

NuScaleTRRaisPEm Resource

From: Foster, Rocky
Sent: Tuesday, December 06, 2016 10:59 AM
To: 'Bergman, Tom'
Cc: smirsky@nuscalepower.com; Pope, Steven (spope@nuscalepower.com); 'Unikewicz, Steve'; NuScaleTRRaisPEm Resource; Akstulewicz, Frank; Bradford, Anna; Lee, Samuel; Cranston, Gregory; Mrowca, Lynn; Caruso, Mark; Foster, Rocky
Subject: Request for Additional Information Letter No. 10 for the Review of NuScale Topical Report, TR-0915-17772, "Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plants Sites"
Attachments: Final RAI 10 eRAI_8712 EPZ TR.pdf

Tom,

Attached please find NRC staff's request for additional information concerning NuScale Topical Report, TR-0915-17772, entitled, "Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites."

Please submit your response by April 6, 2017, to the NRC Document Control Desk. If you have any questions, please feel free to contact me.

Thank you,

Rocky D. Foster
Project Manager
Licensing Branch 1
Division of New Reactor Licensing
Office of New Reactors
U.S. Nuclear Regulatory Commission
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From: Foster, Rocky

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Recipients Received:

December 6, 2016

Mr. Thomas Bergman
Vice President, Regulatory Affairs
NuScale Power, LLC
1100 NE Circle Boulevard, Suite 200
Corvallis, OR 97330

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 10 FOR THE
REVIEW OF NUSCALE TOPICAL REPORT, TR-0915-17772, "METHODOLOGY
FOR ESTABLISHING THE TECHNICAL BASIS FOR PLUME EXPOSURE
EMERGENCY PLANNING ZONES AT NUSCALE SMALL MODULAR
REACTOR PLANT SITES," REVISION 0 (CAC NO. RQ6006)

Dear Mr. Bergman:

In a December 22, 2015, letter, NuScale Power, LLC (NuScale), submitted for U.S. Nuclear Regulatory Commission (NRC) staff review Topical Report (TR) TR-0915-17772, "Methodology for Establishing the Technical basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites," Revision 0. The NRC staff is performing a detailed review of this topical report to enable the staff to reach a conclusion on the safety of the proposed application. The NRC staff has identified that additional information is needed to continue portions of the review. The NRC staff's request for additional information (RAI) is contained in the enclosure to this letter.

To support the review schedule, NuScale is requested to respond within 120 calendar days of the date of this letter. If changes are needed to the topical report, the NRC staff requests that the RAI response include the proposed wording changes.

If you have any questions or comments concerning this matter, you may contact me at 301-415-5787.

Sincerely,

/RA/

Rocky D. Foster
Project Manager
Licensing Branch 1
Division of New Reactor Licensing
Office of New Reactors

Docket No. PROJ0769
eRAI Tracking No. 8712
Enclosure: Request for Additional Information

Request for Additional Information 10

Issue Date: 12/06/2016

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

QUESTIONS

01.05-26

NuScale Power, LLC has submitted licensing topical report (LTR) TR-0915-17772-P), Revision 0, proprietary version, "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. Statements in Section 3.5 of the topical report indicate that a core damage frequency threshold ($1E-08/\text{year}$) is the sole criterion used to select accident sequences for consideration in the "less probable, more severe" category. However, the structured decision process depicted in Figure 3-2 of the topical report seems to indicate that a necessary, but not sufficient, criterion for including sequences in scenario groups for the category is that a sequence in the scenario includes either containment failure or containment by-pass (first rectangle in the top row of the figure). A frequency threshold for selecting the containment failure or containment by-pass scenarios is not specified. Please provide a clear and complete explanation of the basis for selecting scenarios in the first step of the structured decision process depicted in Figure 3-2, i.e., "Containment Failure Scenario (...) from the PRA", including the criteria used to select scenarios in the first step and update the LTR accordingly. Specifically, provide a clear and complete explanation of what role does core damage frequency play in the selection process and what role does containment failure/by-pass play in the selection process.

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 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

ENCLOSURE

exceeding a deterministic effect dose is low and decreasing at the chosen outer boundary of the plume exposure EPZ. There is no specific NRC guidance on how to justify a plume exposure EPZ of a smaller size than given in the cited regulations, including specific guidance on developing the technical basis. The assumptions and approach used on the dose analysis, including the selection of accident sequences on which source terms are based can affect the distance at which predetermined dose levels can be exceeded.

