RAIO-0618-60567

June 20, 2018

Docket No. 52-048

U.S. Nuclear Regulatory Commission
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Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 428 (eRAI No. 9360) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 428 (eRAI No. 9360)," dated April 23, 2018

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) response to the referenced NRC Request for Additional Information (RAI).

The Enclosures to this letter contain NuScale's response to the following RAI Questions from NRC eRAI No. 9360:

- 18-41
- 18-42
- 18-43

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 428 (eRAI No. 9360). NuScale requests that the proprietary version be withheld from public disclosure in accordance with the requirements of 10 CFR § 2.390. The enclosed affidavit (Enclosure 3) supports this request. Enclosure 2 is the nonproprietary version of the NuScale response.

This letter and the enclosed responses make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Steven Mirsky at 240-833-3001 or at smirsky@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9360, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9360, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0618-60568

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Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9360, proprietary

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Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 9360, nonproprietary

Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 9360
Date of RAI Issue: 04/23/2018

NRC Question No.: 18-41

Title 10 of the Code of Federal Regulations (10CFR) Section 52.47(a)(8) requires an applicant for a design certification to provide a final safety analysis report (FSAR) that 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). Section 10 CFR 50.34(f)(2)(iii) requires an applicant 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, "Human Factors Engineering," of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," and NUREG-0711, "Human Factors Engineering Program Review Model," identify review criteria the staff uses to evaluate whether an applicant meets the regulation. The FSAR, Tier 2, Section 18.0, "Human Factors Engineering - Overview," indicates that the human factors engineering (HFE) program incorporates the applicable guidance provided in NUREG-0711, Revision 3. This regulatory basis applies to the first two questions in this RAI.

Review Criteria

NUREG-0711, Review Criterion 2.4.4(2) says, "The applicant's method should…track issues until the potential for negative effects on human performance is reduced to an acceptable level."

Application and Evaluation

"Human Factors Engineering Program Management Plan (HFE PMP), Section 5.1, "Availability of Human Factors Engineering Issue Tracking System," says the applicant uses a database to track human engineering discrepancies until resolution. The application includes a milestone for when Priority 1 HEDs will be addressed in the design and will be closed in the tracking system. The HFE PMP, Section 5.4.8, "HED Process Flow" says Priority 2 HEDs have a direct or indirect impact on plant performance and operability and will be resolved before the plant design is completed.

Because resolution of Priority 1 and 2 human engineering discrepancies provides assurance that negative effects of the human engineering discrepancy (HED) will be reduced to an acceptable level, the staff would like to understand at what point the applicant considers the plant design to be complete and when Priority 2 HEDs may be expected to be resolved.

Additional Information Requested

Please identify a milestone when the plant design will be considered complete and solutions to Priority 2 HEDs will be implemented in the design.

NuScale Response:

NuScale design activities supporting Chapter 18 of the Design Certification are complete when:

- all priority 1 and 2 HEDs are closed,
- retesting required for HED closure is completed satisfactorily,
- the Verification and Validation Results Summary Report is submitted, and
- all Chapter 18 RAIs have been satisfactorily addressed.

Section 2.0, Configuration Control of HSIs, was added to RP-0914-8544, Human Factors Engineering Design Implementation Implementation Plan, to document this milestone.

Impact on DCA:

RP-0914-8544, HFE Design Implementation Implementation Plan, and conforming changes to RP-0914-8543, Human Factors Verification and Validation Implementation Plan, have been revised as described in the response above and as shown in the markup provided with this response.

Human Factors Engineering Design Implementation Implementation Plan

~~September 16, 2016~~
Draft Revision ~~1~~2
Docket: PROJ0769
NuScale Nonproprietary

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Department of Energy Acknowledgement and Disclaimer

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Abstract

~~NUREG-0711 provides guidance for the development of methodologies to address the elements of the human factors engineering program. Design implementation is an element of the HFE program that verifies conformance of the as-built design to the planned design. The Design Implementation element is complete after the plant construction is complete.~~

~~This implementation plan describes the methodology for conducting the design implementation element. The methodology is consistent with the applicable provisions of Section 12 of NUREG-0711, Revision 3.~~This implementation plan describes the methodology for conducting the design implementation element of the human factors engineering (HFE) program. Design implementation is an element of the HFE program that verifies conformance of the as-built design to the planned design. The Design Implementation element is complete once the HFE inspections, tests, analyses, and acceptance criteria (ITAAC) item is closed.

