



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

January 27, 2019

MEMORANDUM TO: Samuel Lee, Chief
Licensing Branch 1
Division of Licensing, Siting,
and Environmental Analysis
Office of New Reactors

FROM: Getachew Tesfaye, Senior Project Manager **/RA/**
Licensing Branch 1
Division of Licensing, Siting,
and Environmental Analysis
Office of New Reactors

SUBJECT: AUDIT PLAN FOR THE PHASE IV REGULATORY AUDIT OF
THE EQUIPMENT QUALIFICATION AND RADIATION
PROTECTION NEUTRON SOURCE TERM FOR NUSCALE
POWER, LLC., DESIGN CERTIFICATION APPLICATION, REV 1

By letter dated December 31, 2016, NuScale Power, LLC (NuScale), submitted to the U.S. Nuclear Regulatory Commission (NRC), its Design Certification Application (DCA) (Agencywide Documents Access and Management System (ADAMS) Accession Number ML17013A229). The NRC staff started its detailed technical review of NuScale's DCA on March 27, 2017.

The purpose of this audit is for the NRC staff to obtain additional information related to identifying, in the application, the type of radiation present; the quantity of radiation present; and the energy of that radiation, as it is used to determine the dose rate and total dose from the incident neutron and gamma radiation. The NRC staff will examine the induced gamma radiation from incident neutron radiation, gamma radiation resulting from decay of activated materials, and the technical bases for the stated values, in areas inside containment, under the bioshield and areas adjacent to the bioshield. Some of the requests for additional information (RAIs) with a nexus to the incident neutron fluence that are under review by the NRC staff include, but are not limited to:

- RAI 9282 – Neutron Flux and Spectrum in Containment;
- RAI 9291 – Gamma Fluence Under the Bioshield;
- RAI 9447 – Bioshield Design;
- RAI 9295 – Bioshield Wall Shielding

The staff will also review documents related to the following RAIs to close open items:

- RAI 9613, Question 12.02-33 - Reactor Building Airborne activity
- RAI 9266, Question 12.02-13 - Reactor Building Airborne activity
- RAI 9270 - Reactor Building Airborne activity
- RAI 9284 - Smooth Surface

The audit process will allow the NRC staff to access supporting documentation that has been

identified as potentially significant to the review, such as neutron fluence calculations, activation calculations, shielding calculations, equipment qualification, and other non-docketed information in NuScale's Electronic Reading Room (eRR).

This audit will take place at NuScale's offices, in Rockville, Maryland, and/or via the NRC staff's review of electronic information to which NuScale will grant electronic access via the eRR. The audit entrance meeting took place on February 11, 2019. The revised schedule for the audit is from March 4 2019 to March 14, 2019, with an exit meeting on April 4, 2019. The audit plan is provided as an enclosure.

Docket No. 52-048

Enclosure:
Audit Plan

cc w/encl.: DC NuScale Power, LLC Listserv

CONTACT: Getachew Tesfaye, NRO/DLSE
(301) 415-8013

SUBJECT: AUDIT PLAN FOR THE PHASE IV REGULATORY AUDIT OF THE EQUIPMENT
QUALIFICATION AND RADIATION PROTECTION NEUTRON SOURCE TERM
FOR NUSCALE POWER, LLC., DESIGN CERTIFICATION APPLICATION
DATED: January 27, 2019

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ADAMS Accession No.: ML19058A523

NRO-002

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|--------|---------------|-----------------|-----------------|
| OFFICE | NRO/DLSE/RPAC | NRO/DLSE/LB1:LA | NRO/DLSE/LB1:PM |
| NAME | RLaVera | CSmith | GTesfaye |
| DATE | 12/13/2018 | 01/07/2019 | 01/27/2019 |

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U.S. NUCLEAR REGULATORY COMMISSION
AUDIT PLAN FOR THE PHASE IV REGULATORY AUDIT OF THE EQUIPMENT
QUALIFICATION AND RADIATION PROTECTION NEUTRON SOURCE TERM
FOR NUSCALE POWER, LLC., DESIGN CERTIFICATION APPLICATION

DOCKET NO. 52-048

AUDIT PLAN

APPLICANT: NuScale Power, LLC. (NuScale)

APPLICANT CONTACTS: Carrie Fosaaen (NuScale)

DURATION: March 4, 2019, through March 14, 2019

LOCATION: NuScale Rockville Office
11333 Woodglen Drive, Suite 205
Rockville, Maryland 20852

AUDIT TEAM: Ronald LaVera (NRO, Technical Reviewer)
Edward Stutzage (NRO, Technical Reviewer)
Zachary Gran (NRO, Technical Reviewer)
Timothy Drzewiecki (NRO, Technical Reviewer)
Alfred Hathaway (RES, Reactor Systems Engineer)
Michael Dudek (NRO/RPAC Branch Chief)
Getachew Tesfaye (NRO, Senior Project Manager)
Supporting NRC Staff (as needed)

I. BACKGROUND

By letter dated December 31, 2016, NuScale Power, LLC (NuScale), submitted a Design Certification Application (DCA) to the U.S. Nuclear Regulatory Commission (NRC) for review (Agencywide Documents Access and Management System (ADAMS) Accession Number ML17013A229). On March 15, 2017, the NRC staff accepted the DCA for docketing and initiated its technical review.

