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

September 9, 2019

MEMORANDUM TO: Samuel S. 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 SUMMARY REPORT FOR THE REGULATORY AUDIT OF NUSCALE POWER, LLC, HUMAN FACTORS ENGINEERING VERIFICATION AND VALIDATION RESULTS SUMMARY REPORT SUPPORTING ANALYSES AND CONFIRMATORY ITEMS CLOSURE VERIFICATION

From June 11, 2019 through August 7, 2019, the U.S. Nuclear Regulatory Commission (NRC) staff conducted a regulatory audit of NuScale Power, LLC, documents, databases, and supporting analyses used to generate, "Human Factors Engineering Verification and Validation Results Summary Report," RP-1018-61289 (hereinafter referred to as the V&V RSR). The staff exited the audit with an exit briefing on August 7, 2019.

The goal of this regulatory audit was for the NRC staff to gain understanding regarding certain statements in the V&V RSR and to verify that the conclusions in the V&V RSR are supported by sound human factors analyses that have been prioritized, documented, and resolved in accordance with NUREG-0711, "Human Factors Engineering Program Review Model," Revision 3 (November 2012). The secondary goal was to clarify how the results of the verification and validation activities addressed certain open items in the staff's Phase 2 Safety Evaluation.

The NRC staff's audit plan, dated June 5, 2019, can be accessed via the NRC's Agencywide Documents Access and Management System under Accession No. ML19150A321. The NRC staff conducted the audit in accordance with the Office of New Reactors (NRO) Office Instruction NRO-REG-108, "Regulatory Audits." All the audit objectives documented on the audit plan were successfully met.

Docket No. 52-048

Enclosure:
Audit Summary Report

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

SUBJECT: AUDIT SUMMARY REPORT FOR THE REGULATORY AUDIT OF NUSCALE POWER, LLC, HUMAN FACTORS ENGINEERING VERIFICATION AND VALIDATION RESULTS SUMMARY REPORT SUPPORTING ANALYSES AND CONFIFMATORY ITEMS CLOSURE VERIFICATION DATE: SEPTEMBER 9, 2019

DISTRIBUTION:

PUBLIC	LB1 R/F
SLee, NRO	MScheetz, NRR
PChowdhury, NRO	BGreen, NRR
MMoore, NRO	LNist, NRR
GCranston, NRO	NuScale DC Listserv
AMasters, NRR	DDesaulniers, NRR
CCowdrey, NRR	NHughes, RES

ADAMS Accession Nos.:
PKG: ML19220B590
Memo/Enclosure: ML19220B675 ***via Email** **NRO- 002**

OFFICE	NRO/DLSE/LB1: PM	NRO/DLSE/LB1: LA	NRR/DIRS/IRAB: BC	NRO/DLSE/LB1: PM
NAME	PChowdhury*	MMoore*	AMasters*	PChowdhury
DATE	08/08/2019	08/13/2019	08/08/2019	09/09/2019

OFFICIAL RECORD COPY

U.S. NUCLEAR REGULATORY COMMISSION

HUMAN FACTORS ENGINEERING VERIFICATION AND VALIDATION RESULTS SUMMARY REPORT SUPPORTING ANALYSES AND CONFIRMATORY ITEMS CLOSURE VERIFICATION

AUDIT TEAM MEMBERS

Brian Green (NRR/DIRS/IRAB) (Staff)
Maurin Scheetz (NRR/DIRS/IOLB) (Staff)
Niav Hughes (RES/DRA/HFRB) (Staff)
David Desaulniers (NRR/DIRS) (Staff)
Prosanta Chowdhury (NRO/DLSE/LB1) (Project Manager)

BACKGROUND

On January 6, 2017[1], 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 (Agencywide Documents Access and Management System (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).

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, "Human Factors Engineering Program Review Model," Revision 3 (November 2012), to determine whether the NuScale design complies with HFE related NRC requirements.