The methodology described is consistent with the applicable provisions of Section 12 of U.S. Nuclear Regulatory Commission, "Human Factors Engineering Program Review Model," NUREG-0711, Rev. 3 (Reference 9.2.3).

Executive Summary

The methodology for design implementation ensures that the as-built HFE design of the NuScale Power plant accurately reflects the verified and validated design resulting from the human factors engineering design process. This implementation plan describes how ownership of the HFE program is transferred from NuScale to a licensee and the actions a licensee completes in order to close the HFE ITAAC. Design implementation activities include evaluation of those aspects of the design that were not addressed during human factors verification and validation. The methods used to verify that the final human-system interfaces, facility configuration, procedures, and training program conform to the planned design include~~ing configuration control,~~ ~~HFE~~subject matter expert reviews and~~,~~ plant walkdowns~~, and review of potential design changes~~. The HFE issues identified during these activities are documented, evaluated, and resolved in the licensee's quality assurance (QA) policy related programs and processes. Any changes to the human-system interfaces are addressed by the licensee.~~tracked as human engineering discrepancies within the HFE issues tracking system. Conformance of the as-built design to the planned design is assured by an inspections, tests, analysis, and acceptance criteria item that tracks the design implementation activities. Any changes to the human-system interfaces following fuel load are addressed by the holder of a combined license.~~

1.0 Introduction

1.1 Purpose

This document is designed to be implemented by a licensee and ensures actions needed to address the HFE ITAAC are completed. Because a transition in ownership of HFE design, configuration control, and corrective action resolution must occur, specific transition criteria are provided. Prior to meeting these criteria NuScale maintains responsibility for HFE program and process controls. When transition criteria are met, NuScale will provide a turnover package as described in Section 2.0 and the licensee assumes responsibility for the HFE program and process controls.

This document provides the implementation plan (IP) for design implementation (DI) within the NuScale ~~plant human factors engineering (~~HFE~~)~~ program. DI demonstrates that the HFE program "as-built" design of the human-system interface (HSI), facility configuration, procedures, and training program accurately reflects the verified and validated design resulting from the HFE design process. DI activities also include an evaluation of those aspects of the design that were not addressed during the human factors verification and validation (V&V) including new human error deficiencies (HEDs) identified after completion of the V&V.

Features evaluated during DI generally include those that cannot be accurately simulated:

- ergonomic considerations such as lighting and background noise
- HSIs outside of the main control room (MCR) but within the NuScale plant HFE program scope

Priority 3 ~~Human engineering discrepancies (~~HEDs identified~~) generated~~ during V&V and HEDs identified after completion of the V&V are tracked and resolved in accordance with Section 3.0 of this document. ~~that do not have any impact on plant safety or plant performance and operability, but are determined to require resolution, are resolved during DI. The HEDs that are generated after completion of V&V that are determined to require resolution are also resolved during DI. Resolution of the HEDs is in accordance with the process described in the HFE Program Management Plan (Reference 8.2.1).~~

~~Any reevaluation or HFE program activity iterations that are needed after V&V are conducted and documented during DI. The DI element of the HFE program is complete after the plant construction is complete. Any changes to the HSI following fuel load are addressed by the combined license holder.~~

Completion of DI activities ~~is tracked and confirmed by an inspections, tests, analysis, and acceptance criteria (ITAAC) item. This~~ ensures that the as-built HFE design conforms to the verified and validated design resulting from the HFE design process hereafter called the post V&V HFE design. The HFE ITAAC tracks completion of DI activities and therefore~~. Therefore~~, a results summary report (RSR) is not prepared for the DI element of the HFE program. ~~as part of design certification.~~

1.2 Scope

For the MCR and each local control station (LCS), the DI element confirms that:

- ~~the facility configuration of~~ the as-built design matches the post V&V HFE design ~~aspects of the facility that were simulated during the integrated system validation (ISV).~~
- other aspects of the facility that were not simulated but are relevant to the overall HFE program are evaluated using an appropriate V&V method.
- HFE design changes made subsequent to completion of the V&V have been properly integrated into the post V&V HFE design.

The HSIs, procedures, and training program evaluated for conformance apply to the MCR and certain LCSs during normal, abnormal, and emergency operating conditions. This IP does not apply to maintenance or refueling activities, activities completed by craft/technical personnel (i.e., mechanical, electrical, or instrumentation and control (I&C), health physics, chemistry, engineering, or information technology), or activities associated with ~~the remote shutdown station (RSS),~~ the technical support center ~~(TSC)~~, emergency operations facility ~~(EOF)~~, operations support center ~~(OSC)~~, or any other emergency response facilities ~~unless they are determined to impact licensed operator responsibilities~~ (see Reference 9.2.1).

