NuScaleTRRaisPEm Resource

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Sent:	Thursday, March 28, 2019 12:30 PM
To:	Request for Additional Information
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Subject:	Request for Additional Information Letter No. 9666 (eRAI No. 9666) Topical Report, Design-Specific Methodology for Determining Appropriate Accidents to be Evaluated , 1.05, SPRA
Attachments:	Request for Additional Information No. 9666 (eRAI No.9666).pdf

Attached please find NRC staff's request for additional information (RAI) concerning review of the NuScale Topical Report.

Please submit your technically correct and complete response by May 22, 2019, to the NRC Document Control Desk.

If you have any questions, please contact me.

Thank you.

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Request for Additional Information No. 9666 (eRAI No. 9666)

Issue Date: 03/28/2019
Application Title: NuScale Topical Report
Operating Company: NuScale
Docket No. PROJ0769
Review Section: 01.05 - Other Regulatory Considerations
Application Section: TR-0915-17772-P, 3.0 Design-Specific Methodology for Determining Appropriate Accidents to be Evaluated 1.05

QUESTIONS

01.05-34

The following regulatory basis and discussion applies to all five questions in this request for additional information (RAI).

Regulatory basis: Emergency planning requirements are codified in 10 CFR 50.47 and 10 CFR Part 50 Appendix E. Specifically, the plume exposure emergency planning zone (EPZ) for power reactors generally consists of an area about 10 miles in radius, or it may be determined on a case-by-case basis for reactors with an authorized power level less than 250 megawatts thermal (MWt). The technical basis for the 10-mile plume exposure EPZ is given in NUREG-0396, which was based upon evaluation of the offsite consequences of accidents (both design basis and severe) and comparison of doses to the Environmental Protection Agency (EPA) guidance on when to take emergency response actions. The EPA emergency response actions include sheltering and evacuation as given in the Protective Action Guides (PAGs), or, for very low-probability and high-consequence accidents, demonstration that the probability of exceeding a deterministic effect dose is low and decreasing at the chosen outer boundary of the plume exposure EPZ. The assumptions and approach used in the analysis, including the selection of accident sequences for source term calculations, can impact the results.

Discussion

NuScale Power, LLC submitted licensing topical report (LTR) TR-0915-17772-P, Revision 1, "Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites," for review by the NRC staff. As stated in Section 3.0 of the LTR, EPZ size was optimized using a risk-informed approach and insights from the NuScale design specific probabilistic risk assessment (PRA).

Question

The methodology described in this LTR is based on the Combined License Applicant's (COL) PRA, but the existing review guidance for a COL PRA (Standard Review Plan Chapter 19.0 and Interim Staff Guidance DC/COL-ISG-028) is not sufficient to demonstrate the PRA is acceptable for use in risk-informed applications such as sizing the plume exposure EPZ. NuScale is asked to demonstrate how the PRA that will be used in the LTR methodology is acceptable for its intended use, including how numerical screening thresholds are affected by parameter and model uncertainties associated with a new un-built design. Staff notes that RG 1.200 provides an NRC accepted approach for determining the technical acceptability for PRA results for risk-informed activities.

01.05-35

Question

The methodology described in this LTR uses a seismic screening threshold of 1.67 times the ground motion acceleration of the design-basis safe-shutdown earthquake while all other hazards use a screening threshold based on core damage frequency (CDF). Staff notes this PRA-based seismic margins approach was specifically approved in the SRM to SECY 93-087 for design certification and combined license applications. It is stated to be useful in developing the reliability assurance program, identifying operator training requirements, and focusing on accident management capabilities. The Commission did not approve its use in risk-informed applications such as establishing the plume exposure EPZ. Per the LTR methodology, all structures in rev. 2 of the NuScale DCA would screen out, but if the CDF screening threshold was applied using the seismic CDFs from the NuScale SAMDA analysis, seismic events would screen in. Screening out seismic risk is inconsistent with the SRM to SECY-04-0118, Phased Approach to Probabilistic Risk Assessment Quality, which states if there is a PRA standard for a hazard group, it should be used to assess risk for risk-informed applications. The staff cannot make a finding the methodology is acceptable for risk-informed applications if seismic

hazards have been screened out. The staff requests that NuScale justify why a seismic PRA is not needed to determine the EPZ size for early protective actions (evacuation and sheltering) in order to provide dose savings and protect the public.