To understand the technical basis for NuScale's stated neutron and gamma radiation environment underneath the bioshield, in areas adjacent to the bioshield, locations within the containment vessel, and in and around the reactor vessel; the staff asked the applicant to provide additional information about the characteristics of the radiation environment in these areas. Based on the applicant's responses to the questions and information obtained during the "Phase II Regulatory Audit of the Design Basis Failed Fuel Fraction for NuScale Power, LLC Design Certification Application," (ML18348A966), the staff identified a difference between the

Enclosure

gamma dose rate stated in the applicant's response to RAI 9291 dated February 27, 2018 (ML18058A720), and the values calculated by the staff. Following clarification conversations with the staff on October 18, 2018 (ML18295A077), and October 23, 2018 (ML18295A077), the applicant submitted its supplemental response to RAI 9291 dated November 28, 2018 (ML18332A397) that showed the revised gamma dose rates resulting from the Nitrogen 16 contribution, as was expected. However, in that same response, the applicant also revised the neutron dose rate and the neutron induced gamma dose rate, but provided no details as to the technical bases for those additional changes. In the staff's discussions with the applicant on December 6, 2018, the applicant stated that in an unrelated activity from determining the gammas emitted from the coolant, they had also changed parameters used to calculate neutron and neutron induced gamma dose rates that were provided during the initial application submittal. The changes to the neutron and neutron induced gammas were also reflected in the supplemental response to RAI 9292.

As a result, the NRC staff will review calculations and other information related to the neutron and neutron induced gamma radiation inside containment, under the bioshield, and adjacent areas where neutron radiation and neutron induced gamma radiation is present in appreciable quantities. This includes identifying the types of radiation present, the quantities of radiation present, and the energies of that radiation, as they are used to determine the dose rate and total dose from the incident radiation, as well as the induced radiation from incident radiation, and the bases for the stated values.

To facilitate the NRC staff's evaluation of information related to characterizing the radiation fields present, the NRC staff proposes this audit plan to include:

- A regulatory audit that will commence on March 4, 2019, then end on March 14, 2019, and exit on April 4, 2019. The audit will take place at NuScale's offices in Rockville, Maryland, and/or via the NRC staff's review of electronic information to which NuScale grants access. During this audit, the NRC staff will examine information requested and any NuScale documentation that will facilitate an understanding of the type of radiation present, the quantity of radiation present, and the energy of that radiation, as it is used to determine the dose rate and total dose from the incident radiation, as well as the induced radiation from incident radiation, and the bases for the stated values, for areas underneath the bioshield, in areas adjacent to the bioshield, locations within the containment vessel and in and around the reactor vessel.

II. PURPOSE AND REGULATORY BASIS

The purpose of the focused NRC Phase IV Regulatory Audit of the Nuclear Power Module radiation environment is to:

- Allow the NRC staff to conclude that the revised calculated radiation environment from neutrons and neutron induced gammas is fully and appropriately accounted for as it impacts radiological conditions of the facility and the environmental qualification of equipment, consistent with the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.49(e)(4).
- Allow the NRC staff to conclude that the now current calculated radiation environment from neutrons and neutron induced gammas is fully and appropriately accounts for the kinds and quantities of radioactive materials expected to be produced in the operation

and the means for controlling and limiting radioactive effluents and radiation exposures within the limits set forth in Part 20 of this chapter, consistent with the requirements of 10 CFR 52.47(a)(5).

The NRC staff determined efficiency gains would be realized by auditing the information supporting the DCA, as well as in the responses to RAIs, and would help determine if further specific information is needed to support its regulatory findings. During the audit and interactions with the applicant, additional detailed NRC requests for information may be developed, which could be part of a future formal correspondence.

