



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

April 12, 2024

Ms. Carrie Fosaaen  
Senior Director, Regulatory Affairs  
NuScale Power, LLC  
1100 NE Circle Blvd., Suite 200  
Corvallis, OR 97330

SUBJECT: NUCLEAR REGULATORY COMMISSION INSPECTION REPORT OF  
NUSCALE POWER LLC., NO. 05200050/2024-201, AND NOTICE OF  
VIOLATION

Dear Ms. Fosaaen:

On February 26 through March 1, 2024, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an hybrid inspection at the NuScale Power, LLC (hereafter referred to as NuScale), facility in Corvallis, Oregon, and at the NRC headquarter facility in Rockville, Maryland. The purpose of this technically focused NRC inspection was to verify that NuScale effectively implemented quality assurance (QA) processes and procedures for design activities performed in support of the NuScale Standard Design Approval Application (SDAA). The inspection focused on assessing compliance with the provisions of selected portions of Appendix B, "Quality Assurance Program Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," 10 CFR Part 21, "Reporting of Defects and Noncompliance," and 10 CFR Part 73, "Physical Protection of Plants and Material."

The enclosed report presents the results of this inspection. This NRC inspection report does not constitute NRC's endorsement of your overall QA, 10 CFR Part 21, or 10 CFR Part 73 programs.

Based on the results of this inspection, the NRC staff determined that one Severity Level IV violation of NRC requirements occurred. This violation is cited in the enclosed Notice of Violation (NOV) and the circumstances surrounding them are described in detail in the subject inspection report. The violation is being cited in the Notice for NuScale's failure to implement the requirements of Criterion V, "Instructions, Procedures and Drawings," in accordance with Appendix B to 10 CFR Part 50. Specifically, NuScale did not adequately follow prescribed procedures for the (a) classification of an engineering calculation assessing the safety-related function of the Decay Heat Removal System pertaining to its ability to achieve and maintain safe shutdown and (b) screening of an error related to combustible gas control accumulation in the Reactor Coolant System, for applicability to the Emergency Core Cooling System evaluation model in NuScale's Design Certification.

You are required to respond to this letter and to follow the instructions specified in the enclosed NOV when preparing your response. In your response to the enclosed NOV, NuScale should document the results of the extent of condition review for the finding and determine if there

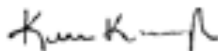
are any effects on design activities associated with the SDAA. If you have additional information that you believe the NRC should consider, you may provide it in your response to the NOV. The NRC's review of your response to the NOV also will determine if further enforcement action is necessary to ensure compliance with regulatory requirements.

Please provide a written statement or explanation within 30 days of this letter in accordance with the instructions specified in the enclosed NOV. We will consider extending the response time if you show good cause for us to do so.

In accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," of the NRC's "Rules of Practice," a copy of this letter, its enclosure(s), and your response will be made available electronically for public inspection in the NRC's Public Document Room or from the NRC's document system (ADAMS), accessible at <http://www.nrc.gov/readingrm/adams.html>. To the extent possible, your response, (if applicable), should not include any personal privacy, proprietary, or safeguards information (SGI) so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material is withheld from public disclosure, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information).

If SGI is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of safeguards information: performance requirements."

Sincerely,



Signed by Kavanagh, Kerri  
on 04/12/24

Kerri A. Kavanagh, Chief  
Quality Assurance and Vendor Inspection Branch  
Division of Reactor Oversight  
Office of Nuclear Reactor Regulation

Docket No.: 05200050

EPID: I-2024-201-0009

Enclosure:

1. Notice of Violation
2. Inspection Report No. 05200050/2024-201 and Attachment

SUBJECT: NUCLEAR REGULATORY COMMISSION INSPECTION REPORT OF  
 NUSCALE POWER LLC., NO. 05200050/2024-201, AND NOTICE OF  
 VIOLATION DATE: April 12, 2024

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**ADAMS Accession No.:** ML24099A129

NRR-106

<b>OFFICE</b>	NRR/DRO/IQVB	NRR/DRO/IQVB	NRR/DRO/IQVB
<b>NAME</b>	FVega	DZhang	YDiaz-Castillo
<b>DATE</b>	04/8/2024	04/10/2024	04/8/2024
<b>OFFICE</b>	NRR/DRO/IQVB	NRR/DRO/IQVB	NRR/DSS/SNRB
<b>NAME</b>	DPark	MFitzgerald FVega for	ABarrett
<b>DATE</b>	04/10/2024	04/10/2024	04/11/2024
<b>OFFICE</b>	NRR/DSS/SNRB	NRR/DSS/SNRB	NRR/DSS/SFNB
<b>NAME</b>	RNolan	SLu	JKaizer
<b>DATE</b>	04/10/2024	04/10/2024	04/11/2024
<b>OFFICE</b>	NRR/DRO/IQVB	NRR/DRA/APLC	NRR/DSS/SNRB
<b>NAME</b>	AKeim	MPohida	RPatton
<b>DATE</b>	04/10/2024	04/10/2024	04/11/2024
<b>OFFICE</b>	NRR/DRA/APLC	NRR/DRO	NRR/DRO/IQVB
<b>NAME</b>	SVasavada	BHughes	KKavanagh
<b>DATE</b>	04/10/2024	04/11/2024	04/12/2024

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**U.S. NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
DIVISION OF REACTOR OVERSIGHT  
STANDARD DESIGN APPROVAL APPLICATION  
QUALITY ASSURANCE PROGRAM IMPLEMENTATION INSPECTION REPORT**

Report No.: 05200050/2024-201

Applicant: NuScale Power, LLC  
1100 NE Circle Boulevard, Suite 200  
Corvallis, OR 97330

Applicant Contact: Ms. Carrie Fosaaen  
Senior Director, Regulatory Affairs  
NuScale Power, LLC  
Email: cfosaaen@nuscalepower.com  
Office: (541) 452-7126

Nuclear Industry Activity: NuScale Power, LLC submitted its Standard Design Approval Application (SDAA) to the U.S. Nuclear Regulatory Commission for the NuScale Small Modular Reactor in January 2023.

Inspection Dates: February 26 – March 1, 2024

Inspectors:

Frankie Vega	NRR/DRO/IQVB	Team Leader
Deanna Zhang	NRR/DRO/IQVB	Team Leader
Yamir Diaz-Castillo	NRR/DRO/IQVB	
Dong Park	NRR/DRO/IQVB	
Michael Fitzgerald	NRR/DRO/IQVB	Trainee
Ryan Nolan	NRR/DSS/SNRB	
Andrea Keim	NRR/DRO/IQVB	
Antonio Barrett	NRR/DSS/SNRB	
Joshua Kaizer	NRR/DSS/SFNB	
Shanlai Lu	NRR/DSS/SNRB	
Marie Pohida	NRR/DRA/APLC	
Rebecca Patton	NRR/DSS/SNRB	
Shilp Vasavada	NRR/DRA/APLC	

Approved by: Kerri A. Kavanagh, Chief  
Quality Assurance and Vendor Inspection Branch  
Division of Reactor Oversight  
Office of Nuclear Reactor Regulation

## NOTICE OF VIOLATION

NuScale Power, LLC  
1100 NE Circle Boulevard, Suite 200  
Corvallis, OR 97330

Docket No. 05200050  
Report No. 2024-201

Based on the results of a U.S. Nuclear Regulatory Commission (NRC) inspection conducted at the NuScale Power, LLC (hereafter referred to as NuScale) facility in Corvallis, OR, and at the NRC headquarter facility in Rockville, Maryland from February 26 through March 1, 2024, one violation of NRC requirements was identified. In accordance with the NRC Enforcement Policy, the violation is listed below:

Criterion V, "Instruction, Procedures, and Drawings," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the Code of Federal Regulations (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," states that "Activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings."

Section 2.5, "Instructions, Procedures, and Drawings," of NuScale's Quality Assurance Program Description (QAPD), states that "NuScale has established the necessary measures and governing procedures to ensure that activities affecting quality are prescribed by, and performed in accordance with, instructions, procedures, or drawings of a type appropriate to the circumstances and which, where applicable, include quantitative or qualitative acceptance criteria to implement the QAP as described in this document."

Section 5.2.2 of Engineering Procedure (EP)-0303-2109, "Classification of Structures, Systems, and Components," Revision 11, dated August 30, 2023, states that "the subject matter expert will review the system functions, design basis events, and functional categorization that have been identified for the SSC's systems and documented in the system function report."

