



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

June 12, 2018

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 II REGULATORY AUDIT OF THE  
POOL LEAKAGE DETECTION SYSTEM FOR THE ULTIMATE  
HEAT SINK FOR NUSCALE POWER, LLC

NuScale Power, LLC (NuScale) submitted letter dated December 31, 2016, to the U.S. Nuclear Regulatory Commission (NRC) for its Design Certification Application (DCA) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17013A229). The NRC staff started its detailed technical review of NuScale's DCA on March 27, 2017.

The purpose of this audit plan for this focused NRC Phase II Regulatory Audit is for the staff to obtain additional information for the responses provided for request for additional information (RAI) 9292, Questions 12.03-43, 44, 45, 46, and 47 as they relate to the pool leakage detection system (PLDS) for the ultimate heat sink (UHS) described by NuScale. In addition the staff seeks to obtain additional information on RAI 8963, Question 03-08-05, and RAI 9328, Question 09.01.02-36, since these RAIs relate to concerns being addressed by RAI 9292. The audit process will allow the staff to access support documentation that has been identified as potentially significant to the review; such as figures, system diagrams, and 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 to via the ERR. The audit is currently scheduled to start on June 14, 2018, and end on June 28, 2018. 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 II REGULATORY AUDIT OF THE POOL  
LEAKAGE DETECTION SYSTEM FOR THE ULTIMATE HEAT SINK FOR  
NUSCALE POWER, LLC  
DATED: June 12, 2018

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ADAMS Accession No.: ML18158A164

NRO-002

OFFICE	NRO/DSEA/RPAC	NRO/DLSE/LB1: LA	NRO/DLSE/LB1: PM
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DATE	06/06/2018	06/07/2018	06/12/2018

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**U.S. NUCLEAR REGULATORY COMMISSION REGULATORY**  
**AUDIT PLAN FOR THE PHASE II REGULATORY AUDIT OF THE POOL LEAKAGE**  
**DETECTION SYSTEM FOR THE ULTIMATE HEAT SINK FOR NUSCALE POWER, LLC**  
**DESIGN CONTROL DOCUMENT DESIGN CERTIFICATION**

**DOCKET NO. 52-048**

**AUDIT PLAN**

**APPLICANT:** NuScale Power, LLC (NuScale)

**APPLICANT CONTACTS:** Steve Mirsky (NuScale)

**DURATION:** June 14, 2018 through June 28, 2018

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

**AUDIT TEAM:**

Zachary Gran (NRO, Technical Reviewer, Audit Lead)  
Ronald LaVera (NRO, Technical Reviewer)  
Edward Stutzcage (NRO, Technical Reviewer)  
Sean Meighan (NRO, Technical Reviewer)  
Raul Hernandez (NRO, Technical Reviewer)  
Ata Istar (NRO, Technical Reviewer)  
Robert Roche-Rivera (NRO, Technical Reviewer)  
Andrew Yeshnik (NRO, Technical Reviewer)  
John Ma (NRO, Technical Reviewer)  
Michael Dudek (NRO/ RPAC Branch Chief)  
Getachew Tesfaye (NRO, Senior Project Manager)  
Supporting staff (As needed)

**I. BACKGROUND**

By letter dated December 31, 2016, NuScale Power, LLC (NuScale) submitted a Design Control Document for its Design Certification Application (DCA) to the U.S. Nuclear Regulatory Commission (NRC) for review (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17013A229). On March 15, 2017, the NRC staff accepted the DCA for docketing and initiated its technical review.

To understand the Pool Leakage Detection System (PLDS) as described in Design Control Document (DCD) Tier 2, Revision 0, and the responses to RAI 8963, Question 03.08.05, Question 23, dated October 17 2017 (RAI-8963-03.08.05-23); and RPAC staff issued RAI 9292,

Enclosure

Questions 12.03-43, 44, 45, 46, and 47. In addition, RAI 9328, Question 9.01.02-36 was also issued to understand how the current design of the PLDS is capable of preventing degradation of the safety related concrete structures of the Ultimate Heat Sink (UHS).

