

**From:** Murray, Demetrius  
**Sent:** Friday, August 6, 2021 10:42 AM  
**To:** Request for Additional Information  
**Cc:** Mesania, Fehmida; English, Liz; Dudek, Michael; Pettis, bob; Istar, Ata; Colaccino, Joseph; Tesfaye, Getachew; NuScale-SDA-720RAIsPEm Resource  
**Subject:** Final Request for Additional Information No. 0003 (eRAI No. 9860)  
**Attachments:** Final RAI\_9860.pdf

Attached please find NRC staff's request for additional information (RAI) concerning the review of Licensing Topical Report TR-0920-71621-P, Revision 0, "Building Design and Analysis Methodology for Safety-Related Structures," (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20353A404).

Please submit your technically correct and complete response by the agreed upon date to the NRC Document Control Desk.

If you have any questions, please do not hesitate to contact me.

Demetrius Murray, Project Manager  
U.S. Nuclear Regulatory Commission  
Office of Nuclear Reactor Regulation  
Division of New and Renewed Licenses  
Washington, D.C.  
301-415-7646 (office)

**Hearing Identifier:** NuScale\_SDA720\_RAI\_Public  
**Email Number:** 4

**Mail Envelope Properties** (SA0PR09MB6986D8D7F76C49851EB21DDE9BF39)

**Subject:** Final Request for Additional Information No. 0003 (eRAI No. 9860)  
**Sent Date:** 8/6/2021 10:41:50 AM  
**Received Date:** 8/6/2021 10:41:52 AM  
**From:** Murray, Demetrius

**Created By:** Demetrius.Murray@nrc.gov

**Recipients:**

"Mesania, Fehmida" <FMesania@nuscalepower.com>  
Tracking Status: None  
"English, Liz" <EEnglish@nuscalepower.com>  
Tracking Status: None  
"Dudek, Michael" <Michael.Dudek@nrc.gov>  
Tracking Status: None  
"Pettis, bob" <Robert.Pettis@nrc.gov>  
Tracking Status: None  
"Istar, Ata" <Ata.Istar@nrc.gov>  
Tracking Status: None  
"Colaccino, Joseph" <Joseph.Colaccino@nrc.gov>  
Tracking Status: None  
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>  
Tracking Status: None  
"NuScale-SDA-720RAIsPEm Resource"  
<NuScale-SDA-720RAIsPEm.Resource@usnrc.onmicrosoft.com>  
Tracking Status: None  
"Request for Additional Information" <RAI@nuscalepower.com>  
Tracking Status: None

**Post Office:** SA0PR09MB6986.namprd09.prod.outlook.com

<b>Files</b>	<b>Size</b>	<b>Date &amp; Time</b>
MESSAGE	721	8/6/2021 10:41:52 AM
Final RAI_9860.pdf	207434	

**Options**

**Priority:** Normal  
**Return Notification:** No  
**Reply Requested:** No  
**Sensitivity:** Normal  
**Expiration Date:**

## Request for Additional Information 0003 (eRAI No. 9860)

Issue Date: 08/06/2021

Application Title: Pre-Application Activities for NuScale SDA Application

Operating Company: NuScale

Docket No. 99902078

Review Section: NTR - NuScale Topical Report for SDA

Application Section: TR-0920-71621, Revision 0

### QUESTIONS

NTR-25

#### Requirement

10 CFR Part 50, Appendix A, General Design Criteria (GDC) 1, 2 and 4 as it relates to the design of seismic Category I structures, systems, and components.

DSRS 3.8.4, "Other Seismic Category I Structures," (Agencywide Documents Access and Management System (ADAMS) Accession No ML15355A444) states the structural acceptance criteria for seismic Category I structures appear in ACI 349, with additional guidance provided by NRC Regulatory Guide (RG) 1.142 for concrete structures, AISC N690-1994 for steel structures, and DSRS 3.8.4, Subsection II.4.J, for structures that use modular construction methods evaluated on a case-by-case basis.

#### Issue

In Section 6.7.1.3, "Ductility Ratios," of the TR, the applicant provided a ductility ratio demand limit of 10 for "Flexure-controlled SC walls" in Table 6-4, "Ductility ratio demand." In Item 2 of Section 6.7.1.4, "Response Determination," the applicant stated the plate principal strain can be limited to 0.05 for SC walls subjected to impulsive loads. However, the applicant did not provide the rotational limitation of yield hinge less than or equal to 0.07 radians (4 degrees) as required in provision F.3.4 of ACI 349-13, and as stated in NRC Draft Guide (DG-1304), proposed new Regulatory Guide 1.243, "Safety-Related Steel Structures and Steel-Plate Composite Walls for Other Than Reactor Vessels and Containments."

NRC DG-1304 states in Section 11.1.4 that *"For flexure-controlled SC walls as defined in Section N9.6b of ANSI/AISC N690 18, the permissible displacement ductility ratio demand should satisfy all of the following:*

- *ductility ratio less than or equal to 10,*
- *principal strain of the faceplates less than or equal to 0.05 and*
- *rotational capacity of any yield hinge less than or equal to 0.07 radians (4 degrees)."*

Rotational capacities of SC wall sections can be estimated using the experimental investigations of one-way SC wall section test data presented in the Journal of Structural Engineering article by Bruhl, J. C., and Varma, A. H. (2017), titled: "Experimental Resistance and Available Ductility of Steel-Plate Composite Walls in One-Way Bending." The paper provides moment-curvature results from bending experiments where the SC wall section's rotational capacity can also be estimated. Further, provision F.3.4 of ACI 349-13 states *"When flexure controls design, the rotational capacity  $r\theta$  in radians of any yield hinge shall be limited to  $0.0065(d/c)$  but shall not exceed 0.07 radians."*

#### Request

The staff requests the applicant to describe, when flexure controls the design, why the rotational limitation of yield hinge less than or equal to 0.07 radians (4 degrees), as required in provision F.3.4 of ACI-349-13, and stated in DG-1304, was not considered in the TR. Revise the TR as necessary.

