



February 12, 2018

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. 298 (eRAI No. 9228) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 298 (eRAI No. 9228)," dated December 15, 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. 9228:

- 03.07.04-2

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,

A handwritten signature in black ink, appearing to read "Zackary W. Rad".

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. 9228



Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9228

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

eRAI No.: 9228

Date of RAI Issue: 12/15/2017

NRC Question No.: 03.07.04-2

Appendix S to 10 CFR Part 50 requires that suitable instrumentation be provided for the evaluation of the seismic response of nuclear plant features important to safety after an earthquake. On the public meeting conducted October 10, 2017, to discuss NuScale's response to DCA RAI 8927, Question 03.07.04-1, NRC staff mention the importance regarding the use of the updated Regulatory Guide (RG) 1.12, Revision 3, "Nuclear Power Plant Instrumentation for Earthquakes" and/or the American National Standard (ANS)-2.2- 2016, "Earthquake Instrumentation for Nuclear Power Plants." Both of these documents specify the current acceptable means for the placement of seismic instrumentation at a site and in structures (in lieu of RG 1.12, Revision 2, which was published in 1997).

The updated RG 1.12 was first released by the NRC for public comment as a draft DG-1332 in September 2016 (ML16104A220), and the final version became publically available on November 8, 2017 (ML17094A831). The revision to the RG 1.12 incorporates ANS-2.2- 2016 and addresses the current state-of-practice for seismic instrumentation that allows for a more reliable evaluation for seismic response of the reactor building (RXB) after an earthquake. Specifically, this would include the following:

- A. downhole seismic instrument. NuScale's proposed basemat is located at the depth of 86 ft. below the plant grade. According to RG 1.12, Rev. 3, if the depth of the site specific Ground Motion Response Spectra (GMRS) or Foundation Input Response Spectra (FIRS) exceeds 40 ft. below the plant grade, two free-field seismic instruments are recommended: (a) one located at the ground surface and (b) the second one in the borehole to record ground motion at the elevation corresponding to the GMRS or FIRS.
- B. Additional seismic instrumentation on the basemat. Considering the length (approximately 350 ft.) and the irregularity of the weight distribution in the RXB, RG 1.12, Rev. 3, recommends more than one seismic instrument on the basemat for such structures. The instruments should be appropriately placed to record the rocking or torsional responses predicted by the engineering analyses.

In order for the NRC staff to determine if the site, RXB, and CRB are adequately instrumented with seismic monitors in accordance with Appendix S to 10 CFR Part 50, please update Section



3.7.4 consistent with the RG 1.12, Rev. 3, and/or ANS-2.2-206 recommendations stated above; or provide an equivalent methodology and justification that would meet their intent for the placement of instrumentation that would allow for a reliable evaluation of the RXB's seismic response after an earthquake.

NuScale Response:

In NuScale's previous response to RAI 8927 Question 03.07.04-1, locations of six seismic monitoring units within the reactor building (RXB) and control building (CRB) were identified. The locations were selected to coincide with key mass points used to develop the enveloping floor response spectra shown in FSAR Tier 2, Figures 3.7.2-106, 3.7.2-109, 3.7.2-112, 3.7.2-116 and 3.7.2-119. During a public meeting, on October 10, 2017, NuScale and the NRC staff discussed incorporation of the updated Regulatory Guide (RG) 1.12, as it applies to seismic monitoring instrumentation

In accordance with RG 1.12 Revision 3, released November 8, 2017, the seismic monitoring instrument locations for the NuScale Power plant design have been updated and are listed in FSAR Tier 2, Section 3.7.4.2. Two new sensors have been added to the design, a downhole sensor in the free field and an additional sensor located on the basemat of the RXB.