1.3 Abbreviations and Definitions

Table 1-1. Abbreviations

Term	Definition
DC	design certification
DI	design implementation
HED	human engineering discrepancy
HFE	human factors engineering
~~HFEITS~~	~~human factors engineering issue tracking system~~
HPM	human performance monitoring
HSI	human-system interface
IHA	important human action
IP	implementation plan
ISV	integrated system validation
ITAAC	Inspections, tests, analyse~~i~~s, and acceptance criteria
LCS	local control station
MCR	main control room
NRC	Nuclear Regulatory Commission
QA	quality assurance
RSR	results summary report
~~RSS~~	~~remote shutdown station~~
SME	subject matter expert
~~TSC~~	~~technical support center~~

Term	Definition
V&V	verification and validation

2.0 Configuration Control of HSIs

Changes to the post V&V HSI design will be controlled under the NuScale Appendix B programs and processes and the applicable 10 CFR 52 Appendix, Section VIII.B.5 (50.59-like process). NuScale is responsible for maintaining HFE design configuration control until the turnover requirements are met.

NuScale design activities supporting Chapter 18 of the Design Certification (DC) are complete when the DC is approved by the NRC. Chapter 18 is supported by completion of the following:

- all priority 1 HEDs are closed
- retesting required for priority 1 HED closure is completed satisfactorily
- the V&V results summary report is submitted
- all NRC Requests for Additional Information are satisfactorily addressed

NuScale will be prepared to turnover responsibility for HFE program implementation to the licensee when:

- 10 CFR 52 Appendix specific to the NuScale DC is issued.
- the licensee's QA policy is approved by the NRC.

Approval of the QA policy establishes programs and processes comparable to those used in the NuScale HFE program. Turnover of the HFE program implementation responsibilities to the licensee is supported by the following:

- all priority 2 HEDs are closed
- retesting required for priority 2 HED closure is completed satisfactorily

Turnover of HFE responsibilities to the licensee marks the end of NuScale engineering activities associated with the DC Chapter 18 implementation.

When turnover requirements are met NuScale will provide the following material:

1. The HFE design configuration validated by the ISV.
2. The procedures and training documentation used to support the ISV.
3. NuScale Generic Technical Guidelines (GTGs) for emergency procedures.
4. HFE design changes and testing results demonstrating design change acceptability for all priority 1 HEDs identified after submittal of the V&V RSR.

5. HFE design changes and testing results demonstrating design change acceptability for all priority 2 HEDs that were not addressed in the V&V RSR.

6. HFE design changes made as a result of addressing priority 3 HEDs.

When the licensee assumes responsibility for the HFE program, they will track and resolve HEDs under their QA policy related programs and processes.

~~2.0~~3.0 Design Implementation Assessments

Design implementation uses the following methods to verify that the final HSIs, facility configuration, procedures, and training program conform to the post V&V HFE design: ~~planned design that resulted from the HFE design process and V&V activities:~~

- ~~configuration control~~
- ~~HFE~~subject matter expert (SME) review
- plant walkdowns
- ~~review of design changes~~

The licensee is responsible for completing assessments of the following elements:

- conditions that could not be accurately simulated in the ISV
- negative findings in the comparison of the as-built configuration to the post V&V HFE design
- open priority 3 HEDs
- new HEDs identified as the design matures

Each of these elements could potentially identify the need for an HFE design change. The licensee's programs and processes determine when such changes are implemented. It is expected that some HFE design changes will not have sufficient priority to be implemented prior to the ITAAC closure. For those that do, the design change amends the post V&V HFE design. The amended design is used as the standard for verifying that the as-built configuration is consistent with the design. ITAAC closure is designed to verify the amended HFE design is properly integrated with the post V&V HFE design.