Section 5.1 of LP-102185, "10 CFR 50.46 Reporting," Revision 1, dated October 5, 2023, requires the "screening of any change to or error in the Emergency Core Cooling System (ECCS) evaluation model or in the application of the model using 10 CFR 50.46 Screening Form, FM-102395 and report the results to the RM (Responsible Manager). Instruction for Form FM-102395 are included in Appendix A of this procedures."

Contrary to the above, as of March 1, 2024, NuScale failed to perform activities affecting quality in accordance with prescribed instructions, procedures, or drawings. Specifically, NuScale did not adequately adhere to prescribed procedures, EP-0303-2109 and LP-102185, in the following instances:

- NuScale failed to appropriately classify engineering calculation (EC) 101197, "DHRS Thermal Hydraulic Calculation for the NPM-20," in accordance with EP-0303-2109. EP-0303-2109 defines safety-related SSCs as "those structures, systems and components that are relied upon to remain functional during and following design-basis events to assure...the capability to shut down the reactor and maintain it in a safe shutdown condition." EC-101197 was classified as "Non-Safety Related" and treated as non-safety-related calculation during NuScale's design verification process when its stated

scope is, in part, to assess the decay heat removal system's ability to perform its safety-related function to achieve and maintain safe shutdown.

- NuScale failed to adhere to the process defined in LP-102185 to perform a screening under 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," of an error in accordance with LP-102185. NuScale did not assess whether combustible gas control accumulation in the reactor coolant system may be an error in the NuScale Design Certification ECCS evaluation model, which must be evaluated against reporting thresholds, as required by 10 CFR 50.46(a)(3).

This issue has been identified as Notice of Violation 05200050/2024-201-01.

This is a Severity Level IV violation (Section 6.9.d of the NRC Enforcement Policy). Pursuant to the provisions of 10 CFR Part 2.201, "Notice of Violation," NuScale is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Chief, Quality Assurance and Vendor Inspection Branch, Division of Reactor Oversight, Office of Nuclear Reactor Regulation, within 30 days of the date of the letter transmitting this Notice of Violation. This reply should be clearly marked as a "Reply to a Notice of Violation" and should include: (1) the reason for the violation or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence if the correspondence adequately addresses the required response. Where good cause is shown, the NRC will consider extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

Because your response will be made available electronically for public inspection in the NRC's Public Document Room or from the NRC's Agencywide Documents Access and Management System, which is accessible from the NRC Web site at <http://www.nrc.gov/readingrm/adams.html>, to the extent possible, it should not include any personal privacy, proprietary, or Safeguards Information (SGI) so that the agency can make it available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material be withheld, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information would create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If SGI is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Dated this 12th day of April 2024.

## **EXECUTIVE SUMMARY**

NuScale Power, LLC  
Inspection Report No. 05200050/2024-201

The U.S. Nuclear Regulatory Commission (NRC) conducted this inspection to verify that NuScale Power, LLC, (hereafter referred to as NuScale) implemented an adequate quality assurance (QA) program in support of the Standard Design Approval Application (SDAA) that complies with the requirements of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," and 10 CFR Part 21, "Reporting of Defects and Noncompliance." In addition, the NRC inspection team verified that NuScale's Safeguards Information (SGI) program provided adequate controls to meet the applicable regulatory requirements of 10 CFR Part 73, "Physical Protection of Plants and Material," and was being adequately implemented. The NRC inspection team conducted the inspection at the NuScale's facility in Corvallis, Oregon, and NRC's headquarter in Rockville, Maryland from February 26 to March 1, 2024.

Appendix B to 10 CFR Part 50 and 10 CFR Part 21 served as the bases for the NRC inspection. The NRC inspection team used Inspection Procedure (IP) 35017, "Quality Assurance Implementation Inspection," dated December 10, 2020; IP 43002, "Routine Inspections of Nuclear Vendors" dated February 10, 2023; IP 43004, "Inspection of Commercial-Grade Dedication Programs," dated February 10, 2023; IP 36100, "Inspection of 10 CFR Part 21 Programs for Reporting Defects and Nonconformance," dated February 10, 2023; and IP 81811, "Protection of Safeguards Information by Design Certification Applicants and Vendors," dated April 8, 2020.

With the exception of the Notice of Violation (NOV) and the unresolved item (URI) described below, the NRC inspection team concluded that NuScale is effectively implementing its QA program for activities affecting quality in support of the SDAA in accordance with the applicable requirements of Appendix B to 10 CFR Part 50 and 10 CFR Part 21. Additionally, the NRC inspection team concluded that the NuScale had adequate controls in place to effectively control SGI. The results of this inspection are summarized below.

### **Instructions, Procedures, and Drawings**

The NRC inspection team issued NOV 05200050/2024-201-01 in association with NuScale's failure to implement the regulatory requirements of Criterion V, "Instructions, Procedures, and Drawings," of Appendix B to 10 CFR Part 50. NOV 05200050/2024-201-01 cites NuScale for failing to perform activities affecting quality using established instructions, procedures, or drawings. Specifically, NuScale did not adequately adhere to prescribed procedures in the following instances: (a) NuScale failed to appropriately classify engineering calculation (EC) 101197, "DHRS Thermal Hydraulic Calculation for the NPM-20," in accordance with EP-0303-2109 "Classification of Structures, Systems, and Components," (b) NuScale failed to perform a screening under 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," of an error in accordance with LP-102185, "10 CFR 50.46 Reporting".

## Design Control

Based on the results of the Probabilistic Risk Assessment (PRA) analyses, NuScale's Engineering Change Request (ECR)-105612 identified the need to incorporate a venturi flow restrictor in the Chemical and Volume Control System (CVCS) injection and discharge lines. However, based on the limited sample of documents available for review, the NRC inspection team did not find sufficient objective evidence that engineering documents (e.g., engineering report, engineering calculations) were generated to document the functional and performance requirements of the CVCS venturi flow restrictors. The NRC inspection team issued Unresolved Item (URI) 05200050/2024-201-02 to follow up on this issue.

## Other Inspection Areas

Based on the limited sample of documents reviewed, the NRC inspection team determined that NuScale is implementing its commercial-grade dedication, American Society of Mechanical Engineers (ASME) code compliance, procurement document control, control of purchased materials, equipment, and components, corrective actions, and internal audits program in accordance with the applicable regulatory requirements of Appendix B to 10 CFR Part 50. The NRC inspection team determined that NuScale is implementing its 10 CFR Part 21 program for evaluating deviations and reporting defects that could create a substantial safety hazard in support of the SDAA in accordance with the applicable regulatory requirements. In addition, the NRC inspection team concluded that NuScale's SGI program implementation was consistent with the requirements of 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements," and 10 CFR 73.22, "Protection of Safeguards Information: Specific Requirements." No findings of significance were identified in these areas.



## REPORT DETAILS

### 1. Instructions, Procedures, and Drawings

#### a. Inspection Scope

The U.S. Nuclear Regulatory Commission (NRC) inspection team reviewed NuScale Power, LLC's (hereafter referred to as NuScale) NuScale's policies and implementing procedures that govern the implementation of its instructions, procedures, and drawings program to verify compliance with the requirements of Criterion V, "Instructions, Procedures, and Drawings," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," and the NuScale Standard Design Approval Application (SDAA).

The NRC inspection team reviewed a sample of completed engineering documents and evaluations developed to support the NuScale SDAA. The NRC inspection team reviewed the technical work performed within these documents against the applicable procedures and instructions that NuScale had established in writing. The NRC inspection team also reviewed a sample of completed screening evaluations under 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," included in recent condition reports (CRs).

The NRC inspection team also discussed the instructions, procedures, and drawings program with NuScale's management and technical staff. The attachment to this inspection report lists the documents reviewed and staff interviewed by the NRC inspection team.

