



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

April 5, 2019

Mr. Thomas Bergman, Vice President
Regulatory Affairs
NuScale Power LLC
1100 NE Circle Blvd., Suite 200
Corvallis, OR 97330

SUBJECT: NUCLEAR REGULATORY COMMISSION INSPECTION OF NUSCALE POWER
LLC., INSPECTION REPORT NO. 05200048/2019-201

Dear Mr. Bergman:

On February 25 through February 28, 2019, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at the NuScale Power, LLC (NuScale), facilities in Corvallis, Oregon. The purpose of this technically focused NRC inspection was to verify that NuScale effectively implemented quality assurance (QA) processes and procedures for design and testing activities performed in support of the NuScale design certification application. 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 endorsement of your overall QA, 10 CFR Part 21, "Reporting of Defects and Noncompliance," or Safeguards Information programs. Within the scope of this inspection, no violations were identified during this inspection.

In accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's "Rules of Practice," the NRC will make available electronically for public

inspection a copy of this letter and its enclosure through the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System, which is accessible at <http://www.nrc.gov/reading-rm/adams.html>.

Sincerely,

/RA/ JOrtega-Luciano for

Kerri A. Kavanagh, Chief
Quality Assurance Vendor Inspection Branches 1 and 2
Division of Construction Inspection
and Operational Programs
Office of New Reactors

Docket No.: 05200048

EPID: I-2019-201-0030

Enclosure:
Inspection Report No. 05200048/2019-201
and Attachment

SUBJECT: NUCLEAR REGULATORY COMMISSION INSPECTION REPORT OF
 NUSCALE POWER LLC., INSPECTION REPORT NO. 05200048/2019-201
 Dated: April 5, 2019

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NRO-002

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| DATE | 04/03/19 | 04/04/19 | 04/05/19 |

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**U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NEW REACTORS
DIVISION OF CONSTRUCTION INSPECTION AND
OPERATIONAL PROGRAMS
DESIGN CERTIFICATION TESTING INSPECTION REPORT**

Report No.: 05200048/2019-201

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

Applicant Contact: Mr. Cyrus Afshar
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Nuclear Industry Activity: NuScale Power, LLC submitted its Design Certification (DC) application for the NuScale Small Modular Reactor in December 2016.

Inspection Dates: February 25 – February 28, 2019

Inspectors: Greg Galletti, NRO/DCIP/QVIB-1 Team Leader
Jonathan Ortega-Luciano, NRO/DCIP/QVIB-2
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Approved by: Kerri A. Kavanagh, Chief
Quality Assurance Vendor Inspection Branches 1 and 2
Division of Construction Inspection
and Operational Programs
Office of New Reactors

Enclosure

EXECUTIVE SUMMARY

NuScale Power, LLC
Inspection Report No. 05200048/2019-201

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 Design Certification Application (DCA) submission that comply 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." In addition, the NRC inspection team also verified that NuScale implemented a program that meets the requirements of 10 CFR Part 21, "Reporting of Defects and Noncompliance." The NRC inspection team also 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 facility in Corvallis, Oregon, from February 25 to February 28, 2019.

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 July 29, 2008; IP 36100, "Inspection of 10 CFR Part 21 Programs for Reporting Defects and Nonconformance," dated February 13, 2012; IP 71152, "Problem Identification and Resolution," Appendix 1, "Guidance for Gathering SCWE and PI&R Insights," dated January 1, 2015; and IP 81811, "Protection of Safeguards Information by Design Certification Applicants and Vendors," dated September 6, 2016.

The NRC inspection team concluded that NuScale's QA policies and procedures complied with the applicable requirements in Appendix B to 10 CFR Part 50 and 10 CFR Part 21; and confirmed that NuScale's personnel were implementing these policies and procedures effectively in support of NuScale's DCA development activities. Additionally, the team concluded that the applicant had adequate controls in place to effectively control safeguards information. The results of this inspection are summarized below.

10 CFR Part 21 Program

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

Design Control

The NRC inspection team concluded that, with the exception of the minor issues identified herein, NuScale is implementing its design control program in accordance with the regulatory requirements of Criterion III "Design Control," 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 DCA submittal consistent with the regulatory requirements. No findings of significance were identified.

Digital Instrumentation and Control Design and Software Development

The NRC inspection team concluded that NuScale is implementing its Digital Instrumentation and Controls (I&C) and software design control program in accordance with the regulatory requirements of Criterion III “Design Control,” of Appendix B to 10 CFR Part 50 and is consistent with the policies and procedures governing Digital I&C and software development. No findings of significance were identified.

Control of Procurement and Oversight of Contracted Activities

The NRC inspection team concluded that NuScale’s implementation of its procurement document control program and control of purchased material, equipment, and services program, including implementation of supplier audits, were consistent with the regulatory requirements of Criterion IV, “Procurement Document Control,” and Criterion VII, “Control of Purchased Material, Equipment, and Services,” of Appendix B to 10 CFR Part 50. No findings of significance were identified.

