RAIO-1117-57089

November 10, 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. 187 (eRAI No. 9014) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 187 (eRAI No. 9014)," dated August 18, 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. 9014:

- 09.01.02-3
- 09.01.02-4
- 09.01.02-5
- 09.01.02-6
- 09.01.02-7
- 09.01.02-8
- 09.01.02-9
- 09.01.02-10
- 09.01.02-12
- 09.01.02-13

The response to question 09.01.02-11 will be provided by January 29, 2018.

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 187 (eRAI No. 9014). 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,

Jennie Wike
Manager, Licensing
NuScale Power, LLC

Distribution: Gregory Cranston, NRC, OWFN-8G9A
Samuel Lee, NRC, OWFN-8G9A
Anthony Markley, NRC, OWFN-8G9A

Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9014, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9014, nonproprietary

Enclosure 3: Affidavit of Thomas A. Bergman, AF-1117-57091

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9014, proprietary

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

Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 9014, nonproprietary

NuScale Power™

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

eRAI No.: 9014
Date of RAI Issue: 08/18/2017

NRC Question No.: 09.01.02-3

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 197, Section 3.1.5.5.4, the applicant provided the evaluation for the stuck fuel assembly. The applicant states, "A conservative net force of Fs = 1200 lb.is considered to act upwards at the bottom of the fuel tube." The applicant should provide the basis for the magnitude of the net force and explain why it is conservative.

NuScale Response:

The rated capacity of the fuel handling crane is 1200 lbs. Per Section 3.1.5.2 of Technical Report TR-0816-49833-P, "Fuel Storage Rack Analysis", Rev. 0, the weight of a fuel assembly with a control rod assembly is 830lb + 43lb = 873lb. The load cell's setting during fuel handling operations is near the lifted weight (approx. 900lb); therefore, the force applied by the fuel handling crane due to a stuck fuel assembly will not exceed the crane's rated capacity. Therefore, the use of 1200 lb. net force in the stuck fuel assembly analysis is conservative.

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.: 9014
Date of RAI Issue: 08/18/2017

NRC Question No.: 09.01.02-4

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.

Based on the staff review of NuScale FSAR Tier 2 Section 9.1.2, "New and Spent Fuel Storage," the staff finds that additional information will be needed by the COL applicant to incorporate the DC by reference. Therefore, the staff requests that the applicant provide a COL Item to address site-specific procedures for the measurement of post-seismic gaps between racks and between walls and racks and, if required, the repositioning of the racks to re-establish the gaps specified in the design-basis seismic analysis of the racks.

NuScale Response:

The seismic interaction of the fuel storage racks within the Spent Fuel Pool (SFP) is performed to determine the seismic forces and movements during a safe-shutdown earthquake (SSE). The assumption of SSE seismic forces and displacements are bounding compared to operating basis earthquake (OBE) seismic forces and displacements. As indicated in Section 3.1.4.10.3 of Technical Report TR-0816-49833-P, "Fuel Storage Rack Analysis", Revision 0, no contact occurs between the racks and the SFP walls.

FSAR Table 1.8-2 contains two COL items which address the need to monitor the plant for seismic activity and assess the plant after seismic activity has been identified. Item 3.7-7 states, "A COL applicant that references the NuScale Power Plant design certification will provide a seismic monitoring system and a seismic monitoring program that satisfies RG 1.12 "Nuclear Power Plant Instrumentation for Earthquakes," Rev. 2 (or later) and RG 1.166 "Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Post-earthquake Actions," Rev. 0 (or later). Item 3.7-8 states, "A COL applicant that references the NuScale Power Plant design certification will identify the implementation milestone for the seismic monitoring program." In addition, FSAR Table 1.9-2, "Conformance with Regulatory Guides" identifies that NuScale

conforms with RG's 1.166, "Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Post-earthquake Actions," Rev. 0 and 1.167, "Restart of a Nuclear Power Plant Shut Down by a Seismic Event." Table 1.9-2 also states that adherence to these RG's is the responsibility of the COL applicant. Among other activities which are specified in these RG's, the COL applicant will be responsible for post-seismic inspection and assuring that the plant is started up post-seismic activity in a configuration consistent with the licensing basis of the plant.

Review of RG 1.167 indicates that there is no specific activity that would assure that the fuel racks are inspected and placed in a configuration consistent with the initial conditions of the fuel racks design . Therefore, COL item 3.7-8 in Table 1.8-2 was expanded to include reference to RG 1.166 and RG 1.167 and text that requires the COL applicant to develop post-earthquake procedures that include an activity to assure that the plant is started up after a seismic event with the fuel racks in a configuration consistent with the design basis. COL item 3.7-8 in Table 1.8-2 was revised as indicated below in response to this RAI.

Impact on DCA:

Section 3.7.4.6 and Table 1.8-2 have been revised as described in the response above and as shown in the markup provided with this response.

RAI 02.04.13-1, RAI 03.04.02-1, RAI 03.04.02-2, RAI 03.04.02-3, RAI 03.05.01.04-1, RAI 03.05.02-2, RAI-03.06.02-15, RAI 03.07.01-2, RAI 03.07.01-3, RAI 03.07.02-8, RAI 03.07.02-12, RAI 03.09.02-15, RAI 03.09.02-48, RAI 03.09.03-12, RAI 03.09.06-5, RAI 03.09.06-6, RAI 03.09.06-16, RAI 03.09.06-27, RAI 03.11-8, RAI 03.11-14, RAI 03.13-3, RAI 06.04-1, RAI 09.01.02-4, RAI 09.01.05-3, RAI 09.01.05-6, RAI 09.03.02-3, RAI 09.03.02-4, RAI 09.03.02-5, RAI 09.03.02-6, RAI 09.03.02-8, RAI 10.02-1, RAI 10.02-2, RAI 10.04.10-2, RAI 13.01.01-1, RAI 13.01.01-1S1, RAI 13.02.02-1, RAI 13.03-4, RAI 13.05.02.01-2, RAI 13.05.02.01-2S1, RAI 13.05.02.01-3, RAI 13.05.02.01-3S1, RAI 13.05.02.01-4, RAI 13.05.02.01-4S1

