RAIO-1217-57890

December 21, 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. 130 (eRAI No. 8968) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 130 (eRAI No. 8968)," dated August 05, 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. 8968:

- 03.08.04-8
- 03.08.04-9

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 130 (eRAI No. 8968). 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 Marty Bryan at 541-452-7172 or at mbryan@nuscalepower.com.

Sincerely,

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

Distribution: Gregory Cranston, NRC, OWFN-8G9A
Samuel Lee, NRC, OWFN-8G9A
Marieliz Vera, NRC, OWFN-8G9A

Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 8968, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 8968, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-1217-57891

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 8968, proprietary

NuScale Power, LLC
1100 NE Circle Blvd., Suite 200 Corvalis, Oregon 97330, Office: 541.360.0500, Fax: 541.207.3928
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Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 8968, nonproprietary

NuScale Power, LLC
1100 NE Circle Blvd., Suite 200 Corvalis, Oregon 97330, Office: 541.360.0500, Fax: 541.207.3928
www.nuscalepower.com

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

eRAI No.: 8968
Date of RAI Issue: 08/05/2017

NRC Question No.: 03.08.04-8

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment. Consistent with DSRS Section 3.8.4, the staff reviews description of the structures, loads and loading combinations, and design and analysis procedures.

While FSAR Sections 3.7.3 and 9.1.5 describe analysis and design aspects for the Reactor Building Crane (RBC), the staff review did not find design details pertaining to the rails supporting the RBC. To assist the staff in its evaluation of the structural adequacy of the RBC rails, the staff request the applicant to provide the following information and include such information in the FSAR.

a. Provide the loads (including impact loads both in the vertical and horizontal directions), load combinations, design criteria, assumptions, and resulting dimensions of the steel rails that support the reactor building crane.
b. Describe how the rails, which support the RBC, are supported. Describe the design of the supports and provide figures with design details of the rails and supports.
c. Describe the magnitude of forces and bending moments on the rail supports, and how these forces and bending moments are transmitted down to the basemat.

NuScale Response:

To assist the staff in its evaluation of the structural adequacy of the reactor building crane (RBC) rails, the following information, pertaining to the rails supporting the RBC, is provided. Note, the description of the RBC analysis has been removed from FSAR Tier 2, Section 3.7.3.3.1, per response to RAI 8928 Question 03.07.03-5, as DSRS Section 3.7.3 is not applicable to the RBC seismic analysis. Cranes designed to meet ASME NOG-1 have been accepted by the NRC as meeting requirements for NUREG-0554 and General Design Criteria 2. FSAR Tier 2, Section 3.8.4.1.13 is updated to include a description of how the rails, which support the RBC, are supported and designed.

a)

Normal operating loadings are resisted by the crane rails. During a seismic event, all lateral, transverse, and upward loadings are resisted by a seismic restraint system and all vertical downward forces are resisted by the crane rail.

Maximum operating loadings, which include impact at the RBC bridge wheels, are listed as follows:

At the RBC rail:

- Fx = 36.478 kips per wheel acting perpendicular to the reactor building (RXB) pool wall (north to south)
- Fy = 141.380 kips at each of two rows of 16 wheels (8.84 kips per wheel) acting in line with the RXB pool wall (east to west)
- Fz = 211.080 kips per wheel acting downward vertical to the RXB pool wall

Maximum Extreme (SSE Seismic) loadings, which include lifted loading at the RBC bridge wheels, are listed as follows:

At the RBC rail:

- Fx = 0 kips per wheel acting perpendicular to the RXB pool wall (north to south)
- Fy = 0 kips per wheel acting in line with the RXB pool wall (east to west)
- Fz = 278.3 kips per wheel acting downward vertical to the RXB pool wall

At the lateral seismic restraint:

- Fy = 1459 kips at seismic restraint acting in line with the RXB pool wall (east to west)
- Fx = 3194 kips per seismic restraint acting perpendicular to the RXB pool wall (north to south)
- Fz = 2310 kips per seismic restraint acting upward vertical to the RXB pool wall