Internal Audits

The NRC inspection team concluded that NuScale’s implementation of its internal audit program was consistent with the regulatory requirements of Criterion XVIII, “Audits,” of Appendix B to 10 CFR Part 50. No findings of significance were identified.

Nonconformances and Corrective Actions

The NRC inspection team concluded that NuScale’s program requirements and implementation of nonconformance and corrective action programs were consistent with the requirements of Criterion XV, “Nonconforming Material, Parts, or Components,” and Criterion XVI, “Corrective Action,” of Appendix B to 10 CFR Part 50. No findings of significance were identified.

Protection of Safeguards Information

The NRC inspection team concluded that NuScale’s SGI program implementation were 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.

Safety Conscious Work Environment (SCWE)

The NRC inspection team concluded that NuScale’s SCWE program requirements and implementation were consistent with the NRC’s guidance in IP 71152, “Problem Identification and Resolution,” Appendix 1, “Guidance for Gathering SCWE and PI&R Insights.” Based on a limited number of interviews conducted with random individuals in the NuScale organization, the NRC inspection team determined that individuals were willing to raise safety concerns and the individual’s perception of their management’s responsiveness to these concerns was positive. No findings of significance were identified.

REPORT DETAILS

1. 10 CFR Part 21 Program

a. Inspection Scope

The NRC inspection team reviewed NuScale Power, LLC's (hereafter referred to as NuScale) policies, and procedures that govern the evaluation program to determine compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21, "Reporting of Defects and Noncompliance." The inspection team verified that NuScale's nonconformance and corrective action processes provide adequate links to the Part 21 procedure.

The NRC inspection team reviewed NuScale's procedures to perform a 10 CFR Part 21 evaluation and determined that it addresses the requirements for evaluating deviations and failures to comply. The NRC inspection team reviewed only the procedures because at the time of the inspection NuScale had not performed any evaluations under 10 CFR Part 21.

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 determined that the implementation of NuScale's 10 CFR Part 21 program is consistent with the regulatory requirements of 10 CFR Part 21. No findings of significance were identified.

2. Design Control

a. Inspection Scope

The NRC inspection team reviewed NuScale's policies and procedures for design control to verify compliance with Criterion III, "Design Control," of Appendix B, "Quality Assurance Program Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," (Appendix B to 10 CFR Part 50). The NRC inspection team evaluated NuScale's implementation of the design control process and procedures established within NuScale's quality assurance (QA) Program. Specifically, the NRC inspection team reviewed NuScale procedures QP-0303-10267, EP-0303-303, EP-0303-310, EP-0303-52592, and EP-0303-22376 to verify that NuScale's process provides for maintaining adequate control of design inputs and outputs, analyses and testing, records and reports, and design changes.

The NRC inspection team reviewed NuScale Power Integral System Test (NIST)-1, test HP-43, HP-49, and EC-T080-6620 associated with the NRELAP5 model. The NRC

inspection team also reviewed the design change that NuScale made to the Reactor Flange Tool (RFT) seismic analysis. For these samples, the NRC inspection team verified that the design process as implemented consisted of an independent verification of the design changes, and the identification and tracking of unverified assumptions. The NRC inspection team, also reviewed NuScale's open design item (ODI) process as described in EP-0303-310. The NRC inspection team verified NuScale's ODI process provides for tracking unverified assumptions and requires use of the design change process if the assumption is found to be incorrect or requires revision. The NRC inspection team reviewed how the ODI process interfaced with the design certification application (DCA) development. The NRC inspection team reviewed the list of ODIs and selected a sample for more detailed review.

The NRC inspection team discussed the design control process and ODI process 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

The NRC inspection team determined that condition report (CR) 1018-62367, "Impact of NIST-1 Heater Rod Model Changes on NRELAP5 Validation Calculations," dated October 29, 2018, adequately documented NuScale's evaluation and proposed corrective actions to correct the anomalies identified during the evaluation of the NRELAP5. EC-T080-3468 is the base line document used by NuScale to describe the calculation that predicts the rod centerline temperature. When NuScale ran test HP-43, rod centerline temperature recorded was higher than calculated in EC-T080-3468. NuScale performed a sensitivity study (EC-T080-6557) using the data collected to understand why the rod centerline temperature was higher than predicted in their calculations. NuScale realized that the material was not dissipating the heat as assumed, and the insulation was not completely uniform creating air gaps between the rod and the thermowell. The results of the sensitivity study provided a better understanding of the dissipation of the heat. With this revised understanding, NuScale performed a correction on the data obtained in test HP-43. They then re-ran the NRELAP5 model with the new set of corrected values which resulted in a new prediction for the rod centerline temperature. Subsequently, NuScale ran test HP-49, and confirmed that the rod centerline temperature data demonstrated that the temperature was consistent with the predicted values of the NRELAP5 model (EC-T080-6620).

During the review of EC-T080-6620, the NRC inspection team noted that the air gap percent, one of the inputs of NRELAP5 model, was different than the value in EC-T080-6557. NuScale evaluated the calculation and was able to confirm that the value used when they ran the NRELAP5 model was the correct value as documented in EC-T080-6557. The NRC inspection team determined this issue was not more than minor because the value in EC-T080-6620 was a simple typographical error and was an isolated event that did not affect the calculations or the results obtained from the NRELAP5 model. NuScale issued corrective action CR-0219-64698, dated February 27, 2019, to address this issue.

