RAIO-0818-61553

August 27, 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 Supplemental Response to NRC Request for Additional Information No. 116 (eRAI No. 8926) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 116 (eRAI No. 8926)," dated August 01, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 116 (eRAI No.8926)," dated September 29, 2017
3. NuScale Power, LLC Supplemental Response to "NRC Request for Additional Information No. 116 (eRAI No. 8926)" dated May 21, 2018

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 Enclosures to this letter contain NuScale's supplemental response to the following RAI Question from NRC eRAI No. 8926:

- 19-23

Enclosure 1 is the proprietary version of the NuScale Supplemental Response to NRC RAI No. 116 (eRAI No. 8926). NuScale requests that the proprietary version be withheld from public disclosure in accordance with the requirements of 10 CFR § 2.390. The enclosed affidavit (Enclosure 3) supports this request. Enclosure 2 is the nonproprietary version of the NuScale response.

This letter and the enclosed responses make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Paul Infanger at 541-452-7351 or at pinfanger@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

Distribution: Gregory Cranston, NRC, OWFN-8G9A
Samuel Lee, NRC, OWFN-8G9A
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Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8926, proprietary

Enclosure 2: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8926, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0818-61554

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8926, proprietary

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Enclosure 2:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8926, nonproprietary

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

eRAI No.: 8926
Date of RAI Issue: 08/01/2017

NRC Question No.: 19-23

10 CFR 52.47(a)(27) states that a design certification application (DCA) must contain a final safety analysis report (FSAR) that includes a description of the design-specific probabilistic risk assessment (PRA) and its results. 10 CFR 52.47(a)(2) states that the standard plant should reflect through its design, construction, and operation an extremely low probability for accidents that could result in the release of radioactive fission products. 10 CFR 52.47(a)(4) states that each DCA must contain an FSAR that includes an analysis and evaluation of the design and performance of systems, structures and components (SSCs). The objectives of the analysis and evaluation are to assess the risk to public health and safety resulting from operation of the facility and to determine the margins of safety during normal operations and transient conditions anticipated during the life of the facility. Standard Review Plan (SRP) Section 19.0, Revision 3, states, “Shutdown and refueling operations for small, modular reactor designs may be performed in ways that are new and completely different from those used at large traditional light water reactors (LWRs) either licensed or under review by the NRC. In these cases, a more in-depth review will be needed to ensure that the PRA model is of acceptable scope, level of detail, and technical adequacy.”

The staff reviewed FSAR Chapters 9 and 19 and ER-P060-7085, “Dropped Module Consequence Analysis,” Revision 1, dated 8/11/2016. The staff is requesting that the FSAR be updated with the following key assumptions and details regarding module drop and module movement, so the staff can make a reasonable assurance finding regarding the adequacy of the risk insights obtained from the dropped module risk analysis.

1. The Dropped Module Consequence Analysis report states that the reactor pressure vessel (RPV) and containment vessel (CNV) are pressurized with {{ }} 2(a),(c) which is a design condition prior to transporting the module. The staff requests that the rationale for this design condition be discussed in the FSAR Section 19.1.6 and that this design condition be included as a key assumption for the low power and shutdown risk analysis. psia of nitrogen gas,

2. The Dropped Module Consequence Analysis report states that the assessment is based on the module being shutdown for 48 hours. The staff requests the applicant to justify in

the FSAR how this PRA assumption will be maintained by the combined license (COL) holder (e.g., by a Limiting Condition of Operation, a Condition of the License, or some other means).

3. Table 19.1-71, “Key Assumptions for the Low Power and Shutdown Probabilistic Risk Assessment,” states that the module is kept below the height that could damage the ultimate heat sink (UHS). The staff requests the applicant to define this height as a key assumption in the module drop analysis and justify in the FSAR how this PRA assumption will be maintained by the COL holder (e.g., by a Limiting Condition of Operation, a Condition of the License, or some other means). The staff is also requesting the applicant to justify the basis for this height in the FSAR.

4. Table 19.1-74, “External Flooding Susceptibility during Low Power and Shutdown Plant [(LPSD)],” states that operators are assumed not to move modules with the crane when forecasts indicate the potential for flooding hazards. Therefore, the external flooding effects were not considered for plant operating states (POSs) 3, 4, and 5. The staff finds that this assumption regarding the availability of forecasts to indicate a potential flooding hazard does not apply to all flooding mechanisms such as catastrophic dam breach. The staff requests that a COL information item be added to the FSAR requiring a COL applicant referencing the certified NuScale design to evaluate the risk of external flooding during POSs 3, 4, and 5.

5. The staff is requesting the applicant to clarify in FSAR Section 19.1.6 whether a module drop event (with the CNV intact or not) results in any automated signals or manual actions for the dropped module or any other modules such as reactor trip or main control room isolation.