Table 1.8-2: Combined License Information Items

Item No.	Description of COL Information Item	Section
COL Item 1.1-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will identify the site-specific plant location.	1.1
COL Item 1.1-2:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will provide the schedules for completion of construction and commercial operation of each power module.	1.1
COL Item 1.4-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will identify the prime agents or contractors for the construction and operation of the nuclear power plant.	1.4
COL Item 1.7-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will provide site-specific diagrams and legends, as applicable.	1.7
COL Item 1.7-2:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will list additional site-specific P&IDs and legends as applicable.	1.7
COL Item 1.8-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will provide a list of departures from the certified design.	1.8
COL Item 1.9-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will review and address the conformance with regulatory criteria in effect six months before the docket date of the COL application for the site-specific portions and operational aspects of the facility design.	1.9
COL Item 1.10-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will evaluate the potential hazards resulting from construction activities of the new NuScale facility to the safety-related and risk significant structures, systems, and components of existing operating unit(s) and newly constructed operating unit(s) at the co-located site per 10 CFR 52.79(a)(31). The evaluation will include identification of any management and administrative controls necessary to eliminate or mitigate the consequences of potential hazards and demonstration that the limiting conditions for operation of an operating unit would not be exceeded. This COL item is not applicable for construction activities (build-out of the facility) at an individual NuScale Power Plant with operating NuScale Power Modules.	1.10
COL Item 2.0-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will demonstrate that site-specific characteristics are bounded by the design parameters specified in Table 2.0-1. If site-specific values are not bounded by the values in Table 2.0-1, the COL applicant will demonstrate the acceptability of the site-specific values in the appropriate sections of its combined license application.	2.0
COL Item 2.1-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will describe the site geographic and demographic characteristics.	2.1
COL Item 2.2-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will describe nearby industrial, transportation, and military facilities. The COL applicant will demonstrate that the design is acceptable for each potential accident, or provide site-specific design alternatives.	2.2
COL Item 2.3-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will describe the site-specific meteorological characteristics for Section 2.3.1 through Section 2.3.5, as applicable.	2.3
COL Item 2.4-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will investigate and describe the site-specific hydrologic characteristics for Section 2.4.1 through Section 2.4.14, as applicable.	2.4

Table 1.8-2: Combined License Information Items (Continued)

Item No.	Description of COL Information Item	Section
COL Item 3.7-6:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will perform a SSSI analysis that includes the RXB, CRB, RWB and both Turbine Generator Buildings. The COL applicant will confirm that the site-specific seismic demands of the standard design SSC are bounded by the corresponding design certified seismic demands and, if not, the standard design SSC will be shown to have appropriate margin or should be appropriately modified to accommodate the site-specific demands.	3.7
COL Item 3.7-7:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will provide a seismic monitoring system and a seismic monitoring program that satisfies RG 1.12 "Nuclear Power Plant Instrumentation for Earthquakes," Rev. 2 (or later) and RG 1.166 "Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Post-earthquake Actions," Rev. 0 (or later). This information is to be provided as noted below.	3.7
COL Item 3.7-8:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will identify the implementation milestone for the seismic monitoring program. In addition, a COL applicant that references the NuScale Power Plant design certification will prepare site-specific procedures for activities following an earthquake. These procedures and the data from the seismic instrumentation system will provide sufficient information to determine if the level of earthquake ground motion requiring shutdown has been exceeded. An activity of the procedures will be to address measurement of the post-seismic event gaps between the fuel racks and the pool walls and between the individual fuel racks and to take appropriate corrective action if needed (such as repositioning the racks or assuring that the as-found condition of the racks is acceptable based on the assumptions of the racks' design basis analysis). Acceptable guidance for procedure development is contained in RG 1.166 "Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Post-earthquake Actions," Rev. 0 (or later) and 1.167, "Restart of a Nuclear Power Plant Shut Down by a Seismic Event," Rev. 0 (or later).	3.7
COL Item 3.7-9:	A COL applicant that references the NuScale Power Plant design certification will include an analysis of performance-based response spectra (PBRS) established at the surface and intermediate depth(s) that take into account the complexities of the subsurface layer profiles of the site and provide a technical justification for the adequacy of V/H spectral ratios used in establishing the site-specific foundation input response spectra (FIRS) and PBRS for the vertical direction.	3.7
COL Item 3.7-10:	A COL applicant that references the NuScale Power Plant design certification will perform a site-specific configuration analysis that includes the RXB with applicable configuration layout of the desired NPMs. The COL applicant will confirm the following are bounded by the corresponding design certified seismic demands: 1) The ISRS of the standard design at the foundation and roof 2) The maximum forces in the NPM lug restraints and skirts 3) The maximum forces and moments in the east and west wing walls and pool walls If not, the standard design will be shown to have appropriate margin or should be appropriately modified to accommodate the site-specific demands.	3.7
COL Item 3.8-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will describe the site-specific program for monitoring and maintenance of the Seismic Category I structures in accordance with the requirements of 10 CFR 50.65 as discussed in RG 1.160. Monitoring is to include below grade walls, groundwater chemistry if needed, base settlements and differential displacements.	3.8
COL Item 3.8-2:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will confirm that the site independent RXB and CRB are acceptable for use at the designated site.	3.8
COL Item 3.9-1:	A COL ~~Applicant~~applicant that references the NuScale Power Plant design certification will provide the applicable test procedures prior to the start of testing and will submit the test and inspection results from the comprehensive vibration assessment program for the NuScale Power Module, in accordance with Regulatory Guide 1.20.	3.9

3.7.4.5 Instrument Surveillance

The SMS is expected to be operable during all modes of plant operation, including periods of plant shutdown.

The COL applicant will discuss in-service inspection, calibration, and maintenance requirements as part of the response to COL Item 3.7-1.

3.7.4.6 Program Implementation

RAI 09.01.02-4

COL Item 3.7-8: A COL applicant that references the NuScale Power Plant design certification will identify the implementation milestone for the seismic monitoring program. In addition, a COL applicant that references the NuScale Power Plant design certification will prepare site-specific procedures for activities following an earthquake. These procedures and the data from the seismic instrumentation system will provide sufficient information to determine if the level of earthquake ground motion requiring shutdown has been exceeded. An activity of the procedures will be to address measurement of the post-seismic event gaps between the fuel racks and the pool walls and between the individual fuel racks and to take appropriate corrective action if needed (such as repositioning the racks or assuring that the as-found condition of the racks is acceptable based on the assumptions of the racks' design basis analysis). Acceptable guidance for procedure development is contained in RG 1.166 "Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Post-earthquake Actions," Rev. 0 (or later) and 1.167, "Restart of a Nuclear Power Plant Shut Down by a Seismic Event," Rev. 0 (or later).

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

eRAI No.: 9014
Date of RAI Issue: 08/18/2017

NRC Question No.: 09.01.02-5

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. DSRS 3.8.4 (I)(7) in part states that the applicant should describe materials, quality control procedures, and any special construction techniques.