The NRC inspection team determined that CR-0918-61937, "Reactor Flange Tool Stand (RFTS) Analysis Methodology," dated September 25, 2018, adequately documented NuScale's evaluation and proposed corrective actions to correct a wrong assumption that was used in the calculation. One action from CR-0918-61937 was to initiate

engineering change request (ECR) A010-64323, requiring a new calculation using the correct engineering assumptions. During the review of the ECR form, the NRC inspection team noted that under the section title 'Basis for Change' CR-0918-61937 was not listed as an applicable CR that initiated the ECR. The ECR form has instructions to provide details of the basis for the proposed changes. A written description should accompany any applicable CR or request for information (RAI) number listed. The instructions state that, "if requesting initial approval to proceed for an alternate design, include: purpose of the alternative design; description of scope; discussion on objective of the design effort." The NRC inspection team concluded that the engineer did not follow the requirements of the form and only listed one of the CRs that initiated the ECR. The engineer was able to provide an auditable trail to CR-0918-61937 from the documents listed in the ECR. The CR listed in the ECR was for the upper portion of the RFT and the engineer thought that by referencing one CR, it was understandable that CR-0918-61937 also applied to the ECR 'Basis Section' of the form. NuScale was able to provide an objective evidence that the documentation established the basis for the change and that the corrective action listed in CR-0918-61937 was completed. The NRC inspection team concluded that this issue is not categorized more than minor and does not present a safety concern to the calculations in EC-B131-6907. NuScale issued corrective action CR-0219-64713, dated February 28, 2019, to address this issue.

During the review of EC-B131-6907 the NRC inspection team noted that, as part of the new calculation, NuScale issued ODI-19-0001 for RFT Support Model Geometry. The NRC inspection team determined that NuScale is implementing their ODI process in accordance with EP-0303-310, which provides a process for managing unverified assumptions that are required to be verified. ODIs are required to be identified in accordance with QP-0303-10267, "Design Control Process." An ODI is required to be created when an unverified assumption that requires verification is present in an engineering evaluation. An ODI is resolved when a verified source for the ODI exists in an approved revision of the engineering document. Upon resolution of the ODI, implementing documents are required to be updated in accordance with the design control process. QP-0303-10267, requires verification that ODIs are identified and assigned. The NRC inspection team was able to verify that the ODI identified in EC-B131-6907 was listed in NuScale ODI Tracking list and it was properly referencing the affected documents were the ODI resides. No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that, with the exception of the minor issues identified herein, 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 DCA submittal. No findings of significance were identified.

3. Digital Instrumentation and Control Design and Software Development

a. Inspection Scope

The NRC inspection team reviewed NuScale's policies and procedures for design and software control to verify compliance with Criterion III, "Design Control," of Appendix B to 10 CFR Part 50. Specifically, the NRC inspection team concentrated in the implementation of the Digital Instrumentation and Controls (I&C) and software design control programs.

Software Design Control Policies and Procedures

The NRC inspection team reviewed PL-0302-973, "Digital I&C Software Quality Assurance Plan," Revision 3, which describes the approach used for the development of software products and complex logic devices for use in the Nuclear safety-related I&C systems to confirm the plan contains adequate guidance to implement a development program consistent with NRC requirements. PL-0302-973 is based on guidance in Institute of Electrical and Electronics Engineers (IEEE) Std.730-2002, which defines requirements compliant with applicable sections of American Society of Mechanical Engineers (ASME) Quality Assurance Requirements for Nuclear Facility Applications (NQA-1), 2008, and 2009 Addenda. The NRC Inspection team reviewed the guidance to verify compliance with NQA-1 Part 1 and NQA-1 Part II, Subpart 2.7, "QA Requirements for Computer Software," and subpart 2.14, "Quality Assurance Requirements for Commercial Grade Items and Services," as well as applicable portions of IEEE Std. 7-4.3.2-2003 associated with safety-related software used in Nuclear Power Generating Stations.

The NRC inspection team also reviewed PL-0302-11002, Digital I&C Software Configuration Management Plan (SwCMP), Revision 2, to confirm the guidance was developed consistent with RG 1.169, "Configuration Management Plans for Digital Computer Software Used in Safety Systems of Nuclear Power Plants," and IEEE Std. 828-2005. PL-0302-11002 defines organizational structures and roles and responsibilities, listing of the minimum set of configuration items (CI) required for project, and various activities associated with the CI's including, but not limited to, CI identification, change control, status accounting, and CI auditing. The NRC inspection team discussed the implementation of the plan and engineering procedure EP-0303-52175 with respect to development and use of the Software configuration management plan implementation tools to confirm the applicant's staff were adequately trained and familiar with the requirements of the program. The NRC inspection team verified that the selected staff were cognizant of their roles and responsibilities, current state of implementation of the SwCMP, and the on-going efforts to develop the remaining CI's during the conceptual phase that will be subject to configuration control.