To accomplish this integration the licensee performs the following actions:

- the as-built design is compared to the post V&V design. Deviations are documented.
- each deviation is justified. If the deviation is caused by implementing an approved modification then the deviation is considered justified.
- deviations that cannot be justified are resolved in accordance with Section 4.0
- when all deviations are justified, the deviations as a group are evaluated to determine if there is any collective significance that would invalidate the ISV conclusions

3.1 Human System Interface Assessment

The DI assessments for software and~~,~~ hardware~~, and facility~~ configurations confirm clear configuration-controlled design traceability for HSI components (alarms, controls, and indications~~, and procedures~~) and peripheral equipment. ~~The as-built configuration is compared to the drawings, specifications, and other final design documents used for ISV to determine conformance. If the as-built configuration is not confirmed to be in~~

~~conformance with these design documents, further HFE review is conducted to determine if the as-built HSI is equivalent to the HSI of the ISV.~~

The DI assessment for HSI configuration is conducted by plant walkdown and SME reviews and includes:

- Conformance with HFE design documents such as the HFE style guide, display schematics, drawings and specifications
- Screen navigation
- Control functionality
- Automation functionality
- Alarm and notification functionality
- Procedure interface functionality

3.2 Facility Configuration Assessment

The DI assessment for facility configuration is conducted by performing plant walkdowns ~~and includes~~that include the:

- physical configuration of workstations, panels, and displays
- visibility and sight lines
- accommodations for communication
- inclusion of emergency plan and personal protection equipment
- lighting
- background noise
- environmental controls/conditions (e.g., temperature and humidity)

The evaluation of aspects of the facility not simulated (e.g., LCSs) but relevant to the overall HFE program include:

- a walkdown to confirm conformance to the latest approved HFE design documentation including the HFE style guide.~~approved by the HFE team and that these components do not challenge conclusions of the V&V.~~
- a ~~subject matter expert (~~SME~~)~~ review of:
  - the suitability of the LCS for executing the operating procedures where operating procedures direct use of that LCS (i.e., typically not computer-based procedures).
  - the suitability of those procedures.

3.3 Procedures and Training Material Assessment

The DI assessment of procedures and training material compares the final HSIs, procedures, and training material with the post V&V HFE design and the procedures and training material supporting the development of that design. Any identified discrepancies should be corrected, or justified.

Emergency operating procedures should be evaluated against the GTGs. The GTGs provide the design basis for these procedures and are a more authoritative source than the emergency procedures used for the ISV.

- ~~an SME evaluation of training material used for the MCR and LCS HSIs to ensure it comprehensively includes the material provided to operators who participated in the ISV.~~

~~Where configuration-controlled design traceability, HFE review for HSI equivalency to the HSI of the ISV, and/or plant walkdown do not confirm that the as-built HSIs, procedures, and training program design is the planned design, an HED is generated. If an HED evaluation determines that a design change would potentially resolve the HED, a design change review is conducted to determine the significance of the differences between planned and as-built. If the design change review concludes that the design change has no impact on the completed ISV, then a specific validation method (e.g., tabletop walkthrough, mockup, part-task simulator, or plant walkdown) is determined. If the ISV results are impacted by the design changes, the applicable portion(s) of ISV are repeated.~~

~~The design change review also determines the need to reiterate or repeat other elements or activities of the HFE program and the extent of this rework.~~

~~3.0~~4.0 Human Factors Engineering Issue~~s Tracking System~~ Resolution

The following milestones are associated with HED resolution:

- all priority 1 HEDs will be resolved prior to issuing the V&V RSR.
- all priority 2 HEDs generated during V&V activities and those identified after completion of the V&V are resolved by NuScale prior to turning over configuration HFE program control to the licensee.
- all priority 3 HEDs generated during V&V and those identified after completion of the V&V are either resolved by NuScale prior to turning over HFE program responsibilities to the licensee or transferred to the licensee.

The transferred HEDs and HEDs identified during the DI activities described in Section 3.0 are tracked and resolved in the licensee's QA policy programs and processes. Some HEDs may be on-going due to anticipated technology or other advancements.

For each HED, an evaluation is conducted to determine:

- if the configuration, procedure, or training design is equivalent to the V&V HFE design. If equivalent, the basis for the equivalency shall be documented and design, procedure and training documentation revised as necessary.
- if a design change is needed to correct the as-built configuration so it conforms to the post V&V HFE design.
- If the current design is different from the post V&V design but potentially acceptable. If potentially acceptable, a design change review is conducted to determine the significance of the differences between planned and as-built. If the design change review concludes that the design change is acceptable and has no impact on the completed ISV results, then a specific validation method (e.g., tabletop walkthrough, mockup, part-task simulator, or plant walkdown) is determined. If the ISV results are impacted by the design changes, the applicable portion(s) of ISV are repeated.
- if procedure changes are necessary, procedural changes are validated in accordance with the licensee's procedure change process.
- if training changes are necessary. Training changes are validated in accordance with the licensee's program for Systematic Approach to Training.

