**From:** Chowdhury, Prosanta
**Sent:** Monday, April 26, 2021 11:50 AM
**To:** NuScaleTRRaisPEm Resource
**Cc:** Schiller, Alina
**Subject:** RE: Request for Additional Information No. 9830 (eRAI No. 9830)
**Attachments:** Request for Additional Information 9830 (eRAI No. 9830).docx

**From:** Chowdhury, Prosanta
**Sent:** Monday, April 26, 2021 11:48 AM
**To:** Request for Additional Information <RAI@nuscalepower.com>
**Cc:** Dudek, Michael <Michael.Dudek@nrc.gov>; Cranston, Greg <Gregory.Cranston@nrc.gov>; Schiller, Alina <Alina.Schiller@nrc.gov>; Jung, Ian <Ian.Jung@nrc.gov>; Hayes, Michelle <Michelle.Hayes@nrc.gov>; English, Liz <EEnglish@nuscalepower.com>; Luchsinger, Deb <DLuchsinger@nuscalepower.com>
**Subject:** Request for Additional Information No. 9830 (eRAI No. 9830)

Attached please find NRC staff's request for additional information (RAI) concerning the review of Licensing Topical Report TR 0915-17772, "Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones," Revision 2 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20217L422).

Please submit your technically correct and complete response by May 23, 2021, to the NRC Document Control Desk.

If you have any questions, please do not hesitate to contact me or Alina Schiller (copied).

Thank you.

PROSANTA CHOWDHURY, PROJECT MANAGER
US NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
DIVISION OF NEW AND RENEWED LICENSES
NEW REACTOR LICENSING BRANCH
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**From:** Chowdhury, Prosanta

**Created By:** Prosanta.Chowdhury@nrc.gov

**Recipients:**
"Schiller, Alina" <Alina.Schiller@nrc.gov>
Tracking Status: None
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Tracking Status: None

**Post Office:** SA0PR09MB6428.namprd09.prod.outlook.com

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**Request for Additional Information 9830 (eRAI 9830)**
Issue Date: 04/23/2021
Application Title: NuScale Topical Report
Operating Company: NuScale Power, LLC
Docket No. 99902043
Review Section: 01.05 - Other Regulatory Considerations
Application Section:

QUESTIONS

01.05-49

**Requirement**

The regulations in 10 CFR 50.47, "Emergency Plans," and 10 CFR Part 50 Appendix E, "Emergency Planning and Preparedness for Production and Utilization Facilities," contain the requirements for establishing the plume exposure pathway emergency planning zone (EPZ) for nuclear power plants. These regulations require the plume exposure pathway EPZ to consist of an area about 10 miles (16 km) in radius; however, there is a provision (10 CFR 50.47(c)(2)) for a different EPZ size for reactors that are gas-cooled and with a thermal power of 250 MWt or less on a case-by-case basis.

**Issue**

Revision 2 of NuScale Power (NuScale) topical report, TR-0915-17772-P, "Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones," (Agencywide Document Access and Management System (ADAMS) Accession No. ML20217L422) provides a methodology to determine the plume exposure EPZ for advanced reactors including non-light water reactors (non-LWRs). In Revision 2 of the topical report, the applicant expands the applicability of the topical report beyond its original scope of light-water reactors (LWRs) without revising the content to explicitly address such designs. Information pertinent to non-LWRs is necessary in the topical report because of: (1) the significant differences in designs between LWRs and non-LWRs; and (2) the ways the corresponding PRAs are developed and used. The following examples highlight the staff's need for additional information on non-LWRs in order to review and potentially approve the topical report:

- The topical report does not provide a pertinent method for demonstrating technical acceptability of non-LWR probabilistic risk assessments (PRAs). Assumption 4 in Section 3.1 of the topical report states a technically adequate PRA is necessary for use in the risk-informed EPZ sizing methodology. However, the ASME/ANS consensus standards and NRC guidance typically used to assess PRA acceptability are substantially different between LWR PRAs and non-LWR PRAs. Section 3, "Accident Screening Methodology," of the topical report refers only to LWR guidance when it discusses the technically acceptable PRA for use. Specifically, it refers to ASME/ANS RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," and Regulatory Guide (RG) 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed

Activities," Revision 3, (ADAMS Accession No. ML20238B871) through which the NRC staff endorsed the LWR standard with clarifications. In addition, the topical report also refers to Standard Review Plan, NUREG-0800, Section 19.0, "Probabilistic Risk Assessment and Severe Accident Evaluation for New Reactors," which contains guidance for LWRs. The remaining sections of the topical report contain guidance based on LWR PRAs, some of which is not applicable to, or insufficient for, non-LWR applicants.

- The surrogate risk metrics of core damage frequency and large early release frequency as used in the topical report are typically used for LWRs. These surrogate risk metrics are not applicable to many advanced non-LWR designs. For example, because of the use of different materials for the fuel, moderator, and coolant, LWR risk metrics, such as core damage frequency, are not useful or relevant for many advanced non-LWR designs.