01.05-27

NuScale Power, LLC has submitted licensing topical report (LTR) TR-0915-17772-P), Revision 0, proprietary version, "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. It is stated in Section 3.5 of the topical report that one of the steps in the process of determining accident sequences in the "less probable, more severe" category is the following:

"Only actions taken in the emergency operating procedures (EOP) are to be credited."

However, it is stated in Section 4.3.3 of the topical report that:

"In the case of the less probable, more severe accident source term evaluations, however, the impact on source term of multi-module effects and operationally-focused mitigation (i.e., severe accident management guidelines (SAMGs), extensive damage mitigating guidelines (EDMG), and other EPZ-oriented operator mitigation actions in addition to EOPs) will be considered as discussed in Sections 3.5..."

Statements in Section 4.3.3 of the topical report seem to indicate that operationally-focused mitigation measures beyond EOPs are being credited. Please clarify this apparent inconsistency in the description of the method.

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 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. There is no specific NRC guidance on how to justify a plume exposure EPZ of a smaller size than given in the cited regulations, including specific guidance on

developing the technical basis. The assumptions and approach used on the dose analysis, including the selection of accident sequences on which source terms are based can affect the distance at which predetermined dose levels can be exceeded.

01.05-28

NuScale Power, LLC has submitted licensing topical report (LTR) TR-0915-17772-P), Revision 0, proprietary version, "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. The structured decision process depicted in Figure 3-2 of the topical report includes a qualitative criterion (3RD rectangle in top row of Figure 3-2) and a quantitative criterion (first rectangle in bottom row of Figure), both of which must be met, for screening source terms out of the dose analysis for a given scenario. Please provide a description of the specific criteria for judging adequacy of defense-in-depth and update the LTR accordingly. The example application of the qualitative criterion in Appendix C of the topical report only seems to identify specific design features that apply to the sequence and does not describe how such features, together, provide an adequate level of defense-in-depth. The description of the quantitative criterion in the topical report is not clear. It appears to be a criterion on frequency of scenarios involving core damage plus either containment failure or containment by-pass; but this is speculation on the part of the staff based on the information provided in the topical report. Please provide a clear and complete clarification of the proper interpretation of this criterion and update the LTR accordingly.

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 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. There is no specific NRC guidance on how to justify a plume exposure EPZ of a smaller size than given in the cited regulations, including specific guidance on developing the technical basis. The assumptions and approach used on the dose analysis, including the selection of accident sequences on which source terms are based can affect the distance at which predetermined dose levels can be exceeded.

01.05-29

NuScale Power, LLC has submitted licensing topical report (LTR) TR-0915-17772-P), Revision 0, proprietary version, "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. Section 3.7.1 of the topical report focuses on multi-module risks associated with shared systems between modules. The *bounding* event for multi-module risk is identified in Section 3.7.1, but a complete and adequate basis for concluding the event bounds all other multi-module events is not provided. Accordingly:

1. Please, briefly describe accident sequences, including significant human errors, that lead to multiple module core damages and releases of radioactivity and the systematic process used to identify them. Please include a qualitative or quantitative assessment of their likelihood and update the LTR accordingly.
2. Please describe the rationale for concluding that the "bounding" multi-module event identified in Section 3.7.1 of the topical report bounds the other events NuScale has described in response to Part 1 of this request for information and update the LTR accordingly.

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 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. There is no specific NRC guidance on how to justify a plume exposure EPZ of a smaller size than given in the cited regulations, including specific guidance on developing the technical basis. The assumptions and approach used on the dose analysis, including the selection of accident sequences on which source terms are based can affect the distance at which predetermined dose levels can be exceeded.

01.05-30

NuScale Power, LLC has submitted licensing topical report (LTR) TR-0915-17772-P), Revision 0, proprietary version, "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. Section 3.8.2 of the topical report addresses selection of accident sequences initiated by high winds (e.g., tornado and hurricane) for the "less probable, more severe"

category of events. The discussion in this section indicates that all such sequences will be screened from consideration because all buildings will be designed in accordance with existing requirements for protection against high winds. High winds events that have an associated hazard beyond the design basis are required to be considered in a COL applicant's PRA in accordance with the current ASME/ANS Standard for PRA (i.e., ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," New York, NY, 2009). Please provide a clear and complete explanation as to why does the method for selecting accident sequences not consider results of the PRA for high winds events.

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 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. There is no specific NRC guidance on how to justify a plume exposure EPZ of a smaller size than given in the cited regulations, including specific guidance on developing the technical basis. The assumptions and approach used on the dose analysis, including the selection of accident sequences on which source terms are based can affect the distance at which predetermined dose levels can be exceeded.