Neither NuScale FSAR Tier 2, Section 9.1.2 nor the Technical Report addresses the governing quality assurance/quality control (QA/QC) requirements and procedures for the design and construction of the spent fuel storage racks. There is no information about the manufacturing process; the fabrication techniques; and the sequences used for constructing the fuel storage racks, in order to minimize fabrication distortions and to provide accessibility for welding. The staff requests the applicant identify the governing QA/QC I requirements; describe rack fabrication techniques and welding sequences; and specify the NDE methods to be used. The applicant should provide this information in the Technical Report and summarize it in the FSAR.

NuScale Response:

The spent fuel storage racks will be fabricated in accordance with the requirements of ASME Code Section III, Subsection NF, as described in Section 1.2 (page 5) of the Technical Report. The fabricator will adhere to specifications provided for the fabrication of the racks, but particular fabrication methods and sequences will not be specified. The detailed drawings that are provided in eRAI 9025 Question 09.01.02-15(a) allow for review of accessibility of welds and other rack details. The weld locations are accessible and can be inspected as they are made.

Impact on DCA:

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

NuScale Power

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

eRAI No.: 9014
Date of RAI Issue: 08/18/2017

NRC Question No.: 09.01.02-6

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. DSRS 3.8.4 specifically indicates that freestanding storage racks are subject to sliding, uplift, and impact between racks and with the pool walls.

The staff reviewed FSAR Tier 2, Section 9.1.2, and TR-0816-49833-P and did not find any technical specification or other formal restriction that requires all fuel racks to be in place when FAs are in any of the racks. To ensure that the fuel storage racks are not installed or configured in an unanalyzed condition, the staff requests the applicant describe whether any such restriction exists or address the condition of overturning and sliding stability, and seismic/structural design for fewer than the current design basis of a whole pool set of racks.

NuScale Response:

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}}2(a),(c)

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.: 9014
Date of RAI Issue: 08/18/2017

NRC Question No.: 09.01.02-7

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.

The staff reviewed TR-0816-49833-P and identified the following inconsistencies that should be corrected.

a. In the 2nd paragraph on page 13 of TR-0816-49833-P, the staff requests the applicant correct the reference to Figure 3-67. Staff believes the correct reference is Table 3-67.

b. On Page 37 of TR-0816-49833-P, Figure 3-19 represents the spectral ratio for TH1 X direction. However, the label indicates the Y direction. The staff requests the applicant correct this inconsistency for Figure 3-19 and Figure 3-29 for the TH1 Z direction.

c. On Page 172 of TR-0816-49833-P, there is an asterisk next to the ultimate stress for the stainless steel material at a temperature of 212 degrees F with no explanation or footnote for the asterisk. The staff requests the applicant provide this information.

NuScale Response:

The following inconsistencies in the NuScale technical report TR-0816-49833 have been corrected as suggested in the eRAI question:

a. The reference to Figure 3-67 in the 2nd paragraph on page 13 has been corrected to reference Table 3-67.
b. Figures 3-19 and 3-29 have been corrected to properly label the TH1 X and the TH1 Z spectral ratio directions, respectively.
c. "Note" in the footnote at the bottom of Table 3-28 has been replaced with "*".

Impact on DCA:

Technical Report TR-0816-49833, Fuel Storage Rack Analysis, has been revised as described in the response above and as shown in the markup provided in this response.

3.0 Analysis

3.1 Structural Analysis

The structural analysis of the fuel storage racks involves several steps as described in this section, including the development of the analysis models, both detailed and simplified, the time history development, fuel assembly load drop analysis, whole-pool analysis, and fuel storage rack interactions. Using the analysis obtained, the detailed stress analysis and design are carried out. Finally, a sensitivity analysis with partially loaded, whole-pool scenarios and varying frictional factors are investigated, and conclusions are drawn in comparison to the fully loaded, whole-pool analysis results.

3.1.1 Fuel Storage Detailed and Simplified Structural Model Development

3.1.1.1 Methodology

Two models have been created for different aspects to the NuScale fuel storage rack analysis. A detailed model of the 11x11 fuel storage rack module is used in the stress evaluation to ensure the design meets ASME acceptance criteria (References 7 and 12). ~~Figure~~Table 3—67 contains fuel rack design parameters.

The detailed model of the fuel storage rack is used to determine the natural frequencies of the fuel storage rack. A simplified model of the fuel storage rack is created using predominant modal frequencies determined from the detailed model to validate that the simplified model is an adequate equivalent to the detailed model. {{

}}2(a),(c) The simplified model is made to improve computer run times while capturing accurate responses during the time history analysis.

3.1.1.2 Major Assumptions

The following are modeling simplifications for the detailed model:

1. The holes in the baseplate are modeled as square openings of equal area to the circular openings they simplify. This may result in higher stresses in the corners, but improves the mesh shape of the bottom plate and connections with the vertical members.

2. Lifting lugs are not explicitly modeled. The mass of the lifting lugs is insignificant (0.08 percent of total mass) and does not affect the seismic response. Removing them from the model reduces elements and therefore computer analysis time.

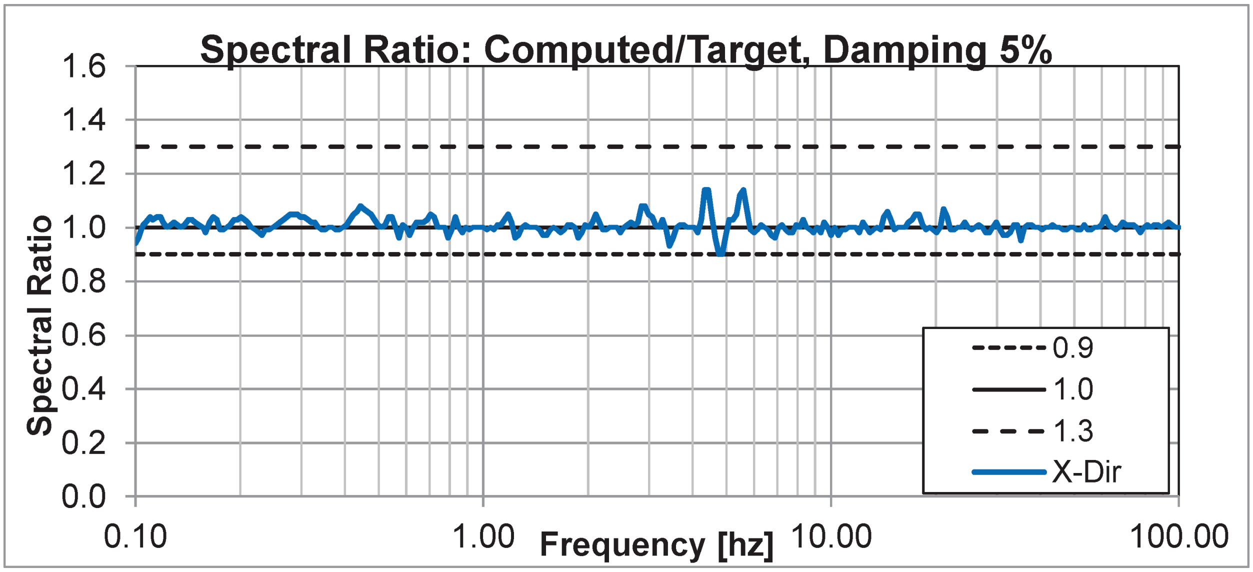

Figure 3—19 Spectral ratio, TH1 X direction

TH1, Y Direction Time History

Figure 3—20 shows the acceleration, velocity, and displacement time history of the initial seed and the final modified time history of TH1 Y direction. The seed time history is scaled for illustrative purposes so that the ZPA matches the target RS.