Design Engineering and Software Lifecycle Activities

The NRC inspection team assessed the status of lifecycle phase (conceptual) to determine the sample of documents to review and interviews to perform. The NRC inspection team reviewed and verified a sample of the lifecycle plans and lower tiered documents against the applicable IEEE Standards and found that the documents generally invoked the IEEE requirements. The NRC inspection team interview both the design and independent verification and validation (IV&V) staff for their understanding

and use of the project plans as it relates to the current phase of project. Additionally, both teams provided presentation and real time examples for the projects control of both design and software using IBM Rational DOORS. The NRC inspection team found use of DOORS is consistent with both design and software control plans and provides the ability to track requirements, anomalies, and produce outputs consistent with the templates describe in various plans appropriately.

The NRC inspection team verified that design change documents are subject to design control measures commensurate with those applied to the original design and the effect of the changes on the overall design and analyses were evaluated. The NRC inspection team questioned NuScale engineering staff responsible for design of the Module Protection System (MPS) on the status of two MPS design changes currently in progress; 1) Decay Heat Removal System (DHRS) logic that will facilitate plant startup, and (2) the removal of the Emergency Core Cooling System (ECCS) actuation on reactor vessel level and the future path forward of each. The NRC inspection team found that the information obtain through the interview process was consistent with the NuScale engineering and software control processes, and the activities in progress were being performed consistent with the requirements of the program.

Training

The NRC inspection team reviewed a sample of documents specific to NuScale IV&V staff training and conducted interviews with NuScale IV&V staff on training program implementation. The NRC inspection team found that the indoctrination and training of personnel performing activities affecting quality have been adequately implemented and that the staff were adequately trained and familiar with the requirements of the program.

NRELAP5 3D

The NRC inspection team interviewed NuScale staff concerning the processes used to update the NRELAP5 codes. The NuScale staff discussed the process of procuring and implementing the RELAP 5 3D program, including error report tracking and disposition, and required regression analyses activities. The NRC inspection team determined that the actions required for NRELAP5 updates were adequate and consistent with the NuScale policies and procedures for procurement and use of third-party software products.

The NRC inspection team discussed the instrumentation and control design and software development 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. Conclusions

The NRC inspection team concluded that NuScale has established its design and software control activities 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 determined that NuScale is implementing its policies and procedures associated with design and software control in support of the NuScale's DCA submittal. No findings of significance were identified.

4. Control of Procurement and Oversight of Contracted Activities

a. Inspection Scope

The NRC inspection team reviewed NuScale's policies and implementing procedures that govern procurement, supplier oversight and contracted activities in compliance with the requirements of Criterion IV, "Procurement Document Control" and Criterion VII, "Control of Purchased Material, Equipment, and Services" to Appendix B to 10 CFR Part 50 and the NuScale Design Certification (DC) application.

The NRC inspection team reviewed a sample of procurement orders (POs) of safety-related suppliers on NuScale's evaluated supplier's list (ESL). The NRC inspection team verified that the POs included, as appropriate: the scope of work, right of access to facilities, and extension of contractual requirements to subcontractors. In addition, the NRC inspection team verified that the documents included design specifications, testing and inspection activities, special processes requirements and invoked the requirements of Appendix B to 10 CFR Part 50 and 10 CFR Part 21. The NRC inspection team reviewed a sample of external audit reports to verify audits were performed at the required frequency, used approved procedures and complied with the applicable regulatory and technical requirements.

The NRC inspection team reviewed samples of POs 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 reviewed annual evaluations of suppliers from the ESL and discussed the supplier oversight program with NuScale's management and technical staff.

The NRC inspection team discussed the control of procurement and oversight of contracted activities 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 oversight of contracted activities 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 DCA submittal. No findings of significance were identified.

5. Internal Audits

a. Inspection Scope

The NRC inspection team reviewed the policies and procedures governing the implementation of NuScale's audit program, to verify compliance with Criterion XVIII, "Audits", of Appendix B to 10 CFR Part 50. The NRC inspectors reviewed a sample of QA internal audits from last two years regarding the NuScale project design and aspects of NuScale's QA program.

The NRC inspection team reviewed QP-1803-9543, "Internal Audits Process," and verified that the sampled audits were developed consistent with the procedural guidance. The NRC inspection team also reviewed QP-0203-10362, "Lead Auditor, Auditor and Technical Specialist Qualifications" and reviewed a sample of training records to verify they included specified training requirements for NuScale personnel tasked with performing audits.

The NRC inspection team discussed the internal audit 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's QA internal audit program requirements are consistent with Criterion XVIII of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspectors determined that NuScale is adequately implementing their QA program for internal audits in support of NuScale's DCA submittal. No findings of significance were identified.

6. Corrective Action

a. Inspection Scope

The NRC inspection team reviewed the policies and procedures governing the implementation of the NuScale corrective action program to verify compliance with Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50.

The NRC inspection team reviewed a sample of items entered into the NuScale corrective action program during calendar year 2017, 2018, and 2019. For the condition reports selected for review, the NRC inspection team assessed whether appropriate evaluations had been conducted, whether reasonable corrective actions were specified, and whether corrective actions taken for significant conditions adverse to quality were sufficient to prevent recurrence as required by Criterion XVI of Appendix B 10 CFR Part 50.

