

October 18, 2017

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. 189 (eRAI No. 9025) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 189 (eRAI No. 9025)," dated August 19, 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 Enclosures to this letter contain NuScale's response to the following RAI Questions from NRC eRAI No. 9025:

- 09.01.02-14
- 09.01.02-16

The response to question 09.01.02-15 will be provided by November 11, 2017.

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 189 (eRAI No. 9025). 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 Carrie Fosaaen at 541-452-7126 or at cfosaaen@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 Response to NRC Request for Additional Information eRAI No. 9025, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9025, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-1017-56715



Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9025, proprietary



Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 9025, nonproprietary

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

eRAI No.: 9025

Date of RAI Issue: 08/19/2017

NRC Question No.: 09.01.02-14

10 CFR Part 50, Appendix A, General Design Criteria (GDC) 1, 2, 4, 5, 63, and 10 CFR 52.80(a) provide the regulatory requirements for the design of the new and spent fuel storage facilities. SRP Sections 9.1.2 and DSRS Sections 3.8.4 Appendix D describe the specific SRP acceptance criteria for the review of the fuel racks to meet the requirements of the Commission's regulations identified above. Specifically, DSRS 3.8.4 Table 1 defines F_d as the force caused by the accidental drop of the heaviest load from the maximum possible height.

FSAR Tier 2, Section 9.1.2 states, "The maximum lift height for a fuel assembly is 45'-3" building elevation. This lift height is required to clear the weir wall between the SFP and RFP." The applicant should clarify that the lift height is defined to the base of the fuel assembly. The applicant should also describe any operational controls to ensure the analyzed drop height will not be exceeded.

In addition, in the TR, on page 122, in Section 3.1.3.4, Item 2, the applicant describes the initial condition for the drop cases, "... the LS-DYNA model applies a uniform gravity load to all bodies and considers the FA at an initial speed before impact that accounts for buoyancy forces." For each drop case, the applicant should provide the drop heights, basis for the maximum drop heights, and calculated initial velocities. The applicant should include a discussion describing whether new FAs may be moved above the surface of the water and therefore have higher drop heights than the spent FAs.

NuScale Response:

The drop height is based on the bottom of the fuel assembly being located 3" above the weir gate, or at the 45'-3" building elevation. The maximum drop distance is calculated from the bottom of the fuel assembly to the top of the SFS rack for the shallow vertical drop. In the case of a deep drop, the maximum drop distance is calculated from the bottom of the fuel assembly to the top of the baseplate. The following table summarizes the drop heights, initial conditions and acceptance criteria.



The fuel handling crane will be limited to the drop height analyzed through stops and other measures (see FSAR Section 9.1.4). All new fuel will be placed in the pool by the new fuel elevator that is located in the south-west corner of the fuel pool. Transportation of new fuel assemblies will only be in this region via the new fuel jib crane, eliminating the concern that the new fuel assemblies will drop onto spent fuel racks (see FSAR Section 9.1.4). Therefore, geometric and mechanical limits will prevent new fuel from being lifted outside of this area and spent fuel above the analyzed drop heights.

The LS-DYNA models for the impact scenarios use an arbitrary drop height of 6” with an initial velocity equal to the velocity achieved in freefall from the defined maximum drop height to 6” from the top of the fuel rack. The 6” drop height eliminates the unnecessary time steps for solution before impact and also provides sufficient time for the program to initialize prior to impact occurring. At impact, the fuel assembly experiences the impact velocity that is equal to the velocity of the fuel assembly dropped from the maximum drop height, thereby simulating the kinetic energy on impact. The acceleration due to gravity is modified for the effects of buoyancy, but drag effects are not considered. The following table summarizes drop heights, basis for maximum drop heights, and initial velocities. Acceptance criteria and results are shown in Table 3-7 of TR-0816-49833-P.

Summary of Fuel Assembly Impact Scenarios

Impact Scenario	Maximum Drop Height	Model Initial Velocity	Impact Velocity	Basis for Maximum Drop Height	Assumptions/ Conservatisms
Shallow Drop (center strike)	131”	{{ }} ^{2(a),(c)}	{{ }} ^{2(a),(c)}	Maximum distance from the bottom of the fuel assembly to the top of the rack	Buoyancy is accounted for but drag effects are neglected.
Deep Drop (center strike)	236”	{{ }} ^{2(a),(c)}	{{ }} ^{2(a),(c)}	Maximum distance from the bottom of the fuel assembly to the top of the rack baseplate	Buoyancy is accounted for but drag effects are neglected.
Deep Drop (corner strike)	236”	{{ }} ^{2(a),(c)}	{{ }} ^{2(a),(c)}	Maximum distance from the bottom of the fuel assembly to the top of the rack baseplate	Buoyancy is accounted for but drag effects are neglected.
Deep Drop (outside strike)	236”	{{ }} ^{2(a),(c)}	{{ }} ^{2(a),(c)}	Maximum distance from the bottom of the fuel assembly to the top of the rack baseplate	Buoyancy is accounted for but drag effects are neglected.
Horizontal Drop	220.8”	{{ }} ^{2(a),(c)}	{{ }} ^{2(a),(c)}	Conservatively Dropped from same elevation as the hook	Dropped from same elevation as the hook, Impact in air



Impact on DCA:

There are no impacts to the DCA as a result of this response.

