



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 13, 2018

MEMORANDUM TO: Samuel S. Lee, Chief
Licensing Branch 1
Division of New Reactor Licensing
Office of New Reactors

FROM: Getachew Tesfaye, Senior Project Manager /RA/
Licensing Branch 1
Division of New Reactor Licensing
Office of New Reactors

SUBJECT: SUMMARY REPORT FOR THE REGULATORY AUDIT OF
DRAFT REVISION 3 OF THE ACCIDENT SOURCE TERM
METHODOLOGY TOPICAL REPORT TR-0915-17565 FOR
NUSCALE POWER, LLC

NuScale Power, LLC (NuScale) submitted Topical Report (TR)-0915-17565, "Accident Source Term Methodology," Revision 1 to the U.S. Nuclear Regulatory Commission (NRC) for review on April 8, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16099A394). NuScale submitted Revision 2 of TR-0915-17565 by letter dated September 11, 2017 (ADAMS Accession No. ML17254B068). At a public meeting on January 23, 2018, NuScale presented planned changes to the methodology in the TR, to be submitted in July 2018. Presentation materials for the public meeting were submitted by letter dated January 17, 2018 (ADAMS Accession No. ML18019A156).

To facilitate NRC staff preparation for further pre-submittal interactions with NuScale on the planned revision for the TR, the staff conducted an audit of non-docketed material providing NuScale's proposed draft revisions and additions to the TR. The audit plan used to support these interactions is located in ADAMS under Accession No. ML18095A956.

The audit began April 9, 2018, and ended on May 4, 2018. The audit summary report is enclosed.

Docket No.: 52-048

Enclosures:
As stated

cc w/encl.: DC NuScale Power LLC Listserv

CONTACT: Getachew Tesfaye, NRO/DNRL
301-415-8013

SUBJECT: SUMMARY REPORT FOR THE REGULATORY AUDIT OF DRAFT REVISION 3 OF THE ACCIDENT SOURCE TERM METHODOLOGY TOPICAL REPORT TR-0915-17565 FOR NUSCALE POWER, LLC
DATE: June 13, 2018

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DATE	5/18/2018	5/23/2018	6/13/2018

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NUSCALE POWER, LLC
SUMMARY REPORT OF AUDIT TO SUPPORT
PRE-SUBMITTAL INTERACTION ON A PROPOSED
REVISION TO THE NUSCALE POWER, LLC ACCIDENT SOURCE TERM
METHODOLOGY TOPICAL REPORT TR-0915-17565
APRIL 9 – MAY 4, 2018

1.0 BACKGROUND AND PURPOSE

On April 8, 2016, Nuscale Power, LLC (NuScale) submitted Topical Report (TR)-0915-17565, “Accident Source Term Methodology,” Revision 1 to the U.S. Nuclear Regulatory Commission (NRC) for review (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16099A394). The TR is referenced by and supports the Design Control Document for the Design Certification Application (DCA) of the NuScale design.

NuScale submittal Revision 2 of TR-0915-17565 by letter dated September 11, 2017. At a public meeting on January 23, 2018, NuScale presented planned changes to the methodology in the TR to be submitted in July 2018. To aid in the staff’s preparation for a pre-submittal meeting in April 2018 on the planned TR revision, NuScale proposed to make the draft revisions and additions to the TR available for staff inspection.

The audit was performed to examine and evaluate non-docketed information such as draft revised text for the subject TR and any other supporting documents to gain a better understanding of NuScale’s proposal to revise the NuScale Accident Source Term Methodology TR.

2.0 AUDIT REGULATORY BASES

A regulatory audit is a planned, license or regulation-related activity, that includes the examination and evaluation of primarily non-docketed information. A regulatory audit is conducted with the intent to gain an understanding, verify information, and/or identify information that will require docketing to support the basis of the licensing or regulatory decision. The NRC staff conducted an audit of the non-docketed draft proposed revision to the NuScale Accident Source Term Methodology TR and supporting information to aid in its understanding of the proposed revision to the methodology and assist in the review of the subject TR.

