below the flood level, and because CRB tunnel is a seismic Category I structure, the staff requests the applicant to provide finished grade elevation of CRB tunnel and evaluate whether the dynamic loads due to wave action should be considered at this location if the flood level is above the proposed plant grade elevation.

NuScale Response:

The top of concrete elevation of the control building (CRB) tunnel is at elevation 100 ft, finished grade. The probable maximum flood level of the design is at elevation 99 ft. The CRB tunnel is not expected to experience any wave action given the site characteristics as described in FSAR Tier 2, Chapter 2. Flooding exterior to the CRB would not impact the ability of the plant to safely shutdown as the structure is sealed and penetrations below grade are minimized as described in FSAR Tier 2, Section 3.4.2.1.

Impact on DCA:
There are no impacts to the DCA as a result of this response.