From:	Getachew Tesfaye
Sent:	Thursday, February 13, 2025 8:57 AM
To:	Request for Additional Information
Cc:	River Rohrman; Mahmoud -MJ- Jardaneh; Griffith, Thomas; Cummings, Kristopher; NuScale-SDA-720RAIsPEm Resource
Subject:	Nonproprietary - NuScale FSR TR-145417, "NuScale US460 Fuel Storage Rack Design Topical Report," Revision 0 - Request for Additional Information No. 001 (RAI-10502-R1)
Attachments:	TR-145417-P (FSR) - RAI-10502-R1 - FINAL NON-PROPRIETARY.pdf

Attached please find NRC staff's nonproprietary request for additional information (RAI) concerning the review of NuScale Topical Report TR-145417, "NuScale US460 Fuel Storage Rack Design Topical Report," Revision 0 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML23283A336). The encrypted proprietary version will be submitted in a separate email.

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.

Thank you,

Getachew Tesfaye (He/Him)
Senior Project Manager
NRC/NRR/DNRL/NRLB
301-415-8013

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

REQUEST FOR ADDITIONAL INFORMATION No. 001 (RAI-10502-R1)
BY THE OFFICE OF NUCLEAR REACTOR REGULATION
NUSCALE STANDARD DESIGN APPROVAL APPLICATION
TR-145417-P, "NuScale US460 Fuel Storage Rack Design Topical Report"
Revision 0
NUSCALE STANDARD DESIGN APPROVAL (SDA)
DOCKET NO. 99902078
ISSUE DATE: 2/13/2025

Background

By letter dated October 9, 2023, NuScale Power, LLC (NuScale or the applicant) submitted for U.S. Nuclear Regulatory Commission (NRC) staff review Topical Report (TR) TR-145417, "NuScale US460 Fuel Storage Rack Design Topical Report," Revision 0 (ML23283A336). The NRC staff has reviewed the information in TR-145417-P, Revision 0, and determined that additional information is required to complete its review.

Regulatory Basis

- 10 CFR 50.68(b) provides the requirements that are necessary to prevent criticality accidents in fuel storage in lieu of a monitoring system.
- General Design Criterion (GDC) 62 requires criticality in the fuel storage and handling system to be prevented by physical systems or processes, preferably by use of geometrically safe configurations.

Question FSR.LTR-1

Issue Description

The applicant's criticality safety analysis in "NuScale US460 Fuel Storage Rack Design Topical Report," TR-145417-P, Revision 0, used TRITON/ORIGEN-S as the depletion code to estimate the post irradiated isotopic content of the fuel for utilization of burnup credit. To validate the depletion code, the applicant used 5% of the reactivity change from fresh unpoisoned fuel to the burnup of interest as the uncertainty, citing NEI 12-16, "Guidance for Performing Criticality Analyses of Fuel Storage at Light-Water Reactor Power Plants," Revision 4 (ML19269E069), Section 4.2.3 as justification.

NRC Regulatory Guide 1.240, "Fresh and Spent Fuel Pool Criticality Analyses," (ML20356A127) endorses, with limitations and conditions, NEI 12-16. Section 4.2.3 of NEI 12-16 states, in part, "In lieu of a formal lattice depletion validation, the licensee may apply an uncertainty equal to 5% of the reactivity decrement, if the licensee uses the lattice depletion code in a manner that is consistent with nuclear design calculations previously performed for commercial power reactor licensing. This ensures that the depletion code will produce reliable and predictable results for the intended application." The information provided by the applicant does not appear to demonstrate its use of TRITON/ORIGEN-S as the depletion code consistent with nuclear design calculations previously performed for commercial power reactor licensing. Typically, this is done by using an established code in commercial power reactor licensing or via an NRC approved topical report that establishes that the code has been benchmarked to appropriate data and

produces reliable and predictable results when used with the established methodology within the prescribed limitations and conditions. There is no NRC approved topical report that establishes TRITON/ORIGIN-S as an approved code for use nor is the code in active use for commercial power reactor licensing.

Information Requested

NuScale is requested to provide equivalent justification for using the uncertainty equal to 5% of the reactivity decrement for its depletion uncertainty. Otherwise, NuScale can validate TRITON/ORIGEN-S in an alternate manner such as those described in NUREG-2215, "Standard Review Plan for Spent Fuel Dry Storage Systems and Facility – Final Report," (ML20121A190) and NUREG-2216, "Standard Review Plan for Transportation Packages for Spent Fuel and Radioactive Material: Final Report," (ML20234A651).