- The dose criteria for "less severe" or "more severe" scenarios used in the methodology are based on intact or failed containment. The scenarios are not applicable to those designs of non-LWRs that do not have a traditional containment but may be applicable to non-LWRs that do have a traditional containment.

The recently issued industry consensus standard, ASME/ANS RA-S-1.4-2021, "Probabilistic Risk Assessment Standard for Advanced Non-Light Water Reactor Nuclear Power Plants," provides guidance on the development and use of PRAs for non-LWRs. Note that the NRC staff expects to issue a trial use regulatory guide endorsing this standard later this year. The industry also submitted NEI 20-09, "Performance of PRA Peer Reviews Using the ASME/ANS Advanced Non-LWR PRA Standard," to the NRC for review and approval and it is currently under NRC staff review. In addition, the NRC staff engaged with industry on a risk-informed and performance-based approach to non-LWR licensing, called the Licensing Modernization Project (LMP). The approach, fundamentally different from the traditional approach for LWRs, is documented in Regulatory Guide (RG) 1.233, "Guidance for a Technology-Inclusive, Risk-Informed, and Performance-Based Methodology to Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals For Non-Light-Water Reactors," Revision 0 (ADAMS Accession No. ML20091L698). The RG endorses Nuclear Energy Institute (NEI) 18-04, Revision 1, "Risk-Informed Performance-Based Technology Inclusive Guidance for Non-Light Water Reactor Licensing Basis Development." While not required, the NRC staff anticipates that many non-LWR applicants would use the LMP approach in their licensing applications. Many of these documents appear to be relevant to this topical report and could be used by the applicant in demonstrating technically acceptable PRAs and their uses for non-LWRs; however, it appears they have not been considered in developing the methodology.

The staff's comparison of these documents against the topical report (Revision 2) confirms the need for additional information in the topical report as indicated above and including the following observations:

- In non-LWR PRAs, the risk is assessed based on a 'per plant' basis (versus 'per module' in the topical report) including all radiological sources.

- In non-LWR PRAs, event sequence family is defined and used (versus event sequence in the topical report). For instance, the non-LWR PRA standard has requirements on

screening criteria based on event sequence family, which may be different from those in the topical report.

- In the LMP, the licensing basis events (i.e., anticipated operational occurrences, design basis events, beyond design basis events, and design basis accidents) are selected in a risk-informed and performance-based manner based on the frequency-consequence target described in NEI 18-04. They are defined differently from the traditional licensing basis events in Chapter 15, "Transient and Accident Analysis," of the NUREG-0800 on which the topical report is based. The definitions of licensing basis events such as design basis accidents used in the topical report may be different from those for non-LWRs.

The NRC staff notes that the approach discussed above using ASME/ANS RA-S-1.4-2021 and the LMP process is one acceptable method. If another approach is used, the applicant should explain it in sufficient detail in the topical report.

In summary, the method in Section 3, "Accident Screening Methodology," and Section 4, "Methodology for Source Term and Dose Evaluations," of the topical report (Revision 2) needs additional information to address differences between LWR and non-LWR guidance documents and licensing approaches, or the topical report should explain why the same approach is applicable to both LWRs and non-LWRs. This information is necessary to assess if the approach described in the topical report is an acceptable approach to determine the plume exposure EPZ by non-LWR applicants.

**Request**

The NRC staff requests that the applicant provide additional information in the topical report with sufficient justification such that the topical report contains clear guidance and criteria for non-LWRs to determine the plume exposure EPZ. Specifically, in accordance with the examples and observations provided above, the NRC staff requests that the following be provided:

- Provide a detailed discussion on demonstrating technical acceptability of PRAs for non-LWRs, or explain why the approach is the same as for LWRs. (Using the ASME/ANS Advanced Non-LWR PRA Standard is one acceptable approach for such demonstration).

- Provide the surrogate risk metrics for various non-LWR designs if used and corresponding guidance on how such risk metrics are developed and used in the topical report.

- Provide the dose criteria for the scenarios of the non-LWR designs without a traditional containment and corresponding guidance, including sufficient technical bases, (e.g., how the dose criteria were developed and how they will be used), in the topical report.

- Provide the criteria and corresponding guidance that reflect technically acceptable non-LWR PRAs performed based on a per plant basis including all radiological sources, or explain why the approach can also be used for both LWRs and non-LWRs.

- Provide the criteria and corresponding guidance on event sequence families (instead of event sequences) for non-LWR designs to be included in Revision 2 of the topical report.

- Provide the definitions of licensing basis events such as design basis accidents for non-LWR designs that the applicant intends to include in Revision 2 of the topical report.

The requested items above are some of the significant ones based on the NRC staff's high-level evaluation of the topical report against the consensus industry standard (i.e. ASME/ANS RA-S-1.4-2021) and the LMP. The applicant should evaluate RG 1.233, NEI 18-04, Revision 1, ASME/ANS RA-S-1.4-2021, and NEI 20-09 to gain relevant information as part of the effort to provide additional information.