To facilitate the NRC staff's evaluation of information related to the safety analyses and assessment of the PLDS, the NRC staff proposes this audit plan that includes:

- A regulatory audit that will commence on June 14, 2018. 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 document that will facilitate an understanding of the PLDS. The NRC staff anticipates reviewing piping and instrumentation diagrams (P&ID), supporting calculations, and presentations that NuScale may make available to assist staff in its understanding of the PLDS.

## II. PURPOSE AND REGULATORY BASIS

The purpose of this audit plan for the focused NRC Phase II Regulatory Audit of the PLDS for the UHS is to:

- Allow staff to conclude that the PLDS in its current design is capable of collecting and quantifying sources of leaks from the UHS,
- Verify the structural integrity of the UHS, and
- Review welding controls and configurations to assess the applicant's statement that UHS leakage will not degrade safety-related structures, systems, and components, or result in the uncontrolled release of liquid effluents.

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 be effective in identifying specific information needed to support its regulatory findings. During the audit and interactions with the applicant, there may be additional detailed NRC requests for information developed which could be part of a future formal correspondence.

The NRC staff's acceptance criteria described in the Design Specific Review Standard (DSRS) and the NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (SRP) are based on meeting the relevant requirements of the following NRC regulations:

- Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A GDC 2
- 10 CFR Part 50, Appendix A GDC 4
- 10 CFR 52.47(a)(6) in requiring compliance with 10 CFR 20.1406
- 10 CFR 52.47(a)(22)
- 10 CFR Part 20, Subpart F—Surveys and Monitoring
- 10 CFR 20.1003
- 10 CFR 20.1101(b)

The DSRS and SRP are not a substitute for NRC regulations and compliance with 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.

However, the NRC staff must have sufficient information to ensure that the applicant has adequately addressed the regulatory requirements used as the basis for the NuScale DSRS Sections for 3.8.4, 3.8.5, 12.3, 12.4, and other relevant guidance.

### III. REGULATORY AUDIT SCOPE

The scope of this audit will be focused on the review of the technical information, including the design documents needed to review NuScale's PLDS design. The NRC staff will schedule time with NuScale staff to review specific documents at the NuScale Rockville office.

The NRC staff has identified the following questions for the audit:

1. eRAI 9292, Question 12.03-43 (includes concerns related to eRAIs 8963 and 9328)
  - a. Staff has reviewed the response provided by NuScale and the staff seeks to understand the function of the floor/wall joint area channels in more detail and to understand how the floor/wall joint area is designed to collect wall leakage.
    - i. The staff would like to review drawings and understand the concept of how the wall leakage will not follow any potential cracks or gaps before it reaches the floor/wall joint area channels.
    - ii. The staff also seeks to understand how the floor/wall joint area channel is set up to collect wall leakage.
  - b. Staff has concerns with the described ability to monitor and differentiate sources of leakage.
    - i. In the response, NuScale describes that leakages that flow into the reactor building (RXB) equipment drain sumps would be manually initiated, with the exception of the PLDS. In review of figure 9.3.3-1, the other sources of water would be from the RXB equipment drains and the chemical and volume control (CVC) IX Cell drains. Is it correct to say that these are the only sources into the sump, and that they are manually initiated? Are there floor drains on the 24' elevation that go to another sump?
    - ii. In the event of ground water intrusion into this sump, would operators receive the alarm to verify the source of leakages, even when it is not due to the PLDS channels? How would operators differentiate uncontrolled ground water leakage from pool liners leakage?
  - c. Staff is seeking clarity for the technical justification in the NuScale DCD to support the statement that a "leak of the UHS liner is not probable." In the past, the NRC staff has accepted less information on pool liners if defense-in-depth is provided for each weldment (e.g. a leak channel). If NuScale does not choose to have a second layer of defense, they will need to provide more information why liner leakage is not probable. The finding is based upon the following facts:

- i. NuScale states that the liner will be made from type 304L stainless steel “or equivalent.” The provision to use “equivalent” material would permit the use of material which may be more susceptible to degradation compared to type 304L stainless steel. Staff cannot make a finding on the susceptibility of the liner to leaking without knowing the material that is going to be used. NuScale has multiple options: they can delete the words “or equivalent,” or may specify multiple options for types/grades of material, or may clarify the term “or equivalent” by placing limitations on chemical composition, mechanical properties, corrosion properties, and other properties as needed.
- ii. Staff seeks to better understand what material specifications would be used for the liner plates. The Final Safety Analysis Report (FSAR) as currently written, would allow American Society for Testing and Materials , American Society of Mechanical Engineers, DIN, JIS, or any number of other standards to be used. There can be significant variability in the quality assurance, definitions of material heats/lots, marking, and documentation among different material standards.
- iii. Staff seeks to understand sufficient details in the quality assurance for the liner material to confirm its performance would be “consistent with their importance to safety,” as noted in Appendix B, Criteria II. More information needs to be provided for a determination to be made on whether the construction of the liner would have sufficient quality to perform its safety functions (i.e. will be greater than commercial grade). NuScale has a variety of options available: the liner plates may be procured by a material supplier with an audited quality assurance program on the COL applicant’s Approved Supplier List (ASL), or samples of liner materials may be sent to a laboratory on the COL applicant’s ASL for verification testing, or the material may be procured from a supplier with an accredited quality assurance program (i.e. meeting ASME Section III, NCA-3800).
- iv. Staff seeks to better understand the requirements and specifications for welding of the liners. Welding requirements should include the code of construction (ASME Section IX, AWS, etc.), weld filler material, NDE to be performed and acceptance criteria, and qualification of welders. This information is needed to provide a technical justification why the welds will not leak over the 40 year lifetime of the certified design.
- v. In FSAR Section 9.2.5.5 the applicant states: “The liner welds are inspected during power operation or shutdown for leak tightness.” This statement would suggest that NuScale will inspect all the welds on a continuing basis. However, the FSAR seems to indicate that NuScale intends on monitoring the pool drainage sump and performing periodic visual checks for boric acid deposits. Additionally, docketed information (in the FSAR or in RAI responses) indicates that the only volumetric examination will be performed during component fabrication and that no in-service inspection of the welds will be performed. NuScale needs to correct any conflicting docketed information and provide a description on all nondestructive examinations that will be performed during the lifetime of the UHS liner.
- vi. Operational experience from current nuclear power plants has shown that spent fuel pools, refueling canals, and other stainless steel lined concrete

pools may experience leakage. Pool leakage typically occurs in the vicinity of weldments. Staff seeks to understand what, if any, supplemental welding controls may be used by COL applicant to justify that leaks associated with the welds for the NuScale UHS are not probable given the experience with spent fuel pools at the current nuclear power plants. NuScale should describe any process controls that would be imposed. This may include: additional cleaning steps, the use of low-heat welding processes, weld sequencing, imparting a compressive stress on the wetted weldment surface, requiring multiple pass processes, etc. Additionally, NuScale should provide operating experience which demonstrates that the process controls will be effective in preventing leakage.

- d. Staff is seeking clarity for the response to RAI 9292, Question 12.03-43, the applicant stated: “In the event the leak does not travel vertically down the outside of the liner to the leak channel, and remains somehow trapped at the general leakage site, it will propagate through the wall until it exits in the RXB corridor area between the leak site and the floor. A wet area will identify the leakage.” For the aforementioned case, the staff requests the applicant to describe what mechanism or procedure does the applicant have in place to ensure that the propagation of borated water through the five feet thick wall until it exits in the RXB corridor area does not adversely affect the structural integrity of the wall.
  - e. Staff is seeking clarity for information related to the construction sequence and potential effects of the concrete pour on the structural integrity of the liner plate and associated welding and anchorage.
2. eRAI 9292, Question 12.03-44
- a. Staff has reviewed the response provided by NuScale and in the response the applicant states that there are sample points on the Rad Waste Drain System sump tanks. Staff seeks to understand how this sample would quantify/qualify pool leakage?
3. eRAI 9292, Question 12.03-47
- a. Staff has reviewed the response provided by NuScale and seeks to understand the response provided. As requested in question 12.03-44, a DCD figure depicting the sumps would help with understanding the response. The response provided describes that if there were flooding of the bottom level of the plant where the leakage channels are it would have to fill the sump and rise 7” from the ground level. Are the sumps located below the 24’ level?