Question FSR.LTR-28

Issue Description

NuScale US460 Fuel Storage Rack Design Topical Report, TR-145417-P, Revision 0, Section 6.3.4, "KENO-V.a Criticality Model" discusses the axial burnup profiles used to represent irradiated fuel in the spent fuel pool (SFP) model. Section 6.3.4 states, in part, "…For all assemblies the burnup distribution is normalized and grouped by average exposure at intervals of 5 GWD/MTU. For each group the minimum normalized value is chosen for the top and bottom 5 nodes. For the middle 15 nodes the average value is chosen. The resulting distribution is not renormalized, resulting in average normalized values below 1.0. …" NRC Regulatory Guide 1.240 endorses, with limitations and conditions, NEI 12-16, Revision 4. During the audit, the applicant indicated that they are following Section 5.1.4 of NEI 12-16; however, the averaging of the middle 15 nodes is not part of the guidance in Section 5.1.4 of NEI 12-16 Revision 4. While the applicant has stated the composite axial burnup shapes were not renormalized, the resulting average burnup in most of the composite axial burnup shapes is essentially 1.0. Therefore, it is not clear that the guidance was followed, since there is little to no margin with respect to the composite shape's average burnup.

Information Requested

NuScale is requested to:

a) Indicate where the values in TR-145417-P, Revision 0, Table 6-6 come from.

b) Indicate how many different profiles were evaluated in each burnup group.

c) Explain how those profiles differ from each other in how they were generated.

d) Indicate whether transition cycles were included in determining the composite axial burnup shapes.

e) Describe the analysis that was performed, including any calculations, to demonstrate the method used in determining that the composite axial burnup shapes were conservative relative to actual axial burnup shapes.

Question FSR.LTR-31, 32, 33, 34, 35

Issue Description

NuScale US460 Fuel Storage Rack Design Topical Report, TR-145417-P, Revision 0, Section 6.5.1, “Fuel Storage System Tolerance Analysis” discusses the fuel assembly and storage rack tolerances that are being evaluated. NRC Regulatory Guide 1.240 discusses the importance of the fuel assembly and storage rack tolerances’ effect on the estimation of k_{eff}. However, it is not clear what fuel assembly and storage rack tolerances are being evaluated, how they are being determined, and how they are included into the estimation of the spent fuel pool (SFP) k_{eff}.

Information Requested

NuScale is requested to provide the following additional information:

a) What fuel assembly and storage rack tolerances are being evaluated,
b) How they are being determined, and
c) How they are included in the estimation of the SFP k_{eff}.

Question FSR.LTR-41

Issue Description

The applicant’s criticality safety analysis is contained in TR-145417-P, Revision 0, Section 6.5.3.2, “System Bias for Thermal Expansion in TRITON/ORIGEN-S Depletion,” Tables 6-19 and 6-20 have the biases, while Tables 6-20 and 6-22 have the standard deviations. In some cases, {{

}} Additionally, the {{

}} in TR-145417-P, Section 6.5.1.1. {{

}}

Information Requested

Explain and justify {{ }} in TR-145417-P, Revision 0, Section 6.5.3.2.

Question FSR.LTR-48

Issue Description

The applicant’s criticality safety analysis in TR-145417-P, Revision 0, Section 6.5.11, “Multiple Misloaded Fuel Assemblies” {{

}} During the audit, the applicant cited NEI 12-16, Revision 4 Section 6.3.5 as a reference for its approach. NEI 12-16, Revision 4 Section 6.3.5, states that it is important to have a multi-tier defense-in-depth program to prevent or mitigate a multiple fuel misload scenario. The applicant does not explicitly define the administrative controls that will prevent multiple fuel misload.

Information Requested

Provide an explanation of the administrative controls that would prevent multiple fuel misload. Otherwise, provide an explanation and justification for not modeling multiple fresh fuel assemblies misloaded into Zone 1. The discussion should be detailed and use NEI 12-16, Revision 4 Section 6.3.5 as guidance. Include all requirements that future combined license applicants will have to adopt to be consistent with TR-145417-P, Revision 0.