#### b. Observation and Findings

The NRC inspection team identified two findings in the area of Criterion V of Appendix B to 10 CFR Part 50 during the review of engineering documents and evaluations. In both cases, NuScale failed to follow established instructions, procedures, or drawings, for activities affecting quality. Specifically, the NRC inspection team observed the following:

- NuScale failed to appropriately classify EC-101197, Revision 2, "DHRS [(Decay Heat Removal System)] Thermal Hydraulic Calculation for the NPM-20," in accordance with its procedures. Section 5.1.6 of QP-0303-10267, "Design Control Process," Revision 20, states that "the preparer is responsible for identifying the safety classification of the design deliverable, based on the functionality categorized through the Classification of Structure, Systems, and Components, EP-0303-2109," and defines safety-related classification as "a deliverable that establishes an engineering design basis for safety-related SSC functions. Examples can include but are not limited to...a calculation that evaluates margins for performance of safety-related functions." Section 3.1.19 of EP-0303-2109, "Classification of Structures, Systems, and Components," Revision 11, defines "Safety-related SSCs," as "those structures, systems and components that are relied upon to remain functional during and following design-basis events to assure...the capability to shut down the reactor and maintain it in a safe shutdown condition..." Section 1.2 of EC-101197, states that "[t]his calculation confirms the ability of the DHRS to bring the NPM to a safe shutdown mode by maintaining passive cooling, for the range of conditions that can occur as a result of plant upset events." Contrary to Section 5.2.2 of EP-0303-2109, EC-101197 was classified as "Non-Safety Related" when its stated

scope is, in part, to assess the decay heat removal system ability to perform its safety-related function to achieve and maintain safe shutdown. The failure to correctly classify the functions of the DHRS contributed to failing to perform required screening per Section 5.1 of LP-102185, "10 CFR 50.46 Reporting," Revision 1.

- NuScale did not evaluate the impact of its failure to assess combustible gas control (CGC) in the Reactor Coolant System (RCS) in NuScale's Design Certification (DC), as documented in Condition Report (CR) No. 152940. The CR included attachments with statements that the issue of CGC in the RCS was not considered or recognized for the DC, but the evaluation was focused solely on the SDAA. The NRC inspection team interviewed the NuScale staff member responsible for performing the 10 CFR 50.46 screening evaluation of the condition against the SDAA, who confirmed that the documented evaluation was only applicable to the SDAA, and a 10 CFR 50.46 screening evaluation had not been performed because he believed the CR was only written for the SDAA. The inspection team reviewed the documentation appended to the CR and considered part of the CR and noted the appended information clearly indicated the condition was applicable to both designs. The failure to evaluate CGC in the RCS of NuScale's DC prevented an adequate evaluation against the reporting thresholds identified in 10 CFR 50.46.

The NRC inspection team identified these issues as Notice of Violation (NOV) 05200050/2024-201-01.

c. Conclusion

The NRC inspection team issued NOV 05200050/2024-201-01 in association with NuScale's failure to implement the regulatory requirements of Criterion V of Appendix B to 10 CFR Part 50. NOV 05200050/2024-201-01 cites NuScale for failing to follow established procedures in the performance of activities affecting quality. Specifically, NuScale failed to follow procedures when classifying the safety-related functions of the DHRS and failed to evaluate the impact of not previously assessing CGC in the RCS to determine if a reportable condition existed under 10 CFR 50.46.

2. Design Control

a. Inspection Scope

The NRC inspection team reviewed NuScale's policies and implementing procedures that govern the implementation of its design control program to verify compliance with the requirements of Criterion III, "Design Control," of Appendix B to 10 CFR Part 50. The NRC inspection team reviewed NuScale's implementing processes and procedures for maintaining adequate control of design inputs and outputs, analyses and testing, records and reports, and design changes in the areas below.

Density Wave Oscillation (DWO) Analysis and Design Verification Testing

The NRC inspection team reviewed a sample of documents related to the DWO analysis and design verification testing for the SDAA and verified that these were completed in accordance with NuScale's design control process procedure QP-0303-10267. The NRC inspection team reviewed EP-1103-2992, "Test Control," Revision 18, SDR-114346, "TF-2

DWO Testing Test Plan and Procedure (Phase 3),” TR-131981-P, “Methodology for the Determination of the Onset of Density Wave Oscillations,” TD-130103, “DWO Phase 3A Test Data Package,” Revision 2, and QP-0703-10256, “Procurement of Items and Services,” Revision 20, with respect to design verification testing. In addition, the NRC inspection team reviewed test plans, test procedures, acceptance review documents, test reports, and POs associated with DWO design verification testing and confirmed that the testing was performed in accordance with the POs and test plans, and that test anomalies were adequately dispositioned by NuScale.

#### NRELAP Base Model Documentation

The NRC inspection team reviewed and discussed with NuScale engineering calculations, EC-0000-7782, “NPM-20 NRELAP5 Base model,” Revision 3, EC-120192, “NPM-20 Geometric Parameters and Weight Calculation,” Revision 2, and ER-104903, “Reactor Module Geometry Constraints for Safety Analysis,” Revision 2, associated with NRELAP base model creation, to verify that NuScale’s design control process procedure, QP-0303-10267, provides for maintaining adequate control of design inputs and outputs, analyses and testing, records and reports, and design changes. The NRC inspection team reviewed the iterative process used to update the base model and associated design documents to verify that the engineering change control process was adequately implemented.

#### Control Rod Depletion Calculations

The NRC inspection team reviewed a sample of engineering reports associated with control rod depletion calculations to verify that NuScale’s design control process procedure, QP-0303-10267, provides for maintaining adequate control of design inputs and outputs, analyses and testing, records and reports, and design changes.

#### Loss of Coolant Accident (LOCA) Evaluation Models

The NRC inspection team reviewed a sample of engineering reports and calculations used to develop LOCA evaluation models to verify that these documents were developed in accordance with NuScale’s design control processes. The NRC inspection team reviewed NuScale’s design control measures and verified that these measures included requirements for performing independent verification of reactor physics and safety analyses. The NRC inspection team verified that design verification activities for the sample of engineering reports and calculations reviewed were performed by individuals other than those who performed the original design and analyses.

#### Software Configuration Controls

The NRC inspection team reviewed documents associated with the NuScale Software Test Plan, “NRELAP5 Software Test Plan,” Revision 5. The NRC inspection team confirmed how NuScale’s software test plan provides for implementation of software quality assurance (QA) controls, including regression analysis and testing for code changes, and code change records, and corrective actions for software used to perform safety analyses. The NRC inspection team reviewed the Software Test Report SwTR-0304-17153, “SwTR-Software Test Report,” Revision 8, which contains the results of the acceptance testing. The NRC inspection team verified, based on the limited documents reviewed, that the Software Test Plan was being followed and adequately considers software quality assurance controls, including regression analysis and testing for code changes (including comparisons to

previous code versions), code change records and corrective actions for NRELAP software used to perform safety analyses.

The NRC inspection team reviewed how NuScale's NRELAP5 change implementation process, DI-15338-58170 "NRELAP5 Change Implementation" Revision1, was executed as part of the Software Configuration Management Plan.

### Decay Heat Removal System

The NRC inspection team reviewed a sample of documents related to the DHRS to assure that applicable regulatory requirements and the design basis for those SSCs are correctly translated into specifications, drawings, procedures, and instructions. Specifically, the NRC inspection team reviewed EC-101197, "DHRS Thermal Hydraulic Calculation for NPM-20," Revision 2, and ES-0303-8204, "Guidance for Non-LOCA System Transient Analysis," Revision 0, and found that NuScale failed to appropriately classify engineering calculation EC-101197 which assessed the safety-related function of the DHRS pertaining to its ability to achieve and maintain safe shutdown. This issue is identified as one example in support of NOV 05200050/2024-201-01, as discussed in Section 1.b of this inspection report.

### Probabilistic Risk Assessment (PRA) and Design Reliability Assurance Program (D-RAP)

The NRC inspection team evaluated NuScale's implementation of the design control process associated with the SDAA PRA. Specifically, the NRC inspection team reviewed NuScale's design control procedures to verify that NuScale's process provides for maintaining adequate control of design inputs and outputs, records and reports, and design changes associated with the PRA. The NRC inspection team reviewed documents, including necessary changes to the SDAA final safety analysis report, associated with design changes documented in Engineering Change Request (ECR), ECR-A013-68107, "CES CIV resize," and verified that the engineering change control processes described in EP-0303-52592 "Engineering Change Control," Revision 12, were appropriately implemented. The NRC inspection team also reviewed design changes documented in CR-136249, "Non-conservative Noncombustible Gas Masses specified in Combustible Gas Calculation," which resulted in a revision to engineering calculation, EC-118992, "NPM-Non Condensable Gas Mass", Revision 2 and CR-136249, which resulted in a revision to engineering calculation, EC-121960, "NPM-20 Combustible Gas Management", Revision 2. The NRC inspection team confirmed that the changes in these calculations were implemented in accordance with NuScale's design change process and the results of the design changes were adequately documented.