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

Following the June 2017 inspection at NuScale, the NRC identified two minor issues related to ODIs as documented in inspection report (IR) No. 0500048/2017-201 (ADAMS Accession No. ML17201J382). The June 2017 NRC inspection report identified an example where inaccurate information was present in a topical report at the time of submittal. Specifically, the cover page to a calculation made a statement that a value was obtained by analysis, when it was an assumed value identified as an ODI. NuScale documented the issue in CR-0617-54417. The NRC inspection team identified an example, where an assumption was not identified as an ODI by NuScale. Specifically, NuScale made the assumption to neglect the main reactor pool heat input into the spent fuel pool heat load. In the DCA supporting documentation NuScale identified that this assumption should be verified, which is an ODI by NuScale definition. NuScale documented the issue in CR-0617-54423.

During the current inspection, the NRC inspection team reviewed CR-0617-54417 and CR-0617-54423. With respect to CR-0617-54417, NuScale reviewed its topical report, which is a description of the methodology to perform subchannel analysis, which inadvertently included a statement referring to a "calculated" engineering uncertainty. The supporting calculation and the topical report were corrected to state that it is an assumed value requiring verification. This error was determined to be a human error and not a process deficiency. Other ODIs in the calculation were correctly identified and no similar CRs were identified.

With respect to CR-0617-54423, NuScale's acceptance review form and file comments identify an assumption as potentially non-conservative. Upon further evaluation it was determined that the assumption was appropriate for the purposes of the evaluation. A separate evaluation of concurrent heatup of both the spent fuel pool and reactor pool was completed per the Ultimate Heat Sink Boil off calculation. Therefore, this item is not an ODI. NuScale provided additional documentation to clarify that the assumption was conservative for the one calculation and to reference the evaluation of the design basis limiting heatup condition of the ultimate heat sink. Therefore, the staff finds that NuScale did not miss the identification of an ODI in this example.

The NRC inspection team reviewed the documentation that provided objective evidence for the completion of the corrective actions and reviewed the updated procedures. In addition, the NRC inspection team reviewed current implementation of the procedures. Based on this review, the NRC inspection team finds the actions acceptable.

c. Conclusion

The NRC inspection team determined that for the sample evaluated, 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 inspectors determined that NuScale is adequately implementing their corrective action program in support of NuScale's DCA submittal. No findings of significance were identified.

7. Nonconforming Materials, Parts, or Components

a. Inspection Scope

The NRC inspection team reviewed NuScale's policies and implementing procedure that govern the control of the nonconformance program to verify compliance with the requirements of Criterion XV, "Nonconforming Materials, Parts, or Components," of Appendix B to 10 CFR Part 50.

The NRC inspection team reviewed a sample of nonconformance reports (NCRs), currently covered in supplier deviation notices, to verify that NuScale: (1) dispositioned the NCRs in accordance with the applicable procedures; (2) documented an appropriate technical justification for various dispositions; and (3) took adequate corrective action with regard to the nonconforming items. For NCRs that were dispositioned as "use-as-is," the NRC inspection team confirmed the technical justifications were documented to verify the acceptability of the nonconforming item. The NRC inspection team also verified that NCRs provided a link to the 10 CFR Part 21 program.

The NRC inspection team discussed the control of the nonconformance 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 determined that for the samples evaluated, the implementation of NuScale's Nonconformance program is consistent with the regulatory requirements of Criterion XV of Appendix B to 10 CFR Part 50. Based on the limited sample of documents reviewed, the NRC inspectors determined that NuScale is adequately implementing their Nonconformance program in support of NuScale's DCA submittal. No findings of significance were identified.

8. Protection of Safeguards Information

a. Inspection Scope

The NRC inspection team reviewed NuScale's policies and procedures for control of Safeguards Information (SGI) information to verify compliance with 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements," and 10 CFR 73.22, "Protection of Safeguards Information: Specific Requirements." The NRC inspection team reviewed NuScale's program to determine if SGI is effectively protected and prevent unauthorized disclosure.

The NRC inspection team discussed the control of SGI with NuScale's management and staff. The attachment to this inspection report lists the individuals interviewed and documents reviewed 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 control of SGI program in accordance with the regulatory requirements of 10 CFR 73.21, and 10 CFR 73.22. Based on the limited sample of documents reviewed, the NRC inspection team also determined that NuScale is adequately implementing their SGI control program in support of NuScale's DCA submittal. No findings of significance were identified.

9. Safety Conscious Work Environment

a. Inspection Scope

The NRC inspection team reviewed the processes and procedures that support the NuScale safety culture, including the employee concerns program, differing professional opinions program and safety culture policy statement. The NRC inspection team interviewed a sample of the technical staff to gain insight on the NuScale staff's willingness to raise nuclear safety issues. The NRC inspection team determined that the NuScale staff appear to be comfortable raising issues and pursuing issues with NuScale upper management. The NuScale staff have the ability to enter issues directly into the corrective action program and the employee concerns program. The staff can also enter issues into these programs anonymously.