The 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). NUREG-0711, Section 1.2.2, "Review Elements," explains that implementation plans (IPs) describe processes and methods for performing HFE activities, and results summary reports (RSRs) describe the results of performing those activities.

NuScale submitted an IP titled, "Human Factors Verification and Validation Implementation Plan" (V&V IP) for the HFE verification and validation element with the design certification. NuScale completed the evaluation activities and analyses associated with the IP during the course of the design certification review. The NRC staff conducted an audit of the associated

[1] The Design Certification Application was submitted via a transmittal letter dated December 31, 2016.

data collection activities during an audit in July and August of 2018 (Audit summary report can be accessed via ADAMS Accession No. ML18298A190).

In March of 2019, NuScale submitted, “Human Factors Engineering Verification and Validation Results Summary Report” (V&V RSR), RP-1018-61289, Revision 0 (ADAMS Accession No. ML19077A331), which summarized the analyses and results of the V&V process. The NRC staff reviewed the RSR and determined that it was necessary to review certain databases and supporting analyses to confirm that the results in the RSR are consistent with review elements in 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 were considered confirmatory items at the time this audit was conducted. The staff used this audit to verify that the work associated with resolution of these RAIs was complete.

Audit Activities

The staff developed the following audit objectives, which are stated in the audit plan (ADAMS Accession No. ML19150A321).

1. Verify that 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, partial 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.
f. 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.

6. Clarify information regarding Generic Technical Guideline (GTG) validation activities and results.

7. Clarify information regarding Chapter 13 SER Open Item 13.5-1 associated with RAI 9430: consistency between Type B Post Accident Monitoring variables and GTG flowcharts.

- To meet the objectives described above, the staff reviewed the following documents: "Human Factors Engineering Verification and Validation Results Summary Report" (V&V RSR), RP-1018-61289, Revision 0.
- "Integrated System Validation Test Report," RP-1018-62006, Revision 0 for audit.
- A smart sample of HEDs in Human Factors Engineering Issue Tracking System (HFEITS), the HED tracking database, and various supporting documents (such as screen shots of HSIs and procedures) that were hyperlinked in the database.
- GTG Validation checklists (GTG CA-3, GTG HC-8, GTG HP-3, GTG CI-6_CV-5).
- Excerpts from the ISV data collection video for Scenario VIII.
- "HED Post Development Testing," Revision 0.
- "ISV HED Validation Testing," February 22, 2019.
- Main Control Room Evacuation Abnormal Operating Procedure (Computer Based).
- Simulator Systems Not Modeled.
- Emergency Action Level, "(EAL) Quick Reference Chart."
- "HED#1 Additional Information."
- "Usage of Type B variables to assess the status of Critical Safety Functions" (Rev 4).

Audit Results

1. *Verify the detailed descriptions of human engineering discrepancies (HEDs) are appropriately documented and prioritized.*

The staff reviewed a sample of HEDs documented in the RSR by accessing the associated database entries.

The sample of HEDs were selected given the following criteria:

- The sample included the full range of HED priorities available. No priority 1 HEDs were identified in the RSR. One HED was initially identified as a potential priority 1 HED and then justified as a priority 2, therefore, this HED was included in the sample. A sample of priority 2 and 3 HEDs were also included.

- One HED was observed by staff during ISV data collection, therefore, staff wanted to track this HED through resolution.

- HEDs associated with the alarm system and/or automations were included because of the importance of these systems to operator performance and their identification in NUREG/CR-7126, "Human-Performance Issues Related to the Design and Operation of Small Modular Reactors," (June 2012), as issues related to small modular reactors.

- HEDs that were related to systems of interest related to Open Items in the Phase 2 SER (such as, the safety display and indication (SDI), RSS, or the emergency operating procedures (EOPs)).

- Any other HED description of interest that could have a potentially significant impact on human performance.

The sample included ten HEDs that were identified during HFE design verification activities, three HEDs associated with task support verification activities, and nine HEDs identified during integrated system validation activities.