The NRC inspection team reviewed NuScale's processes and procedures that implement the D-RAP, including:

- EP-0303-2109, Revision 11, "Classifications of Structures, Systems and Components"
- EP-0303-2122, Revision 6, the Design Reliability Assurance Program Implementation Procedure"

### Chemical and Volume Control System (CVCS)

The NRC inspection team reviewed a sample of documents related to the CVCS flow restricting venturis to verify implementation of design control measures to assure that applicable regulatory requirements and the design basis for those SSCs are correctly

translated into specifications, drawings, procedures, and instructions. Specifically, the NRC inspection team reviewed ECR-105612, "Create New CVCS flow area restriction in new CNV safe-end for NPM 20," ED-108491, "CNV Nozzle Penetrations," ED-119287, "NMP-20 CNV Upper Weldment and Machining," and EQ-146988, "ASME Design Specification for Containment Vessel."

#### Open Design Issues (ODIs)

The NRC inspection team reviewed NuScale's procedures for controlling and issuing ODIs, including EP-0303-310 "Open Design Item (ODI) Management", Revision 11, dated November 30, 2023, as well as interfacing engineering procedures. The NRC inspection team also reviewed open CR 140409, "Updates to ODI guidance provide significant challenges for engineers," dated May 9, 2023, which noted that certain open items did not need to be designated as ODIs when the unverified assumption as noted as "TBD [(To be determined)]" in a document, such as a drawing. The NRC inspection team interviewed NuScale staff to gain clarity on the "TBD" provisions, contrary to the detailed tracking required for ODIs. The NRC inspection team also reviewed a sample of closed ODIs as well as open ODIs. From the selected sample of ODIs, the NRC inspection team reviewed a sample of the engineering documents that include those ODIs as listed assumptions. The NRC inspection team confirmed that the sampled ODIs conformed to the process described in NuScale procedures and were appropriately tracked and documented.

#### Compliance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code

The NRC inspection team verified that, as an N-Certificate Holder, NuScale developed an American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code quality assurance manual that will be implemented when NuScale enters into contracts or awards contracts that require compliance with the ASME B&PV Code. NuScale will act as an Owner's designee for design input for construction. NuScale plans to subcontract construction, shop assembly, and installation activities to holders of appropriate Certificates of Authorization. These items will be certified and stamped with the Certification Mark in accordance with the ASME B&PV Code.

The NRC inspection team reviewed a sample of ASME B&PV Code design specifications to verify the design specifications contained the required information in accordance with ASME B&PV Code requirements. In addition, the NRC inspection team reviewed a sample of ECRs associated with ASME B&PV Code design specifications. For the sample of design specifications and ECRs reviewed, the NRC inspection team confirmed that they were developed and implemented in accordance with NuScale's procedures and ASME B&PV Code requirements, as applicable.

The NRC inspection team reviewed a sample of training and qualification records for the NuScale personnel involved in the development of the ASME design specifications and confirmed that NuScale personnel had completed all the required training and had maintained the applicable training and qualifications in accordance with NuScale's policies and procedures.

The NRC inspection team discussed the design control and ODI processes with NuScale's management and technical staff. The attachment to this inspection report lists the individuals interviewed and documents reviewed by the NRC inspection team.

## b. Observations and Findings

### D-RAP Procedure Inadequacy

The NRC inspection team requested to review the DID Adequacy reports for the Backup Diesel Generators (BDGs) and the Reactor Coolant Pressure Boundary (RCPB) to verify that the DID reports were completed in accordance with Section 5.2.2, “Defense-in-Depth (DID) Adequacy Evaluation,” of EP-03030-2122, “Design Reliability Program Implementation Procedure,” in support of the D-RAP list determination. Section 5.2.2 of EP-0303-2122 specifies, in part, that “the completion of a DID adequacy report by the PRA group, with cross-disciplinary review from system subject matter experts, and the results presented to the D-RAP panel, along with the D-RAP equipment list...The expert panel shall perform a DID adequacy evaluation towards the end of the SSC classification process that is documented in the D-RAP summary report...The expert panel shall consider the following well-established DID fundamental objectives when conducting DID adequacy evaluations.”

During discussions with NuScale’s D-RAP panel, NuScale stated that while the SDAA D-RAP list determination is complete, the DID adequacy reports as described in Section 5.2.2 of EP-03030-2122 are not required to be completed as part of the SDAA D-RAP evaluation. The D-RAP panel also stated that the D-RAP summary reports have not been completed. NuScale agreed that the NRC’s observation regarding the term “DID adequacy evaluation” being used inconsistently throughout Section 5.2.2 of EP-03030-2122. As such, NuScale initiated CR 157912, on February 29, 2024, “Opportunity to improve clarity of procedural guidance in D-RAP DID evaluation” to address the NRC inspection team’s observation. This issue is classified as minor because the D-RAP process is still ongoing, and the final D-RAP summary report has not been issued.

### Inadequate corrective action implementation

The NRC inspection team reviewed TR-0116-21012-P-A, “NuScale Power Critical Heat Flux Correlation Topical Report,” Revision 1 and observed that the document did not contain the NRC safety evaluation, the transmittal letter of the final safety evaluation, or the requests for additional items, as required for an approved version of the topical report. Upon discussions with NuScale staff, NuScale stated that this issue was caused by a change in their document control system and that they had opened a previous condition report, CR-0820-71263 to resolve this issue. However, NuScale admitted that the previous CR was clearly not fully implemented as this problem persisted in at least this topical report. As a result, NuScale opened a new condition report, CR 157887, to address the incomplete implementation of the original CR and resolve this issue.

### Training and Qualifications

The NRC inspection team found limited objective evidence of training and qualification for personnel to document subject matter expertise in complex analysis techniques. Specific examples include qualifications and expertise in the DWO Stability and Instability analysis in time and frequency domain. This issue is identified as minor because there is no evidence that the work performed by these personnel resulted in safety-significant issues and the DWO analyses are still ongoing. NuScale did not open a CAR to address this issue.

## Unresolved Item

Based on the results of the PRA analyses, NuScale's ECR-105612 identified the need to incorporate a venturi flow restrictor in the CVCS injection and discharge lines. However, based on the limited sample of documents available for review, the NRC inspection team did not find sufficient objective evidence that engineering documents (e.g., engineering report, engineering calculations) were generated to document the functional and performance requirements of the CVCS venturi flow restrictors. The NRC inspection team issued URI 05200050/2024-201-02 to follow up on this issue.

### c. Conclusion

With the exception of the minor issues and the URI identified in Section 3.b of this inspection report, the NRC inspection team concluded that NuScale is implementing its design control program in accordance with the regulatory requirements of Criterion III of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that NuScale is adequately implementing their design control program in support of NuScale's SDAA. No findings of significance were identified.

## 3. 10 CFR Part 21 Program

### a. Inspection Scope

The NRC inspection team reviewed NuScale's policies and implementing procedures that govern the implementation of its 10 CFR Part 21, "Reporting of Defects and Noncompliance," program to verify compliance with the regulatory requirements. The NRC inspection team evaluated the 10 CFR Part 21 postings and a sample of NuScale's procurement orders (POs) for compliance with the requirements of 10 CFR 21.6, "Posting requirements," and 10 CFR 21.31, "Procurement Documents," respectively. The NRC inspection team also verified that NuScale's corrective action program provide a link to the 10 CFR Part 21 program.

The NRC inspection team discussed the 10 CFR Part 21 program with NuScale's management and technical staff. The attachment to this inspection report lists the documents reviewed and staff interviewed by the NRC inspection team.

### b. Observations and Findings

No findings of significance were identified.

### c. Conclusion

The NRC inspection team concluded that NuScale is implementing its 10 CFR Part 21 program in accordance with the regulatory requirements of 10 CFR Part 21. Based on the limited sample of documents reviewed, the NRC inspection team also determined that NuScale is implementing its policies and procedures associated with the 10 CFR Part 21 program in support of NuScale's SDAA. No findings of significance were identified.

#### 4. Document Control and QA Records

##### a. Inspection Scope

The NRC inspection team reviewed NuScale's policies and implementing procedures that govern the implementation of its document control and maintenance of records in accordance with the requirements of Criterion VI, "Document Control," of Appendix B to 10 CFR Part 50.

