November 8, 2016 Docket: PROJ0769

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Submittal of Response to Request For Additional Information Letter No. 4 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 (TAC No. RN6110)

REFERENCES:

1. Letter from NuScale Power, LLC to U.S. Nuclear Regulatory Commission, "Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites," L0-1215-18837, Revision 0, dated December 22, 2015 (ML15356A842).
2. NuScale Topical Report "Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites," TR-0915-17772, Revision 0, dated December, 2015 (ML15363A115).
3. Letter from U.S. Nuclear Regulatory Commission to NuScale Power, LLC, "Request for Additional Information Letter No. 4 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,' Rev 0. (TAC No. RN6110)," dated September 9, 2016 (No. ML16253A172).

In a letter dated December 22, 2015 (Reference 1) NuScale Power, LLC (NuScale) submitted the topical report entitled "Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites," Revision 0, (Reference 2). In a letter dated September 9, 2016 (Reference 3), the NRC Staff submitted Requests for Additional Information (RAI) regarding the subject topical report.

The purpose of this letter is to provide NuScale's response to the NRC RAIs. Enclosure 1 contains the proprietary version of NuScale's "Response to Request for Additional Information Letter No. 4 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." NuScale requests this enclosure be withheld from public disclosure pursuant to 10 CFR § 2.390. The enclosed affidavit (Enclosure 3) supports this request.

Enclosure 2 is the nonproprietary version of NuScale's "Response to Request for Additional Information Letter No. 4 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."

This letter makes no regulatory commitments and no revisions to any existing regulatory commitments.

Please feel free to contact Steven Mirsky at 301-770-0472 or at smirsky@nuscalepower.com if you have any questions.

Sincerely,

Thomas A. Bergman
Vice President, Regulatory Affairs
NuScale Power, LLC

Distribution: Frank Akstulewicz, NRC, TWFN-6C20
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Enclosure 1: "Response to Request for Additional Information Letter No. 4 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." (TAC No. RN6110)," proprietary version
Enclosure 2: "Response to Request for Additional Information Letter No. 4 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." (TAC No. RN6110)," nonproprietary version
Enclosure 3: Affidavit, AF-1116-51883

Enclosure 1:

“Response to Request for Additional Information Letter No. 4 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." (TAC No. RN6110),” proprietary version

Enclosure 2:

“Response to Request for Additional Information Letter No. 4 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." (TAC No. RN6110),” nonproprietary version

NRC RAI Number: 4 NRC RAI Date: September 9, 2016

NRC Review of: Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites, TR-0915-17772, Revision 0.

NRC RAI Question Number: 01.05-1

NRC RAI Question

On page 10, Table 1-2, “Definitions,” the definition of “engineered safety feature” makes reference to the offsite exposure guidelines of 10 CFR 100.11 (Reference 7.1.12) and provides a reference for the regulation in Section 7 of the topical report. 10 CFR 100.11 is not applicable for new nuclear power plant licensing applications after January 10, 1997. Correct the topical report to reference the appropriate regulation, 10 CFR 50.34(a)(1) as referenced by 10 CFR 100.21, and ensure that all instances of this error within the topical report are corrected for clarity.

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 such as 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 can affect the distance at which predetermined dose levels can be exceeded.

NuScale RAI Question Response

The definition of “engineered safety feature” on page 11 will be amended to replace the out of date reference to 10 CFR 100.11 with 10 CFR 50.34(a)(1). Reference 7.1.12 will also be updated. This is the only place in the document where 10 CFR 100.11 is referenced so no additional changes are necessary.

Impact of NRC RAI Question Response on Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites:

The following revisions will be made to Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites, TR-0915-17772, Revision 0.

In Section 1.3, revise Table 1-2 to:

engineered safety feature	A structure, system, or component that is relied upon during, or following design-basis events to ensure the capability to prevent or mitigate the consequences of those events that could result in potential off-site exposures comparable to the guideline exposures of ~~10 CFR 100.11~~10 CFR 50.34(a)(1) (Reference 7.1.12) excluding reactor coolant pressure boundary and reactor protection system items.