The following five operational load cases have been evaluated:

- Case 1: Gravity applied on the whole model
- Case 2: 15% of the live load (Vertical Impact)
- Case 3: 5% of rated load plus trolley weight + bridge weight (Transverse Impact)
- Case 4: 10% of trolley weight + rated load (Lateral Impact)
- Case 5: Load case 1 + load case 2 + load case 3 + load case 4

The following two extreme load cases have been evaluated:

- PC10: Dead weight of bridge + dead weight of trolley + credible critical load + safe shutdown earthquake load
- PC11: Dead weight of bridge + dead weight of trolley + safe shutdown earthquake load

Safe shutdown earthquake loading is based on a modal analysis and subsequent response spectrum analysis. The response spectra was selected at 145’-6” feet elevation with 7% damping for low frequency input and high frequency input configurations.

Load combinations were analyzed using the operating and seismic load cases coupled with nine variances on the Trolley Positions, Hook Positions and Load; End-Hook up, Quarter-Hook up, Mid-Hook up, End-Hook down, Quarter-Hook down, Mid-Hook down, End-No Load, Quarter-No Load, Mid-No Load.

The RBC is supported at the bridge wheels by a rail connected to a steel anchor plate embedded into the reactor building (RXB) walls at a wall offset at elevation 145’-6”. The RBC is designed to withstand a safe shutdown earthquake (SSE) event. Impact loadings of 15% vertical, 10% lateral, and 5% transverse are included in the operation load cases. The steel rails and anchor plates meet the design criteria set by AISC N690 Specification for Safety-Related Steel Structures for Nuclear Facilities and ACI 349 Code Requirements for Nuclear Safety-Related Concrete Structures and Commentary, consistent with 10CFR 50, Appendix A, GDC 1, 2, and 4 and DSRS Section 3.8.4.

Assumptions associated with the design and analysis of the RBC rails are listed as follows:

- During a seismic event, the RBC brake system will not have time to engage and all non-downward vertical seismic loadings will be resisted by the seismic restraint system.
- The crane rail and associated anchor plate will resist all normal operating vertical and horizontal wheel loads applied from 32 total RBC bridge wheels.
- The anchor plate on the face of the RXB pool walls adjacent to the 4 RBC seismic restraints will resist vertical uplift and horizontal load from the seismic restraints.

The RBC rails will be ASTM A759 175 lb crane rail supported on embedded plates located at column lines RX-B and RX-D (column lines shown in FSAR Tier 2, Figure 1.2-18). Top of crane rail elevation is 146’-0”.

b)

The RBC rails and seismic restraints are supported by steel plates anchored into the top of the RXB pool walls at column lines RX-B and RX-D. The operating lateral forces as well as all

vertical downward forces are transferred to the RXB structure through the crane rail directly to the supporting embedded plates. At the embedded plates, the rail forces are resisted by direct bearing onto the walls and by anchors from the embedded plates into the supporting walls. Seismic lateral forces are transferred directly into the RXB walls by the seismic restraint system through direct bearing and shear. Figure 1 shows the RBC rail.

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}}2(a),(c)

c)

The magnitude of the forces is given in response to part a) of this RAI response. Operational bending moments induced into the rail due to operational lateral loadings are resisted through the rail to the embedded plate connection and then imparted onto the RXB pool walls through a combination of direct bearing and embedded anchorage resisting tensile induced forces. All vertical downward forces are resisted through direct bearing onto the RXB pool walls. Seismic uplift and lateral forces are resisted by the seismic restraints and impart direct bearing and shear forces onto the RXB pool walls. Once these loads are imparted into the RXB pool walls, the forces are resisted to the basemat through the lateral force resisting elements of the RXB structure. The RBC was modeled and analyzed as part of the RXB structure. The induced loadings from the RBC have already been accounted for in the overall global analysis of the RXB.