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}}2(a),(c)

Figure 3—28 Acceleration response spectra, TH1 Z direction

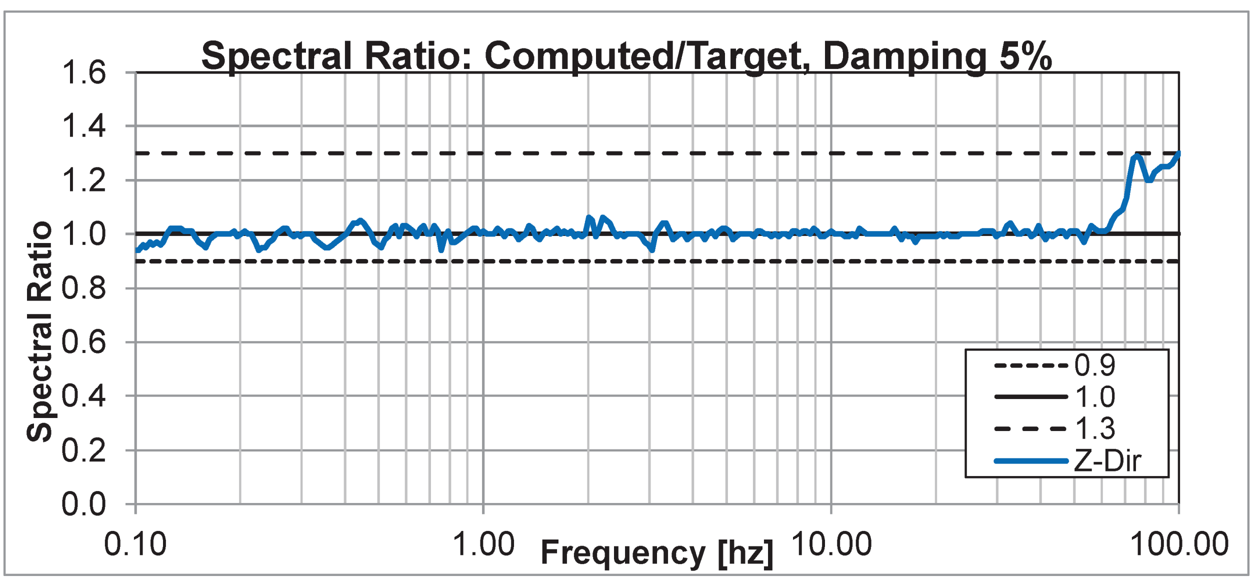

Figure 3—29 Spectral ratio, TH1 Z direction

P_f = the maximum uplift force that can be exerted by the fuel bridge on a stuck FA.

E = dynamic load due to operating basis earthquake.

E' = dynamic load due to SSE.

F_d = impact loads due to a dropped FA. The dropped FA criteria for the fuel storage rack are evaluated in the load-drop analysis (Section 3.1.3).

3.1.5.5.1 Material Properties

Unless otherwise noted, material properties are taken from Table TM-1 and Table NF-2 in Reference 7 at 100 degrees F, which is the operating temperature of the fuel storage rack. Thermal expansion coefficients and allowable stress values are also shown at 212 degrees F, the temperature of the rack under accident conditions.

The {{ }}2(a),(c) stainless steel (see Section 3.4) meets the corrosion requirements {{ }}2(a),(c) while providing the minimum mechanical properties {{ }}2(a),(c) . The allowable stresses for stainless steel Type {{ }}2(a),(c) are used throughout the analysis.

Type {{ }}2(a),(c) stainless steel is only applicable for the bearing plates, which are analyzed in Section 3.1.3. Other than allowable stress, this material has similar properties to Type {{ }}2(a),(c) stainless steel. This material also has the same mean coefficient of thermal expansion as type {{ }}2(a),(c) stainless steel.

Table 3-28 {{ }}2(a),(c) stainless steel - Allowable stress values (based on type {{ }}2(a),(c))

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}}2(a),(c)

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

eRAI No.: 9014
Date of RAI Issue: 08/18/2017

NRC Question No.: 09.01.02-8

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.

To fully understand the configuration and design of the fuel racks and FAs, additional details and dimensions of the fuel racks should be provided. These details should identify all of the structural members and connections (e.g., welds) for the various elements, including the poison plates, along with dimensions, sizes, material thicknesses, and weld types/sizes. Figures 1-1 and 1-2 provide some of this information, but the additional details described are needed.

NuScale Response:

Five additional figures have been added to the Technical Report in response to eRAI 9025, Question 09.01.02-15(a) that provide more details and labels for the rack components, including expanded views of the assemblies supplementing the general view of Figures 1-1 and 3-120. General weld locations are identified to help with the understanding of the assembly of the grid and rack structure.

In addition, detailed fabrication drawings are provided to the NRC reading room to support the understanding of the configuration and design of the fuel racks and fuel assemblies. These drawings provide additional detail and dimensions of the fuel racks.

Impact on DCA:

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

NuScale Power

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

eRAI No.: 9014
Date of RAI Issue: 08/18/2017

NRC Question No.: 09.01.02-9

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. DSRS 3.8.4 specifically states that the review of the design and analysis procedures used for seismic Category I structures focuses on the extent of compliance with American National Standards Institute (ANSI)/American Institute of Steel Construction (AISC) N690-1994 including Supplement 2 (2004) for steel structures. The use of more recent codes and standards is reviewed for adequacy on a case-by case basis.

On Page 1 of TR-0816-49833-P, the applicant states, "The structural integrity of the fuel storage racks are evaluated to criteria specified in ASME Code Section III, Division I, Subsection NF (Reference 12) and AISC 9th Edition (Reference 16)." Since only AISC N690-1994 including Supplement 2 (2004) has been accepted by the staff in DSRS 3.8.4, the applicant is requested to explain why Reference 16 (AISC, "Manual of Steel Construction," 9th edition) was used and to identify all cases where it was used.