In Section 7.1, revise Reference 7.1.12 to:

7.1.12 *U.S. Code of Federal Regulations*, ~~"Determination of exclusion area, low population zone, and population center distance," Section 11, Part 100, Chapter 1, Title 10, "Energy," (10 CFR 100.11).~~ "Content of applications; technical information," Section 34, Part 50, Chapter 1, Title 10, "Energy," (10 CFR 50.34(a)(1)).

Attachments:

None.

NRC RAI Question Number: 01.05-2

NRC RAI Question

On page 60, Section 4.1.3, it is stated that the MACCS2 computer code is used to calculate the dry deposition velocities and partitions the accident release fractions into plume segments. The MELCOR Accident Consequence Code System (MACCS) code requires the deposition velocity to be provided as an input parameter (VDEPOS) for each chemical class and particle size bin. The plume segments are likewise defined as input parameters to MACCS via such parameters as PDELAY, PLDUR, RELFRC, etc. The allowable number of particle size groups and plume segments that can be defined for MACCS is a function of the version of MACCS being used. Likewise, in Section 4.1.3, the dose conversion factors (DCFs) are stated to include Federal Guidance Report (FGR)-11, FGR-12, and FGR-13 (for cancer risk factors) for the same 69 nuclides used in the NRC's State-of-the-Art Reactor Consequence Analyses (SOARCA) project studies. Different DCF files have been provided with different versions of MACCS. A DOSFAC2 DCF file was provided with MACCS2, and the most recent versions of WinMACCS have a DCF file based on FGR-13. The MACCS dose conversion factor file for SOARCA was derived by post-processing dose rate databases in the CD supplement for FGR-13, and was not one of the DCF files distributed with the MACCS2 or WinMACCS codes. Given this ambiguity, the staff requires the following information to clarify the proposed methodology and complete its review of the topical report:

a. Because the allowable number of particle size groups and plume segments that can be defined for MACCS is a function of the version of MACCS being used, and because the dose conversion factor files provided with MACCS2 V1.13.2 (or earlier versions) are different from those used in the current WinMACCS sample problems, indicate which version of the MACCS code will be used or describe what process will be used to select a version of the MACCS code for use.

b. The deposition velocities and plume segmentation approach can have a significant effect on MACCS estimates of dose. For example, an analysis where windshift is modeled (i.e., a straight-line model defined by IPLUME=1 is not used and multiple plume segments are allowed to travel in different directions) can reduce doses relative to a straight line model. Indicate where in the topical report that the process for determining the deposition velocity and plume segmentation is described, or if this process is not described in the document, indicate how the deposition velocities will be determined and how the plume segments will be defined, and revise the topical report to include this information.

c. Indicate where in the topical report that the process for identifying the DCF file is described, or if that process is not described, indicate which DCF file will be used or what process would be used to select or generate the MACCS DCF file to be used, and revise the topical report to include this information.

- U.S. Environmental Protection Agency, Federal Guidance Report No. 11, "Limiting Values Of Radionuclide Intake And Air Concentration And Dose Conversion Factors For Inhalation, Submersion, And Ingestion," September 1988
- U.S. Environmental Protection Agency, Federal Guidance Report No. 12, "External Exposure to Radionuclides in Air, Water, and Soil," September 1993
- U.S. Environmental Protection Agency, Federal Guidance Report No. 13, "Cancer Risk Coefficients for Environmental Exposure to Radionuclides," September 1999

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 such as 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 can affect the distance at which predetermined dose levels can be exceeded.

NuScale RAI Question Response

a. {{

}}2(a),(c) It will be noted that specific version numbers are presented in appendices along with example results. {{

}}2(a),(c) In Appendix A and B, specific version numbers for all computer codes used will be added.

b. The following information and recommendations for the user of the methodology will be added to Section 4.1.3, {{

}}2(a),(c) A full description will be included in Revision 1 of the report.

c. The process to select a DCF file is not currently described in the report. The text on DCFs in Subsection 4.1.3 will be simplified to state, {{

}}2(a),(c) To clarify what was actually used in the example calculations, the following text will be added to Appendix A and B, {{

}}2(a),(c)

{{

}}2(a),(c)

Impact of NRC RAI Question Response on Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites:

a. The following revisions will be made to Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites, TR-0915-17772, Revision 0.