6. The second type of module drop event, called "UPV," reflects the possibility of dropping the upper RPV section onto the stationary core, which remains in the reactor flange tool (RFT). The applicant states that “The radiological dose calculation of potential radionuclide release due to damaged fuel indicates that a large release does not occur due to this type of module drop. Thus, the UPV type of module drop is not considered further in the LPSD probabilistic risk assessment.” The staff requests the applicant to (1) clarify what the acronym “UPV” stands for; and (2) justify in FSAR Section 19.1.6 why the source term from module drop events during refueling operations (with the containment open or breached) does not result in a large release.

NuScale Response:

NuScale is supplementing its response to RAI 8926 (Question 19-23) originally provided in letter RAIO-0917-56321 (dated September 29, 2017) and supplemented in letter RAIO-0518-60115 (dated May 21, 2018). This supplemental response results from discussions with the NRC in a public meeting held on June 27, 2018.

The NuScale response to Item 1 as provided in RAIO-0518-60115 is supplemented to add the following sentence:

> "FSAR Sections 9.3.6 and 19.1.6.1.3 have also been modified to refer to pressurization of the module in support of refueling and maintenance operations."

Impact on DCA:

FSAR Sections 9.3.6 and 19.1.6.1.3 have been revised as described in the response above and as shown in the markup provided with this response.

9.3.6 Containment Evacuation System and Containment Flooding and Drain System

The containment evacuation system (CES) and the containment flooding and drain system (CFDS) are used to transfer liquids and gases between the containment vessel (CNV) free volume and other plant systems.

The functions of the CES include:

- establishing and maintaining a vacuum in the CNV during NPM operation by removing non-condensable gases from the CNV, which reduces convective heat transfer from the reactor vessel to the reactor pool.
- measuring CNV pressure during NPM operation via pressure sensors on the CES vacuum pump suction line to monitor leakage into the CNV from all sources.
- monitoring radioactivity levels in the non-condensable gas removed from the CNV and, depending on the radioactivity level in the gas, either filtering and discharging the gas through the reactor building ventilation system (RBVS) plant exhaust stack or transferring the gas to the gaseous radioactive waste system (GRWS).
- support the plant sampling system (PSS), as described in Section 9.3.2 providing a suction and return path for continuous monitoring of hydrogen and oxygen concentration in the containment atmosphere.
- support post-accident monitoring, providing a suction path for post-accident monitoring of hydrogen and oxygen concentration in the containment atmosphere as described in Section 9.3.2. The return path for monitoring of hydrogen and oxygen concentration in the containment atmosphere is the CFDS.
- support post-accident sampling, providing grab sample capability of the containment atmosphere using the CES particulate, iodine, and gaseous radiation monitor, as described in Section 9.3.2.
- vaporizing and removing water from the CNV during NPM startup following refueling, condensing the water vapor, and discharging the water to the radioactive waste drain system (RWDS).
- removing water vapor from the CNV during NPM operation and providing a method to condense, collect, and sample the water removed from the CNV prior to the water being discharged to the RWDS.
- quantifying the amount of water vapor removed from the CNV during NPM operation to monitor leakage into the CNV from all sources and to allow leak-before-break (LBB) methodology to be applied to leakage from feedwater and main steam piping in the CNV.
- removing non-condensable gases from the reactor coolant system (RCS), prior to CFDS pump-down of the CNV.

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- providing a path for pressurization of the CNV in support of refueling and maintenance operations.

The functions of the CFDS include:

parameters of such a module drop, the probability of the module remaining upright is assigned by engineering judgment. A module dropped in the refueling area is assumed to not remain upright. The transfer event trees provided as Figure 19.1-32 through Figure 19.1-35 are used to link the module drop initiating event frequencies provided in Table 19.1-68 to the event trees used to evaluate the end state of a module drop event; these event trees are provided as Figure 19.1-36 and Figure 19.1-37.

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Figure 19.1-36 depicts the possibility of a module drop in the operating area. The initiating event shown in the figure, IE-RBC-DROP-OP-FTS, is a placeholder, and the initiating event frequency is added through the POS-specific transfer event trees shown in Figure 19.1-32 and Figure 19.1-34. The top event RBC-T01 depicts the possibility of the module tipping if dropped. If the module remains upright, cooling from natural circulation and conduction through the flooded CNV is unaffected and the module remains cooled. If the module remains upright, no core damage occurs and the sequence results in an "OK" end state. If the module falls over, core damage occurs, and the sequence is assigned the end state "MD-CD." It is further conservatively assumed that the CNV is damaged in a manner that provides a radionuclide release path, but does not allow inflow of water that would prevent core damage. Analysis shows that the offsite dose consequences of core damage in a horizontal module with a damaged CNV results in a radionuclide release that is a small fraction of that associated with a large release. The radionuclide release is limited because of the scrubbing effect of the reactor pool. The practice of pressurizing the CNV in preparation for module transport as identified in Section 9.3.6, or the gas used for pressurization, does not affect the potential for core damage or radiological consequences of postulated module drop accidents, as modeled in the PRA.