NuScale Response:

DSRS Section 3.8.4.I.4 states that review of the design and analysis procedures used for seismic Category I structures focuses on the extent of compliance with American National Standards Institute (ANSI)/American Institute of Steel Construction (AISC) N690-1994 including Supplement 2 (2004) for steel structures. However, the fuel storage racks are designed in compliance with DSRS 3.8.4, Appendix D. DSRS 3.8.4, Appendix D, Section I.2, which states, "Design, fabrication, and installation of spent fuel racks of stainless steel material may be performed based on ASME Code, Section III, Division 1, Subsection NF requirements for Class 3 component supports." All design criteria used in the design of the racks are in accordance with ASME Code Section III, Division I, Subsection NF. AISC 9th edition was only used to obtain the section properties of the 6"x6"x1/2" corner post support angles. To eliminate confusion, the reference to AISC 9th Edition has been deleted from Page 1 of TR-0816-49833.

Impact on DCA:

Technical Report TR-0816-49833, Fuel Storage Rack Analysis, the Executive Summary section has been revised as described in the response above and as shown in the markup provided in this response.

Executive Summary

This technical report contains a summary of the documents, analytical inputs, interpretations, and methodologies used to design and analyze the fuel storage racks as a basis to demonstrate compliance with the applicable regulations to support the NuScale Power design certification. Regulatory Guide 1.29 (Reference 1) classifies fuel storage racks as Seismic Category I structures. The fuel storage racks are designed per 10 CFR 50, Appendix B (Reference 3) and ASME NQA-1 (Reference 4) requirements.

The design of fuel storage racks are in compliance with regulatory requirements in the areas of structural analysis, thermal hydraulics, nuclear criticality, and materials analysis.

The structural analysis of the fuel storage racks evaluates the design for the event of a fuel assembly drop, seismic and structural integrity. The fuel assembly drop is evaluated to the design criteria in NuScale Design Specific Review Standard (DSRS) 3.8.4 (Reference 11). The seismic design criteria for the fuel racks are specified in DSRS 3.7.1 (Reference 8) and ASCE/SEI 43 (Reference 9). The structural integrity of the fuel storage racks are evaluated to criteria specified in ASME Code Section III, Division I, Subsection NF (Reference 12) and AISC 9th Edition (Reference 16). The fuel storage racks are in compliance with regulatory requirements in the area of structural analysis.

The thermal-hydraulic analysis evaluates the ability to cool the spent fuel according to the criteria recommended in DSRS 9.1.2 (Reference 2), III Review Procedure 4.I. The thermal-hydraulic analysis of the flow through the fuel racks is adequate for decay heat removal from the spent fuel assemblies with two trains of spent fuel pool (SFP) cooling in operation and upon loss of one cooling train. Furthermore, the thermal-hydraulic analysis shows adequate flow circulation of the coolant during anticipated operating conditions (one failed SFP cooling train), including full core-offloads during refueling, to prevent nucleate boiling for all fuel assemblies.

The nuclear criticality analysis of the fuel storage racks evaluates the designs to ensure criticality control is provided to meet the criticality-related portions of 10 CFR Part 50 (Reference 3), Section 50.68. The fuel storage racks are in compliance with regulatory requirements in the area of nuclear criticality.

The structural components of the fuel storage racks are at risk to degrade through corrosion mechanisms. To mitigate these risks, stainless steel is chosen for the structural components of the racks. These materials have a proven positive performance in light water reactors and are expected to perform well in the NuScale SFP environment for the design lifetime of 60 years.

Based on the evaluations summarized within this document, the fuel storage rack design is in compliance with the regulatory requirements. The fuel storage racks allow placement of fuel assemblies with a maximum initial enrichment of 5 percent U-235 and a maximum burn-up of {{ }}[2(a),(c)] without restrictions for zoning or loading patterns after 72 hours post shutdown of the reactor.

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

eRAI No.: 9014
Date of RAI Issue: 08/18/2017

NRC Question No.: 09.01.02-10

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 146, in Section 3.1.4.10, the applicant describes the application of gravity load to all the parts in the model except the concrete pool but does not discuss the effects of buoyancy. The applicant should provide where in the report the effects of buoyancy are described or add to the report an explanation of how the effects of buoyancy were considered

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NuScale Response:

The following paragraph is added to the TR as the third bullet in Section 3.1.4.8:

The buoyancy effects on the rack analysis are considered by the interaction of the fluid (ALE) elements with the fuel rack elements. Fluid elements simulate the increasing water pressure along the depth. The pressure at the bottom of a column of fluid is greater than at the top of the column. Similarly, the pressure at the bottom of the submerged rack in water is greater than at the top of the rack. This pressure difference results in a net upwards force on the rack. The magnitude of the force exerted on the rack is proportional to the pressure difference, and is equivalent to the weight of the fluid that would otherwise occupy the volume of the object, i.e., the displaced fluid.

Impact on DCA:

Technical Report TR-0816-49833, Fuel Storage Rack Analysis, has been revised as described in the response above and as shown in the markup provided in this response.

3.1.4.8 Initial Conditions, Boundary Conditions, and Limitations

The initial conditions of the analysis include:

- The fuel storage rack has openings on the sides between the tubes and top for FA insertion where water is capable of flowing. These spaces are filled with a flexible member. This prevents the water of ALE elements from occupying the small spaces between tubes. These elements are soft and do not affect the response of the structure due to hydrodynamic or impact forces. This reduces the need to model very small water elements between tubes and reduces computational time significantly. Additionally, because the fuel storage rack is shown to be fairly rigid in Table 3-1, rigid body motion is expected to occur, and this simplification has no impact on the results of the analysis (see Section 3.1.1).

- The fuel storage racks are initially butted up against each other when considering the baseplate level. For the whole-pool analysis, an artificial initial gap of 0.2 inches is modeled to prevent instability and initial contact penetration in the analysis.

- The buoyancy effects on the rack analysis are considered by the interaction of the fluid (ALE) elements with the fuel rack elements. Fluid elements simulate the increasing water pressure along the depth. The pressure at the bottom of a column of fluid is greater than at the top of the column. Similarly, the pressure at the bottom of the submerged rack in water is greater than at the top of the rack. This pressure difference results in a net upwards force on the rack. The magnitude of the force exerted on the rack is proportional to the pressure difference, and is equivalent to the weight of the fluid that would otherwise occupy the volume of the object, i.e., the displaced fluid.

NuScale Power

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

eRAI No.: 9014
Date of RAI Issue: 08/18/2017

NRC Question No.: 09.01.02-12

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.