Impact on DCA:

FSAR Tier 2, Sections 3.8.4.1.13 and 3.8.4.1.14 have been revised as described in the response above and as shown in the markup provided with this response.

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

eRAI No.: 8968
Date of RAI Issue: 08/05/2017

NRC Question No.: 03.08.04-9

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment. Consistent with DSRS Section 3.8.4, the staff reviews description of the structures, loads and loading combinations, and design and analysis procedures.

FSAR section 9.1.4.1 refers to Sections 3.7 and 3.8 for information pertaining to the analysis, design, and criteria associated with establishing the ability of seismic Category I structures housing the fuel handling equipment (FHE) and supporting systems to withstand the effects of natural phenomena such as the safe shutdown earthquake. However, staff review did not find design details pertaining to the rails supporting the fuel handling machine (FHM). To assist the staff in its evaluation of the structural adequacy of the FHM rails, the staff request the applicant to provide the following information and include such information in the FSAR.

a. Provide the loads (including impact load both in the vertical and horizontal directions), load combinations, design criteria, assumptions, and resulting dimensions of the steel rails that support the refueling machine.
b. Describe how the rails, which support the refueling machine, are supported. Describe the design of the supports and provide figures with design details of the supports.
c. Describe the magnitude of forces and bend moments on the rail supports, and how these forces and bending moments are transmitted down to the basemat.

NuScale Response:

To assist the staff in its evaluation of the structural adequacy of the fuel handling machine (FHM) rails, the following information, pertaining to the rails supporting the FHM, is provided. FSAR Tier 2, Section 3.8.4.1.14 is added to include a description of how the rails, which support the FHM, are supported and designed.

a)

Normal operating loadings are resisted by the FHM rails. During a seismic event, all lateral, transverse, and upward loadings are resisted by a seismic restraint system and all vertical downward forces are resisted by the FHM rail.

Maximum operating loadings, which include impact at the FHM bridge wheels, are listed as follows:

At the FHM rail:

- Fx = 2.64 kips per wheel acting perpendicular to the reactor building (RXB) pool wall (north to south)
- Fy = 2.35 kips per wheel acting in line with the RXB pool wall (east to west)
- Fz = 25.60 kips per wheel acting downward vertical to the RXB pool wall

Maximum Extreme (SSE Seismic) loadings, which include lifted loading at the FHM bridge wheels, are listed as follows:

At the FHM rail:

- Fx = 0 kips per wheel acting perpendicular to the RXB pool wall (north to south)
- Fy = 0 kips per wheel acting in line with the RXB pool wall (east to west)
- Fz = 114.24 kips per wheel acting downward vertical to the RXB pool wall

At the lateral seismic restraint:

- Fx = 70.53 kips per seismic restraint acting perpendicular to the RXB pool wall (north to south)
- Fy = 143.46 kips at seismic restraint acting in line with the RXB pool wall (east to west)
- Fz = 66.10 kips per seismic restraint acting upward vertical to the RXB pool wall

The following five operational load cases have been evaluated:

- Case 1: Gravity applied on the whole model
- Case 2: 15% of the live load (Vertical Impact)
- Case 3: 5% of rated load plus trolley weight + bridge weight (Transverse Impact)
- Case 4: 10% of trolley weight + rated load (Lateral Impact)
- Case 5: Load case 1 + load case 2 + load case 3 + load case 4

The two extreme load cases are as follows:

- PC10: Dead weight of bridge + dead weight of trolley + credible critical load + safe shutdown earthquake load
- PC11: Dead weight of bridge + dead weight of trolley + safe shutdown earthquake load

Safe shutdown earthquake loading is based on a modal analysis and subsequent response spectrum analysis. The response spectra was selected at 139'-8" feet elevation with 5% damping for the uncracked and cracked concrete configuration. However, it is to be noted that the FHM operates at 100' elevation. Therefore, using a spectra from 139'-8" is conservative for the evaluation of FHM due to the higher accelerations typically seen at the higher elevation.