~~HFE issues found during the DI activities described in Section 2.0 are documented, evaluated, and tracked as HEDs within the HFE issues tracking system (HFEITS) (see Reference 8.2.1). As described in the human factors V&V IP (Reference 8.2.2), HEDs from earlier HFE program elements and those generated during V&V activities are closed prior to ISV.~~

~~HEDs generated during V&V that do not affect plant safety or plant performance and operability, but determined to require resolution, and HEDs generated after completion of V&V that are determined to require resolution are *resolved* during DI. Some HEDs may not be resolved during HFE program activities and may be on-going due to anticipated technology or other advancements; however, all HEDs are *closed* prior to DI completion.~~

~~4.0~~5.0 Addressing Important Human Actions

Important human actions (IHA) are determined, addressed, and tracked by the Treatment of Important Human Actions element of the HFE program. Features that provide for reliable implementation of the~~The~~ IHAs are incorporated into the HSI ~~(alarms, controls, indications, and procedures)~~ design (e.g., alarms, controls, indications, and procedures).

As described in the human factors V&V IP (Reference 9.2.2~~8.2.2~~), IHAs are considered among the significant conditions, personnel tasks, and situational factors sampled during V&V activities as the ISV scenarios are developed. The ISV assesses the successful performance of the integrated crew and the HSI for IHAs. During V&V, HEDs are processed when discrepancies are found for any IHA. HEDs found during V&V are resolved ~~during DI~~ as described in Section 4.0~~3.0~~. A description of how the HFE program addressed each IHA is submitted as part of the V&V RSR.

~~5.0~~6.0 Additional Considerations for Human Factors Engineering Aspects of Control Room Modifications

The licensee's responsibilities for HFE program implementation begin when the 10 CFR 52 Appendix specific to the NuScale DC is issued and the licensee's QA policy is approved. Approval of the QA policy establishes programs and processes comparable to those used in the NuScale HFE program. After assuming HFE program responsibility,~~completion of start-up testing and provisional turn over,~~ a licensee institutes a human performance monitoring (HPM) program to evaluate impacts on human performance going forward. The HPM program evaluates design change proposals for HSI design, procedures, or training against the design bases established for the as-built design. ~~The design change proposal evaluation considers HEDs in HFEITS regardless of which stage of the design in which they were initiated.~~

The licensee's HFE program ~~activity~~should implement the guidance of NUREG-0711, Human Factors Engineering Program Review Model, Revision 3.~~results that are invalidated by design changes are reconducted to support plant modification without reducing human performance (see Section 2.0).~~

~~A licensee's design change process is governed by regulatory requirements such as 10 CFR 50.59, Changes, tests, and experiments (Reference 8.2.3).~~

~~6.0~~7.0 Results Summary Report

Completion of DI activities is tracked and confirmed by an ITAAC item. This ensures that the as-built design conforms to the verified and validated design resulting from the HFE design process. Therefore, an RSR is not prepared for the DI element of the HFE program as part of design certification.

~~7.0~~8.0 NUREG-0711 Conformance Evaluation

Table 8-1~~7 1~~ indicates where each NUREG-0711, Rev. 3 (Reference 0~~8.2.4~~) criterion is met in this IP.