In FSAR Section 9.1.2.2.2, "Fuel Storage Rack Design," the applicant states, Based on the travel limitations of the fuel handling machine, the fuel storage racks can safely store 1,404 fuel assemblies vertically in the SFP; however, only 1,393 fuel storage locations are considered accessible due to the possible difficulty reaching the storage locations closest to the weir wall." On Page 2 of TR-0816-49833- P, the applicant states "The fuel storage racks can safely store at least 1404 FAs vertically in the SFP, factoring in the maximum reach of the fuel handling machine path. Because of the reach of the fuel handling machine, not all fuel cells can be safely reached. Therefore, a maximum of 1404 FAs is used in the analysis."

The applicant should confirm whether the maximum number of fuel assemblies that are permitted to be stored within the racks is 1,404 or 1,393. The applicant should also confirm that the whole pool analysis model uses the same fill arrangement.

Further, the applicant should identify where the FSAR states that fuel assemblies are only permitted to be stored within the red line region as shown in Figure 9.1.2-1 or provide a statement in the FSAR to identify this restriction. The applicant should explain whether there is a technical specification requirement or other means of ensuring that the maximum permissible fuel assembly configuration is never exceeded.

NuScale Response:

The response to RAI 8760, question 9.1.1-10 clarified wording that the fuel storage racks store at most 1404 fuel assembles. Technical specification Section 4.3.3 states, "The spent fuel pool is designed and shall be maintained with a storage capacity limited to no more than 1404 fuel assemblies."

The red line does not define the limit for the storage of spent fuel storage. The red line region is the physical limitation of the fuel handling machine to install fuel assemblies into the fuel storage racks outside that region. Thus, the capacity of the racks to store 1404 fuel assemblies is limited by the physical constraints of the fuel handling machine, not the fuel storage rack design.

TR--0816-49833-P, Section 1.0, paragraph 3 states:

"The fuel storage racks can safely store at least 1404 fuel assembles vertically in the spent fuel pool, factoring in the maximum reach of the fuel handling machine path. Because of the reach of the fuel handling machine (red line shown in Figure 1-2), not all fuel cells can safely be reached. Therefore, a maximum of 1404 fuel assembles is used in the supporting spent fuel rack analyses, including the whole pool analysis."

Due to this limitation, the analysis was completed with 1404 fuel assembles installed in the accessible locations.

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.: 9014
Date of RAI Issue: 08/18/2017

NRC Question No.: 09.01.02-13

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.

In Section 3.1.4.1 (page 130) of TR-0816-49833-P, the methodology for modeling the water in the pool is described. The applicant describes the use of the Arbitrary- Lagrangian-Eulerian (ALE) capability in LS- DYNA which considers the hydrodynamic coupling effects between the rack and the fluid within the spent fuel pool (SFP). The applicant is requested to summarize the validation of the LS-DYNA computer code, including the use of the ALE methodology in the code. The description of the validation for the ALE methodology should include specific solutions to test problems applicable to the modeling of the water in the SFP. The results of these test problems in LS-DYNA should be compared to solutions obtained from classical solutions, other codes or experimental results.

NuScale Response:

Several test problems were developed to validate the modeling of a drop of a fuel assembly and fluid-structure interaction capabilities of the computer program LS-DYNA. Four such test problems applicable to the modeling of the fluids in the SFP are presented here. Each of these 4 problems is derived from ANSYS verification problems available in the ANSYS Verification Manual. ANSYS has a well-established and accepted QA program. Validation problems are provided in the verification manual, which include known solutions that can be used to validate results. Each of the test problems presented include ALE methods for hydrodynamic coupling.

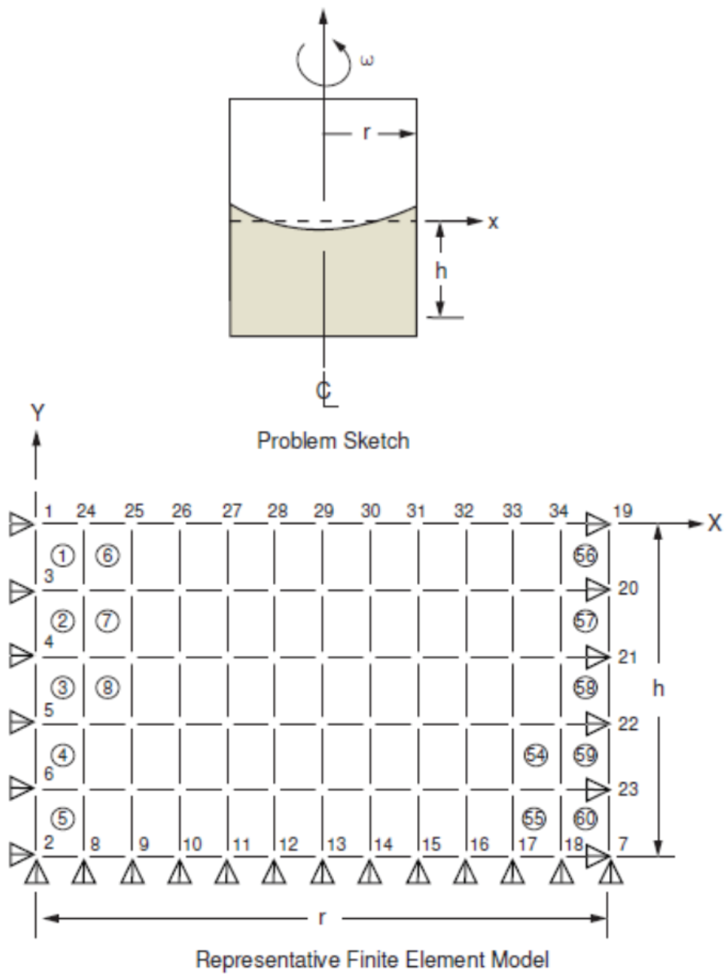
In order to validate the LS-DYNA V971 R7 program, each test problem is run on Red Hat Linux V6.4 Operating System (OS). The LS-DYNA results for Test Problems 1-3 are compared to the theoretical results from the ANSYS Verification Manual, as well as to results computed by ANSYS 15.0.7 on the same OS. Test Problem 4 uses a modified geometry based on VM158 from the ANSYS Release 15 Verification manual and is compared to results obtained by

ANSYS 15.0.7 on the same OS.

Test Problem #1 - VM149: Rotation of Tank Fluid

Test Problem #1 is run in ANSYS V15.0.7. It is then run in LS-DYNA V971 R7 to confirm accuracy of LS-DYNA. The results of these cases are compared with the values provided in the ANSYS Verification Manual.

A large cylindrical tank is partially filled with an incompressible liquid as depicted in the following figure. The tank rotates at a constant angular velocity about its vertical axis, as shown. The elevation (δ) of the liquid surface relative to the center (lowest) elevation for various radial positions is calculated.



