



February 28, 2019

Docket: PROJ0769

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. 9646 (eRAI No. 9646) on the NuScale Topical Report, "Accident Source Term Methodology," TR-0915-17565, Revision 2

REFERENCES: 1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 9646 (eRAI No. 9646)," dated February 18, 2019
2. NuScale Topical Report, "Accident Source Term Methodology," TR-0915-17565, Revision 2, dated April 2016

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

The Enclosures to this letter contain NuScale's response to the following RAI Question from NRC eRAI No. 9646:

- 01.05-33

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 9646 (eRAI No. 9646). 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-8H12
Samuel Lee, NRC, OWFN-8H12
Getachew Tesfaye, NRC, OWFN-8H12

Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9646, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9646, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0219-64725

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9646, proprietary

Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 9646, nonproprietary

Response to Request for Additional Information Docket: PROJ0769

eRAI No.: 9646

Date of RAI Issue: 02/18/2019

NRC Question No.: 01.05-33

Regulatory basis

10 CFR 52.47(a)(2) requires, in part, a description and analysis of engineered safety features and barriers that must be breached before a release of radioactive material to the environment can occur. In performing this assessment, an applicant shall assume a fission product release from the core into the containment and use the expected demonstrable containment leak rate. 10 CFR 52.47(a)(27) requires a description of the design-specific probabilistic risk assessment and its results. 10 CFR 51.55 requires an environmental report addressing the costs and benefits of severe accident mitigation design alternatives (SAMDA).

Request for additional information

The NuScale Final Safety Analysis Report (FSAR) Revision 2 uses the methodology in the NuScale Accident Source Term Methodology topical report TR-0915-17565-P, Revision 2, to calculate radiological consequences. Section 3.3.7 of the topical report states that the containment is assumed to leak at the design basis limit leak rate for 24 hours and then at half of the design basis limit leak rate thereafter. Table 12.2-28 of the FSAR implements this assumption as 0.2% per day for the first 24 hours of the accident and 0.1% per day after 24 hours. Section 6.2.6 of the FSAR states that the specified maximum allowable containment leak rate, L_a , is 0.20 weight percent of the containment air mass per day at the calculated peak accident pressure, P_a , identified in Section 6.2.1.

In discussions with NRC staff, NuScale stated that the topical report and the FSAR implement the containment leak rate assumptions in Regulatory Guide 1.183. However, the containment leak rate assumptions in Regulatory Guide 1.183 are based on containment designs which have

a larger containment air mass compared to NuScale's evacuated containment design. This difference is illustrated by a staff independent MELCOR confirmatory calculation for a NuScale severe accident scenario using a containment hole sized to give a containment leak rate of 0.2% per day when the containment is filled with air at 1000 psia and 72 F. The staff's calculation predicted a leak rate of 0.7% per day following core damage and that the 0.7% percent per day leak rate would continue beyond 24 hours. The higher leak rate is due to the higher severe accident mole fractions of hydrogen and steam (which are less dense than air) in containment for the NuScale design. The leak rate is scenario-dependent because the amount of hydrogen generated is scenario-dependent. The leak rate also could depend on the amount of xenon and krypton released.

Question

The staff has determined that a containment leak rate of 0.7% per day could result in a larger release of radioactive material to the environment and higher radiological consequences. As such, NuScale is requested to provide technical justification in the topical report for the containment leak rate assumed in the MHA radiological consequence assessment, including the reduction in the leak rate at 24 hours; or to revise the topical report to use a containment leak rate applicable to NuScale accident scenarios. The technical justification should address how the basis for technical specification containment leakage rate requirements is reflected in the assumed containment leakage rate during an accident. If the containment leak rate is changed in the topical report, NuScale should provide revisions to documents that are affected by this change, including the assumptions and results in FSAR 15.0.3, "Design Basis Accident Radiological Consequence Analysis for Advanced Light Water Reactors," in FSAR section 19.1.4.2.1.4, "Release Categories," in the Environmental Report, and in the EPZ Topical Report.

NuScale Response:

NuScale has followed industry precedents in utilizing RG 1.183. Additionally, NuScale has independently verified the applicability of the RG 1.183 leak rate assumptions to NuScale, as will be described in this response.

