



March 02, 2018

Docket No. 52-048

U.S. Nuclear Regulatory Commission  
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**SUBJECT:** NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 241 (eRAI No. 9151) on the NuScale Design Certification Application

**REFERENCES:** 1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 241 (eRAI No. 9151)," dated September 27, 2017  
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 241 (eRAI No.9151)," dated November 21, 2017

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) supplemental response to the referenced NRC Request for Additional Information (RAI).

The Enclosure to this letter contains NuScale's supplemental response to the following RAI Question from NRC eRAI No. 9151:

- 19-31

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 Darrell Gardner at 980-349-4829 or at [dgardner@nuscalepower.com](mailto:dgardner@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 Supplemental Response to NRC Request for Additional Information eRAI No. 9151



**Enclosure 1:**

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 9151

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

**eRAI No.:** 9151

**Date of RAI Issue:** 09/27/2017

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### **NRC Question No.:** 19-31

10 CFR 52.47(a)(27) states that a DC application must contain an FSAR that includes a description of the design-specific probabilistic risk assessment (PRA) and its results. In accordance with the Statement of Consideration (72 FR 49387) for the revised 10 CFR Part 52, the staff reviews the information contained in the applicant's FSAR Chapter 19, and issues requests for additional information (RAI) and conducts audits of the complete PRA (e.g., models, analyses, data, and codes) to obtain clarifying information as needed. The staff uses guidance contained in SRP Chapter 19.0 Revision 3, "Probabilistic Risk Assessment and Severe Accident Evaluation for New Reactors." In accordance with SRP Chapter 19.0 Revision 3, the staff determines whether:

"The assumptions made in the applicant's PRA during design development and certification, in which a specific site may not have been identified or all aspects of the design (e.g., balance of plant) may not have been fully developed, are identified in the DC [design certification] application and either remain valid or are adequately addressed within the COL [combined license] application," and

"FSAR Chapter 19 includes PRA quantitative and qualitative results, including CDF [core damage frequency], LRF [large release frequency], the identification of *key PRA assumptions*, the identification of PRA-based insights, and discussion of the results and insights from importance, sensitivity, and uncertainty analyses." (Emphasis added)

The DC PRA results and insights rely on key assumptions to account for the incomplete design and operational details. These key assumptions used in the DC PRA need to be appropriately evaluated and dispositioned during the COL phases to ensure that the PRA results and insights continue to remain valid.

The staff has reviewed COL Item 19.1-8 which states that: "A COL applicant that references the NuScale Power Plant design certification will confirm the applicability of assumptions and data and modify as necessary for the to the [*sic*] as-built/as-operated probabilistic risk assessment" Based on its review, the staff has determined that the docketed action statement does not provide adequate guidance to ensure that key PRA assumptions identified in FSAR Tables 19.1-21, 19.1-28, 19.1-46, 19.1-54, 19.1-58, 19.1- 61, and 19.1-71 will be appropriately evaluated and dispositioned during the COL phases. First, the guidance on how unconfirmed

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assumptions or data are to be addressed is ambiguous. Second, the docketed action statement does not identify the specific assumptions or data to be confirmed, which are in the tables listed above.

Please revise COL Item 19.1-8 to clarify that all key assumptions supporting all hazards and all modes of the PRA will be evaluated and dispositioned by the COL applicant or by the COL holder for the plant- specific probabilistic risk assessment as appropriate, and that any unconfirmed assumptions or data will be addressed appropriately in the plant-specific PRA.

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### **NuScale Response:**

NuScale provided its original response to RAI 9151, Question 19.1-31, in letter RAIO-1117-57303, dated November 21, 2017. Per discussion with the staff during a public meeting on January 23, 2018, NuScale is modifying its response with regard to the FSAR markup to clarify that COL Item 19.1-8 refers to "key assumptions". Key assumptions are summarized in tabular form for each internal and external hazard, and operating mode, evaluated in the NuScale probabilistic risk assessment (PRA); tables of key assumptions are consistently titled as "Key Assumptions". The change is as follows:

The following text regarding COL Item 19.1-8 in FSAR Section 19.1.9.1 :

"A COL applicant that references the NuScale Power Plant design certification will confirm the validity of assumptions and data used in the design certification application and modify, as necessary, for applicability to the to the as-built, as-operated probabilistic risk assessment."