The NRC inspection team discussed the implementation of the various programs that support the NuScale safety culture with NuScale's management and staff. The attachment to this inspection report lists the individuals interviewed and documents reviewed by the NRC inspection team.

b. Observations and Findings

No findings of significance were identified.

c. Conclusion

The NRC inspection team concluded that the safety culture at NuScale is adequate. No findings of significance were identified.

10. Entrance and Exit Meeting

On February 25, 2019, the NRC inspection team discussed the scope of the inspection with Dale Atkinson, Chief Operating Officer/Chief Nuclear Officer of NuScale, and other members of the NuScale management team and technical staff. On February 28, 2019, the NRC inspection team presented the inspection results and observations during an exit meeting with Mr. Thomas Bergman, Vice President, Regulatory Affairs of NuScale, 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. PERSONS CONTACTED

| Name | Title | Affiliation | Entrance | Exit | Interviewed |
|-------------------------|--|-------------|----------|------|-------------|
| Greg Galletti | Inspector, Team Lead | NRC | X | X | |
| Aaron Armstrong | Inspector | NRC | X | X | |
| Jonathan Ortega-Luciano | Inspector | NRC | X | X | |
| Andrea Keim | Inspector | NRC | X | X | |
| Joseph Ashcraft | Technical Reviewer | NRC | X | X | |
| Jose Reyes | Chief Technical Officer | NuScale | X | | |
| Dale Atkinson | Chief Operating Officer/Chief Nuclear Officer | NuScale | X | | |
| Mike Melton | Licensing Manager | NuScale | X | | |
| Tom Bergman | Vice President Regulatory Affairs | NuScale | X | X | |
| Carolyn Monaco | Quality Assurance Director | NuScale | X | X | X |
| Cyrus Afshar | Supervisor, Regulatory Affairs | NuScale | X | | X |
| Robert Gamble | Vice President, Engineering | NuScale | X | X | |
| Gary Becker | Regulatory Affairs Counsel | NuScale | X | | |
| Kathy Warnock | Quality Assurance Specialist 3 | NuScale | | | X |
| David Ethington | Manager, Quality Assurance | NuScale | X | X | |
| Jeff Jones | Engineering Lead | NuScale | X | | |
| Bob Houser | Manager, T&CD | NuScale | X | | |
| Ben Frisk | Supervisor, Nuclear Engineering IV and V | NuScale | X | | |
| Brian Gardes | Manager, Instrumentation & Controls and Electrical | NuScale | X | | |
| Russell Goff | Licensing Specialist 2 | NuScale | X | X | |

| | | | | | |
|------------------|---|---------|---|---|---|
| Kevan Griffith | Nuclear Engineering IV and V Level 3 | NuScale | | | X |
| Ryan Hanson | Nuclear Engineering | NuScale | | | X |
| Brandon Hanson | Employee Concerns Manager | NuScale | X | X | X |
| Scott Harris | Supervisor, Mechanical Systems | NuScale | X | | X |
| Christopher Hope | Nuclear Engineering IV and V Level 5 | NuScale | | | X |
| Zack Houghton | Manager, Mechanical Design Engineering | NuScale | X | | X |
| John Marking | Nuclear Engineering IV and V Level 3 | NuScale | | | X |
| Rob Meyer | Instrumentation and Control 5 | NuScale | | | X |
| Neil Olivier | Director, Corporate Services | NuScale | X | | X |
| Jamie La Salle | PI Supervisor | NuScale | X | X | |
| Graham Gallaway | Manager, Procurement | NuScale | X | X | |
| J.J. Arthur | Manager, Structure and Design analysis | NuScale | X | X | |
| Zackary Rad | Director, Regulatory Affairs | NuScale | X | X | X |
| Kyle Ulassin | Manager, Performance Improvement | NuScale | X | | X |
| Mark Chitty | Licensing Specialist 4 | NuScale | | X | X |
| Britt Carlosn | IT Helpdesk Supervisor | NuScale | | | X |
| Kevin Deyette | Program Manager Nuclear Security Emergency Programs | NuScale | | | X |
| Jorge Bermudez | Nuclear Engineering IV and V Level 4 | NuScale | | | X |

| | | | | | |
|-------------------|---------------------------------------|---------|--|--|---|
| Dylan Addison | Mechanical Engineer | NuScale | | | X |
| Meghan McCloskey | Acting Supervisor, Methods Validation | NuScale | | | X |
| Elizabeth English | Licensing Specialist 3 | NuScale | | | X |
| Brian Wolf | Supervisor Code Development | NuScale | | | X |
| Steven Blomgren | Lvl 4 code developer | NuScale | | | X |