Section 4.1 will be revised to:

{{

}}2(a),(c)

A similar table to the following example will be inserted in Appendices A & B for each of the computer codes used:

{{

}}2(a),(c)

b. The following revisions will be made to Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites, TR-0915-17772, Revision 0.

The text from the response above will be inserted verbatim as a new paragraph immediately following the 2nd paragraph of Subsection 4.1.3.

c. The following revisions will be made to Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites, TR-0915-17772, Revision 0.

The last paragraph of Subsection 4.1.3 will be revised to read:

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}}2(a),(c)

The text in the second set of quotations from the response above will be inserted verbatim into the first paragraph of Sections A.4 and B.4.

Attachments:

None.

NRC RAI Question Number: 01.05-3

NRC RAI Question

On page 60, Section 4.1.3, a model that includes evacuation parameters from Surry and Peach Bottom is described. Use of a model that includes evacuation or other modeled protective actions, including relocation, can result in credit being taken for protective actions and thereby result in lower estimate of dose than a model in which evacuation (or other protective actions) is not modeled. In Section 4.3.1, it is stated that a no evacuation model will be used with relocation beyond the EPZ, and that the timing of relocation will be as discussed in the NEI white paper (Reference 7.1.7), "Proposed Methodology and Criteria for Establishing the Technical Basis for Small Modular Reactor Emergency Planning Zone," (December 23, 2013), with either a site-specific relocation time or a four day exposure time. Given this uncertainty, the staff requires the following information to clarify the proposed methodology and complete its review of the topical report:

a. Indicate where in the topical report the use of models that include evacuation or other protective actions would be used to inform the dose estimates used to support determination of EPZ size is described. If such use is not described, describe how MACCS code outputs that credit protective actions would be used to inform the dose estimates used to support determination of EPZ size, and revise the topical report to include this information.

b. Because use of a model that includes relocation can result in credit being taken for protective actions and thereby result in lower estimate of dose than a model in which relocation is not modeled, describe how the non-evacuating cohort will be defined and how the exposure duration will be determined, and revise the topical report to include this information.

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 such as 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 can affect the distance at which predetermined dose levels can be exceeded.

NuScale RAI Question Response

a. The text in Section 4.1.3 is incorrect and will be modified. {{

}}$^{2(a),(c)}$

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}}2(a),(c)

b. {{

}}2(a),(c)

Impact of NRC RAI Question Response on Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites:

a. The following revisions will be made to Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites, TR-0915-17772, Revision 0.

The third paragraph of Subsection 4.1.3 will be revised to:

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}}2(a),(c)

The final two bullets in Subsection 4.3.1 will be revised to:

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}}2(a),(c)

The first paragraph of Section A.4 will be revised to:

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}}2(a),(c)

The second bullet of Section B.4 will be revised to:

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}}2(a),(c)

b. The following revisions will be made to Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites, TR-0915-17772, Revision 0.

The third paragraph of Subsection 4.1.3 will be revised to:

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}}2(a),(c)

Attachments:

None.

NRC RAI Question Number: 01.05-4

NRC RAI Question

There is no discussion on pages 66-69, Sections 4.3.1 or 4.3.2 of the approach that would be taken for the development of shielding and protection factors associated with the ability of structures to reduce inhalation exposures or the providing of shielding from sources external to the building. Such a discussion is, however, provided on pages 69-71, Section 4.3.3 for the dose assessment for less probable, more severe accidents. Because the dose estimated by MACCS is directly related to the shielding and protection factors assumed, describe how shielding and protection factors for inhalation, cloudshine, and groundshine will be developed for design basis accidents and for more probable, less severe accidents, and revise the topical report to include this information.

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 such as 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 can affect the distance at which predetermined dose levels can be exceeded.

NuScale RAI Question Response

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}}2(a),(c)

Impact of NRC RAI Question Response on Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites:

The following revisions will be made to Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites, TR-0915-17772, Revision 0.

In Subsection 4.3.3, revise the last subbullet of the 5th bullet to:

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}}2(a),(c)

The text in the above bullet will be added verbatim as the final bullet in Subsection 4.3.1.

The first paragraph of Section A.4 will be revised to:

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}}2(a),(c)

A new bullet will be added to Section B.4 as follows:

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}}2(a),(c)

Attachments:

None.