Specifically, this regulatory audit is based on the following:

- Title 10 of the *Code of Federal Regulations* (10 CFR) 50.34(f)(2)(vii), (viii), (xxvi) and (xxviii)
- 10 CFR 50.49(e)(4)
- 10 CFR Part 50, Appendix A, General Design Criteria () 19
- 10 CFR 52.47(a)(2)(iv)

- 10 CFR 50.47(b)(8) and (b)(11) and Paragraph IV.E.8 of Appendix E to 10 CFR Part 50
- 3.0 AUDIT OBJECTIVES**

The NRC staff's objective in conducting this audit was to gather information on NuScale's proposed revision to the subject TR, with the following goals:

- Gain a better understanding of NuScale's proposal to revise the NuScale Accident Source Term Methodology TR;
- Identify implications to the review of the NuScale DCA, including information in the final safety analysis report with regard to design basis accident (DBA) radiological consequence analyses, control room habitability, equipment qualification, certain TMI-related requirements, and other related topic areas; and
- Identify any staff questions about the proposed revision for discussion at a forthcoming pre-submittal public meeting with NuScale.

4.0 SCOPE OF THE AUDIT AND AUDIT ACTIVITIES

The audit was conducted April 9 through May 4, 2018, through review of documents available in NuScale's electronic reading room (eRR). The NRC staff conducted the audit in accordance with the Office of New Reactors (NRO) Office Instruction NRO-REG-108, "Regulatory Audits" (Reference 1).

Members of the audit team, listed below, were selected based on their detailed knowledge of DBA radiological consequence assessment and severe accident consequence assessment; their experience supporting previous early site permit reviews; their knowledge of the regulatory framework regarding exemptions; and their knowledge regarding implementation of the review framework for small modular reactors. Audit team members included:

Staff	Topic Area
Michelle Hart (lead reviewer)	<ul style="list-style-type: none"> – DBA radiological consequence analyses – DBA source terms – Fission product transport and removal – Control room and technical support center radiological habitability analyses
Jason Schaperow	<ul style="list-style-type: none"> – DBA source terms – Fission product transport and removal – Severe accidents progression and consequences – Event frequency
Mark Caruso	<ul style="list-style-type: none"> – Probabilistic risk assessment (PRA) and use of risk information
Brad Harvey, Jason White	<ul style="list-style-type: none"> – Atmospheric dispersion
Ronald LaVera, Edward Stutzcage	<ul style="list-style-type: none"> – Equipment qualification – TMI-related requirements and operator access

	— Shielding
Timothy Drzewiecki, Jeffrey Schmidt	Event categorization
Michael Dudek	Office of New Reactors/Radiation Protection and Accident Consequences Branch, Branch Chief
Anthony Markley, Getachew Tesfaye	Project Manager

On April 9, 2018, an entrance meeting was held on the telephone between the NRC staff and NuScale staff to review key elements of the audit plan (ADAMS Accession No. ML18095A956). The documents reviewed by the staff during the audit are listed below:

1. NuScale document TR-0915-17565-P, Draft Revision 3, “Accident Source Term Methodology,” an “in-process” draft revision of the subject TR
2. NuScale document EC-0000-6210, Revision 0, “Radiological Consequences of Credible Design Basis Source Term”

The NRC staff ended the audit on May 4, 2018, and held an audit exit meeting on May 10, 2018, by telephone. The NRC staff’s summary of observations listed below is based on the notes taken by the staff during the audit. The NRC staff did not acquire any documents during the audit.

5.0 SUMMARY OF OBSERVATIONS

Based on the NRC staff’s audit of the draft revision to the NuScale Accident Source Term Methodology TR and related documents, the staff observed the following:

1. Staff observed that NuScale added a coolant activity (with iodine spike) source term as an alternative to a core melt source term, which they call the credible iodine spike maximum hypothetical accident (MHA) source term. The coolant activity source term is to be used if the core damage frequency (CDF) is less than 10^{-6} /year. Staff observed that the proposed revision to the TR does not provide justification for using a coolant activity source term beyond the justification previously provided (i.e., the CDF is less than 10^{-6} per year). The staff notes that NuScale has stated that they will provide a white paper to provide the basis for the decision point to choose whether a core melt source term is assessed for the MHA based on accident frequency. The staff has determined that it has the appropriate understanding of the proposed addition to the TR of the credible iodine spike MHA source term methodology to be able to engage in the forthcoming public meeting, to include the following questions:
 - a. Considering that the TR is a methodology developed for a specific design (NuScale SMR) that has a design PRA, why was a risk-informed screening threshold to determine whether a core damage event is a “credible” DBA or not added? Who are the intended applicants (other than the NuScale design certification)? Could different applicants (although using the same methodology for the same plant) make a different decision? Is the NuScale CDF expected to change before TR implementation?
 - b. Section 4.2 states: “Applications referencing this topical report may also elect to use the MHA source term for other design purposes (e.g., environmental qualification, post-accident operator access, etc).” Clarification is needed as to

what this statement means. Will NuScale identify in the appropriate sections of the DCA FSAR the basis for which source term is used for each of those other design purposes?

2. For the coolant activity source term, it is the staff's interpretation that NuScale assumes all of the activity in the coolant is airborne in the containment as vapor and leaks to the environment at the design basis leak rate. The eRR also included NuScale proprietary calculation EC-0000-6210, which calculates the radiological dose consequences of the credible iodine spike MHA. Staff observed through review of EC-0000-6210 that the analysis methodology generally conforms to guidance in Regulatory Guide (RG) 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors." The staff did not review calculation package or the description of the source term methodology for the credible iodine spike MHA in detail, but has gained a general understanding of the features of the analysis. Detailed review of the methodology for developing the source term for the credible iodine spike MHA will be undertaken in the review of the revision to the TR, when submitted on the docket. The staff has determined that it has the appropriate understanding of the proposed addition of the credible iodine spike MHA source term to the accident source term methodology to be able to engage in the forthcoming public meeting, to include the following question:
 - a. The credible iodine spike MHA source term assumes that the containment leakage is reduced at 24 hours to 50% of the technical specification design leakage, for the duration of the event, based on guidance from RG 1.183 for pressurized water reactor (PWR) containment leakage for the loss-of-coolant accident (LOCA). Considering that RG 1.183 guidance on assumed leakage reduction was based on LOCA containment thermal hydraulic conditions, will the revision to the TR provide justification to show that the RG analysis assumptions on containment leak rate is applicable to the credible iodine spike MHA?
3. Staff observed that the draft revision to the TR retained the core melt source term to be used for the MHA analysis if the CDF is greater than 10^{-6} /year. NuScale has made changes to the methodology previously submitted. Staff notes that NuScale has stated in the draft revision that they are still working on updating the other figures and tables in the core melt source term section of the TR. NuScale also made some terminology changes. Detailed review of the methodology for developing the source term for the core melt MHA will be undertaken in the review of the revision to the TR, when submitted on the docket. The staff has determined that it has the appropriate understanding of the proposed changes to the core melt MHA source term methodology to be able to engage in the forthcoming public to include the following questions to be discussed in the forthcoming meeting:
 - a. In the core melt MHA source term modeling of aerosols, staff identified that NuScale {{ }}. What is the reason for this change? Was it in response to RAI 9224 for the TR? Will this be more fully described in the revision to the TR?
 - b. Credit {{ }} has not been previously approved in modeling of aerosol deposition for DBA dose analyses. Will the revision to the TR provide the basis and justification {{ }} in aerosol deposition?

4. In Section 5, the TR provides example calculations to aid in understanding of the methodology. The staff notes that it appears that the draft revision available in the eRR has made some revisions to the example calculations. The staff has the following questions for the forthcoming meeting on the TR:
 - a. Does NuScale plan to make any additional changes to the example calculations in the revised TR to reflect the final proposed methodology?
 - b. Similarly, will the sensitivity analyses be updated in the revised TR?

6.0 REFERENCES

1. NRO Office Instruction, NRO-REG-108, "Regulatory Audits," Revision 0, April 2009
2. TR-0915-17565, "Accident Source Term Methodology," Revision 2, September 11, 2017 (ADAMS Accession No. ML17254B068)
3. NuScale letter: "NuScale Power, LLC Submittal of Presentation Materials Entitled 'NuScale Source Term Revision,' Revision 0, PM-0118-58201," January 17, 2018 (ADAMS Accession No. ML18019A156)