2. DOCUMENTS REVIEWED

General Policies and Procedures

- CP-0003-9225, "Employee Concerns Program," Revision 0, dated December 12, 2014
- CP-0003-9226, "Differing Professional Opinions," Revision 0, dated December 12, 2014
- CP-0503-50354, Verification and Validation Criticality Analysis, Revision 0
- CP-0503-49425, Verification and Validation Requirements Allocation Analysis, Revision 0
- CP-0503-49423, Verification and Validation Concept Documentation Evaluation, Revision 0
- CP-0503-50389, Verification and Validation Hazard Analysis, Revision 0
- CP-0503-51188, Verification and Validation Regression Analysis, Revision 0
- CP-0503-50011, Verification and Validation Traceability Analysis, Revision 0
- DI-49423-51208, Concept Documentation Evaluation Documented Instruction, Revision 0
- EP-0303-52175, Digital I&C Configuration Management, Software Development and System Installation, Revision 1
- EP-0303-22376, "Development and use of Engineering Notices," Revision 5, dated July 26, 2018
- EP-0303-303, "Preparation and Approval of Engineering Calculation," Revision 15 dated May 30, 2018
- EP-0303-310, "Open Design Item (ODI) Management," Revision 6, dated February 2, 2017
- EP-0303-52592, "Engineering Change Control," Revision 5, dated November 11, 2018
- EP-0603-2680, "Reporting Violations and Security Incidents," Revision 0, dated April 9, 2015
- EP-0603-2984, "Methods for protection of Safeguard Information," Revision 4, dated April 24, 2018
- IVV Core Proficiency Verification, Course Roster Report, dated February 25, 2019
- Learning Path Progress Report, dated February 25, 2019
- LP-1503-9815, "10 CFR Part 21 Reporting," Revision 4, dated November 30, 2018
- PY-ENT-036, "Safety Culture Policy," Revision 3, July 24, 2017
- QP-1803-9543, "Internal Audit process," Revision 4, dated March 14, 2018
- QP-0203-10362, "Lead Auditor, Auditor and Technical Specialist Qualifications," Revision 2, dated April 24, 2017
- QP-1803-8443, "Supplier Audits," Revision 3, dated March 12, 2018

- QP-0703-235, "Supplier Evaluation and Qualification," Revision 10, dated October 30, 2018
- QP-0703-16922, "Development and Processing of Statements of Work," Revision 5, dated March 14, 2018
- QP-0703-10256, "Procurement of Items and Services," Revision 14, dated October 25, 2018
- QP-1603-12896, "Corrective Action Program," Revision 8, dated January 2, 2019
- QP-1503-8527, "Control of Nonconforming Items," Revision 3, dated November 30, 2018
- QP-0303-10267, "Design Control Process," Revision 10, dated August 18, 2014
- SDN-0219-64595, Supplier Deviation Notice Testing Services, Revision 0, dated November 9, 2018
- SDN-0119-64311, Supplier Deviation Notice Testing Services, Revision 0, dated October 5, 2018.
- SDN-0917-55911, Supplier Deviation Notice Testing Services, Revision 1, dated October 4, 2017
- SOW SW-0918-61550, Aircraft Impact Assessment Reconciliation, Revision 1, dated January 15, 2019
- SwRS-0304-1320, "Piping Analyses Software Requirements Specification" Revision 0, dated May 17, 2016

Supplier Audits

- A2-0718-60788-13, Piping Analyses Supplier Audit Checklist, dated August 20, 2018
- A2-0718-60788-2, Piping Analyses Supplier Audit Plan, dated May 7, 2018
- A2-0718-60788-5, Piping Analyses Supplier Audit Report, dated August 20, 2018
- A2-0916-51231-3, Supplier Audit Report Testing Services, Revision 0, December 21, dated 2016
- CO-0713-4326, Master Services Agreement Aircraft Impact Assessment, Revision 0, dated July 30, 2013
- CO-0713-4326, Master Services Agreement Aircraft Impact Assessment Amendment 2, dated September 25, 2018
- CO-0713-4326 Task Order 16 Aircraft Impact Assessment, Revision 2, dated November 3, 2019

Internal Audits

- A1-1118-62399, Software Program Audit (NQA-1 Req. 3, 7, 11, 15-17), dated November 26, 2018
- A1-0718-60519, Procurement Audit (NQA-1 Req. 4, 7, 15-17, 2.14), dated August 9, 2018
- A1-0818-61175, Design Control Audit (NQA-1 Req. 3, 5-7, 11, 16-17), dated August 21, 2018

Purchase Orders (PO)

- PO-000161, "Piping Analyses Software Commitment Authorization," Revision 2, dated May 27, 2014
- PO-000978, NuScale Purchase Order for Piping Analyses Software, Revision 1, dated April 25, 2018
- PO-000834, NuScale Purchase Order for Piping Analyses Software, Revision 0, dated July 18, 2017
- PO-000834, NuScale Purchase Order for Piping Analyses Software, Revision 1, dated July 18, 2017
- PO-000161, NuScale Purchase Order for Piping Analyses Software, Revision 2, dated May 29, 2014

Engineering Calculations

- EC-B131-6907, "Reactor Flange Tool Seismic Analysis," Revision 0, dated January 2, 2019
- EC-T080-3468, "NIST-1 NRELAP5 Base Input Model," Revision 2, dated January 21, 2016
- EC-T080-6557, "NRELAP5 Assessment Against NuScale Loss of Feedwater Flow Test NIST-NLT-02a," Revision 0, dated August 16, 2018
- EC-T080-6620, "NRELAP5 Assessment of Spurious RRV Opening Test NIST-1 HP49," Revision 0, dated August 30, 2018
- EE-T080-5608, "NIST-1 Heater Rod Characterization," Revision 0, dated December 19, 2017

