



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

June 5, 2019

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

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

SUBJECT: AUDIT PLAN FOR THE REGULATORY AUDIT OF NUSCALE  
POWER, LLC HUMAN FACTORS ENGINEERING  
VERIFICATION AND VALIDATION RESULTS SUMMARY  
REPORT SUPPORTING ANALYSES AND CONFIRMATORY  
ITEM CLOSURE VERIFICATION

The U.S. Nuclear Regulatory Commission staff plans to conduct an audit of the human factors engineering verification and validation results summary report and the supporting databases, to confirm that results in this report are consistent with regulations and applicable regulatory guidance. In addition, staff will verify that activities related to open items associated with other portions of the human factors process have been completed.

The audit will take place at NuScale Power, LLC Rockville office from June 11 – 13, 2019. The audit entrance will be held on June 10, 2019. The audit plan is provided as an enclosure.

Docket No. 52-048

Enclosure:

1. Audit Plan

cc: DC NuScale Power LLC Listserv

CONTACT: Prosanta Chowdhury, NRO/DLSE  
(301) 415-1647

SUBJECT: AUDIT PLAN FOR THE REGULATORY AUDIT OF NUSCALE POWER, LLC  
 HUMAN FACTORS ENGINEERING VERIFICATION AND VALIDATION  
 RESULTS SUMMARY REPORT SUPPORTING ANALYSES AND  
 CONFIRMATORY ITEM CLOSURE VERIFICATION  
 DATE: June 5, 2019

## DISTRIBUTION:

PUBLIC

LB1 R/F

MMoore, NRO

RidsOgcMailCenter

CCowdrey, NRR

AAgrawal, NRR

SLee, NRO

PChowdhury, NRO

GCranston, NRO

MScheetz, NRR

DDesaulniers, NRR

GBowman, NRR

NHughes, RES

BGreen, NRR

RidsAcrcAcnwMailCenter

**ADAMS Accession No: ML19150A321 \*via email****NRO-002**

OFFICE	NRO/DLSE/LB1/PM	NRR/DIRS/IRAB/BC	NRR/DIRS/IOLB/BC	NRO/DLSE/LB3/LA	NRO/DLSE/LB1/PM
NAME	PChowdhury*	AAgrawal* (Acting)	CCowdrey*	SGreen*	PChowdhury
DATE	5/30/2019	5/30/2019	5/30/2019	5/31/2019	6/5/2019

**OFFICIAL RECORD COPY**

**U.S. NUCLEAR REGULATORY COMMISSION  
AUDIT PLAN FOR THE REGULATORY AUDIT OF NUSCALE POWER, LLC  
HUMAN FACTORS ENGINEERING VERIFICATION AND VALIDATION RESULTS  
SUMMARY REPORT SUPPORTING ANALYSES AND CONFIRMATORY ITEM CLOSURE  
VERIFICATION**

**APPLICANT:** NuScale Power, LLC

**APPLICANT CONTACT:** Nadja Joergensen  
Mark Chitty  
Tim Tovar, et al.

**DATE:** June 11, 2019 – June 13, 2019

**LOCATION:** NuScale Power, LLC Office  
11333 Woodglen Avenue, Suite 205  
Rockville, MD 20852

**AUDIT TEAM:** Brian Green (NRR/DIRS/IRAB)  
Maurin Scheetz (NRR/DIRS/IOLB)  
Niav Hughes (RES/DRA/HFRB)  
David Desaulniers (NRR/DIRS)

**PROJECT MANAGER:** Prosanta Chowdhury (NRO/DLSE/LB1)

**PURPOSE**

The purpose of this regulatory audit is for the U.S. Nuclear Regulatory Commission (NRC) staff to confirm that the results described in the NuScale "Human Factors Engineering Verification and Validation Results Summary Report," RP-1018-61289 (HFE V&V RSR), Revision 0 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19077A330), are consistent with, and derived from, the state-of-the-art human factors principles required by Title 10 *Code of Federal Regulations* (10 CFR) 50.34(f)(2)(iii) and described in NUREG-0711, "Human Factors Engineering Program Review Model," Revision 3.

