NuScaleDCRaisPEm Resource

From:	Cranston, Gregory
Sent:	Saturday, August 19, 2017 7:32 AM
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Cc:	NuScaleDCRaisPEm Resource; Lee, Samuel; Chowdhury, Prosanta; Samaddar, Sujit; Neuhausen, Alissa; Markley, Anthony
Subject:	Request for Additional Information No. 189, RAI 9025 (9.1.2)
Attachments:	Request for Additional Information No. 189 (eRAI No. 9025).pdf

Attached please find NRC staff's request for additional information concerning review of the NuScale Design Certification Application.

Please submit your technically correct and complete response within 60 days of the date of this RAI to the NRC Document Control Desk.
The NRC Staff recognizes that NuScale has preliminarily identified that the response to one or more questions in this RAI is likely to require greater than 60 days. NuScale is expected to provide a schedule for the RAI response by email within 14 days.

If you have any questions, please contact me.

Thank you.

Gregory Cranston, Senior Project Manager
Licensing Branch 1 (NuScale)
Division of New Reactor Licensing
Office of New Reactors
U.S. Nuclear Regulatory Commission
301-415-0546

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Request for Additional Information No. 189 (eRAI No. 9025)

Issue Date: 08/19/2017
Application Title: NuScale Standard Design Certification - 52-048
Operating Company: NuScale Power, LLC
Docket No. 52-048
Review Section: 09.01.02 - New and Spent Fuel Storage
Application Section: 9.1.2

QUESTIONS

09.01.02-14

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

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

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

09.01.02-15

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 the shallow-drop and deep-drop analysis provided on Pages 119 through 128 of TR-0816-49833-P. The applicant should provide additional information on the following descriptions related to the load drop analysis.

a. On page 123 of the TR, in Section 3.1.3.6.2, the applicant states, "Thus, the model of the bottom of the rack includes the bottom inner grid, bottom outer grid, bottom outer plate, baseplate, and a small section of the corner posts. The nodes at the locations of the foot assemblies are constrained." The applicant should explain the difference between the outer grid and the inner grid, including a figure if applicable; and whether the nodes at the locations of the foot assemblies are constrained only in the vertical direction.

b. On page 123 of the TR, in Section 3.1.3.6.2, the applicant describes the deep-drop analysis on the center of the baseplate. The applicant should clarify or correct the first sentence in the second paragraph

to refer to the deep-drop analysis. The sentence reads, “The geometry for the shallow-drop analysis is based on the ANSYS model discussed in Section 3.1.1 and shown in Figure 3-121.”

c. For the deep-drop analysis (Figures 3-121, 3-122, and 3-123), the applicant should explain why other FAs (or their equivalent dead load) are not included in the model which would impose additional load on the baseplate, or provide justification for not considering all other fuel assemblies in place when a fuel assembly drops through an empty cell.

d. On page 121 of the TR, Section 3.1.3.3, Item 1 describes the configuration for the shallow drop analysis. Figure 3-120 shows the FEM for the shallow drop which appears to show only 6 fuel tubes (with reduced lengths) in the model. In terms of mass loading on the racks during this shallow drop, the applicant should explain why only a set of 6 fuel tubes with reduced lengths are considered and not all of the fuel tubes and poison plates.

e. For all of the shallow drop evaluations, provide figures that clearly show the path of the dropped fuel assembly as it impacts the lead-ins, top grid, corner posts, and fuel tubes.

f. In the load drop analysis described in TR-0816-49833-P, Section 3.1.3, the applicant did not include a shallow drop on the corner of the fuel storage rack. On page 121, assumption 2 states that a shallow drop onto the center of the rack envelopes a shallow drop onto the corner post, because the corner of the rack is stiffer than the center of the rack. The staff requests the applicant provide additional justification that a shallow drop onto the corner post is bounded by a shallow drop onto the center of the rack. The applicant should confirm that the corner post does not buckle.

g. For all of the fuel drop accident analyses described in Section 3.1.3, explain if any sensitivity analyses were performed to verify the mesh size discretization of the finite elements or explain why these analyses were not performed. Also, describe if the adequacy of the drop analyses were checked by plotting the hourglass energy together with the kinetic energy, internal energy, and total energy throughout the time history to ensure that the hourglass energy is sufficiently small.

09.01.02-16

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

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