The containment leak rate assumptions of RG 1.183 remain valid for the NuScale design, despite the smaller volume and air mass of the NuScale containment (CNV) compared to the larger containments contemplated by RG 1.183. The NuScale CNV design is similar to Mark I and Mark II boiling water reactor (BWR) containments with respect to how hydrogen and steam

would affect the leak rate. NuScale severe accident simulations result in approximately 30 to 100 percent metal-water reaction of fuel cladding, which correspond to maximum hydrogen concentration values of approximately 82 to 97 percent by volume. A 30 to 100 percent metal-water reaction of the cladding in a postulated loss of coolant accident (LOCA) at a BWR (Mark I and Mark II containments) is estimated to result in a containment atmosphere with a hydrogen concentration by volume of approximately 44 to 73 percent (U.S. Nuclear Regulatory Commission, "Light Water Reactor Hydrogen Manual," NUREG/CR-2726 SAND82-1137, Rev. 3, August 1983). In this respect, there is precedent for light water reactor (LWR) containments with the potential to become hydrogen-rich during a severe accident scenario to assume RG 1.183 leak rate assumptions based on containment air mass leakage rather than hydrogen or steam based leakage rates.

There is no industry precedent for specifying containment leakage based on anything besides an air atmosphere, and existing regulatory guidance (U.S. Nuclear Regulatory Commission, "RADTRAD: A Simplified Model for RADionuclide Transport and Removal and Dose Estimation," NUREG/CR-6604, Rev. 0, April 1998) recommends the use of RADTRAD, which employs an air leakage transport mechanism for containment leakage modeling. This practice is standard even though it is known that core damage accidents in operating reactor designs have resulted in accident gas atmospheres containing hydrogen. The assumption of dry air technical specification containment leakage in accident dose evaluations is also standard industry practice, even though RG 1.183 requires the evaluation of a LOCA with core damage and the core damage would result in the presence of hydrogen in the containment atmospheres.

Although the staff does not describe the underlying assumptions or methodology choices of their independent MELCOR confirmatory calculation in RAI 9646, NuScale has independently performed leak rate calculations by multiple methods, including an orifice flow leak rate estimation resulting in values similar to those provided by the staff. Additionally, during an October 3, 2018 public teleconference with the staff on their earlier, preliminary independent analysis, the orifice flow assumption was stated as being used. It is therefore inferred that the staff independent leak rate calculation applied an orifice flow assumption.

NuScale believes an orifice flow assumption is not a reasonable assumption for estimating a leak rate by which conservatism of the NuScale design basis leak rate should be comparatively judged. Per Battelle Pacific Northwest Laboratories report "Estimation of Gas Leak Rates Through Very Small Orifices and Channels", BNWL-2223, February 1977, it is recognized that with respect to accident leak rate estimation the "only definitive assertion, which can be made, is a statement on the maximum possible leak rate, which would result if the leak were assumed to be an orifice." NuScale does not believe estimation of the maximum possible leak rate in this



fashion constitutes a reasonable estimate for judgment of conservatism of the NuScale design basis leak rate.

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The technical specification leakage value is an arbitrarily selected analytical limit determined to result in acceptable radiological consequences when applied as an air leakage value in RADTRAD dose analysis. Because the safety analysis analytical limit (or technical specification) CNV leakage value is an arbitrary value completely unassociated with any physically accurate estimate of leak area for a severe accident, it stands that an accident leak rate derived from the safety analysis analytical limit is also an arbitrary value.

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}}^{2(a),(c)} Therefore, the containment leak rate assumptions of RG 1.183 remain valid for the NuScale design.

NuScale is not updating the topical report to include the justifications provided in this RAI response.



Impact on Topical Report:

There are no impacts to the Topical Report TR-0915-17565, Accident Source Term Methodology, as a result of this response.

Enclosure 3:

Affidavit of Zackary W. Rad, AF-0219-64725

NuScale Power, LLC
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 methodology by which NuScale develops its accident source term.

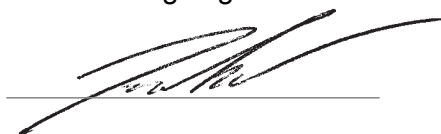
NuScale has performed significant research and evaluation to develop a basis for this methodology and has invested significant resources, including the expenditure of a considerable sum of money.

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. 9646, eRAI 9646. 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 February 28, 2019.



Zackary W. Rad