Table 8-1~~7 1~~. Conformance with NUREG-0711

Review Criteria Stated in NUREG-0711, Rev. 3	DI IP Section No. and paragraph
12.4 Review Criteria 12.4.1 Final HFE Design Verification for New Plants and Control Room Modifications 1. The applicant should evaluate aspects of the design that were not addressed in V&V by an appropriate V&V method. *Additional Information: Aspects of the design addressed by this criterion may include design characteristics, such as new or modified displays for plant-specific design features.*	Section 1.2, all paragraphs Section 3.0~~2.0, all paragraphs~~
2. The applicant should compare the final HSIs, procedures, and training with the detailed description of the design to verify that they conform to the planned design resulting from the HFE design process and V&V activities. This verification should compare the actual HSI, procedures, and training materials to design descriptions and documents. Any identified discrepancies should be corrected, or justified. *Additional Information: Final design means the design existing in the actual plant.*	~~Section 2.0, all paragraphs~~ Section 4.0~~3.0~~, all paragraphs
3. The applicant should verify that all HFE-related issues in the issue-tracking system (Section 2.4.4) are adequately addressed.	Section 2.0~~3.0~~, all paragraphs Section 4.0, all paragraphs
4. The applicant should provide a description of how the HFE program addressed each important HA.	Section 6.0~~4.0~~, all paragraphs
12.4.2 Additional Considerations for Reviewing the HFE Aspects of Control Room Modifications In addition to any of the criteria above that are relevant to the modification being reviewed, the following should be addressed. 12.4.2.1 General Criteria for Plant Modifications 1. The applicant should provide reasonable assurance that the reactor fuel is safely monitored during the shutdown period while physical modifications to the control room are being made.	The remaining criteria are not applicable to the NuScale HFE program. They are to be addressed as part of the licensee HFE program in Section 6.0.~~N/A, Section 5.0~~
2. The applicant should verify that modifications in the plant's procedures and training reflect changes in plant systems, personnel roles and responsibilities, and in HSIs resulting from the new systems.	~~N/A,~~ Section 6.0~~5.0~~
3. Installation should be planned to minimize disruptions to work of plant personnel.	~~N/A,~~ Section 6.0~~5.0~~
4. The applicant should verify that operations and maintenance personnel are fully trained and qualified to operate and maintain all modifications made to the plant before starting up with the new systems and HSIs in place.	~~N/A,~~ Section 6.0~~5.0~~

Review Criteria Stated in NUREG-0711, Rev. 3	DI IP Section No. and paragraph
5. The applicant should have a plan to monitor start-up and initial operations after the modification to reasonably assure that: • operational and maintenance problems arising from personnel's interactions with the new systems, HSIs, and procedures are identified and addressed • personnel are sufficiently familiar with the new systems, HSIs, and procedures to support safe operations and maintenance • any negative transfer of training from the old removed HSIs to the corresponding new ones was identified and corrected • no new problems are created by coordinating tasks between the remaining old HSIs and new HSIs • no unanticipated negative effects on personnel interaction and teamwork have surfaced	~~N/A,~~ Section 6.0~~5.0~~
12.4.2.2 Modernization Programs Consisting of Many Small Modifications 1. The applicant should assure that each modification follows an HFE program that provides standardization and consistency (1) between old and new equipment, and (2) across the new systems being implemented.	~~N/A,~~ Section 6.0~~5.0~~
2. The applicant should verify that new modifications fulfill a clear operational need, and do not interfere with existing systems. *Additional Information: For example, the auditory alerts in a new HSI should not distract operators from addressing more important alarms.*	~~N/A,~~ Section 6.0~~5.0~~
12.4.2.3 Modernization Programs Consisting of Large Modifications during Multiple Outages 1. Interim configurations may exist for long times (e. g., a refueling cycle), and therefore, applicants should verify that they are acceptable from both engineering and operations perspectives and that they meet regulatory requirements. The applicant's evaluations should include: • PRA evaluations to ensure minimizing high-risk situations • FSAR evaluations to assure defense against design basis accidents • technical-specifications evaluations to determine if changes are needed • defense in depth evaluations to ensure meeting the criteria in RG 1.174	~~N/A,~~ Section 6.0~~5.0~~
2. The applicant should perform task analysis for each interim configuration to verify that any task demands are known and do not degrade personnel performance.	~~N/A,~~ Section 6.0~~5.0~~
3. The applicant should update the HRA to address any unique tasks that may impact risk, as well as any changes to existing tasks due to the interim configuration.	~~N/A,~~ Section 6.0~~5.0~~
4. The applicant should verify that the HSIs needed to perform important tasks (as defined in Section 6) are consistent and standardized. Personnel should not have to use both old and new HSIs for different aspects of the same task.	~~N/A,~~ Section 6.0~~5.0~~
5. The applicant should develop procedures for temporary configurations of systems and HSIs that personnel use when the plant is not shutdown.	~~N/A,~~ Section 6.0~~5.0~~
6. The applicant should develop training for temporary configurations of systems, HSIs, and procedures that personnel can use when the plant is not shutdown.	~~N/A,~~ Section 6.0~~5.0~~