Figure 19.1-37 illustrates the possibility of a module drop in the refueling area. The initiating event shown in the figure, IE-RBC-DROP-OP-FTS, is a placeholder, and the initiating event frequency is added through the POS-specific transfer event trees shown in Figure 19.1-33 and Figure 19.1-35. Module drops in the refueling area are assumed to result in core damage because the module is dropped from a height greater than one foot.

19.1.6.1.4 Low Power and Shutdown Data Sources and Analysis

Data sources used in the LPSD probabilistic risk assessment are similar to those discussed for the full power PRA. Differences from the full power PRA are:

- The initiating event frequency from the full-power PRA is adjusted to account for the duration and frequency for each POS.

  The equation used to adjust the frequency is

$$f_{\mathrm{LP}} = f_0 f_{\mathrm{RF}} \frac{t}{8760}$$

  where,

Enclosure 3:

Affidavit of Zackary W. Rad, AF-0818-61554

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AFFIDAVIT of Zackary W. Rad

I, Zackary W. Rad, state as follows:

1. I am the Director, Regulatory Affairs of NuScale Power, LLC (NuScale), and as such, I have been specifically delegated the function of reviewing the information described in this Affidavit that NuScale seeks to have withheld from public disclosure, and am authorized to apply for its withholding on behalf of NuScale.
2. I am knowledgeable of the criteria and procedures used by NuScale in designating information as a trade secret, privileged, or as confidential commercial or financial information. This request to withhold information from public disclosure is driven by one or more of the following:
    a. The information requested to be withheld reveals distinguishing aspects of a process (or component, structure, tool, method, etc.) whose use by NuScale competitors, without a license from NuScale, would constitute a competitive economic disadvantage to NuScale.
    b. The information requested to be withheld consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), and the application of the data secures a competitive economic advantage, as described more fully in paragraph 3 of this Affidavit.
    c. Use by a competitor of the information requested to be withheld would reduce the competitor's expenditure of resources, or improve its competitive position, in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.
    d. The information requested to be withheld reveals cost or price information, production capabilities, budget levels, or commercial strategies of NuScale.
    e. The information requested to be withheld consists of patentable ideas.
3. Public disclosure of the information sought to be withheld is likely to cause substantial harm to NuScale's competitive position and foreclose or reduce the availability of profit-making opportunities. The accompanying Request for Additional Information response reveals distinguishing aspects about the specific values by which NuScale develops its operational processes.

    NuScale has performed significant research and evaluation to develop a basis for this specific values and has invested significant resources, including the expenditure of a considerable sum of money.

    The precise financial value of the information is difficult to quantify, but it is a key element of the design basis for a NuScale plant and, therefore, has substantial value to NuScale.

    If the information were disclosed to the public, NuScale's competitors would have access to the information without purchasing the right to use it or having been required to undertake a similar expenditure of resources. Such disclosure would constitute a misappropriation of NuScale's intellectual property, and would deprive NuScale of the opportunity to exercise its competitive advantage to seek an adequate return on its investment.

4. The information sought to be withheld is in the enclosed response to NRC Request for Additional Information No. 116, eRAI 8926. The enclosure contains the designation "Proprietary" at the top of each page containing proprietary information. The information considered by NuScale to be proprietary is identified within double braces, "{{ }}" in the document.
5. The basis for proposing that the information be withheld is that NuScale treats the information as a trade secret, privileged, or as confidential commercial or financial information. NuScale relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC § 552(b)(4), as well as exemptions applicable to the NRC under 10 CFR §§ 2.390(a)(4) and 9.17(a)(4).
6. Pursuant to the provisions set forth in 10 CFR § 2.390(b)(4), the following is provided for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld:
    a. The information sought to be withheld is owned and has been held in confidence by NuScale.
    b. The information is of a sort customarily held in confidence by NuScale and, to the best of my knowledge and belief, consistently has been held in confidence by NuScale. The procedure for approval of external release of such information typically requires review by the staff manager, project manager, chief technology officer or other equivalent authority, or the manager of the cognizant marketing function (or his delegate), for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside NuScale are limited to regulatory bodies, customers and potential customers and their agents, suppliers, licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or contractual agreements to maintain confidentiality.
    c. The information is being transmitted to and received by the NRC in confidence.
    d. No public disclosure of the information has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or contractual agreements that provide for maintenance of the information in confidence.
    e. Public disclosure of the information is likely to cause substantial harm to the competitive position of NuScale, taking into account the value of the information to NuScale, the amount of effort and money expended by NuScale in developing the information, and the difficulty others would have in acquiring or duplicating the information. The information sought to be withheld is part of NuScale's technology that provides NuScale with a competitive advantage over other firms in the industry. NuScale has invested significant human and financial capital in developing this technology and NuScale believes it would be difficult for others to duplicate the technology without access to the information sought to be withheld.

I declare under penalty of perjury that the foregoing is true and correct. Executed on August 27, 2018.

Zackary W. Rad