Design Control Documents

- Engineering Change Request (ECR-A010-64323), "Move RFT seismic analysis to a new document," Revision 0, dated January 28, 2019
- FS-B131-3112, "Module Assembly Equipment/Bolting Functional Specification," Revision 0, dated March 30, 2015
- EQ-B131-5469, "Design Specification for MEAB and CFT," Revision 0, dated August 1, 2018
- EP-0303-52592-F01, "Engineering Change Request Form," Revision 6
- ECR-A010-60797 "Refueling Tool Duration and 3D CNV Skirt Boundary Conditions," Revision 0, dated July 10, 2018
- Engineering Change Notice (ECN-A010-6569), "Refueling Tool Durations Addition and Appendix B Removal," Revision 0, dated July 24, 2018
- ER-A010-2453, "Seismic Analysis and Design Methodology for the Reactor Module," Revision 1, dated December 23, 2016
- ER-0000-4039, Station Blackout Analysis, Revision 0DI-0211-51466, "Safeguards Information Transmittal," Revision 0, dated September 30, 2016
- ECN-A010-6570, "CNV Skirt Boundary Conditions," Revision 0, dated July 24, 2018
- EC-A010-2322, "Reactor Module Seismic Model," Revision 5, dated May 30, 2018
- ECR-A023-61096, "Upper Core Plate Bolting Change," Revision 0, dated August 6, 2018
- ECN-A023-6683, "LRA Upper Core Plate Bolting and Fuel Pin Length Change," Revision 0, dated September 24, 2018

- ECN-A023-6681, “CSA Upper Core Plate Bolting Change,” Revision 0, dated September 24, 2018

Test Data Package

- TD-1216-52474, “HP-43 Test Data Package,” Revision 0, dated December 14, 2016
- TD-00718-6600, “HP-49 Test Data Package,” Revision 0, dated July 30, 2018

Drawings

- Drawing No. NP12-00B131-M-AS-6933-S01, “RFT Upper Support,” Revision 0, dated January 2, 2019
- Drawing No. NP12-00B131-M-AS-6933-S02, “RFT Upper Support,” Revision 0, dated January 2, 2019
- Drawing No. NP12-00B131-M-AS-6933-S03, “RFT Upper Support,” Revision 0, dated January 2, 2019
- Drawing No. NP12-01-B131-M-GA-5468, “MAEB Seismic Category Identification,” Revision 0, dated August 24, 2017
- Drawing No. NP12-00-B131-M-AS-5460-S01, “RFT Stand and Track Assembly,” Revision 1, dated February 20, 2019

Software Design Control

- PL-0003-3975, “NuScale Digital Safety Systems Project Plan,” Revision 2
- PL-0302-11000, “Digital I&C Software Requirements Management Plan,” Revision 2
- PL-0302-11001, “Digital I&C Software Verification and Validation Plan,” Revision 2
- PL-0302-11002, “Digital I&C Software Configuration Management Plan,” Revision 2
- PL-0302-11003, “Digital I&C Software Safety Plan,” Revision 2
- PL-0302-11004, “Digital I&C Software Master Test Plan,” Revision 1
- PL-0302-11005, “Digital I&C Software Management Plan,” Revision 2
- PL-0302-11006, “Digital I&C Software Development Plan,” Revision 2
- PL-0302-51265, “Digital I&C Software Training Plan,” Revision 1

Condition Reports (CR)

- CR-0518-60089, CR-1118-62936, CR-0917-56000, CR-1018-62367, CR-0918-61937, CR-0617-54417, CR-0617-54423, CR-0617-54426, CR-0618-60305, CR-1018-62367, CR-0918-61937, CR-1217-57624, CR-1217-57707, CR-0518-60097, CR-0119-64012, CR-0118-58214, CR-1018-62141, CR-0718-60985, CR-0718-60987, CR-0718-60983, CR-0918-61707, CR-0918-61706, CR-0918-61699, CR-0918-61700, CR-0918-61711, CR-0918-61708, CR-0918-61701, CR-0918-61703, CR-1217-57729, CR-1217-57730, CR-1217-57731, CR-1217-57732, CR-1217-57733, CR-1217-57735

Condition Reports Issued as a Result of the NRC inspection

- CR-0219-64698, dated February 27, 2019
- CR-0219-64713, dated February 28, 2019

Supplier Deviation Notices (SDN)

- SDN-0119-64311, SDN-0217-53162, SDN-0917-55911, SDN-0219-64595, SDN-0517-54185, SDN-917-55910

Surveillances

- Internal Surveillance No. S1-0918-61382-3, "Internal QA Surveillance of NuScale Safeguards Information Program," dated November 29, 2018
- Internal Surveillance No. S1-0717-54797-1, "2017 Independent Safeguard Information Program Surveillance," dated October 6, 2017