The staff reviewed entries in the HFEITS database and found that the results were consistent with the types of information described in relevant NUREG-0711 criteria. Hyperlinks to supporting documents made it clear what the identified issue was, what evidence was collected to understand the problem, recommendations on how to resolve the issue, and when applicable, a description of the associated resolutions was provided.

The staff observed that the samples of HEDs were prioritized based on the significance of the HED issue and that appropriate documentation was available to support these prioritizations. The staff found that HEDs in the sample were appropriately prioritized in accordance with the V&V IP.

The staff noted that there was one HED that had initially met the criteria for priority 1 HEDs. This HED was subsequently recategorized as a priority 2 HED. Both crews tested failed to meet an ISV acceptance criterion associated with making an emergency action level (EAL) declaration during one test scenario. NuScale provided a justification in the V&V RSR for the decision to classify the HED as a priority 2 instead of priority 1. The justification included a discussion of test artifacts that contributed to the failures and the assessment that the failure did not impact plant safety. Discussions with the applicant added additional perspective. The fifteen-minute time frame associated with the EAL declaration is conservative given the time frames associated with accident scenarios. In addition, there were no negative nuclear safety consequences because the operators and the plant design adequately addressed the underlying event.

The staff was concerned that although there were no nuclear safety issues in this case, in a more serious event, one with potential nuclear safety issues, operators might not be able to implement the emergency plan as required.

The staff confirmed that the SDI had the parameters available to perform the EAL declarations by reviewing the "EAL Quick Reference Chart" and "HED#1 Additional Information" in the applicant's electronic reading room (ERR) to rule out that the available HSIs were presenting inadequate information to the operator as the cause of the crew failures. The staff compared the EAL wall chart to the SDI and found that information presented on the SDI was sufficient to support operators while making the EAL declaration. The staff found that the technical specifications were a sufficient reference to clarify any ambiguity. Therefore, the staff was able to rule out the design of the HSIs as the cause of the crew failures.

The staff noted that creation of the EAL wall chart is a COL activity; therefore, the version used in the ISV was just an example of what the wall chart might look like. The staff observed that the version used was similar to the EALs at existing plants. Making changes to the EALs to better align this version of the wall chart with the SDI is of no practical value because a licensee will eventually create and validate their own version.

By ruling out the design of the SDI and the EAL wall chart as significant contributing factors, the staff concluded that improved training, NuScale's path to resolving the HED, was sufficient.

In summary, the staff found that the HED analysis and documentation was sufficient to support the claims made in the RSR. The staff found that the sample of HEDs reviewed was appropriately prioritized. While there was initially some disagreement about the proper classification of a single HED described above, this difference of opinion of priority is of little consequence because according to the NuScale Human Factors Engineering Program Plan, NuScale will correct all priority 1 and 2 HEDS. In other words, NuScale has committed to resolve the issue regardless of whether it is designated priority 1 or 2. The RSR describes a reasonable means for resolving the issue. Therefore, this HED was considered an anomaly and is not considered to be indicative of a deficiency in the way the applicant has documented or assessed HEDs.

2. *Verify that the RSR and supporting analyses and assessments are accurate and consistent with each other.*

The staff reviewed the sample of HEDs described above to confirm that the supporting analyses in HFEITS were accurate and consistent with each other and adequately represented the brief summaries in the V&V RSR.

The staff found that the HEDs appeared to be generated based upon the methods described in the V&V implementation plan. The staff found that the one-line summaries provided in the V&V RSR were adequate representations of the more thorough analyses provided in HFEITS and other hyperlinked supporting analyses. The staff confirmed this by reviewing the Integrated System Validation Test Report document in the ERR. This report was consistent with the conclusions in the V&V RSR and it contained additional details and analyses that supported the conclusions drawn in the ISV RSR.