The NRC inspection team reviewed a sample of licensing procedures used by NuScale to generate topical reports and verified that the topical reports were generated in accordance with LS-0003-7674, "Topical and Technical Report Guidance." The NRC inspection team verified that LS-0003-7674 included provisions to ensure that topical reports, including changes thereto, are reviewed for adequacy and approved for release by authorized NuScale personnel. The NRC inspection team confirmed that conditions and limitations imposed on the approved topical reports were appropriately included in the underlying design documents such that personnel who perform the prescribed activities (e.g., design analysis) in these topical reports are completing these activities in accordance with the approved topical reports. The NRC inspection team also confirmed that approved topical reports are adequately controlled in accordance with NuScale's established measures for QA records.

##### b. Observations and Findings

No findings of significance were identified.

##### c. Conclusions

The NRC inspection team concluded that NuScale is implementing its document control and quality assurance records programs in accordance with the regulatory requirements of Criterion VI of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that NuScale is implementing its policies and procedures associated with the document control and quality assurance records in support of NuScale's SDAA. No findings of significance were identified.

#### 5. Commercial Grade Dedication

##### a. Inspection Scope

The NRC inspection team reviewed NuScale's policies and implementing procedures that govern the implementation of its commercial-grade dedication (CGD) program to verify compliance with the regulatory requirements of Criterion III and Criterion VII, "Control of Purchased Equipment, Materials, and Services," of Appendix B to 10 CFR Part 50.

The NRC inspection team reviewed a sample of documents associated with the CGD of commercial software and testing services used for the development of the SDA. Within these documents, the NRC inspection team reviewed: (1) POs; (2) CGD plans; (3) technical evaluations; (4) test reports; and (5) Certificates of Conformance. The NRC inspection team evaluated the criteria for the identification of item functions, credible failure mechanisms and modes, selection of critical characteristics and acceptance criteria, identification of verification methods to verify the effective implementation of NuScale's CGD process.



The NRC inspection team also discussed the CGD program with NuScale's management and technical staff. The attachment to this inspection report lists the documents reviewed and personnel interviewed by the NRC inspection team.

b. Observation and Findings

No findings of significance were identified.

c. Conclusions

The NRC inspection team concluded that NuScale is implementing its CGD program in accordance with the regulatory requirements of Criterion III and Criterion VII of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that NuScale is implementing its policies and procedures associated with the CGD program in support of NuScale's SDAA. No findings of significance were identified.

6. Procurement Document Control and Control of Purchased Materials, Equipment and Components

a. Inspection Scope

The NRC inspection team reviewed NuScale's policies and implementing procedures that govern the implementation of its procurement document control and supplier oversight to verify compliance with the regulatory requirements of Criterion IV, "Procurement Document Control" and Criterion VII of Appendix B to 10 CFR Part 50.

The NRC inspection team reviewed a sample of POs, statements of work (SOW) and task orders (TOs), of safety-related suppliers on NuScale's evaluated supplier's list (ESL) and verified the POs and supporting documentation adequately invoked the applicable technical, regulatory, and quality requirements. The NRC inspection team reviewed samples of POs and SOWs from NuScale's ESL to ensure that changes to procurement documents were subject to the same degree of control, review, and approval as those utilized in the preparation of the original procurement documents reviewed.

The NRC inspection team selected a sample of suppliers from the ESL to review the methodology for conducting and documenting audits and verified adequate evaluation of the suppliers' controls for meeting the applicable requirements of Appendix B to 10 CFR Part 50. The NRC inspection team also verified that audit findings were documented and resolved in the NuScale's and the suppliers' corrective action programs. In addition, the NRC inspection team reviewed a sample of training and qualification records of NuScale's lead auditors and confirmed that auditing personnel had completed all the required training and had maintained the applicable qualification and certification in accordance with NuScale's policies and procedures. The NRC inspection team also reviewed annual evaluations of suppliers from the ESL.

The NRC inspection team discussed the procurement document control and supplier oversight programs with NuScale's management and technical staff. The attachment to this inspection report lists the documents reviewed and staff interviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusions

The NRC inspection team concluded that NuScale has established its procurement document control and supplier oversight programs in accordance with the regulatory requirements of Criterion IV and Criterion VII of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team determined that NuScale is implementing its policies and procedures associated with the oversight of contracted activities in support of NuScale's SDAA. No findings of significance were identified.

7. Corrective Action

a. Inspection Scope

The NRC inspection team reviewed NuScale's policies and implementing procedures that govern the implementation of its corrective action program to verify compliance with the regulatory requirements of Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50.

The NRC inspection team selected a sample of CRs to review based on the list of CRs opened within the last two years, with input from recent licensing activities from NuScale. For the sample of CRs selected, the NRC inspection team verified that the CRs contain, as applicable: (1) adequate documentation and description of significant conditions adverse to quality (SCAQ) and conditions adverse to quality (CAQ); (2) an appropriate analysis of the cause of these conditions and the corrective actions to prevent recurrence; (3) direction for review and approval by the responsible NuScale management to verify effective implementation of the corrective actions; (4) a description of the current status of the corrective actions; and (5) the actions taken to verify timely and effective implementation of the corrective actions.

The NRC inspection team discussed the corrective action program with NuScale's management and technical staff. The attachment to this inspection report lists the documents reviewed and staff interviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that the implementation of NuScale's corrective action program is consistent with the regulatory requirements of Criterion XVI of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team determined that NuScale is adequately implementing their corrective action program in support of NuScale's SDAA. No findings of significance were identified.

## 8. Internal Audits

### a. Inspection Scope

The NRC inspection team reviewed NuScale's policies and implementing procedures that govern the implementation of its internal audit program to verify compliance with the requirements of Criterion XVIII, "Audits," of Appendix B to 10 CFR Part 50. The NRC inspection team reviewed a sample of NuScale's internal audit plans, internal audit reports, and CRs generated during internal audits.

For the sample of internal audits reviewed, the NRC inspection team verified that the internal audits were performed by qualified auditors who were not auditing their own work and that the internal audits were performed using the appropriate checklists. The NRC inspection team also verified that NuScale adequately initiated and corrected any findings identified during the internal audits.

The NRC inspection team discussed the internal audits program with NuScale's management and technical staff. The attachment to this inspection report lists the documents reviewed and personnel interviewed by the NRC inspection team.

### b. Observations and Findings

No findings of significance were identified.

### c. Conclusion

The NRC inspection team concluded that NuScale is implementing its internal audit program in accordance with the regulatory requirements of Criterion XVIII of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspection team also determined that NuScale is adequately implementing its policies and procedures associated with the internal audit program in support of NuScale's SDAA. No findings of significance were identified.

## 9. Safeguards Information Program

### a. Inspection Scope

The NRC inspection team reviewed NuScale's policies and implementing procedures that govern the implementation of its safeguards information (SGI) program to verify compliance with the regulatory requirements of 10 CFR Part 73.21, "Protection of Safeguards Information: Performance Requirements," and 10 CFR Part 73.22, "Protection of Safeguards Information: Specific Requirements."

The NRC inspection team: (1) reviewed NuScale's implementing procedures for controlling and protecting SGI; (2) interviewed NuScale's SGI program personnel; (3) inspected the SGI secured location and locked SGI security containers; (4) reviewed a sample of SGI hardcopy materials for proper markings and storage; (5) verified labeling of electronic media such as SGI hard drives and laptops; and (6) reviewed a sample of logs, access lists, program self-assessments, and corrective actions. The NRC inspection team also reviewed a sample of personnel files regarding personnel conditions for access to SGI material.

The NRC inspection team also discussed the SGI program with NuScale's management and technical staff. The attachment to this inspection report lists the documents reviewed and personnel interviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that NuScale is implementing its SGI program in accordance with the regulatory requirements of 10 CFR Part 73.21 and 73.22. Based on the limited sample of documents reviewed and activities observed, the NRC inspection team determined that NuScale is implementing its policies and procedures associated with the SGI program in accordance with the regulatory requirements of 10 CFR Part 73.21 and 10 CFR Part 73.22 in support of NuScale's SDAA. No findings of significance were identified.

10. Entrance and Exit Meeting

On February 26, 2024, the NRC inspection team discussed the scope of the inspection with Dr. Jose Reyes, Chief Technology Officer and Carl Fisher, Chief Operating Officer, and other members of the NuScale management team and technical staff. On March 1, 2024, the NRC inspection team presented the inspection results and observations during an exit meeting with Dr. Reyes and Mr. Fisher, and other members of the NuScale management team and technical staff. The attachment to this report lists the attendees of the entrance and exit meetings, as well as those individuals whom the NRC inspection team interviewed during the course of the inspection.

