RAIO-1117-57303

November 21, 2017

Docket No. 52-048

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

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 241 (eRAI No. 9151)," dated September 27, 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. 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.

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. 9151

Enclosure 1:

NuScale 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

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

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.

NuScale Response:

As stated in Question 19-31, the PRA performed to support design certification is based on assumptions to account for design and operational details that will be available only for an as-built/as-operated plant. The design certification PRA is also based on generic data that may be refined when as-built detail or as-operated experience becomes available. Accordingly, key assumptions have been summarized in FSAR Tables 19.1-21, 19.1-28, 19.1-40, 19.1-46, 19.1-54, 19.1-58, 19.1-61, and 19.1-71. These tables commonly use a heading that includes the wording “Key Assumption”; the tables are associated with specific hazards and operational modes that have been evaluated for design certification. Data sources have also been identified in the FSAR text and summarized in tabular form. The COL items in Chapter 19 are written at a summary level to identify the major COL activities associated with developing a PRA to support an as-built/as-operated facility; thus, itemized references to specific tables have not been included in COL Item 19.1-8 itself.

To more clearly address the applicability of PRA results and insights to the as-built/as-operated facility, COL Item 19.1-8, provided in FSAR Section 19.1.9.1, has been revised. The revision states that the COL applicant that references the NuScale design certification must confirm the “validity of the key assumptions and data used in the design certification application” and modify, as necessary, for "applicability" to the as-built/as-operated PRA.

NuScale notes that COL items facilitate and provide guidance for the transition to an as-built/as-operated PRA. In addition to the specific COL items identified in the FSAR, development of an acceptable combined license application is based on regulatory requirements, such as 10 CFR 52.79(46), regulatory guidance documents, such as DC/COL-ISG-28, and industry standards, such as the ASME/ANS PRA Standard.

Impact on DCA:

FSAR Section 19.1.9.1 has 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 03.09.02-48, RAI 03.09.03-12, RAI 03.09.06-5, RAI 03.09.06-6, RAI 03.09.06-16, RAI 03.09.06-27, RAI 03.11-8, RAI 03.11-14, RAI 03.13-3, 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 10.04.07-3 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

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

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

Item No.	Description of COL Information Item	Section
COL Item 17.5-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will describe the quality assurance program applicable to site-specific design activities and to the construction and operations phases.	17.5
COL Item 17.6-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will describe the program for monitoring the effectiveness of maintenance required by 10 CFR 50.65.	17.6
COL Item 18.5-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will address the staffing and qualifications of non-licensed operators.	18.5
COL Item 18.12-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will provide a description of the human performance monitoring program in accordance with applicable NUREG-0711 or equivalent criteria.	18.12
COL Item 19.1-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will identify and describe the use of the probabilistic risk assessment in support of licensee programs being implemented during the COL application phase.	19.1
COL Item 19.1-2:	A COL ~~Applicant~~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~~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~~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~~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~~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~~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~~applicant that references the NuScale Power Plant design certification will confirm the ~~applicability~~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.	19.1
COL Item 19.2-1:	A COL ~~Applicant~~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~~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~~applicant that references the NuScale Power Plant design certification will evaluate all severe accident mitigation design alternatives screened as "not required for design certification application."	19.2
COL Item 19.3-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will identify any site-specific RTNSS SSC and applicable RTNSS process controls.	19.3
COL Item 20.1-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will ensure equipment and structures credited for FLEX strategies are designed to be available following a site-specific seismic hazard.	20.1

- the mean value of the CDF of a NuScale module is 3.0E-10/mcyr as compared to the CDF safety goal of 1.0 E-4 per reactor year.
  - The ATWS contribution to CDF is 2.2E-11/mcyr, significantly less than the target of 1.0E-5 per reactor year provided in SECY 83-293.
  - With regard to a multi-module configuration, the MM-CDF is about 10 percent of the CDF.
- the mean value large release frequency of a NuScale module, LRF, is 2.1E-11/mcyr as compared to the LRF safety goal of 1.0 E-6 per reactor year.
  - With regard to a multi-module configuration, the MM-LRF is less than 10 percent of the LRF.
- the composite CCFP of a module is less than the safety goal of 0.1.
- 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 (QHOs) defined in Reference 19.1-36. Conformance with the prompt fatality QHO is illustrated by an LRF that is well below the surrogate risk metric of less than 1×10^{-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 1×10^{-4} per reactor year.

RAI 19-31

COL Item 19.1-8: A COL applicant that references the NuScale Power Plant design certification will confirm the ~~applicability~~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.

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.