01.05-36

Question

The Commission goals for advanced LWRs include two risk metrics, CDF and large release frequency (LRF), as specified in the SRM to SECY 90-016. The LTR methodology screens against a CDF threshold, but only appears to consider LRF if the event screens into the defense-in-depth process. Insights from the Level 2 PRA, including release timing, size of release, and risk significant structures are important and should be considered consistent with the Commission goals. NuScale is asked to justify how risk insights from the Level 2 PRA are considered in the methodology, including LRF for sequences that don't screen into the defense-in-depth process.

Additionally, LTR Section 3.8.2, Severe Accident Phenomena, concludes that severe accident phenomena do not need to be further considered in the EPZ methodology because the NuScale Design Certification Application (DCA) found them to either be not credible or to not pose a threat to containment integrity. Staff notes that in a Feb 26, 2019 supplemental response to DCA RAI 9108 (ML19057A618), NuScale revised portions of the DCA related to severe accident phenomena to clarify the presence of analysis uncertainty and remove terms such as "not physically credible." Staff requests that NuScale explain how these severe accident uncertainties are captured in the LTR methodology. Staff also requests that NuScale change the terminology in the LTR (specifically in LTR Sections 3.4.3 and 3.8.2) to be consistent with the DCA.

01.05-37

Question

The methodology discussed in Section 3 of the LTR classifies accidents as "less severe" if the sequence does not include containment failure and evaluates these accidents to early phase PAGs. It classifies accidents as "more severe" if containment integrity is not maintained and evaluates these accidents for early severe health effects. This approach implies more severe accidents are less frequent, which, while appropriate for the large light water reactors evaluated in NUREG-0396, does not seem to be consistent with the unique NuScale design where the containment is not a permanent structure, but regularly transported for refueling. NuScale module drop events are the most likely cause of core damage for the NuScale design, so staff would expect this accident to be considered a more likely event and evaluated to the early phase PAGs. However, this event results in a loss of containment integrity so it is only evaluated for early severe health effects. Staff requests that Nuscale explain and justify how the methodology considers the dose consequences for each of the three module drop scenarios described in DCA Chapter 19.1.6.2, including those that are evaluated, but not quantified in the DCA. Additionally, NuScale is requested to explain and justify how the methodology evaluates the dose consequences from the DCA Chapter 19.1.7.4 module drop accident that impacts one or two other modules.

01.05-38

Question

Section 3.5 of the LTR includes an assessment of accident sequence defense-in-depth to determine if the sequence prevention and mitigation capabilities are consistent with the defense-in-depth philosophy. The methodology ranks attributes such as risk metrics or design features as having high, medium, or low defense-in-depth based on specific criteria. The low ranking is described as the lowest valuation that would be expected for advanced light water reactors (LWRs). For the staff to find that defense-in-depth has been appropriately considered, consistent with the Commission PRA policy

statement (60 FR 42622, August 16, 1995), the staff requests that NuScale justify how the following definitions of low meet expectations for advanced LWRs:

1. For the "Containment Isolation Response" attribute, the definition of low as "only check valves" appears to be inconsistent with intersystem loss-of-coolant accident guidance in the SRM to SECY-93-087. SECY-93-087 expects that systems that have not been designed to full RCS pressure should include the capability for leak testing of the pressure isolation valves and valve position indication that is available in the control room when isolation valve operators are de-energized.
2. For the "Sequences LRF" attribute, the definition of low as > 1E-6 per module year is inconsistent with the SRM to SECY-91-06, which sets a LRF Goal that total LRF < 1E-6 per module year.
3. For the "Safety system response to detect and control initiating event" attribute, the definition of low as an active system with manual control seems inconsistent with the Advanced Reactor Policy Statement which expects highly reliable and less complex shutdown and decay heat removal systems. The Commission encourages the use of inherent or passive means to accomplish this objective.
4. For the "Time to the beginning of core damage" attribute, the definition of low to be less than one hour seems inconsistent with the Advanced Reactor Policy Statement which expects longer time constants and sufficient instrumentation to allow for more diagnosis and management before reaching safety system challenges.