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

eRAI No.: 9025

Date of RAI Issue: 08/19/2017

NRC Question No.: 09.01.02-16

10 CFR Part 50, Appendix A, General Design Criteria (GDC) 1, 2, 4, 5, 63, and 10 CFR 52.80(a) provide the regulatory requirements for the design of the new and spent fuel storage facilities. SRP Sections 9.1.2 and DSRS Sections 3.8.4 Appendix D describe the specific SRP acceptance criteria for the review of the fuel racks to meet the requirements of the Commission's regulations identified above.

On Page 127, Table 3-7, of the report, the applicant presents the results of the various accidental drop analyses and compares the results to various numerical limits. Some of the limits are in terms of displacements and others are in terms of stress values. Provide a description and basis for each of these limits.

NuScale Response:

According to Appendix D of SRP 3.8.4, the functionality of the fuel racks shall be maintained for the $D+L+F_d$ load combination where D is dead load, L is live load, and F_d is the force caused by the accidental drop of the heaviest load from the maximum possible height. The limits shown on Page 127, Table 3-7, of TR-0816-49833-P are based on the functional capability of the SFS racks after all drop scenarios. For all drops, a fuel assembly with a control rod assembly is postulated as the heaviest load.

Shallow drops are inspected to verify that the drops do not deform the top grid sufficiently to adversely affect the function of the poison plates and that the impact does not result in excessive penetration of the fuel assembly into the top grid. Deep drops are inspected to verify that the drops do not result in the fuel assembly penetrating or excessively deforming the baseplate such that no contact is made with the pool liner.

The gap between the bottom of the top grid and the top of the poison plate is $\{\{ \quad \}\}^{2(a),(c)}$ therefore, the deflection of the bottom of the top grid at any time during the impact must be less than $\{\{ \quad \}\}^{2(a),(c)}$. In order to prevent damage to the stored fuel assemblies, the dropped fuel



assembly shall not penetrate through the top grid. In addition, lateral deflection of the top grid and fuel tubes must be minimal in areas near the top of the stored fuel assemblies to allow safe removal of stored fuel assemblies. Stresses in other components, such as the external frame angles, are evaluated to ensure they survive impact loads.

For deep drops, the baseplate must not contact the pool liner. The gap between the bottom of the baseplate and the SFP liner for the SFS rack is $\{\{ \quad \}\}^{2(a),(c)}$. Therefore, maximum deflection in the baseplate must be less than $\{\{ \quad \}\}^{2(a),(c)}$ for the deep drop. In order to prevent penetration of the dropped fuel assembly, the baseplate must not exceed the true ultimate stress or strain upon impact. Baseplate deflections are maximized by the deep drop to the outside (Case 2C). Stresses in the support leg and bearing plate components are evaluated under the maximum impact load, which occurs for the corner strike (Case 2B) directly on top of a foot assembly.

For SFS rack components, Appendix D of DSRS 3.8.4 does not specify any explicit stress criteria from ASME BPVC Section III, Subsection NF for the $D + L + F_d$ load combination. For any components that are required to uphold their configuration in order for the rack to maintain functional capability, Tresca Failure Criterion is used to evaluate maximum stresses. Component tensile stress must be less than the true uniform tensile strength of the applicable material, and shear stress must be less than 50% of the true uniform tensile strength.

Impact on DCA:

There are no impacts to the DCA as a result of this response.



RAIO-1017-56690

Enclosure 3:

Affidavit of Zackary W. Rad, AF-1017-56715

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 structure by which NuScale develops its spent fuel racks.

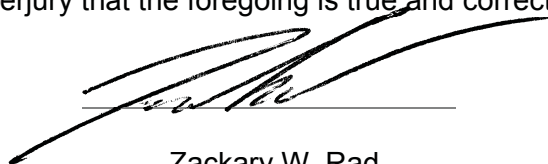
NuScale has performed significant research and evaluation to develop a basis for this structure and has invested significant resources, including the expenditure of a considerable sum of money.

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. 189, eRAI No. 9025. 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 10/18/2017.



Zackary W. Rad