**Attachment**

1. ENTRANCE AND EXIT MEETING ATTENDANCE AND NUSCALE STAFF INTERVIEWED

<b>Name</b>	<b>Title</b>	<b>Affiliation</b>	<b>Entrance</b>	<b>Exit</b>	<b>Interviewed</b>
Carl Britsch	Vice President, Human Resources	NuScale Power, LLC (NuScale)	X	X	
Carrie Fosaaen	Vice President, Regulatory Affairs	NuScale	X	X	
Eric Fischer	Vice President, Information Technology	NuScale	X	X	
Mark Shaver	Director, Regulatory Affairs	NuScale	X	X	
Jose Reyes	Chief Technology Officer	NuScale	X	X	
Robert Gamble	Senior Vice President, Engineering	NuScale	X	X	
Steve Andrews	Program Manager, ASME Code	NuScale	X	X	X
Kathy Warnock	Quality Assurance Specialist	NuScale	X	X	X
Elisa Fairbanks	Supervisor, Licensing	NuScale	X	X	
Chris Coleman	Quality Assurance Specialist	NuScale	X	X	
Brendan Kusisto	Quality Assurance Specialist	NuScale	X	X	X
Mike Smith	Quality Assurance Specialist	NuScale	X	X	
Joe Carter	Manager, Quality Assurance	NuScale	X	X	X
Scott Bailey	Vice President, Supply Chain	NuScale	X	X	
Lloyd Heckle	Director, Enterprise Software	NuScale	X	X	
Karin Feldman	Senior Vice President, Program Management Office	NuScale	X	X	
Lori Smith	Manager, Document Controls and Records Management	NuScale	X	X	
Dustin Greenwood	Vice President, VOYGR Services & Customer Support	NuScale	X	X	
Neil Olivier	Senior Director, Corporate Services	NuScale	X	X	X

Ron Post	Quality Assurance Specialist	NuScale	X	X	
Audrey Anderson	Manager, Training	NuScale	X	X	
Ross Snuggerud	Chief Engineer - Operations	NuScale	X	X	
Amber Berger	Employee Concerns Manager	NuScale	X	X	X
JJ Arthur	Vice President, NSSS Engineering	NuScale	X	X	
Carl Fisher	Chief Operating Officer	NuScale	X	X	
Robert Otis	Quality Assurance Specialist	NuScale	X	X	
Gary Becker	Senior Regulatory Affairs Counsel	NuScale	X	X	X
Stephanie Terwilliger	Program Manager, Licensing	NuScale	X	X	X
Britt Carlson	Program Manager, IT Service Delivery	NuScale			X
Dennis Shannon	Quality Assurance Specialist	NuScale	X	X	
Kris Cummings	Licensing Engineer	NuScale	X	X	X
Carolyn Monaco	Vice President, Quality Assurance	NuScale	X	X	
Roger Singleton	IT System Support	NuScale	X	X	
Allyson Callaway	Senior Manager, Nuclear Fuels	NuScale	X	X	X
Graham Callaway	Director, Procurement & Supply Chain Analytics	NuScale	X	X	
Patrick Byfield	Thermal Hydraulics (TH) Engineer – Software Developer	NuScale	X	X	X
Lloyd Heckle	Director, Enterprise Software	NuScale	X	X	
Kelli Evon	Systems Engineer 5	NuScale			X
Joe Remic	Engineering Manager	NuScale			X
Meghan McCloskey	Thermal Hydraulics Engineer 5	NuScale			X
Ben Bristol	Systems Thermal Hydraulics Supervisor	NuScale			X
Melissa Bates		DOE		X	
Brian Wolf		NuScale			X
Kent Welter		NuScale			X

Hannah Rooks		NuScale			X
Wren Fowler		NuScale			X
Frankie Vega	Inspector, Team Lead	NRC	X	X	
Deanna Zhang	Inspector, Team Lead	NRC	X	X	
Yamir Diaz-Castillo	Inspector	NRC	X	X	
Dong Park	Inspector	NRC	X	X	
Andrea Keim	Inspector	NRC	X	X	
Michael Fitzgerald	Inspector	NRC	X	X	
Antonio Barret	Technical Reviewer	NRC	X	X	
Ryan Nolan	Technical Reviewer	NRC	X	X	
Shanlai Lu	Technical Reviewer	NRC	X	X	
Joshua Kaizer	Technical Reviewer	NRC	X	X	
Marie Pohida	Technical Reviewer	NRC	X	X	
Kerri Kavanagh	Branch Chief	NRC	X	X	
Rebecca Patton	Branch Chief	NRC	X	X	
Shilp Vasavada	Branch Chief	NRC	X	X	
Prosanta Chowdhury	Project Manager	NRC	X	X	
Mahmoud Jardaneh	Branch Chief	NRC	X	X	
Getachew Tesfaye	Project Manager	NRC	X	X	

2. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

<u>Item Number</u>	<u>Status</u>	<u>Type</u>	<u>Description</u>
05200050/2024-201-01	Opened	NOV	Criterion V
05200050/2024-201-02	Opened	URI	Criterion III

3. DOCUMENTS REVIEWED

General QA Policies and Procedures

- NuScale Quality Assurance Program Description (QAPD) (MN-122626), Revision 1, dated June 2023

- MN-0202-52999, NuScale Power, LLC, "Nuclear Quality Assurance Manual, ASME Code Section III, Division 1," Revision 9
- Documented Instruction (DI) DI-49643-49762, "Creating and Updating Technical Core Learning Paths," Revision 6, March 3, 2022
- Standards (ES) ES-0303-7922, "Discipline-Based Impact Analysis Guide," Revision 4, dated December 14, 2023
- LP-102185, "10 CFR 50.46 Reporting," Revision 1, dated October 5, 2023
- LS-0003-7674, "Topical and Technical Report Guidance," Revision 8, dated March 24, 2023
- PG-0602-211, "Protection of Safeguards Information," Revision 12, dated January 2, 2024
- LP-1503-9815, "10 CFR Part 21 Reporting," Revision 7, dated October 4, 2023
- QP-1803-9543, "Internal Audit Process," Revision 11, dated May 23, 2023
- QP-0203-10362, "Lead Auditor, Auditor, and Technical Specialist Qualifications," Revision 7, dated February 12, 2024
- QP-1803-8443, "Supplier Audits," Revision 7
- QP-0703-235, "Supplier Evaluation and Qualification," Revision 16
- QP-0703-10256, "Procurement of Items and Services," Revision 20
- QP-0703-16922, "Development and Processing of Statements of Work," Revision 14
- QP-0203-49634, "Training Management Procedure," Revision 20
- SCP-101512, "Development and Processing of Procurement Specifications," Revision 1
- QP-1003-53498, "Receiving Inspection," Revision 6
- QP-0703-10256, "Procurement of Items and Services," Revision 20
- QP-1603-12896, "Corrective Action Procedure," Revision 17, dated January 29, 2024
- QP-1603-12896-F01, "Condition Report Initiation Form," Revision 5, dated September 5, 2019
- QP-1603-55563, "Conducting Root Cause Evaluation," Revision 5, dated May 4, 2022
- QP-1603-55563-F03, "Effectiveness Review Template," Revision 5, dated November 3, 2021
- Documented Instruction (DI) DI-12896-12927, "Managing Condition Reports," Revision 8, dated January 29, 2024
- SC-1603-58739, "List of Approved Processes for Corrective Action Closure," Revision 6, dated May 6, 2021
- QP-0003-61760, "ASME Code Stamping," Revision 2
- QP-0303-10267, "Design Control Process," Revision 20
- CP-0203-49643, "Training Management Procedure," Revision 20

#### Engineering Procedures

- Engineering Procedure (EP) EP-0303-52592, "Engineering Change Control", Revision 12, date September 16, 2022
- EP-0303-2109, "Classification of Structures, Systems, and Components," Revision 11, dated August 30, 2023
- EP-0303-3340, "Preparation and Approval of Engineering Documents," Revision 15, dated January 24, 2023