Review Criteria Stated in NUREG-0711, Rev. 3	DI IP Section No. and paragraph
7. The applicant should consider the following aspects of V&V: • HFE Design Verification – Temporary configurations of the systems, HSIs, and procedures that operations and maintenance personnel employ when the plant is not shutdown should be reviewed to verify that their design is consistent with the principles of good HFE design (e.g., conforms to a plant-specific style guide or NUREG-0700). • HSI Task-Support Verification – Temporary configurations of the systems, HSIs, and procedures, which operations and maintenance personnel may use when the plant is not shutdown, should be reviewed to verify that their design supports the intended tasks. – Additional Information: For example, if a temporary configuration of plant systems introduces special monitoring requirements, then the HSIs should give the necessary information. • ISV - Interim configurations should be validated if so warranted by the risk significance of the personnel tasks affected by them.	~~N/A,~~ Section 6.0~~5.0~~
12.4.2.4 Modernization Programs Where both Old and New Equipment are Left in Place 1. The applicant should identify and address negative effects on personnel performance due to control room or HSI clutter resulting from using old and new HSIs in parallel.	~~N/A,~~ Section 6.0~~5.0~~
2. The applicant should identify and address negative effects on personnel performance resulting from the simultaneous presence of parallel alarms.	~~N/A,~~ Section 6.0~~5.0~~
3. The applicant should identify and address negative effects on personnel performance resulting from differences in information from old and new systems on the same parameter or equipment.	~~N/A,~~ Section 6.0~~5.0~~
4. The applicant should identify and address any safety concerns from providing controls that operators can access from two different HSIs. Additional Information: For example, a switch may be installed to select which HSI will control the equipment, thus preventing simultaneous control inputs.	~~N/A,~~ Section 6.0~~5.0~~
12.4.2.5 Modernization Programs Where New Non-functional HSIs are in Place in Parallel with Old Functional HSIs 1. The applicant should evaluate the potential for negative effects on personnel performance due to control room or HSI clutter resulting from having old and new HSIs available in parallel. Where safety concerns are identified, the applicant should take measures to improve the HSIs.	~~N/A,~~ Section 6.0~~5.0~~
2. The applicant should ensure that the non-functional state of HSIs is clearly indicated.	~~N/A,~~ Section 6.0~~5.0~~

~~8.0~~9.0 References

~~8.1~~9.1 Source Documents

~~8.1.1~~9.1.1 U.S. Nuclear Regulatory Commission, "Human Factors Engineering Program Review Model," NUREG-0711, Rev. 3, November 2012.

~~8.1.2 U.S. Nuclear Regulatory Commission, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition — Human Factors Engineering," NUREG-0800, Chapter 18, Rev 2, March 2007.~~

~~8.2~~9.2 Referenced Documents

~~8.2.1~~9.2.1 Human Factors Engineering Program Management Plan, RP-0914-8534.

~~8.2.2~~9.2.2 Human Factors Verification and Validation Implementation Plan, RP-0914-8543.

~~8.2.3 *U.S. Code of Federal Regulations, "Changes, tests and experiments," Section 50.59, Part 50, Title 10, "Energy," (10 CFR 50.59).*~~

~~8.2.4 U.S. Nuclear Regulatory Commission, "Human Factors Engineering Program Review Model," NUREG-0711, Rev. 3, November 2012.~~

4.3.4 Environmental Fidelity

The test bed is representative of the actual NuScale plant with regard to environmental features such as lighting, noise, temperature, humidity, and ventilation characteristics. In cases where the test bed cannot accurately simulate the environment, the ISV captures human factors engineering issue tracking system (HFEITS) entries for evaluation and resolution.

4.3.5 Data Completeness Fidelity

In the test bed, information and data provided to personnel represent the complete set of plant systems monitored and controlled from that facility.

4.3.6 Data Content Fidelity

The test bed represents a high degree of data content fidelity. The alarms, controls, indications, procedures, and automation presented are based on an underlying plant model that accurately reflects the engineering design of the NuScale plant. The model also accurately provides input to the HSI, such that the information matches what is presented during operations.

4.3.7 Data Dynamics Fidelity

The test bed represents a high degree of data dynamic fidelity. The plant model provides input to the HSI in a manner such that information flow and control responses occur accurately and in a correct response time. Information is provided to personnel with the same anticipated delays as would occur in the plant.

4.3.8 Remote Human-System Interfaces Containing Important Human Actions

NuScale has no IHAs that are conducted outside of the MCR. In the event that a remote IHA is determined in a later design stage, the test bed uses mockups to verify human performance requirements for IHAs conducted at HSIs remote from the MCR. The simulation or mockup considers, for example, transit times, use of personal protective equipment, and delays associated with the need for operator precision (self-checking).

4.3.9 Test Bed Conformance

The test bed is verified by performance testing to conform to required characteristics before validation tests are conducted.