Load Combinations were analyzed using the operating and seismic load cases coupled with three variances on the Trolley positions; North End, North Quarter, and Mid Span.

The FHM is supported at the bridge wheels by a rail connected to a steel anchor plate embedded into the reactor building (RXB) walls at a wall corbel at grid RX-D and top of wall at grid RX-C at elevation 100'-0" (grid lines shown in FSAR Tier 2, Figure 1.2-17). The FHM is designed to withstand a safe shutdown earthquake (SSE) event. Impact loadings of 15% vertical, 10% side lateral and 5% transverse are included in the operational load cases. The steel rails and anchor plates meet the design criteria set by AISC N690 Specification for Safety-Related Steel Structures for Nuclear Facilities and ACI 349 Code Requirements for Nuclear Safety-Related Concrete Structures and Commentary, consistent with 10 CFR 50, Appendix A, GDC 1, 2, and 4 and DSRS Section 3.8.4.

Assumptions associated with the design and analysis of the FHM rails are listed as follows:

- During a seismic event, the FHM brake system will not have time to engage and all non-downward vertical seismic loadings will be resisted by the seismic restraint system.
- The FHM rail and associated anchor plate will resist all normal operating vertical and horizontal wheel loads applied from 4 total FHM bridge wheels.
- The anchor plate on the face of the RXB pool walls adjacent to the 4 FHM seismic restraints will resist vertical uplift and horizontal load from the seismic restraints.

The FHM rails are supported on embedded plates located near column lines RX-C and RX-D. Top of FHM rail elevation is 100'-0".

b)

The FHM rails and seismic restraints are supported by steel plates anchored to the top of the RXB pool walls at column lines RX-C and RX-D. The operating lateral forces as well as all vertical downward forces are transferred to the RXB structure through the FHM rail directly to the supporting embedded plates. At the embedded plates, the rail forces are resisted by direct bearing to the walls and by anchors from the embedded plates to the supporting walls. Seismic

lateral forces are transferred directly to the RXB walls by the seismic restraint system through direct bearing and shear. Figures 1 and 2 show the FHM rail and seismic constraint connection, respectively.

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c)

The magnitude of the forces is given in part a) of this RAI response. Operational bending moments induced into the rail due to operational lateral loadings are resisted through the rail to the embedded plate connection and then imparted onto the RXB pool walls through a combination of direct bearing and embedded anchorage resisting tensile induced forces. All vertical downward forces are resisted through direct bearing onto the RXB pool walls. Seismic uplift and lateral forces are resisted by the seismic restraints and impart direct bearing and shear forces onto the RXB pool walls. Once these loads are imparted into the RXB pool walls, the forces are resisted to the basemat through the lateral force resisting elements of the RXB structure. The induced loadings from the FHM have been accounted for in the overall global analysis of the RXB.

Impact on DCA:

FSAR Tier 2, Section 3.8.4.1.14 has been revised as described in the response above and as shown in the markup provided with this response.

thick in most locations and covers the pool floor and walls up to the 100 foot elevation. The liner is included as a dead weight in the analysis of the RXB. There is a pool leakage detection system embedded in the concrete beneath the pool. The pool leakage detection system is discussed in Section 9.1.3.2.5.

3.8.4.1.8 Platforms and Miscellaneous Structures

Platforms and miscellaneous structures (e.g., ladders, guard rails, stairs) are utilized in the RXB and CRB. These components are constructed of steel beams, angles, channels, tubing, and grating. Platforms and miscellaneous structures may be Seismic Category I, II, or III depending on their safety function and potential interaction with Seismic Category I SSC. These SSC are included in the seismic analysis of the structure as part of the standard floor load.

3.8.4.1.9 Buried Conduit and Duct Banks

The design does not include any buried safety related pipes or pipe ducts.