In addition, the staff asked questions regarding the overall analyses described in Sections 5.7 and 5.8 of the V&V RSR. For instance, staff questioned the appropriateness of using ratios to

compare the time operators took to complete certain actions to the time available to do so. Using ratios for time comparisons can be problematic when considering short duration tasks because the use of ratios can suggest adequate time margin when in absolute terms the margin may be quite small. To clarify, NuScale provided supporting analyses which confirmed that there were very few short time frame actions considered and explained that those actions that had short time frames were conservatively established to meet regulatory requirements (such as, EAL determinations) and that they were not associated with actions required for safe plant performance.

In summary, the staff observed that the results in the V&V RSR were representative of sound HFE analyses that were adequately tracked in HFEITS.

3. *Ensure that design changes that occurred because of the V&V activities do not negatively impact the Integrated System Validation (ISV) results.*

NuScale has committed to resolving all priority 1 and 2 HEDs prior to turning the plant over to a combined license (COL) applicant (see section 6.0, "Human Engineering Deficiencies Overview," of the V&V RSR). Priority 3 HEDs may be resolved by NuScale or they may be handed over to a COL applicant for their assessment and potential resolution according to the V&V IP.

The V&V RSR indicates that there are no priority 1 HEDs. Multiple priority 2 and priority 3 HEDs were identified.

A sample of eight resolved HEDs was drawn from the HEDs identified in Tables 6-3 and 6-4 of the V&V RSR. This sample included the EAL HED discussed in detail above as well as a selection of other HEDs of interest.

The staff observed that the sample of resolved HEDs had reasonable recommendations that were likely to resolve the issue documented in HFEITS. Confirmation that an HED was resolved was noted in HFEITS. Hyperlinks were used to identify any documentation supporting the resolution. In addition, the staff observed that the NuScale HFEITS Review Team had reviewed and signed off on each recommendation.

Staff looked for instances when the applicant decided not to follow the recommendations documented in the HED. Only one instance of this was identified in the sample. In this case, the staff found sufficient justification for not following the recommendation. In the other HEDs, the staff observed that NuScale had made changes to the HSI design, training, or procedures and verified the acceptability of the change according to the V&V IP.

The EAL declaration HED described above was a unique case in which recommendations are made for the COL applicant to take certain actions, but for which NuScale had not conducted any testing to confirm that the recommendation (additional crew training) was adequate to resolve the HED. The staff found this to be reasonable because training is a responsibility of a COL holder therefore, it is not practical to conduct training within the design certification process. Although it would have been possible to send both crews through a remedial training program, it would have been impossible to conduct the retest without the crews experiencing some level of preconditioning to the importance of EAL declarations. The results of such a test would have ultimately been of little value. In addition, operating experience with the current fleet of reactors suggests that training is a reasonable means of addressing EAL declaration failures.

The staff noted that NuScale provided insights to the COL training staff in Appendix C, "Training Inputs to COL Holder Approved Training Program," of the V&V RSR to help ensure that the insights from the V&V are considered by COL training programs.

The staff observed no bias to justify rather than correct issues. In other words, NuScale appeared to make design changes to support the operators, even in cases when it might be justifiable to take no action at all.

The staff also considered the means used to verify and/or validate that design changes were effective and did not introduce new errors. In general, the same method was used to confirm that the change was adequate as was used to identify the original issue. For instance, verification activities (such as, identifying that a valve icon was not consistent with the HSI Style Guide) were reverified by comparing the new HSI with the same standard to ensure compliance.

For issues identified during ISV, a scenario-based test was used to reverify that the change was appropriate. Some minor changes to the ISV test plan were observed. The staff reviewed an example of a modified test plan and found that it changed elements that were not significant to the validity of the scenario. For instance, in one scenario it was sufficient to test just two operators instead of five because the other three operators would not have a need to interact with the HSI that was modified. In addition, the scenario was truncated after the HSI was used because additional data regarding other HSIs was not within the scope of the retest. Therefore, the staff concluded that the changes to the validation test plans were minor and did not jeopardize the integrity of the test.