The NRC staff may also ask additional questions during the course of the audit that are not currently summarized above, as additional information about the UHS structure and PLDS is discussed. The agenda for the audit is presented in Attachment A of this audit plan. 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 [Getachew.Tesfaye@nrc.gov](mailto:Getachew.Tesfaye@nrc.gov).

#### **IV. INFORMATION AND OTHER MATERIAL NECESSARY FOR THE REGULATORY AUDIT**

The following documents are to be made available to the NRC staff either at a local office or in the ERR:

- P&IDs for the PLDS
- P&IDs for the liquid radioactive drain system
- Structural drawings of the UHS pool liner
- Structural drawings of the Reactor Building Pool
- Structural Drawing of the Reactor Building sumps
- Related Construction Drawings for the UHS
- Related Fabrication Drawings
- Related Design Drawings
- Procurement or Product Specifications containing welding process controls or relating to the quality of weldments.

Other documents may be requested based on the staff's review of the above documents.

#### **V. AUDIT TEAM**

The following are the NRC audit team members:

Zachary Gran (NRO, Technical Reviewer, Audit Lead)  
Ronald LaVera (NRO, Technical Reviewer)  
Edward Stutzcage (NRO, Technical Reviewer)  
Sean Meighan (NRO, Technical Reviewer)  
Raul Hernandez (NRO, Technical Reviewer)  
Ata Istar (NRO, Technical Reviewer)  
Robert Roche-Rivera (NRO, Technical Reviewer)  
John Ma (NRO, Technical Reviewer)  
Andrew Yeshnik (NRO, Technical Reviewer)  
Michael Dudek (NRO/RPAC Branch Chief)  
Getachew Tesfaye (NRO, Senior Project Manager)  
Supporting staff (as needed)

The following are the licensee contacts:

Steve Mirsky (NuScale)

#### **VI. LOGISTICS**

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 supporting staff, the audit is planned to be conducted in from June 14, 2018, through June 28, 2018. 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 the NRC staff will take notes that will be marked as proprietary and will not remove hard copies or copy electronic files. NRC staff will not remove hard copy or electronic files from the audit site(s).

## **VII. SPECIAL REQUESTS**

If necessary, any circumstances related to the performance of the audit will be communicated to Getachew Tesfaye, NRO/DNRL 301-415-8013 or [Getachew.Tesfaye@nrc.gov](mailto:Getachew.Tesfaye@nrc.gov).

## **VIII. DELIVERABLES**

At the completion of the audit, the NRC staff will prepare an audit report within 45 days that will be declared and entered as an official agency record in ADAMS. 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 RAIs (if necessary) in completing its review. With the anticipated exit in June 28, 2018, the audit report will be completed by August 2018. This report will be made publicly available in ADAMS upon completion.

**U.S. NUCLEAR REGULATORY COMMISSION REGULATORY**  
**AUDIT PLAN FOR THE PHASE II REGULATORY AUDIT OF THE POOL LEAKAGE**  
**DETECTION SYSTEM FOR THE ULTIMATE HEAT SINK FOR NUSCALE POWER, LLC**  
**DESIGN CONTROL DOCUMENT DESIGN CERTIFICATION**

**DOCKET NO. 52-048**

**AUDIT PLAN AGENDA**

**June 14, 2018**

Entrance Meeting

**June 28, 2018**

Exit Meeting to Discuss Audit Results

Attachment A