NRC RAI Question Number: 01.05-5

NRC RAI Question

On page 67, Section 4.3.1, it is stated that the mean and 95th percentile doses will be calculated by MACCS based on statistical sampling and evaluation of one year of hourly meteorological data. However, the source of the meteorological data which is to be sampled is not discussed. At close ranges and for large doses, inter-annual variability in meteorological data could have an influence on the numerical stability of estimates of the MACCS dose outputs, particularly for the 95th percentile. Identify the source of the meteorological data to be used for the MACCS analysis and what measures will be taken to ensure that the selected year is representative of the site, and revise the topical report to include this information.

Regulatory basis: Onsite meteorological data are also used to satisfy the 10 CFR 100.21(c) requirements to evaluate site atmospheric dispersion characteristics and to establish dispersion parameters such that: (1) radiological effluent release limits associated with normal operation can be met for any individual located off site; and (2) radiological dose consequences of postulated accidents meet prescribed dose limits at the Exclusion Area Boundary and outer boundary of the Low Population Zone.

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 such as 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 can affect the distance at which predetermined dose levels can be exceeded.

NuScale RAI Question Response

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}}2(a),(c)

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}}2(a),(c)

Impact of NRC RAI Question Response on Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites:

The following revisions will be made to Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites, TR-0915-17772, Revision 0.

In Subsection 4.1.3 the third and fourth paragraphs will be revised to read:

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}}2(a),(c)

In Subsection 4.3.1, two bullets under “Dose Evaluation Methodology” will be revised to:

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}}2(a),(c)

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}}2(a),(c)

In Subsection 4.3.3 the following bullet will be added:

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}}2(a),(c)

In Section B.4, the third bullet will be revised to:

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}}2(a),(c)

Attachments:

None.

NRC RAI Question Number: 01.05-6

NRC RAI Question

On pages 67-68, in the Section 4.3.1 discussion for additional steps within 500 meters (m), NuScale states that the NuScale topical report methodology will be similar to the approach used for Department of Energy (DOE) facilities, and references DOE MACCS code guidance listed in Reference 7.4.10. It states that a DOE code review of MACCS (Reference 7.4.3) found that MACCS can be used at a distance of 100 m or greater if appropriate care is used, and states that either the ARCON96 or AERMOD computer code will be used to evaluate the atmospheric dispersion factors produced by MACCS within 500 m. However, Reference 7.4.3 is the MACCS code manual (Chanin and Young, 1998), and Reference 7.4.10 refers to Volume 3 of the RELAP5 code manual. Reference 7.4.6 refers to the 2004 DOE MACCS code guidance. Note that the 2004 DOE guidance recommends a minimal virtual source size and a cold ground level release to avoid crediting dispersion for building wakes, which also appears to have been the approach used in the NuScale's example described in Appendix B.4, pages 148-149. As noted in Napier et al. (2011), this can be very conservative at very close ranges. Also, as noted in Napier et al. (2011), the Tadmor-Gur parameterization (which is intended for a distance range of 0.5 to 5 km) does not appear appropriate at distances of less than 500 m. The staff requires the following information to complete its review:

a. In order that the technical basis for the approach should be clearly traceable, verify that the references cited in Section 4.3.1 are correct or revise the topical report to correct the information.

b. With very small source terms, the computed distances may fall within 500 m, such that the process for actually determining the distance at which the criteria are exceeded may be controlled by the procedure used. Describe how ARCON96 or AERMOD results will be used to support MACCS outputs for distances of 100-500 m, and revise the topical report to include this information.

References:

- Napier, B.A., J.P. Rishel, and N.E. Bixler, 2011. “Final Review of Safety Assessment Issues at Savannah River Site, August 2011”, PNNL-20990, Pacific Northwest National Laboratory, December 2011
- Department of Energy (DOE), 2015. “Technical Report for Calculation of Atmospheric Dispersion at Onsite Locations for Department of Energy Nuclear Facilities”, NSRD-2015-TD01, US Department of Energy, Office of Environment, Health, Safety, and Security, Office of Nuclear Safety, April 2015.

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 such as 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 can affect the distance at which predetermined dose levels can be exceeded.