- EP-0303-309, "Preparation and Approval of System Design Descriptions," Revision 13, January 24, 2023
- EP-0303-310, "Open Design Item (ODI) Management," Revision 11, dated November 30, 2023
- EP-0303-312, "Preparation and Approval of Engineering Specifications," Revision 23, dated November 21, 2023
- EP-0303-315, "Preparation and Approval of Engineering Drawings," Revision 16, dated May 18, 2023
- EP-0303-2122, "Design Reliability Assurance Program Implementation Procedure," Revision 6
- EP-0603-12984, "Methods for Protection of Safeguards Information," Revision 8, dated February 22, 2024
- EP-0603-2680, "Reporting Safeguards Violations and SGI Incidents," Revision 2, dated December 27, 2023
- EP-0703-1417, "Supplier Deliverable Review and Approval (Design and Testing)," Revision 18
- EP-0303-7000, "Probabilistic Risk Assessment Group Functions and Quality Controls," Revision 8
- EP-0303-1399, "Qualification Requirements for Personnel Performing ASME Certification Activities," Revision 9
- EP-1103-2609, "Commercial Grade Item Dedication," Revision 9

#### Supplier Audits and Evaluations

- Supplier audit report, Audit A2-106414, dated November 16, 2021
- Supplier Audit Report, Audit A2-107474, dated October 5, 2021
- NuScale QA Supplier Audit Checklist A2-109023, dated November 09, 2021
- NuScale QA Supplier Audit Checklist A2-119863, dated September 26, 2022
- NuScale QA Supplier Audit Checklist, A2-106414, dated November 16, 2021
- Supplier Audit report, A2-119863, dated August 2022
- NuScale QA Supplier Audit Checklist A2-119870, dated September 08, 2022
- Annual supplier Evaluation, QS-146414, dated July 3, 2023
- Annual supplier evaluation, QS-150678, dated September 8, 2023
- Annual supplier evaluation, QS-151405, dated September 19, 2023
- Annual supplier evaluation, QS-153488, dated November 09, 2023

#### Internal Audits Records

- LAQ-101147, "Auditor/Lead Auditor Annual Evaluation Record for Dennis Shannon," dated, November 8, 2023
- AI-134172, "Internal Audit Report - Quality Assurance & Procurement," Revision 0, dated April 17, 2023
- AI-137673, "Internal Audit Report – Design Control," Revision 0, dated May 25, 2023
- AI-139866, "Internal Audit Report – Software Programs," Revision 0, dated July 18, 2023
- AI-141305, "Internal Audit Report – Digital Instrumentation and Control," Revision 0, dated September 15, 2023

- AI-151266, "Internal Audit Report – Program Management Office," Revision 0, dated November 6, 2023

#### Procurement Orders (PO), Task Orders (TOs), and Statement of Work (SOW)

- TO #2, Revision 2 for SOW-1119-67895
- TO #6, Revision 4 for SOW-0718-60915
- TO #7 Revision 7 for SOW-0420-69645
- TO #29, Revision 0 for SOW-0120-68461
- TO #2, Revision 0 for SOW-134103
- TO #2, Revision 0 for SOW-134275
- TO #1, Revision 0 for SOW-105508
- PO 001837, Rev 0, March 1, 2023
- SOW-0718-60915, "SGFIV Test Program partial tube array modal testing services," Revision 5, dated March 17, 2020
- SOW 0420-69645 for DWO testing, Revision 5, dated June 6, 2022
- SOW-1119-67895, "Standard Plant Design Phase," Revision 0, dated March 17, 2020
- SOW-134103, "Intermediate design of the containment Isolation valves (CIVs), Revision 5, dated April 13, 2023
- SOW-134275, "Intermediate design of the decay heat removal system actuation valves and containment isolation test fixtures," Revision 0, dated May 1, 2023
- SOW-0120-68461 for ECCS Valve Proof Testing, dated June 18, 2020
- SW-102156, "Statement of Work for F6NM Fracture Mechanics Testing," Revision 0
- Task Order No. CO-104547 for mechanical testing services, Revision 0, dated September 24, 2021

#### Engineering Calculations, Reports and Evaluations

- EE-106376, "TF2 Test Facility Scaling Analysis with NPM-20 for Density Wave Oscillation," Revision 1
- ER-109852, "NRELAP5 DWO Applicability," Revision 0
- EC-101197, "DHRS Thermal Hydraulic Calculation for NPM-20," Revision 2
- EC 132087, "NPM-20 Boron transport analysis," Revision. 1
- ER 121191, "ECCS supplemental boron dissolver sizing report," Revision 0
- EC 135655, "Level C&D Secondary side thermal transients for NPM-20," Revision 0
- ER 101144, "Pressure and thermal transient definitions for analysis for NSSS components," Revision 1
- ER-104903, "Reactor module geometry constraints for safety analysis," Revision 2
- EC-100889, "Cycle-specific nuclear analysis," Revision 1
- EC-105228, "Phase 0 MCHFR Analysis for LOCA and IORV events," Revision 0
- EC-115225, "Subchannel analysis of inadvertent loading and operation of a fuel assembly in an improper position," Revision 2
- EC-132087, "NPM-20 boron transport analysis," Revision 1
- EE-125561, "NPM-20 IORV Evaluation loss of DC power timing," Revision 1
- ER-0000-2379, "Non-LOCA transient analysis methodology report," Revision 0
- ER-0000-2379, "Non-LOCA Methodology Report," Revision 1

- ER-A0000-9002, "Module related parameters and limits," Revision 8
- EC-107502, "NPM-20 Boron dilution transient analysis" Revision 0, Revision 1 and Revision 2
- EC-117383, "NRELAP5 Core model for Phase 0 MCHF analysis," Revision 0 and Revision 1
- EC-102466, "NSP4 CHF correlation Range Applicability Extension," Revision 6,
- EC-0303-322, "Use of Software in Design and Analysis" Revision 10
- EC-0000-7782 "NPM-20 NRELAP5 Base model," Revision 3
- EC-120192, "NPM-20 Geometric Parameters and Weight Calculation," Revision 2
- ER-104903 "Reactor Module Geometry Constraints for Safety Analysis," Revision 2
- EE-106376, "TF2 Test Facility Scaling Analysis with NPM-20 for Density Wave Oscillation," Revision 1
- ER-A021-4818, "Assessment of Control Rod Assembly Absorber Depletion," Revision 1
- TR-131981-P, "Methodology for the Determination of the Onset of Density Wave Oscillations," Revision 1

### ODIs

- ODI #134682, "Lower mixing tube design characteristics," dated January 26, 2023
- ODI #134680, "Dissolver and loading hopper design characteristics," dated January 26, 2023
- ODI #132835, "ESB Supplemental Dissolver Inlet Flow Distribution," dated December 15, 2022
- ODI #119573, "SGIFR Minimum Inlet Loss Coefficient," dated May 31, 2022
- ODI #119572, "Steam Generator Inlet Flow Restrictor Materials," dated May 31, 2022
- ODI #119576, "SGIFR Blockage Acceptance Criteria," May 31, 2022
- ODI #148486, "SGIFR Required Length for Center Orifice Mandrel; dated July 31, 2023
- ODI #124507, "ESB Lower Mixing Tube Configuration," dated August 23, 2022
- ODI #115551, "Use of US720 inputs for US460 design," dated March 11, 2022
- ODI #112988, "ECCS Valve Capacity Maximum Limit," dated January 26, 2022
- ODI #109749, "System Design Requires Updated Neutron Monitoring System Equipment List," dated November 19, 2022
- ODI #115551, "Use of US720 inputs for US460 design,"
- ODI #115553, "Use of US720 drawings for US460 design," dated March 11, 2022
- ODI #111437, "ECCS main valve operation characteristics," dated December 23, 2021
- ODI #112988, "ECCS valve capacity maximum limit," dated January 26, 2022
- ODI #115553, "Use of US720 drawings for US460 design," dated March 11, 2022
- ODI #116376, "Hydrogen Detonation," dated March 30, 2022
- ODI #117286, "Preliminary documents as Reference for Input," dated April 13, 2022
- ODI #119042, "Use of Preliminary IORV MCHF Core Model Results," dated May 17, 2022
- ODI #126020, "Density wave oscillation frequency," dated September 16, 2022
- ODI #127485, "Using an NPM-12 drawing in an NPM-20 calc,"
- ODI #121397, "Possible break locations," dated July 5, 2022
- ODI #132829, "ESB Mixing tube form loss," dated December 15, 2022
- ODI #132831, "ESB Mixing tube inner diameter," dated December 15, 2022