Is replaced with:

"A COL applicant that references the NuScale Power Plant design certification will confirm the validity of the "key assumptions" and data used in the design certification application PRA and modify, as necessary, for applicability to the as-built, as-operated PRA."

FSAR Table 1.8-2 has been modified for consistency with the revised COL Item 19.1-8 wording.

### **Impact on DCA:**

FSAR Section 19.1.9.1 and Table 1.8-2 have been revised as described in the response above and as shown in the markup provided in this response.

RAI 01-61, 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 03.06.03-11, 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 03.09.02-48, RAI 03.09.03-12, RAI 03.09.06-5, RAI 03.09.06-6, RAI 03.09.06-16, RAI 03.09.06-16S1, RAI 03.09.06-27, RAI 03.11-8, RAI 03.11-14, RAI 03.11-14S1, RAI 03.13-3, RAI 05.04.02.01-13, RAI 05.04.02.01-14, RAI 06.04-1, RAI 09.01.02-4, RAI 09.01.05-3, RAI 09.01.05-6, RAI 09.03.02-3, RAI 09.03.02-4, RAI 09.03.02-5, RAI 09.03.02-6, RAI 09.03.02-8, RAI 10.02-1, RAI 10.02-2, RAI 10.03.06-1, RAI 10.04.06-1, RAI 10.04.06-2, RAI 10.04.06-3, 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, RAI 19-31, RAI 19-31S1

**Table 1.8-2: Combined License Information Items**

<b>Item No.</b>	<b>Description of COL Information Item</b>	<b>Section</b>
COL Item 1.1-1:	A COL 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 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 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 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 that references the NuScale Power Plant design certification will list additional site-specific piping and instrumentation diagrams and legends as applicable.	1.7
COL Item 1.8-1:	A COL 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 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 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 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 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 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 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 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 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 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
COL Item 3.2-1:	A COL applicant that references the NuScale Power Plant design certification will update Table 3.2-1 to identify the classification of site-specific structures, systems, and components.	3.2

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

Item No.	Description of COL Information Item	Section
COL Item 19.1-2:	A COL applicant that references the NuScale Power Plant design certification will identify and describe specific risk-informed applications being implemented during the COL application phase.	19.1
COL Item 19.1-3:	A COL applicant that references the NuScale Power Plant design certification will specify and describe the use of the probabilistic risk assessment in support of licensee programs during the construction phase (from issuance of the COL up to initial fuel loading).	19.1
COL Item 19.1-4:	A COL applicant that references the NuScale Power Plant design certification will specify and describe risk-informed applications during the construction phase (from issuance of the COL up to initial fuel loading).	19.1
COL Item 19.1-5:	A COL applicant that references the NuScale Power Plant design certification will specify and describe the use of the probabilistic risk assessment in support of licensee programs during the operational phase (from initial fuel loading through commercial operation).	19.1
COL Item 19.1-6:	A COL applicant that references the NuScale Power Plant design certification will specify and describe risk-informed applications during the operational phase (from initial fuel loading through commercial operation).	19.1
COL Item 19.1-7:	A COL applicant that references the NuScale Power Plant design certification will evaluate site-specific external event hazards, screen those for risk-significance, and evaluate the risk associated with external hazards that are not bounded by the design certification.	19.1
COL Item 19.1-8:	A COL applicant that references the NuScale Power Plant design certification will confirm the validity of the "key assumptions" and data used in the design certification application PRA and modify, as necessary, for applicability to the as-built, as-operated probabilistic risk assessment PRA.	19.1
COL Item 19.2-1:	A COL applicant that references the NuScale Power Plant design certification will develop severe accident management guidelines and other administrative controls to define the response to beyond-design-basis events.	19.2
COL Item 19.2-2:	A COL applicant that references the NuScale Power Plant design certification will use the site-specific probabilistic risk assessment to evaluate and identify improvements in the reliability of core and containment heat removal systems as specified by 10 CFR 50.34(f)(1)(i).	19.2
COL Item 19.2-3:	A COL applicant that references the NuScale Power Plant design certification will evaluate severe accident mitigation design alternatives screened as "not required for design certification application."	19.2
COL Item 19.3-1:	A COL applicant that references the NuScale Power Plant design certification will identify site-specific regulatory treatment of nonsafety systems (RTNSS) structures, systems, and components and applicable RTNSS process controls.	19.3
COL Item 20.1-1:	A COL applicant that references the NuScale Power Plant design certification will ensure equipment and structures credited for diverse and flexible coping strategies are designed to be available following a site-specific seismic hazard.	20.1
COL Item 20.1-2:	A COL applicant that references the NuScale Power Plant design certification will determine if a flood hazard is applicable at the site location. If a flood hazard is applicable, then the COL applicant will ensure equipment and structures credited for diverse and flexible coping strategies are designed to be available following a site-specific flood (including wave action) hazard.	20.1
COL Item 20.1-3:	A COL applicant that references the NuScale Power Plant design certification will determine if high wind and applicable missile hazards are applicable at the site location. If high wind and applicable missile hazards are applicable, then the COL applicant will ensure equipment and structures credited for diverse and flexible coping strategies are designed to be available following a site-specific high wind and applicable missile hazards.	20.1
COL Item 20.1-4:	A COL applicant that references the NuScale Power Plant design certification will determine if snow, ice and extreme cold temperature hazards are applicable at the site location. If snow, ice and extreme cold hazards are applicable, the COL applicant will ensure equipment and structures credited for diverse and flexible coping strategies are designed to be available following a site-specific snow, ice or extreme cold temperature hazard.	20.1