3.8.4.1.10 Buried Pipe and Pipe Ducts

The design does not include any buried safety related pipes or pipe ducts.

3.8.4.1.11 Masonry Walls

Masonry walls are not used in the Reactor Building or in the Control Building.

3.8.4.1.12 Modular Construction

The design of the Seismic Category I RXB and CRB structural walls does not include steel-concrete (SC) modular subsystems. Modular construction techniques (including sacrificial steel) that do not alter the design, normal construction techniques, or analysis may be employed.

3.8.4.1.13 Reactor Building Crane

RAI 03.07.03-5

The Reactor Building crane (RBC) is a bridge crane that rides on rails anchored to the RXB at EL 145' 6". The RBC is part of the Overhead Heavy Load Handling System and is discussed in Section 9.1.5. For analysis of the RXB, the RBC is included as a beam and spring model as described in Section 3.7.2.1.2.3. ~~The seismic analysis of the RBC is described in Section 3.7.3.3.1.~~

RAI 03.08.04-8, RAI 03.08.04-9

<u>The RBC is supported at the bridge wheels by a crane rail connected to a steel anchor plate embedded into the reactor building (RXB) at a wall offsets. Normal operating loadings from the RBC are resisted by the crane rails. During a seismic event, all lateral, transverse, and upward loadings are resisted by a seismic restraint system and all vertical downward forces are resisted by the crane rail. The crane</u>

rails and seismic restraints transfer the RBC loadings to the RXB structure. Safe shutdown earthquake loading is based on a modal analysis and subsequent response spectrum analysis for low frequency input and high frequency input configurations.

RAI 03.08.04-8, RAI 03.08.04-9

The steel rails and anchor plates meet the design criteria set by AISC N690 Specification for Safety-Related Steel Structures for Nuclear Facilities and ACI 349 Code Requirements for Nuclear Safety-Related Concrete Structures and Commentary, consistent with 10 CFR 50, Appendix A, GDC 1, 2, and 4 and DSRS Section 3.8.4.

RAI 03.08.04-8, RAI 03.08.04-9

3.8.4.1.14 Fuel Handling Machine

RAI 03.08.04-8, RAI 03.08.04-9

Design aspects of the Fuel Handling Machine (FHM) are described in Section 9.1.4.2.2.

RAI 03.08.04-8, RAI 03.08.04-9

The FHM is supported at the bridge wheels by a machined rail connected to a steel anchor plate embedded into the reactor building (RXB) walls. Normal operating loadings from the FHM are resisted by the rails. During a seismic event, all lateral, transverse, and upward loadings are resisted by a seismic restraint system and all vertical downward forces are resisted by the rail. The rails and seismic restraints transfer the FHM loadings to the RXB structure. Safe shutdown earthquake loading is based on a modal analysis and subsequent response spectrum analysis.

RAI 03.08.04-8, RAI 03.08.04-9

The steel rails and anchor plates meet the design criteria set by AISC N690 Specification for Safety-Related Steel Structures for Nuclear Facilities and ACI 349 Code Requirements for Nuclear Safety-Related Concrete Structures and Commentary, consistent with 10 CFR 50, Appendix A, GDC 1, 2, and 4 and DSRS Section 3.8.4.

3.8.4.2 Applicable Codes, Standards, and Specifications

The following codes and standards are applicable for the design and construction of Seismic Category I structures and basemats. For the ASTM standards, which are applicable to construction, the code year is not specified. For these standards, the latest endorsed version at the time of construction is used.

3.8.4.2.1 Design Codes and Standards

ACI 207.1R	2005	Guide to Mass Concrete

Enclosure 3:

Affidavit of Zackary W. Rad, AF-1217-57891

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 component by which NuScale designs its reactor building crane and fuel handling machine rails.

   NuScale has performed significant research and evaluation to develop a basis for these components 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. 130, eRAI No. 8968. 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 12/21/2017.

Zackary W. Rad