## NTR-26

### **Requirement**

10 CFR Part 50, Appendix A, GDC 1, 2 and 4 as it relates to the design of seismic Category I structures, systems and components.

DSRS 3.8.4, "Other Seismic Category I Structures," (ADAMS Accession No ML15355A444) states the structural acceptance criteria for seismic Category I structures appear in ACI 349, with additional guidance provided by RG 1.142 for concrete structures, AISC N690-1994 for steel structures, and DSRS 3.8.4, Subsection II.4.J, for structures that use modular construction methods evaluated on a case-by-case basis.

### **Issue**

NRC DG-1304, Section 11.1.3, states *"In addition to the deformation limits under 11.1.4 to 11.1.7 below, the maximum deformation should not result in the loss of intended function of the structural wall nor impair the safety-related function of other systems and components."*

In Section 6.7.1.3, "Ductility Ratios," of the TR, the applicant stated that the effects of impactive and impulsive loads are permitted to be determined using inelastic analysis with limits provided in Table 6-4, "Ductility ratio demand." However, it is not clear to the staff whether the maximum deformations will not result in the loss of intended function of the structural wall as well as not impair the safety-related function of other systems and components as required in provision F.3, "Deformation," of ACI 349-13.

### **Request**

The staff requests the applicant to describe how the maximum deformations will not result in the loss of intended function of the structural wall as well as not impair the safety-related function of other systems and components. Revise the TR as necessary.

## NTR-27

### **Requirement**

10 CFR Part 50, Appendix A, GDC 1, 2 and 4 as it relates to the design of seismic Category I structures, systems, and components.

DSRS 3.8.4, "Other Seismic Category I Structures," (ADAMS Accession No ML15355A444) states the structural acceptance criteria for seismic Category I structures appear in ACI 349, with additional guidance provided by RG 1.142 for concrete structures, AISC N690-1994 for steel structures, and DSRS 3.8.4, Subsection II.4.J, for structures that use modular construction methods evaluated on a case-by-case basis.

### **Issue**

NRC DG-1304, Section 11.1.6, states, *"The permissible displacement ductility ratio in flexure should not exceed 3.0 for loads such as blast and compartment pressurization, which could affect the integrity of the structure as a whole."*

Provision F.3.5 in ACI 349-13 states *"The permissible ductility ratio in flexure shall not exceed 3.0 for loads such as blast and compartment pressurization, which could affect the integrity of the structure as a whole."* In Section 6.7, "Design for Impactive and Impulsive Loads," of the TR, the applicant described *"The design of SC walls for safety-related nuclear facilities needs to be checked for impactive loads (such as...blast pressure, and compartment pressurization)."* However, the applicant did not provide the permissible ductility ratio in flexure for blast and compartment pressurization loads in TR.

### **Request**

The staff requests the applicant to provide the permissible ductility ratio in flexure for blast and compartment pressurization loads as required in provision F.3.5 of ACI 349-13. Revise the TR as necessary.

NTR-28

### **Requirement**

10 CFR Part 50, Appendix A, GDC 1, 2 and 4 as it relates to the design of seismic Category I structures, systems, and components.

DSRS 3.8.4, "Other Seismic Category I Structures," (ADAMS Accession No ML15355A444) states the structural acceptance criteria for seismic Category I structures appear in ACI 349, with additional guidance provided by RG 1.142 for concrete structures, AISC N690-1994 for steel structures, and DSRS 3.8.4, Subsection II.4.J, for structures that use modular construction methods evaluated on a case-by-case basis.

### **Issue**

Provision B3.13, "Design for Corrosion Effects," of ANSI/AISC 360-16 states, *'Where corrosion could impair the strength or serviceability of a structure, structural components shall be designed to tolerate corrosion or shall be protected against corrosion.'* However, the applicant did not describe in the TR the effects of corrosion in the design requirements of SC walls. It should be noted that DG-1304 does not address design considerations for corrosion effects.

### **Request**

The staff requests the applicant to describe why the corrosion effects in the design requirements of SC walls were not described in the TR as required in provision B3.13 of ANSI/AISC 360-16. Revise the TR as necessary.

NTR-29

### **Requirement**

10 CFR Part 50, Appendix A, GDC 1, 2 and 4 as it relates to the design of seismic Category I structures, systems, and components.

DSRS 3.8.4, "Other Seismic Category I Structures," (ADAMS Accession No ML15355A444) states the structural acceptance criteria for seismic Category I structures appear in ACI 349, with additional guidance provided by RG 1.142 for concrete structures, AISC N690-1994 for steel structures, and DSRS 3.8.4, Subsection II.4.J, for structures that use modular construction methods evaluated on a case-by-case basis.

### **Issue**

NRC DG-1304, Section 11.5, states, *"Appendix N9 does not include design provisions for attachments to SC walls."* Additionally, Section 11.5. states, *"The effects of elevated temperature in the concrete due to the welding of attachments to the faceplate after the concrete has cured should also be considered."*

The staff noted that the TR does not provide any information related to welding of attachments to SC walls and the effects of elevated temperature in the concrete due to welding.

### **Request**

The staff requests the applicant to provide information related to attachments to SC walls and the effects of elevated temperature in the concrete due to the welding. Revise the TR as necessary.