The NRC staff's acceptance criteria described in the Design Specific Review Standard (DSRS) Section 12.2, "Radiation Sources" (ML15350A320); DSRS Sections 12.3-12.4, "Radiation Protection Design Features" (ML15350A339); and DSRS Section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment" (ML15355A455), and the SRP are based on meeting the relevant requirements of the following NRC regulations:

- 10 CFR Part 50, Appendix A GDC 4
- 10 CFR Part 50, Appendix A GDC 61
- 10 CFR Part 50, Appendix A GDC 63
- 10 CFR 52.47(a)(5)
- 10 CFR 50.49
- 10 CFR Part 20 Subpart C - Occupational Dose Limits
- 10 CFR 20.1101(b)

The DSRS and NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (SRP), are not a substitute for NRC regulations and compliance when it is not required. As an alternative, an applicant may identify the differences between a DSRS section and the design features, analytical techniques, and procedural measures proposed in an application and discuss how the proposed alternative provides an acceptable method of complying with NRC regulations that underlie the DSRS acceptance criteria. Where the DCA contents differed from the guidance contained in the DSRS, the NRC staff reviewed the associated analytical techniques, data, and conclusions associated with the proposed alternative.

The NRC staff must have sufficient information to ensure that the applicant's analytical approach has adequately addressed the regulatory requirements used as the basis for the NuScale DSRS and other relevant guidance.

III. REGULATORY AUDIT SCOPE

This audit will focus on the characterization of the radiation fields resulting from the transport of fission neutrons. This includes, but is not limited to: neutron source term calculations, neutron shielding and transport calculations, neutron-gamma calculations, neutron activation and decay calculations, dose rate calculation, and equipment qualification calculations. The NRC staff will schedule time with NuScale staff to review specific documents at the NuScale Rockville office,

as needed.

The NRC staff requests the current calculation packages related to the above information be provided on the applicant's eRR to the extent possible. The NRC staff also requests the associated revised Excel® Workbooks and other supporting information, in native format, be provided to support the review. As necessary, the NRC staff will schedule time with NuScale staff to review specific features of the information provided by NuScale.

The NRC staff identified some of the RAIs currently under review that have a nexus to the change in the DBFFF. This includes, but is not limited to:

- RAI 9282 – Neutron Flux and Spectrum in Containment;
- RAI 9291 – Gamma Fluence Under the Bioshield;
- RAI 9447 – Bioshield Design;
- RAI 9295 – Bioshield Wall Shielding

The staff will also review documents related to the following RAIs to close open items:

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However, because of the interrelationship between the neutron source term, and the implications for the resultant design features required for equipment and radiological protection, the NRC staff may also ask additional questions during the course of the audit, that are not currently summarized above. If necessary, any circumstances related to the conductance of the audit will be communicated to the NRC Project Manager, Getachew Tesfaye, at (301) 415-8013 or via e-mail at Getachew.Tesfaye@nrc.gov.

IV. AUDIT TEAM

The NRC audit team members are as follows:

- Ronald LaVera (NRO, Technical Reviewer)
- Edward Stutzcage (NRO, Technical Reviewer)
- Zachary Gran (NRO, Technical Reviewer)
- Timothy Drzewiecki (NRO, Technical Reviewer)
- Albert Hathaway (RES, Reactor Systems Engineer)
- Michael Dudek (NRO/RPAC Branch Chief)
- Getachew Tesfaye (NRO, Senior Project Manager)
- Supporting NRC Staff (as needed)

The applicant contact is as follows:

- Carrie Fosaaen (NuScale)

V. LOGISTICS

The NRC staff will address, in the audit report, the technical areas identified in the Regulatory Audit Scope of this audit plan along with presenting the audit outcomes.

Depending on the availability of the applicant's documentation and the supporting NRC staff, the audit is planned to start on March 4, 2019, and end on March 14, 2019, with an exit meeting on April 4, 2019. The audit is intended to be conducted from the NRC Headquarters via the applicant's eRR or a local office of the applicant.

A non-public entrance meeting will be conducted the first day of the audit, and a non-public exit meeting will be held at the conclusion of the audit.

The NRC staff acknowledges the proprietary nature of the information requested. It will be handled appropriately throughout the audit. While performing the audit, the NRC staff will take notes that will be marked as proprietary and will not remove hard copies or copy electronic files from the audit site(s).

VI. SPECIAL REQUESTS

To facilitate the preparation of the audit report, the NRC staff requests that the documents reviewed during the course of the audit remain available for reference in the eRR and the NuScale office, as appropriate, until 45 days after the audit exit.

If necessary, any circumstances related to the performance of the audit will be communicated to Getachew Tesfaye, at (301) 415-8013 or via email at Getachew.Tesfaye@nrc.gov.

VII. DELIVERABLES

The NRC staff will issue an audit report within 90 days after completion of the audit. The audit outcome may be used to identify any additional information to be submitted for making regulatory decisions, and will assist the NRC staff in the issuance of RAls (if necessary) in completing its review. With the anticipated exit on April 4, 2019, the audit report is expected to be completed by June 14, 2019 and made publicly available in ADAMS.