NuScale RAI Question Response

a. The reference numbers in Section 4.3.1 will be corrected.

b. {{

}}$^{2(a),(c)}$ While no text changes will accompany this portion of the response, the complete methodology will be included in Revision 1 of the report.

Impact of NRC RAI Question Response on Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites:

a. The following revisions will be made to Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites, TR-0915-17772, Revision 0.

The following portion of Subsection 4.3.1 will be revised to:

Additional Steps for Dose Evaluation Inside 0.5 Kilometers

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}}2(a),(c)

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}}2(a),(c)

b. This RAI response does not require licensing document revisions.

Attachments:

None.

NRC RAI Question Number: 01.05-7

NRC RAI Question

On pages 69-71, Section 4.3.3, it is stated that the whole body acute dose will be used as a dose metric. However, MACCS DCF files do not contain a whole body acute dose DCF. Acute inhalation doses (based on a one year dose commitment with dose rate reduction factors applied to exposures of greater than 24 hrs.) are computed. The example on page 149, Appendix B (Footnote 13 to Figure B-40) suggests that the red bone marrow dose will be used (as noted by use the A-RED MARR MACCS parameter). This value, while appropriate for comparison to a dose threshold for acute effects, can be noticeably less than the effective dose from the International Commission on Radiological Protection (ICRP) Publication 60 (MACCS parameter ICRP60ED) because of the 50 year dose commitment used for the effective dose.

In order to clarify the proposed methodology, identify the MACCS dosimetric quantity (i.e., the specific code parameter(s) and output control parameter(s)) used to quantify whole body acute dose including the associated output listing, and revise the topical report to include this information.

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 such as 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 can affect the distance at which predetermined dose levels can be exceeded.

NuScale RAI Question Response

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}}$^{2(a),(c)}$

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}}2(a),(c)

Impact of NRC RAI Question Response on Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites:

The following revisions will be made to Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites TR-0915-17772, Revision 0.

The fourth bullet of Subsection 4.3.1 will be revised to:

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}}2(a),(c)

The fifth bullet of Subsection 4.3.3 will be revised to:

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}}2(a),(c)

The first paragraph of Section A.4 will be revised to:

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}}2(a),(c)

The change from one year to 30-day inhalation exposure duration is made in the mark-up for RAI 10a.

Attachments:

None.

NRC RAI Question Number: 01.05-8

NRC RAI Question

On pages 75-77, Section 4.4.2.2, a process for screening SOARCA uncertainty analysis parameters to eliminate those that are not relevant or not significant to the NuScale design is described, and additional parameters are identified in relation to the candidates for accident sequence selection. It is stated that no additional parameters were identified for MACCS, but the process and candidate MACCS parameters are not identified. There are a number of MACCS parameters that were not evaluated in the SOARCA analysis, and it is not clear that the SOARCA parameter identification is sufficient for the reduced source term, near-field modeling that may be applicable for the NuScale design. In addition, there are model uncertainties that are not amenable to parameter sampling approaches; for example, the choice of a weather year, or the representativeness of a particular meteorological dataset. The staff requires the following information to clarify the proposed methodology and complete its review of the topical report:

a. Because MACCS parameters related to near field effects (wake effects, plume meander, plume rise, etc.) that may not have been important for SOARCA analyses could be important for near field calculations, identify additional MACCS uncertainty analysis parameters and/or models that were considered to address this concern. In particular, identify parameters and model choices related to near field modeling that should be considered.

b. Parameters for the ARCON96 or AERMOD atmospheric dispersion computer codes were not examined in SOARCA uncertainty analyses. If near field corrections from ARCON96 or AERMOD are to be applied, indicate how the input parameters for those codes will be examined in the uncertainty analysis, and revise the topical report to include this information.

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 such as 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 can affect the distance at which predetermined dose levels can be exceeded.

NuScale RAI Question Response

a. A more detailed methodology for performing the uncertainty analysis (UA) will be included in Revision 1 of the topical report. {{

}}2(a),(c)

b. {{

}}2(a),(c)

Impact of NRC RAI Question Response on Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites:

This RAI response does not require licensing document revisions.

Attachments:

None.