The staff noted that some HEDs were not resolved at the time of this audit. Those that remained open were priority 2 or 3 HEDs. These issues do not have impacts on safety. However, resolution of these issues has a potential to impact safety by introducing new problems. By meeting the objectives in this audit, NuScale has demonstrated that their HED resolution process is adequate to confirm that resolutions have been effective. Therefore, the staff considers it very unlikely that the changes to the unresolved HEDS will introduce a new issue that could negatively impact safety.

4. Clarify statements in the RSR regarding simulator fidelity.

The staff sought to better understand what the applicant used to develop the simulator model and what they used to compare simulator response with estimated or expected plant response during simulator certification and scenario-based testing (which they used to meet NUREG-0711 criteria for validation testbed). The applicant explained that they relied on Subject Matter Experts to review simulator test results and that the term "best-estimate response" refers to information about expected plant response gathered from subject matter experts, the Chapter 15 analyses, and probabilistic risk assessment analyses.

Table 3-2, "List of Plant Systems Not Simulated," of the RSR provides the justifications for why some systems were not addressed in the simulator. According to this table, many systems were not included in the simulator because there was no associated control room interface. The staff expressed concerns with this rationale because some systems without control room interfaces can have dramatic effects on plant performance (such as, the jet pumps in a traditional boiling water reactor). NuScale supplemented this table with "Systems Not Modeled.pdf," for staff review in the ERR. The staff found that this document clarified the

reason specific systems were not simulated and described the potential impact to the ISV testing. The staff recommended that the document be docketed as a supplement to the RSR, because the supplemental information is necessary for the staff to evaluate the fidelity of the simulator as a validation testbed.

5. Clarify information regarding other Open Items/RAIs related to earlier HFE design activities.

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, partial exemption request and application changes for Remote Shutdown System (RSS) functionality.

The staff viewed video footage from ISV Scenario VIII which included an MCR evacuation, MCR operator immediate action to trip units and initiate engineered safety features actuation system (ESFAS) functions, one unit failing to trip during immediate actions, operators dispatching to the RSS and operators monitoring and control in a simulator RSS-like station (The NuScale simulator was converted to a room similar to the RSS by turning off unneeded screens and only using hardware that would be available in the RSS). Additionally, the scenario footage included RSS operators initiating a successful non-safety related trip of the unit that failed to trip from the MCR using MCS controls and displays in the RSS. The RSS operators then dispatched a field operator (using a procedure) to module protection system (MPS) cabinets to execute safety related trips required by procedure for MCR evacuation. The NRC staff observed that during this scenario, it took an MCR operator 3 seconds to trip and activate ESFAS functions for one module from HSI in the MCR. The NRC staff also reviewed the Abnormal Operating Procedure (AOP) for MCR Evacuation and found that it contained detailed information for evacuation and remote shutdown actions which were prioritized as follows:

1) Shutdown in MCR prior to exiting (watched this scenario from ISV).

2) Insert trips from module control system (MCS) in RSS (non-safety) HSI is same as that in MCR for MCS.

3) Send operator to MPS cabinets to insert safety related trips.

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.

Automation failures and degraded I&C HSI conditions were tested multiple times during the ISV. The applicant did not identify any priority 1 or 2 HEDS related to automation failures or degraded I&C HSI conditions. The NRC staff reviewed the applicant's HED documentation for two priority 3 HEDs that contained various HSI enhancements for automations. For example, operators requested that the automation HSI reveal all steps of the automation and not just the step currently being executed by the automation. The applicant received positive feedback during ISV regarding the HSI's ability to notify operators about automation failures. Results from V&V indicate that operators can safely control the plant with degraded HSI.

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.

The staff asked NuScale to discuss the impact of the ISV results on the function allocations described in the Functional Requirements Analysis/Function Allocation RSR. The staff observed that some of the HEDs identified in ISV were related to automations; however, the resolution of these HEDs did not cause changes to the function allocation (such as, automating an action that was manual or removing automation and replacing it with a manual action) and there was no impact on plant safety. Therefore, the staff observed that the ISV results were an adequate means of confirming the initial allocation of functions.

d. Chapter 18 SER Open Item 18-2 associated with RAI 8747: Ensure the ISV supports the claims of the staffing plan.