- ODI #132833, "ESB Mixing Tube Maximum Length," dated December 15, 2022
- ODI #132953, "Minimum creditable condensation area for ESB mixing tube," dated December 19, 2022
- ODI #137668, "Boron oxide bulk material flow properties," dated March 22, 2023
- ODI #146533, "Modifications to transient definitions," dated June 28, 2023
- ODI #146642, "Modifications to transient definitions," dated June 28, 2023
- ODI #147883, "ESB dissolver and hopper definitions," dated July 21, 2023
- ODI #147952, "Load regulation transient definition update," dated July 24, 2023
- ODI #148250, "DWO SG tube parameter characterization at power levels below 20%," dated July 26, 2023
- ODI #152748, "Density wave oscillation period, dated October 19, 2023
- ODI #152982, "DWO volumetric flow," dated October 25, 2023
- ODI #116365, "N Certificate Holder acting as Owner," dated March 30, 2022

### Design Control Documents

- CD-0115-10196, "RADTRAD Commercial Grade Dedication Report," Revision 0
- CD-0118-58354, "Commercial Grade Dedication Plan for CMS5," Revision 0
- CD-0118-58354, "Commercial Grade Dedication Plan for CMS5," Revision 1
- CD-0815-16748, "CMS5 Commercial Grade Dedication Report," Revision 2
- CD-102675, "Commercial Grade Dedication Plan for ISO-17025 Testing Services," Revision 0
- CD-122349, "Commercial Grade Dedication Report for F6NM Mechanical Testing Services," Revision 0
- ECR No. 14616, "Change Cobalt Limit for Valves"
- ECR No. 147510, "Revise Class 1 CIV ASME Design Specification"
- ECR No. 140599, "Revise Piping ASME Design Specification"
- ECR No. 132438, "Revise QA Requirements in ASME Design Specification for Piping"
- ECR No. 131254, "Update References to Upper RPV"
- ECR No. 131265, "Update References to Upper CNV"
- ECR-105612 "Create New CVCS flow area restriction in new CNV safe-end for NPM 20"
- EQ-115540, "ASME Design Specification for Class 1, 2, and 3 Piping," Revision 2
- EQ-122514, "ASME Design Specification for Class 1 CIVs," Revision 2
- EQ-146988, "ASME Design Specification for Containment Vessel," Revision 0
- EQ-147436, "ASME Design Specification for Reactor Pressure Vessel," Revision 0
- ME-0914-8313, "Receipt Inspection of CMS5 Commercial Software Package from [...]," dated October 8, 2014
- ME-1114-9392, "Receipt Inspection of RADTRAD Commercial Software Package from [...]," Revision 0, dated November 6, 2014
- S3-0315-12748, "Commercial Grade Survey Report," dated April 3, 2015
- PL-0302-6995, "Commercial Grade Dedication Plan for CMS5," Revision 1
- PL-0714-7910, "Commercial Grade Dedication Plan for RADTRAD," Revision 2
- Certificate of Conformance No. 01-2100019451, dated June 28, 2022
- Certificate of Conformance No. 01-2100019453, dated July 27, 2022
- Certificate of Conformance No. 01-2200005025, dated August 19, 2022
- Certificate of Conformance No. 01-2100019455, dated August 31, 2022

- ES-0303-8190 “Design Control Process”
- EQ-128472, “Equipment specification for ECCS supplemental boron” Revision 1
- ES-0303-8204 “Guidance for Non-LOCA System Transient Analysis” Revision 0

#### Test Control

- PO “CO-0911-178-TO 7 Revision 7\_Redacted.pdf”
- LO-126510, “Subject: NuScale’s Adjustments to Phase 3 Test Matrix Conditions specified in TSD-100497,” Revision 1 (CO-0911-178-TO 7)
- “TF-2 DWO Testing Test Plan and Procedure (Phase 3)” SDR-114346
- “Recommissioning of SIET GEST Facility/TF-2 and Continuation of TF-2 DWO Testing” SW-0420-69645, Revision 5
- TD-130103-R2, “DWO Phase 3A Test Data Package (includes IFR characterization test acceptance)
- TSD-100497, “Test Specification Document – TF-2 DWO Test Program,” Revision 1
- EP-1103-2992, “Test Control”, Revision 18

#### Drawings

- ED 100142, “Emergency Core Cooling System P&ID,” Revision 3

#### Software Design Control

- SwTP-0304-14487 R5 NRELAP5 Software Test Plan, Revision 5
- SwTR-0304-17153 R8 SwTR-Software Test Report, Revision 8
- DI-15338-58170 R1 NRELAP5 Change Implementation, Revision 1, dated September 22, 2020
- NCI-108777, “NRELAP5 Change Implementation, Revision 0
- CP-0803-7437, “Non-I&C Software Configuration Management, Revision 7

#### Condition Reports (CRs)

- Supplier Corrective Action Plan Evaluation, SF-123884, dated November 14, 2022
- Supplier Corrective Action Request, SF-123892, dated March 15, 2023
- CR 118374
- CR 120577
- CR 120659
- CR 122377
- CR 131554
- CR 132542
- CR 132880
- CR 133424
- CR 133645
- CR 134750
- CR 135516
- CR 135882
- CR 136014

- CR 136249
- CR 137138
- CR 140409
- CR 147946
- CR 147947
- CR 149290
- CR 152143
- CR 153483
- CR 153861
- CR 154323
- CR 154379
- CR 154827
- CR 154895
- CR 137138 and 10 CFR 50.46 Screening form
- CR 146718 and 10 CFR 50.46 screening form
- CR 149837 and 10 CFR 50.46 screening form
- CR 150168 and 10 CFR 50.46 screening form
- CR 152940 and 10 CFR 50.46 screening form
- CR 140038
- CR 140039
- CR 137149
- CR 137154
- CR 146107
- CR 152432
- CR 152398
- CR 117956
- CR 139345
- CR 140881
- CR 153412
- CR 154302
- CR 152940
- CR 131443
- CR 131445
- CR 131447
- CR 131450
- CR 154277
- CR 154278
- CR 154299
- CR 154301
- CR 152066
- CR 152421
- CR 156121
- CR 156231
- CR 156316
- CR 156425

- CR 157086
- CR-135516

#### Training and Qualification Records

- Lead auditor qualification records for Ronald Post
- Lead auditor qualification record for Richard Von Roble
- Lead auditor qualification record for Stuart Rushin
- Lead auditor qualification record for Joseph Carter
- ETF-0215-12481 M.McCloskey
- ETF-11920 Anderson, Kenny
- ETF-0513-12814 VanCleave, Mike
- ETF-0515-16098 Danforth, Richard
- ETF-0715-16659 Wolf, Brian
- ETF-0715-17608 Blomgren, Steve
- ETF-0715-17609 Blomgren, Steve
- ETF-0912-12026B. Bristol
- ETF-0914-11960 Barber, Doug
- ETF-0914-11961 Barta, T Andrews 2-28-24
- ETF-0914-12025 Brigantic, Adam
- ETF-0914-12552 Noyes-Rooks, Hannah
- ETF-0914-125676 Rooks, Ken
- ETF-0914-12830 Wang, Maggie
- ETF-0914-12851 Wolf, Brian
- ETF-1214-12204 Galimov
- Transcript for Kenneth Rooks
- Proficiency Verification Form (PVF), Matthew Martineau; Mechanical Engineer 2
- PVF, Garrett Ascherl, Mechanical Engineer 3
- FVF, Hank Pratte, Mechanical Engineer 3
- PVF, Tim Barta, Mechanical Engineer 3
- PVF, Matthew Salac, Mechanical Engineer 4
- PVF, Augustine Cardillo, Supervisor, NSSS Mechanical Systems
- PVF, Joe Remic, Supervisor, NSSS Vessels & Structures
- PVF, Derek Noel, Supervisor, NSSS Piping & Integration

#### Part 21 Records

- LP-1503-9815-F02, "10 CFR Part 21 Screening and Discovery Form" in CR 150168
- LP-1503-9815-F01, "10 CFR Part 21 Evaluation Form" in CR 154302

#### Safeguards Information Records:

- S1-127211 2022 Safeguards Information (SGI) Program Surveillance Report," Revision 0, dated December 13, 2022
- S1-152449 2023 Safeguards Information Program Surveillance," Revision 0, dated December 05, 2023
- Safeguards Information Access Matrix
- Safeguards Information Inventory List

Condition Reports Issued as a Result of the NRC inspection:

- CR 157912
- CR 157913
- CR 157887