NRC RAI Question Number: 01.05-9

NRC RAI Question

Because the assumptions and inputs used in the dose analysis can affect the distance at which predetermined dose levels can be exceeded, and because no specific MACCS code input values are listed in the topical report for staff approval, the specifics of the potential combined license (COL) applicant's analysis that implements the topical report methodology should be available for staff review. Trying to describe the analysis inputs in writing to the extent necessary for the staff to understand the analysis would be very onerous for an applicant; many questions can be clearly answered simply by examining the MACCS code input file. To aid in efficiency of staff review of a COL application which uses the methodology from the topical report, add implementation information to the topical report to include direction to the potential COL applicant to document the site-specific analysis inputs with their supportive bases information and also provide the MACCS code input files for staff review.

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 such as 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.

NuScale RAI Question Response

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}}$^{2(a),(c)}$ A list of parameters to include will be added to Revision 1 of the report. Recommended default values will be included as well as parameters that must be site-specific will also be identified in Revision 1.

Impact of NRC RAI Question Response on Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites:

The following revisions will be made to Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites, TR-0915-17772, Revision 0.

Revise the first paragraph of Section 4.1 to:

{{

}}2(a),(c)

Attachments:

None.

NRC RAI Question Number: 01.05-10

NRC RAI Question

On pages 66-67, Section 4.3, dose-based acceptance criteria for the EPZ size justification are given for three categories of accidents in Table 4.2, which are generally consistent with the discussion in the December 23, 2013 Nuclear Energy Institute (NEI) white paper (Reference 7.1.7), “Proposed Methodology and Criteria for Establishing the Technical Basis for Small Modular Reactor Emergency Planning Zone.” On page 70, Section 4.3.3 gives the dose criteria for the “less probable, more severe accidents” as 200 rem whole body acute dose and the exposure pathways for whole body acute exposure include cloudshine, inhalation and groundshine. A number is given in parentheses following each pathway, which is presumed to be the exposure time (24 hours for cloudshine and groundshine and one year for inhalation) consistent with footnote b of Figures I-15 and I-16 of NUREG-0396. The staff requires the following information to complete its review of the topical report methodology:

a. Define the meaning of the time periods provided in parentheses following each exposure pathway. In particular, if the one year period for inhalation refers to the integration time for exposure following inhalation, as used to derive the acute inhalation dose conversion factor, please so state.

b. The concept of determining the probability of dose exceedance for this “less probable more severe accidents” category is generally consistent with the discussion in NUREG-0396 for more severe accidents, but is lacking in sufficient detail. Therefore, describe the NuScale process for determining the probability of dose exceedance for this "less probable more severe accidents" more clearly in the topical report.

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 such as 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 dose criteria used can affect the distance at which predetermined dose levels can be exceeded.

NuScale RAI Question Response

a. {{

}}2(a),(c)

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}}2(a),(c)

b. {{

}}2(a),(c)

Impact of NRC RAI Question Response on Methodology for Establishing the Technical Basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites:

a. The following revisions will be made to Methodology for Establishing the Technical basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites, TR-0915-17772, Revision 0.

In Subsection 4.3.3, revise the third subbullet under the fifth bullet under "Dose Evaluation Methodology" to read:

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}}2(a),(c)

b. The following revisions will be made to Methodology for Establishing the Technical basis for Plume Exposure Emergency Planning Zones at NuScale Small Modular Reactor Plant Sites, TR-0915-17772, Revision 0.

In Subsection 4.3.3, the fifth bullet will be revised to:

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}}2(a),(c)

In Subsection 4.3.3, the final bullet will be revised to:

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}}2(a),(c)

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}}2(a),(c)

The first two paragraphs of Section B.4 will be revised to:

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}}2(a),(c)

{{

}}2(a),(c)

Attachments:

None.