- the evaluated external events (seismic, internal fire, internal flood, external flood, and high winds) do not pose a significant risk to the plant.

RAI 19-27

The CDF and LRF risk metrics illustrate conformance with the quantitative health objectives defined in Reference 19.1-36. Conformance with the prompt fatality quantitative health objective (QHO) is illustrated by an LRF that is well below the surrogate risk metric of less than  $1 \times 10^{-6}$  per reactor year. Similarly, risk results show that NuScale demonstrates conformance with the latent cancer QHO as illustrated by a CDF that is well below the surrogate metric of less than  $1 \times 10^{-4}$  per reactor year.

RAI 19-31, RAI 19-31S1

COL Item 19.1-8: A COL applicant that references the NuScale Power Plant design certification will confirm the validity of the "key assumptions" and data used in the design certification application PRA and modify, as necessary, for applicability to the as-built, as-operated ~~probabilistic risk assessment~~PRA.

### 19.1.9.2 Perspective of the NuScale Small Core with Respect to Safety Goals

The safety goals are independent of design, thus the size of the potential radionuclide source term is not considered in the core damage or large release frequency safety goals. These goals are surrogates for potential public health consequences. With regard to potential consequences, an additional insight into the significance of a core damage event can be gained by considering the small NuScale radionuclide source term.

As a small reactor, the potential radionuclide source term associated with a severe accident is much smaller than that associated with typical currently operating and large advanced plant designs, e.g., the source term is five percent of that associated with a 1000 MWe design. Even the postulate of severe accidents occurring in all modules would produce a source term that is only a fraction of that associated with a larger design. Thus, while the risk to public health and safety is small as evidenced by the very low calculated CDF, LRF and CCFP risk metrics, the risk of operating a NuScale plant is further reduced because of the small potential radionuclide source term.

### 19.1.9.3 "Focused" Probabilistic Risk Assessment

An additional perspective on the CDF is gained by reporting results of a "focused PRA" which credits only safety-related SSC. In the focused PRA, SSC that are not safety-related are assumed to be failed. The focused PRA was performed as a sensitivity study to the full-power, internal events PRA with results provided in Table 19.1-22 and Table 19.1-31. The results illustrate that safety goals for CDF and LRF are met without reliance on nonsafety-related SSC. A focused PRA was also performed as a sensitivity to the LPSD probabilistic risk assessment; results show that safety goals are met without reliance on nonsafety-related SSC.