



***NRR/NSIR Observations on NuScale's
Proposed RAI Responses on the
NuScale Emergency Planning Zone
Sizing Methodology Topical Report
(LTR) Revision 2***

July 14, 2021

EP Regulatory Basis

- Requirements in 10 CFR 50.47 and 10 CFR Part 50 Appendix E.
- EPZ for power reactors generally 10 miles in radius.
- May be determined on a case-by-case basis for reactors with power < 250 MWt.
- Basis for 10 mile plume exposure from NUREG 0396.
- Page I-9, NUREG 0396, “design basis accidents and less severe core-melt accidents should be considered for Protective Actions.”
- EPA-400/R-17/001, Protective Actions, Table 1-1: Sheltering-in-place or evacuation of the public: 1 to 5 rem dose over four days.
- More severe core damage events compared against 200 rem.

- NOTE: Comment period for draft EP rule for SMR and NLWR and non power production facilities recently closed.

Background

Applicants (now only light water SMRs) can use the LTR to select the appropriate single module and multimodule accident sequences to include in the EPZ technical basis based on their PRA which is to include all internal and external initiators.

- “The most likely mechanism is a COL application; however, it is acknowledged that other regulatory processes exist. For simplicity, “COL applicant” and “COL application” are used throughout this LTR to refer to implementation of the methodology.”
- The staff may write a condition of use that the level of design detail in the PRA used for LTR should be commensurate with a Part 52 design certification application if the applicant is using a licensing approach other than Part 52.

RAI 1.05-43 QHOs

Issue: Staff expects COL PRA used to support this application meets the LRF Commission Goal for new reactors of $<1E-6$ /yr by aggregating the risk for the site with all initiators (external and internal events) ensuring QHOs are met.

- COL/DC PRAs do not require a Seismic PRA for certification (reference SRM to SECY 93-087); therefore COL/DC applicants do not include aggregate risk.
- COL/DC PRAs are not acceptable for risk informed applications (reference DC/COL ISG-028) because they are not required to meet the PRA Standard in its entirety.

Potential resolution:

- The staff may write a condition of use that the COL PRA used to support this risk informed application, considering the aggregate risk including seismic risk shall show that the LRF meets the Commission Goals for new reactors, or
- The response may specify that the PRA used to support this application meets the QHOs considering aggregate risk from all hazards.

RAI 1.05-44 External Event Screening (1/2)

Issue: NuScale has provided no technical justification to support the screening of external events w/initiator frequency $<1E-5/yr$.

- Screening external events with initiator frequencies $<1E-5/yr$ could create a risk gap- risk significant core damage sequences with frequency $> 1E-7$ could be screened.
- NUREG-2161¹ does not support the $1E-5/yr$ screening value. It states, “the results of this study are scenario-specific and related to a single spent fuel pool.” The NuScale proposed LTR screening thresholds pertain to core damage risk at an operating plant; therefore, NUREG-2161 is not applicable.
- RG 1.174: If the hazard or mode is important to the decision it must be evaluated.

1. NUREG-2161, “Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling Water Reactor,” used as main justification for selecting $1E-5/yr$ in LTR.

RAI 1.05-44 External Event Screening (2/2)

Issue: NuScale has provided no technical justification to support the screening of external events w/initiator frequency $<1E-5/yr$.

Potential Resolutions:

- For some risk-informed applications, NRC staff has approved a bounding or conservative approach for screening external hazards
- The response may include screening criteria that is equivalent for internal and external events or specify a conservative or bounding quantitative approach to demonstrate that screening at the $1E-7/yr$ threshold does not impact the decision.

Based on June 15th public meeting, staff understands that NuScale agrees to re-define internal floods and internal fires as internal events in LTR (no completion date for task).

RAI 1.05-45 – PRA uncertainty

Issue: The LTR and response did not address uncertainty against the screening thresholds

- Not addressing uncertainty is inconsistent with the 1995 PRA policy statement and DG 1350, EP for SMRs and Non LWRs.
- NuScale agreed to limitation for appropriate consideration of uncertainties against the numerical thresholds during public meetings for Rev.1 of the TR.
- Risk-informed applications for operating reactors provide examples on how uncertainty has been addressed.
- TR should stipulate how PRA uncertainties will be compensated regarding lack of:
 - ❑ Operating procedures
 - ❑ Operating experience (especially for new design features)
 - ❑ Inability to perform walkdowns
- Consistent with NUREG 1855 on treatment of PRA uncertainties in risk informed regulatory decisions, applicant should:
 - ❑ Assess parameter and model uncertainties and perform sensitivity cases for the key PRA model uncertainties.
 - ❑ Where the sensitivity cases challenge the screening thresholds, additional potential compensatory measures should be identified.

RAI 1.05-46 – PRA Acceptability

RAI: Address in the LTR: (1) the need for the PRA with the application to be peer reviewed, (2) the need for the COL applicant to address hazards/modes not covered by the standards, and (3) the need for the PRA to be Capability Category (CC) II with exceptions identified and justified for (e.g. unique design features with lack of operating experience, and inability to perform walkdowns).

Based on June 15th public meeting and subsequent clarification call, staff understands:

- NuScale agrees to a condition of use for a technically acceptable PRA

Staff comments:

- Staff believes PRA acceptability for this TR would be Capability Category II with exceptions justified
- Staff believes TR should acknowledge that not using RG 1.200 to justify PRA acceptability may result in additional staff review and resources

RAI 1.05-48- Treatment of non-core damage events

Issue: The staff did not find information in the LTR about potential releases due to non-core damage events that would necessitate protective actions. The staff is requesting that the LTR include guidance for the applicant to search for potential releases due to non-core damage events that would necessitate protective actions consistent with the Environmental Protection Agency (EPA) Protective Action Guidance (PAGs).

Staff reviewed changes to proposed RAI response and found the proposed changes to the LTR to be acceptable.

Abbreviations

ALWRs – Advanced Light Water Reactors

COL – Combined License

DC – Design Certification

DG – Draft Guide

EP – Emergency Planning

EPZ – Emergency Planning Zone

LPSD – Low Power and Shutdown

MWt – Megawatt thermal

NLWRs – Non Light Water Reactors

PRA – Probabilistic Risk Assessment

QHOs – Quantitative Health Objectives

RG – Regulatory Guide

SMRs – Small Modular Reactors

TR – Topical Report