Enclosure 3:

Affidavit, AF-1116-51883

NuScale Power, LLC
1100 NE Circle Blvd., Suite 200 Corvallis, Oregon 97330 Office 541.360-0500 Fax 541.207.3928
www.nuscalepower.com

NuScale Power, LLC

AFFIDAVIT of Thomas A. Bergman

I, Thomas A. Bergman , state as follows:

(1) I am the Vice President of Regulatory Affairs of NuScale Power, LLC (NuScale), and as such, I have been specifically delegated the function of reviewing the information described in this Affidavit that NuScale seeks to have withheld from public disclosure, and am authorized to apply for its withholding on behalf of NuScale

(2) I am knowledgeable of the criteria and procedures used by NuScale in designating information as a trade secret, privileged, or as confidential commercial or financial information. This request to withhold information from public disclosure is driven by one or more of the following:

(a) The information requested to be withheld reveals distinguishing aspects of a process (or component, structure, tool, method, etc.) whose use by NuScale competitors, without a license from NuScale, would constitute a competitive economic disadvantage to NuScale.

(b) The information requested to be withheld consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), and the application of the data secures a competitive economic advantage, as described more fully in paragraph 3 of this Affidavit.

(c) Use by a competitor of the information requested to be withheld would reduce the competitor's expenditure of resources, or improve its competitive position, in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.

(d) The information requested to be withheld reveals cost or price information, production capabilities, budget levels, or commercial strategies of NuScale.

(e) The information requested to be withheld consists of patentable ideas.

(3) Public disclosure of the information sought to be withheld is likely to cause substantial harm to NuScale's competitive position and foreclose or reduce the availability of profit-making opportunities. The accompanying response reveals distinguishing aspects about the process, and method by which NuScale develops its Response to Request For Additional Information Letter No. 4 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

NuScale has performed significant research and evaluation to develop a basis for this process, and method and has invested significant resources, including the expenditure of a considerable sum of money.

The precise financial value of the information is difficult to quantify, but it is a key element of the design basis for a NuScale plant and, therefore, has substantial value to NuScale.

If the information were disclosed to the public, NuScale's competitors would have access to the information without purchasing the right to use it or having been required to undertake a similar expenditure of resources. Such disclosure would constitute a misappropriation of NuScale's intellectual property, and would deprive NuScale of the opportunity to exercise its competitive advantage to seek an adequate return on its investment.

(4) The information sought to be withheld is in the enclosed response entitled. The enclosure contains the designation "Proprietary" at the top of each page containing proprietary information.

The information considered by NuScale to be proprietary is identified within double braces, "{{ }}" in the document.

(5) The basis for proposing that the information be withheld is that NuScale treats the information as a trade secret, privileged, or as confidential commercial or financial information. NuScale relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC § 552(b)(4), as well as exemptions applicable to the NRC under 10 CFR §§ 2.390(a)(4) and 9.17(a)(4).

(6) Pursuant to the provisions set forth in 10 CFR § 2.390(b)(4), the following is provided for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld:

(a) The information sought to be withheld is owned and has been held in confidence by NuScale.

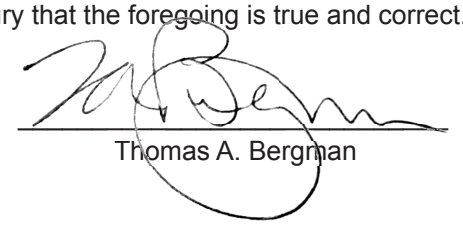
(b) The information is of a sort customarily held in confidence by NuScale and, to the best of my knowledge and belief, consistently has been held in confidence by NuScale. The procedure for approval of external release of such information typically requires review by the staff manager, project manager, chief technology officer or other equivalent authority, or the manager of the cognizant marketing function (or his delegate), for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside NuScale are limited to regulatory bodies, customers and potential customers and their agents, suppliers, licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or contractual agreements to maintain confidentiality.

(c) The information is being transmitted to and received by the NRC in confidence.

(d) No public disclosure of the information has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or contractual agreements that provide for maintenance of the information in confidence.

(e) Public disclosure of the information is likely to cause substantial harm to the competitive position of NuScale, taking into account the value of the information to NuScale, the amount of effort and money expended by NuScale in developing the information, and the difficulty others would have in acquiring or duplicating the information. The information sought to be withheld is part of NuScale's technology that provides NuScale with a competitive advantage over other firms in the industry. NuScale has invested significant human and financial capital in developing this technology and NuScale believes it would difficult for others to duplicate the technology without access to the information sought to be withheld.

I declare under penalty of perjury that the foregoing is true and correct. Executed on November 8, 2016



Thomas A. Bergman