



***Staff Observations on the NuScale
Emergency Planning Zone Sizing
Methodology Topical Report
(Non-Proprietary)***

Public Meeting

January 12, 2021

Meeting Overview and Purpose

NuScale EPZ Sizing Methodology Topical Report (TR) Revision 2 (ML20217L422) uses PRA accident sequences and Design Basis Source Term to size the EPZ for Advanced Light Water Reactors (ALWRs) and Non Light Water Reactors (NLWRs) as applicable.

Discuss staff technical concerns with the NuScale EPZ TR Revision 2.

Emergency Planning (EP) Regulatory Basis

- EP Requirements in 10 CFR 50.47 and 10 CFR Part 50 Appendix E.
- EPZ for power reactors (> 250 MWt) generally 10 miles in radius.
- May be determined on a case-by-case basis for reactors with power < 250 MWt. If reactor > 250 MWt, an exemption may be required.
- Basis for 10 mile plume exposure from NUREG-0396 (ML051390356).
- 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 (ML17044A073), 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.
- NUREG-0396: Infers less severe core damage events more likely than more severe core damage events.
- *NOTE: Comment period for draft EP rule for SMR and NLWR and non power production facilities closed on September 25, 2020.*

Staff Talking Point 1

External events (includes internal fires) should have equivalent treatment to internal events.

- RG 1.174 (ML17317A256), on the use of PRA in risk-informed decisions, states that all plant operating modes and hazard groups be addressed when those risk contributions affect the decision.
- TR should not screen out potentially risk significant external events.

Staff Talking Point 2

Staff is concerned that the screening threshold is too high.

- TR screens core damage sequences on frequency then evaluates remaining sequences for consequences.
- Staff needs to ensure TR consistent with the Quantitative Health Objectives (QHOs):
 - individual within 1 mile of plant; early fatality risk $< 5E-7/\text{year}$
 - risk of cancer to the population in the area near a nuclear power plant $< 2 \times 10^{-6}/\text{year}$
- If core damage sequence consequences unknown, sequences w/frequencies, well below the QHOs, should be retained to ensure QHOs are met.

Staff Talking Point 3

No consideration of numerical uncertainties against the numerical screening threshold.

- Contrary to 1995 PRA policy statement & DG 1350 (ML18082A044), EP for SMRs and NLWRs.
- Discussed in public meetings (Meeting Summary: ML19233A165) for Rev 1 of TR in 2019. Not addressed in Revision 2.
- TR should stipulate, consistent with NUREG-1855, Revision 1*, how PRA uncertainties will be compensated regarding lack of:
 - Operating procedures
 - Operating Experience (especially for new design features)
 - Inability to perform walkdowns

*NUREG-1855, Revision 1: Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decisionmaking, Final Report (ML17062A466).

Staff Talking Point 4

Peer Review and Discussion of hazards/modes where NRC-endorsed Standards do not exist, not included.

- PRA at time of application should be peer reviewed in accordance with NEI 17-07, Rev. 2 (for ALWRs) (ML19231A182) or NEI 20-09 (for NLWRs) (ML20339A485).
- Where NRC-endorsed standards do not exist for specific PRA models (e.g., LPSP), the user must justify the technical adequacy of these models to support the PRA sequence screening.
- PRA used for TR should be developed using RG 1.200 (ML090410014) or RG for Non LWR PRA Standard for Capability Category (CC) II.
- Any exceptions (e.g., inability to perform walkdowns) must be identified and justified.
- RG 1.174 generally expects CC-II for risk-informed applications.

Note: *As stated in DC/COL ISG-028 (ML16130A468), PRA technical adequacy for Design Certification/COL application is not sufficient for Risk Informed Applications.*

Staff Talking Point 5

PRA screening should be based on accident sequence families versus a single of sequence to limit parsing of sequences into individual components for comparison against numerical screening thresholds.

Use of the definition of accident sequence families from NLWR PRA Std and LMP guidance NEI 18-04 Rev 1 (ML19241A472) would ensure consistency.

Event sequence family: a grouping of event sequences with similar challenges to the plant safety functions, response of the plant in the performance of each safety function, response of each radionuclide transport barrier, and end state. An event sequence family may involve a single event sequence or several event sequences grouped together.

Staff Talking Point 6

Similar to the Limits and Conditions of the staff approved NuScale TR on “Risk Significance Determination” (ML16284A016), proposed Condition:

In keeping with NRC policy on risk-informed regulation, the ultimate screening of PRA accident sequences shall be based on the specific application, with appropriate consideration of uncertainties, sensitivities, and maintaining sufficient defense-in-depth and safety margin, such that the user is implementing a “risk-informed” rather than a solely “risk-based” approach.

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