Test Problem #1 - VM149 Fluid Tank Problem Sketch

The table below demonstrates that the computed results from LS-DYNA V971 R7 match the

expected results given in the ANSYS Verification Manual, as well as the results obtained with ANSYS 15.0.7.

Expected vs. Computed Results Test #1

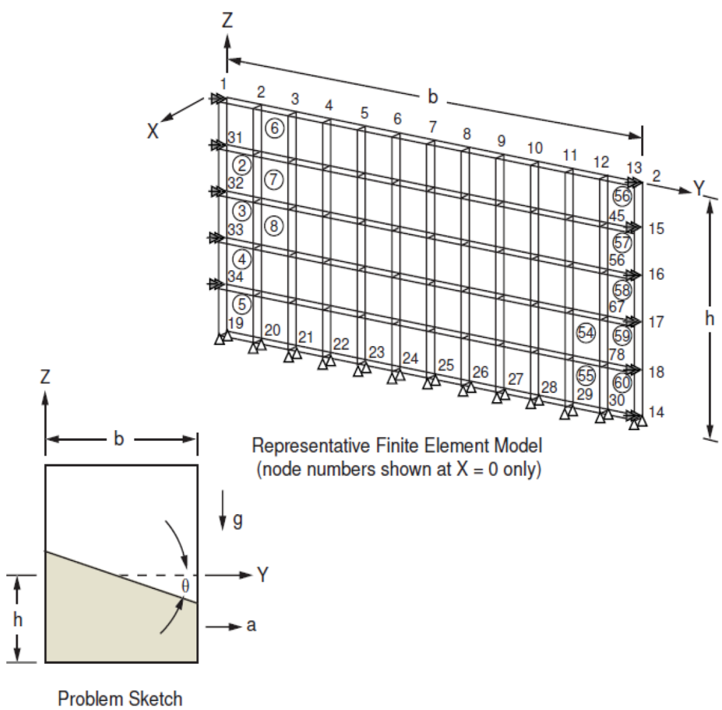
{{

}} 2(a),(c)

Test Problem #2 - VM150: Acceleration of Tank Fluid

Test Problem #2 is run in ANSYS V15.0.7. It is then run in LS-DYNA V971 R7 to confirm accuracy of LS-DYNA. The results of these cases are compared with the values provided in the ANSYS Verification Manual.

A large rectangular tank is partially filled with an incompressible liquid. The tank has a constant acceleration (a) to the right, as shown. Determine the elevation (δ) of the liquid surface relative to the zero acceleration elevation along the Y-axis. Also determine the slope (θ) of the free surface and the pressure p in the fluid near the bottom left corner of the tank.



Test Problem #2 - VM150 Fluid Tank Problem Sketch

The table below demonstrates that the computed results from LS-DYNA V971 R7 match the expected results given in the ANSYS Verification Manual, as well as the results obtained with ANSYS 15.0.7.

Expected vs. Computed Results Test #2

{{

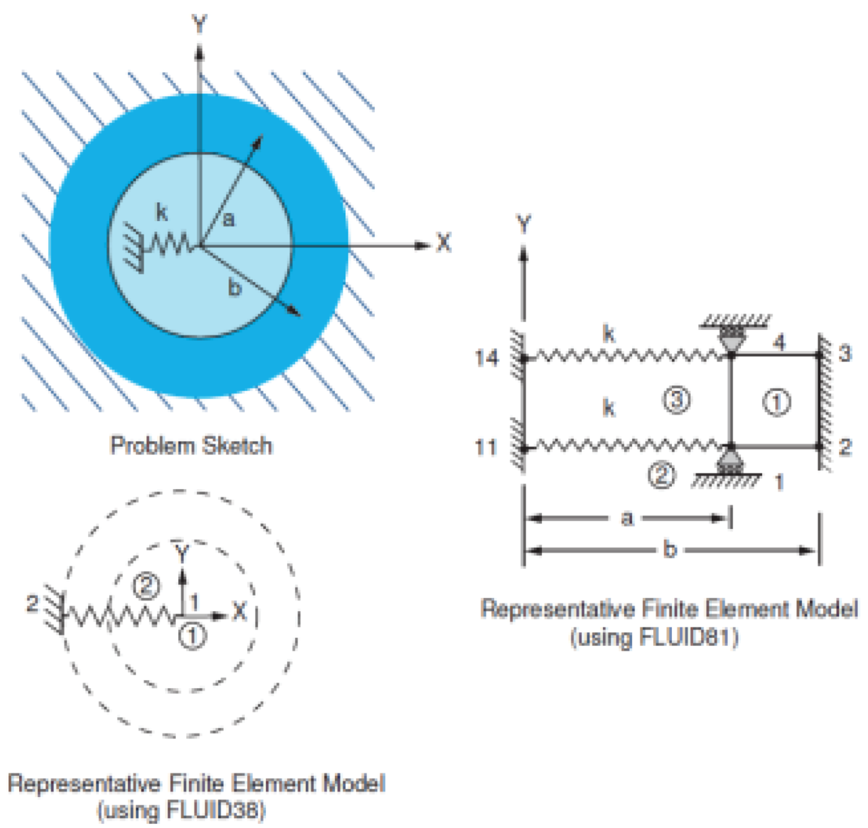
}} 2(a),(c)

Test Problem #3 - VM154: Vibration of Fluid Coupling

Test Problem #3 is run in ANSYS V15.0.7. It is then run in LS-DYNA V971 R7 to confirm accuracy of LS-DYNA. The results of these cases are compared with the values provided in the ANSYS Verification Manual.

A long cylinder is immersed in a circular hole as shown in the figure below. The cylinder is separated from the containment surface by a frictionless, incompressible liquid annulus. A spring restraint is attached to the cylinder from the ground. The natural frequency, f, of the system, based upon the hydrodynamic mass of the liquid annulus, is calculated.

The problem is solved using the fluid-coupling element (ANSYS FLUID38). The total length of the assembly is assumed to be long in comparison with its radius. The solution is based upon radial motion of a unit length of the assembly. The cylinder is assumed to be massless so that all mass effects are from liquid annulus. For the fluid coupling element (ANSYS FLUID38), the nodes are defined as coincident, but are shown apart for clarity. An effective harmonic spring constant, {{ }}[2(a),(c)] is used for each spring to produce equivalent spring force.



Problem Sketch

Representative Finite Element Model (using FLUID81)

Representative Finite Element Model (using FLUID38)

Test Problem #3 - VM154 Fluid Tank Problem Sketch

The table below demonstrates that the computed results from LS-DYNA V971 R7 match the expected results given in the ANSYS Verification Manual, as well as the results obtained with ANSYS 15.0.7.