**BACKGROUND**

On January 6, 2017<sup>1</sup>, NuScale Power, LLC (NuScale) submitted its Standard Plant Design Certification Application (DCA) to the U.S. Nuclear Regulatory Commission (NRC) for review, approval, and granting of standard design certification for the NuScale Standard Plant Design. (ADAMS Accession No. ML17013A229). The DCA includes Final Safety Analysis Report (FSAR) Tier 2, Chapter 18, "Human Factors Engineering," Revision 2, which describes the human factors engineering (HFE) program for the NuScale Power Plant (ADAMS Accession No. ML18310A341).

---

<sup>1</sup> The Design Certification Application was submitted via a transmittal letter dated December 31, 2016.

The NRC staff is using the review criteria in NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,” Chapter 18, “Human Factors Engineering” and NUREG-0711 to determine whether the NuScale design complies with HFE-related NRC requirements.

FSAR Tier 2, Section 18.0, “Human Factors Engineering – Overview,” states the NuScale HFE program incorporates accepted HFE standards and guidelines including the applicable guidance provided in NUREG-0711, Revision 3.

The HFE Program Review Model described in NUREG-0711 consists of 12 elements (refer to Figure 1-1, “Elements of the HFE program’s review model,” of NUREG-0711 for additional information). NuScale submitted two types of technical reports with the DCA to address the 12 elements in NUREG-0711: “Human Factors Engineering Design Implementation Plan,” RP-0914-8544 (DI IP), Revision 2 (ADAMS Accession No. ML19119A378)” and V&V RSR, Revision 0. NUREG-0711, Section 1.2.2, “Review Elements,” explains that IPs describe processes and methods for performing HFE activities, and RSRs describe the results of performing those activities.

NuScale submitted an IP for the HFE verification and validation element and has completed the evaluation activities and analyses associated with this IP. The NRC staff conducted an audit of the associated data collection activities during an audit in July and August of 2018 (ADAMS No. ML18298A190).

NuScale V&V RSR, Revision 0 summarizes the analyses and results of the V&V process. The NRC staff has reviewed the RSR and determined that it is necessary to review certain databases and supporting analyses to confirm that the results in the RSR are consistent with NUREG-0711.

The staff has issued requests for additional information (RAIs) throughout the course of the review. A limited number of the RAIs associated with other NUREG-0711 review elements are currently considered confirmatory items. For instance, RAI 9372 addresses the means of verifying that the function allocations for the plant are appropriate (see Section 4, “Functional Requirements Analysis and Function Allocation,” of NUREG-0711). The NRC staff recognizes that the data collected during the V&V activities is important to drawing conclusions regarding the allocation of functions; therefore, resolution of this RAI has been delayed until the V&V RSR was complete. The NRC staff intends to use the audit to verify that this confirmatory item and others like it have been completed and if necessary, staff will request information be submitted on the docket.

## **REGULATORY AUDIT BASIS**

Subpart B of 10 CFR Part 52, “License, Certifications, and Approvals for Nuclear Power Plants,” Section 52.47, “Contents of applications; technical information,” requires that information submitted for a design certification (DC) must include the information necessary to demonstrate compliance with any technically relevant portions of the Three Mile Island requirements set forth in 10 CFR 50.34(f), except paragraphs (f)(1)(xii), (f)(2)(ix), and (f)(3)(v). As required by 10 CFR 50.34(f)(2)(iii), an applicant is to provide, for Commission review, a control room design that reflects state-of-the-art human factor principles prior to committing to fabrication or revision of fabricated control room panels and layouts. Chapter 18 of NUREG-0800 and NUREG-0711 contain guidance the NRC staff uses to assess whether an application complies with HFE-related NRC requirements.

As part of the DCA, NuScale submitted the following technical reports that are related to this audit:

- Verification and Validation Results Summary Report
- Verification and Validation Implementation Plan
- HFE Program Plan
- Task Analysis Results Summary Report
- Human System Interface (HSI) Design Results Summary Report
- HFE Interface Style Guide
- Generic Technical Guidelines

### **REGULATORY AUDIT OBJECTIVES**

The objectives of the audit include the following:

1. Verify the detailed descriptions of human engineering discrepancies (HEDs) are appropriately documented and prioritized.
2. Verify that the RSR and supporting analyses and assessments are accurate and consistent with each other.
3. Ensure that design changes that occurred because of the V&V activities do not negatively impact the Integrated System Validation (ISV) results.
4. Clarify statements in the RSR regarding simulator fidelity.
5. Clarify information regarding other open items/RAIs related to earlier HFE design activities. Below are some examples (not all inclusive):
  - a. Clarify how the HSI provides a design capability for remote shutdown of the reactor outside the Main Control Room (MCR), (NUREG-0711, Criterion 8.4.4.5(1)) based on NuScale's March 14, 2019, exemption request and application changes for Remote Shutdown System (RSS) functionality.
  - b. Verify that automation failures and degraded Instrumentation and Control (I&C) HSI conditions found during ISV testing were appropriately documented and prioritized and if applicable, resolved.
  - c. NRC staff's Chapter 18 Safety Evaluation Report (SER) Open Item 18-1 associated with RAI 9372: Verify that function allocations are supported by the V&V results.
  - d. Chapter 18 SER Open Item 18-2 associated with RAI 8747: Ensure the ISV supports the claims of the staffing plan.

- e. Chapter 18 SER Open Item 18-3 associated with RAI 9411 and RAI 8847: Verify NuScale's updated "Human-System Interface Style Guide," ES-0304-1381, Revision 3 (ADAMS Accession No. ML19134A022) conforms to Criterion 8.4.3(3) of NUREG-0711 and, ensure the Style Guide and V&V RSR are incorporated by reference in DCA Part 2, Tier 2.

### **INFORMATION AND OTHER MATERIAL NECESSARY FOR THE AUDIT**

1. Access to NuScale staff who are knowledgeable about and involved in administering V&V testing/analyses and the simulator.
2. Access to NuScale staff who are knowledgeable about the NuScale simulator design, information, analyses and tests used to model plant response in the simulator and the results of simulator performance testing conducted in support of the ISV.
3. Access to entries in the HED tracking system and any supporting analyses associated with the HEDs.
4. Results of Generic Technical Guidelines validation activities performed in conjunction with ISV and other validation activities.

### **TEAM ASSIGNMENTS**

Prosanta Chowdhury is the project manager.

The following team members will be responsible for reviewing human factors technical content:

- Brian Green
- Maurin Scheetz
- David Desaulniers
- Niav Hughes

Other staff members may be added if the need arises.

### **LOGISTICS**

The audit will be primarily conducted at the NuScale office in Rockville, MD.

The audit is scheduled to begin at 1:00 p.m. (EDT) on June 11, 2019, and end by 5:00 p.m. (EDT) on June 13, 2019.

The general format of the audit will include reviewing documents, reviewing HEDs in the tracking database, and conducting briefs with the NuScale staff.

The NRC staff may request documents in paper copy and/or be put into the electronic reading room prior to or during the audit.

### **SPECIAL REQUESTS**

None.

## **DELIVERABLES**

The audit team will issue a regulatory audit summary report within 90 days after the completion of the audit that will be placed on the docket and in ADAMS. The audit outcome could also identify any additional information to be reviewed in a follow-up audit or submitted separately for making regulatory decisions.

## **REFERENCES**

- NUREG-0711 - "Human Factors Engineering Program Review Model," Revision 3, dated November 2012 (ADAMS Accession No. ML12324A013)
- RP-0914-8543 – "Human Factors Engineering Verification and Validation Implementation Plan," Revision 5, dated April 29, 2019 (ADAMS Accession No. ML19119A371)
- RP-0914-8534 – "Human Factors Engineering Program Management Plan," Revision 5, dated April 29, 2019 (ADAMS Accession No. ML19119A341)
- RP-0316-17619 – "Human Factors Engineering Human System Interface Design Results Summary Report," Revision 2, dated April 29, 2019 (ADAMS Accession No. ML19119A397)
- RP-0316-17616, "Human Factors Engineering Task Analysis Results Summary Report," Revision 2, dated April 29, 2019 (ADAMS Accession No. ML19119A392) (TA RSR)
- RP-1018-61289, "Human Factors Engineering Verification and Validation Results Summary Report," Revision 0, dated March 18, 2019 (ADAMS Accession No. ML19077A330) (V&V RSR)
- ES-0304-1381, "Human-System Interface Style Guide," Revision 3, dated May 10, 2019 (ADAMS Accession No. ML19134A022) (Style Guide)