To ensure the plant is properly instrumented to assess the effects of a potential earthquake, eight locations have been identified for seismic monitoring instrumentation. These locations include in the free-field, downhole, foundation level and other elevations in the RXB and the CRB. The sensors in the structures have been located, based on the criteria outlined in RG 1.12, at amplified locations and have been identified based on seismic analyses. Each location has been modeled as a mass point in the building dynamic analysis so that the measured motion can be directly compared with the design spectra. It is noted that per Tier 2 Section 3.7.4.1 of the FSAR, the NuScale design requires a deviation from the guidance in the RG 1.12 because the seismic instrumentation cannot be included inside containment. In the selection of the exact sensor locations, the COL Applicant shall adhere to the following criteria to ensure the site RXB and CRB are adequately instrumented for a seismic event:

1. Two sensor units are located in the free field. One sensor is located at the free ground surface consistent with the site conditions and properties used to determine the site-specific ground motion response spectra (GMRS). The second is a downhole instrument located at the foundation level as close as being directly over the first sensor as practical.
2. Two sensor units are located in the RXB on the basemat at elevation 24'-0". One sensor is located near the intersection of Grid Lines RX-1 and RX-A. The other sensor is located near the intersection of Grid Lines RX-7 and RX-A. Note, the NuScale foundation design is equivalent to Figure 1, and described in Table 1 of ANS-2.2-2016 as an "individual foundation" design configuration. Per RG 1.12, this design configuration requires a single sensor on the basemat, however, a second sensor has been added to the RXB basemat



to detect possible rocking or torsional behaviors.

3. A fifth sensor unit is located in the RXB at elevation 75'-0" on the east face of Grid Line RX-6, between RX-B and RX-C.
4. A sixth sensor unit is located on the RXB roof near the intersection of Grid Lines RX-4 and RX-C.
5. A seventh sensor unit is located in the CRB on the basemat at elevation 50'-0" near the intersection of Grid Lines CB-4 and CB-A.
6. An eighth sensor unit is located in the CRB at elevation 100'-0" on the east face of Grid Line CB-1 between CB-B and CB-C.

Impact on DCA:

FSAR Tier 2, Section 3.7.4.2 has been revised as described in the response above and as shown in the markup provided in this response.

in the building dynamic analysis so that the measured motion can be directly compared with the design spectra.

Exact sensor location is site-specific and will be discussed by the COL applicant as part of the response to COL Item 3.7-1.

RAI 03.07.04-1

In the selection of the exact sensor locations, the COL Applicant shall adhere to the following criteria to ensure the site, RXB and CRB are adequately instrumented for a seismic event:

RAI 03.07.04-1, RAI 03.07.04-2

1) Two sensor units are located in the free field. One sensor is located at the free ground surface consistent with the site conditions and properties used to determine the site-specific GMRS. The second is a downhole instrument located at the foundation level as close as being directly over the first sensor as practical.

RAI 03.07.04-1, RAI 03.07.04-2

2) Two sensor units are located in the RXB on the basemat at elevation 24'-0". One sensor is located near the intersection of Grid Lines RX-1 and RX-A. The other sensor is located near the intersection of Grid Lines RX-7 and RX-A.

RAI 03.07.04-1, RAI 03.07.04-2

3) A fifth sensor unit is located in the RXB at elevation 75'-0" on the east face of Grid Line RX-6, between RX-B and RX-C.

RAI 03.07.04-1, RAI 03.07.04-2

4) A sixth sensor unit is located on the RXB roof near the intersection of Grid Lines RX-4 and RX-C.

RAI 03.07.04-1, RAI 03.07.04-2

5) A seventh sensor unit is located in the CRB on the basemat at elevation 50'-0" near the intersection of Grid Lines CB-4 and CB-A.

RAI 03.07.04-1, RAI 03.07.04-2

6) An eighth sensor unit is located in the CRB at elevation 100'-0" on the east face of Grid Line CB-1 between CB-B and CB-C.

Sensor type is site-specific and will be discussed by the COL Applicant as part of the response to COL Item 3.7-1.

3.7.4.3 Control Room Operator Notification

The SMS provides Seismic Category I annunciation in the MCR. Separately, the SMS provides information to the MCR via the PCS.

The COL applicant will discuss alarm levels based upon the site-specific operating basis earthquake as part of the response to COL Item 3.7-1.