The results provided in the V&V RSR, as supported by the documents reviewed in this audit, support the claims of the staffing plan. The results associated with the pass/fail acceptance criteria were positive with only the single exception described under Objective 1 above. The staff found that although there were challenges to operators under a specific set of low probability conditions, these challenges could be overcome with the staff available per the staffing plan given improved training. Moreover, the challenges to operators at making EAL declarations appear to have been limited to these specific conditions. Operators were able to successfully make EAL declarations in other tests when needed.

In addition, the results suggest that overall situation awareness was good, and that workload was reasonable and was not likely to overwhelm operators under a wide variety of operating tasks. There were no conditions when measured situation awareness or workload were unacceptable, and only a few when conservative thresholds were met for additional investigation.

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-0711and, ensure the Style Guide and V&V RSR are incorporated by reference in DCA Part 2, Tier 2.

The staff reviewed Revision 3 of the Style Guide and the HEDs identified during V&V related to the Style Guide. The staff noted two HEDs from ISV (HFEITS Nos. H-03587 and H-03589) that contain examples of how the Style Guide does not contain aspects of the HSI and instances where the HSI is not in accordance with the Style Guide. The staff did not find any impact to safety from these discrepancies. The instances are documented as HEDs which reflect the iterative nature of the Style Guide. The applicant used the Style Guide as intended for verification activities and documenting details that can improve the usability of the Style Guide for future design purposes.

NuScale agreed to incorporate by reference Style Guide and V&V RSR in the next revision of the DCA. The staff will confirm that the Style Guide and V&V RSR are incorporated by reference in DCA Part 2, Tier 2, when the applicant submits the next revision (Revision 3) of the DCA. Since this activity is not yet complete, this audit objective is not completely met. This item is being tracked as a confirmatory item in the staff SER.

6. *Clarify information regarding Generic Technical Guideline (GTG) validation activities and results.*

The staff asked NuScale to explain how they validated the GTGs during verification and

validation activities and reviewed validation checklists for the critical safety functions. The applicant explained how improvements were made to the usability of the GTGs during validation. The staff did not find any priority 1 HEDs related to GTG implementation.

7. *Clarify information regarding Chapter 13 SER Open Item 13.5-1 associated with RAI 9430: consistency between Type B Post Accident Monitoring variables and GTG flowcharts.*

The staff asked NuScale to explain the differences in plant parameters used for monitoring and assessing the critical safety functions listed as Type B variables in DCA Part 2, Tier 2, Chapter 7, "Instrumentation and Controls," and those used in the GTGs. NuScale explained that the list of Type B variables in Chapter 7 are an encompassing set of instruments that could potentially be used to assess the NuScale plant critical safety functions. During GTG development, some of these variables were found as not necessary for the purpose of the GTG functional objectives, however, all of the variables used in the GTGs are included DCA Part 2 Tier 2, Chapter 7, Table 7.1-7, "Summary of Type A, B, C, D and E Variables," and are available to the operators on the Safety Display Indication System in the main control room.

CONCLUSION

The staff conducted an exit brief with NuScale on August 7, 2019, where the staff reviewed the results documented in this report.

The staff recommended that NuScale docket the file, "Systems Not Modeled.pdf," as a supplement to the V&V RSR. NuScale confirmed that this information is already in the new revision.

The staff noted that they were able to accomplish all of the objectives associated with this audit with one minor exception. Objective 5e was partially met because it involves ensuring certain information is included in the next revision of the DCA. NuScale confirmed that the necessary information is in the draft version of the DCA, which is expected to be submitted in its final form by the end of August 2019. The staff will track this via an existing confirmatory item associated with the HSI Style Guide.

In conclusion, the staff found that information in HFEITS and the supporting analyses were sufficient to support the conclusions documented in the V&V RSR. These analyses have been conducted in accordance with applicable criteria in NUREG-0711 and the results are positive supporting the safe operation of the NuScale design given the proposed staffing levels of six operators.