Expected vs. Computed Results Test #3

{{

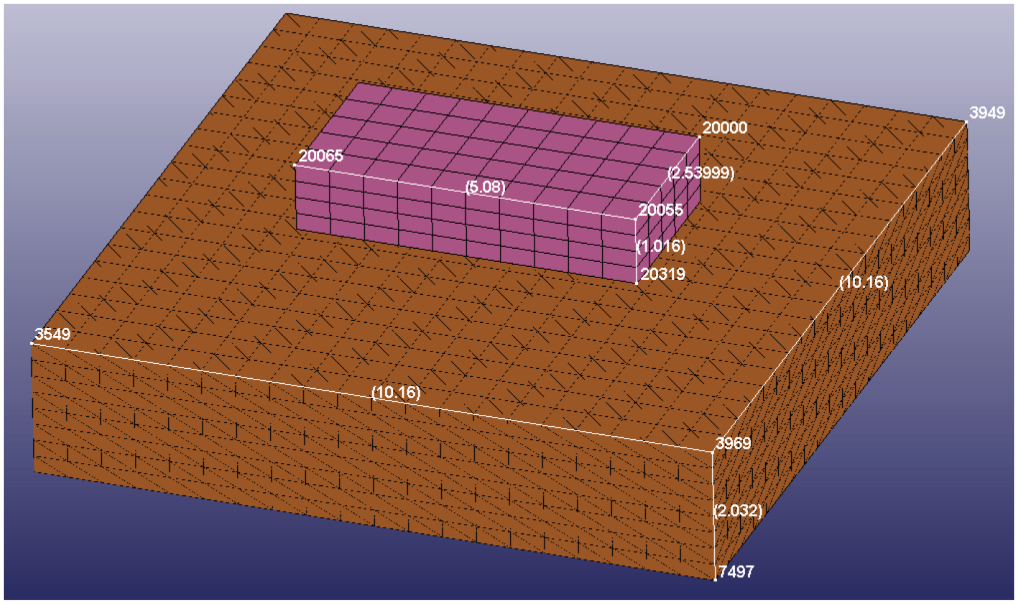
}} 2(a),(c)

Test Problem #4 - VM158: Motion of Bobbing Buoy

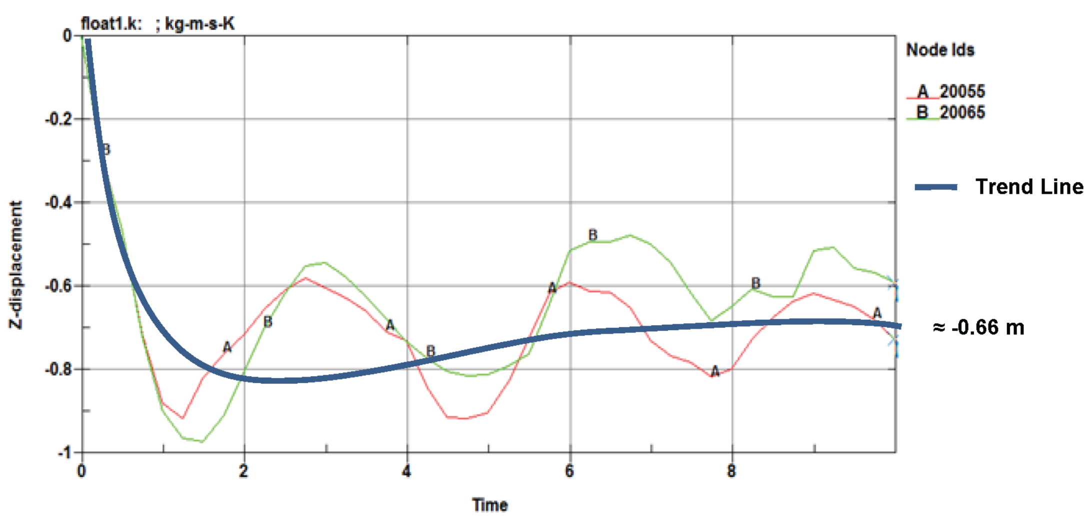
Test Problem #4 is run in ANSYS V15.0.7, which is an accepted code on the AREVA EASI. It is then run in LS-DYNA V971 R7 to confirm accuracy of LS-DYNA. Note that the original ANSYS script for VM158 from the ANSYS Verification Manual has been slightly modified such that the buoy is a rectangular block rather than a thin-walled pipe. The density of the block material, the input damping value, and the water depth has also been changed. These modifications assist with the convergence of the corresponding solution in LS-DYNA. Due to the combination of surface tension and buoyancy in this problem, a theoretical result is not used for comparison to the computational results.

A cylindrical buoy is initially held at the position shown (above its equilibrium position) and then released (with no initial velocity). The equilibrium position (δ) of the top of the buoy relative to the water surface is calculated.

The static solution to this problem is best obtained by the "slow dynamics" technique with damping, since the buoy is initially subjected to free fall. An arbitrary time to steady state of {{ }} 2(a),(c) is selected for the slow dynamics. The mass damping value (α) determines the bouncing (if any) before the final steady-state solution. An approximate value for (α) is determined from F/MV, where the force F = CV and damping C = αM. The force F is the out-of-balance force (buoyancy force minus the buoy weight) for the initial position pushing the buoy into the water, M is the mass of the buoy, and V is an estimated average velocity. Based upon these approximations and the updated rectangular dimensions of the buoy, α is {{ }} 2(a),(c).



Test Problem #4 - VM158 Buoy Problem Dimensions



Test Problem #4 - LS-DYNA Reported Z-Displacements of Block

ANSYS computes the steady-state deflection of the block to be {{ }}[2(a),(c)]. The LS-DYNA model is run to 10 seconds. Because LS-DYNA performs explicit nonlinear time history analyses, it shows some minor oscillation in the block at the final time of 10 seconds, and there is some relative movement of the block between opposite ends. This oscillation is small and near steady-state, therefore there is no need to run the case longer. The figure above displays the Z-displacement of nodes on both ends of the block, as well as an approximated trend line for the median of the block movement over time. This trend line provides a steady-

state deflection of {{ }}[2(a),(c)] , which matches the ANSYS result within the required acceptance criteria bounds. Therefore, the results demonstrate that the computed results from LS-DYNA V971 R7 match the results obtained with ANSYS 15.0.7.

Impact on DCA:

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

Enclosure 3:

Affidavit of Thomas A. Bergman, AF-1117-57091

NuScale Power, LLC

AFFIDAVIT of Thomas A. Bergman

I, Thomas A. Bergman, state as follows:

1. I am the Vice President, 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. 187, eRAI No. 9014. 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 11/10/2017.

Thomas A. Bergman