4.3.10 ISV Simulator Performance Testing

The purpose of ISV Simulator performance testing is to ensure simulator performance is sufficiently complete and accurate to meet the requirements recommended in NUREG-0711, “Human Factors Engineering Program Review Model” as it pertains to simulators used during ISV activities. NUREG-0711 recommends that the simulator used for ISV should have fidelity and functionality compliant with industry standard “ANSI/ANS-3.5-2009, Nuclear Power Plant Simulators for Use in Operator Training and

Examination". ANSI/ANS-3.5 is intended to provide standards used to train licensed operators at an operating facility and not to conduct ISV testing. Therefore, the ISV Simulator Performance Testing uses selected criteria in a similar manner to the concept already used within the ANSI/ANS-3.5 Appendix C standard to establish criteria for part-task and limited-scope simulators.

The following criteria are used to evaluate ISV Simulator performance:

- real time and repeatability testing
- limits of simulation testing
- normal evolution testing
- malfunction testing
- steady state testing

Prior to the start of ISV, the ISV simulator will have completed ISV Simulator performance testing to validate overall performance. The ISV Simulator performance testing provides a comprehensive evaluation of overall simulator performance, while Scenario-Based Testing provides a detailed review of the simulator response to the individual ISV scenarios.

4.3.11 Scenario-Based Testing

The testing is conducted by determining a set of key parameters to be evaluated and ensuring those parameters behave as expected for the developed ISV scenarios. ANSI/ANS-3.5-2009 was referenced for a draft list to select steady state and transient parameters.

The scenarios are then conducted in real time, to ensure the completion of the objectives and termination point is reached. The procedures are executed as described in the current task analysis. The "freeze" feature may only be used during testing to obtain additional data and shall have no effect on the simulator parameters or resuming of the scenario for the test to be considered valid.

The following criteria are used to evaluate the simulator performance while running the ISV scenarios:

- {{

}}2(a),(c)

- {{

}}2(a),(c)

4.4 Plant Personnel

Individual operating crews participating in the ISV may be previously licensed commercial reactor or senior reactor operators, operators with Navy nuclear experience, or design engineering staff members familiar with the NuScale Power plant design. The personnel participating in ISV are trained, qualified, and are assigned to roles commensurate with their experience, skill, and knowledge level.

Personnel who constitute the ISV operating crews are not part of the HFE V&V team or HFE design team. Operating crew makeup is not varied from scenario to scenario and remains consistent throughout the validation (i.e., crew members are not rotated between operating crews).

To control crew bias, individual crew members are distributed across crews with consideration for:

- age distribution
- gender distribution
- education level distribution

Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 9360
Date of RAI Issue: 04/23/2018

NRC Question No.: 18-42

Review Criteria

NUREG-0711, Review Criterion 2.4.1(4) says, “The applicant’s HFE program should cover the MCR, remote shutdown facility (RSF), technical support center (TSC), emergency operations facility (EOF), and local control stations (LCS). The 12 HFE elements should be applied to each of them, unless otherwise noted for a specific HFE element. However, applicants may apply the elements of the HFE program in a graded fashion to facilities other than the MCR and RSF, providing justification in the HFE program plan.”

Application and Evaluation

The “Human Factors Engineering Operating Experience Review Results Summary Report,” Table 3-1, “Comparison of commercial PWR systems to NuScale systems,” identifies a “refueling monitoring station” in the NuScale plant design. “Human Factors Engineering Staffing and Qualifications Results Summary Report” explains that refueling operations are performed by a dedicated staff, including a senior reactor operator, separate from the main control room. The “Concept of Operations,” Section 3.2.5, “Arrangement of Human-System Interfaces,” indicates the HSIs associated with refueling are considered local control stations. DCD Tier 2, Section 18.7.2.3.3, “Human-System Interface Style Guide” says, “The style guide section for VDU-based HSIs is used for MCR, facilities that use HSIs derived from MCR, and LCS human-system interfaces. The HSIs on the VDU-based LCSs are MCR derivatives. For vendor-supplied LCSs, the NuScale HFE program scope is limited to ensuring that those interfaces adhere as closely as possible to the HSI style guide.”

During refueling, the reactor building crane will be used to move the module. As noted by the staff in RAI 9128, Question 19-37, Chapter 19 of the FSAR shows that module drop events dominate the NuScale core damage frequency, and several operator errors of commission were estimated to be important in the module drop frequency. Given that FSAR Chapter 19 identifies operator errors that could contribute to module drop, and the risk-significance of the reactor building crane used during module movement, the staff would like to understand whether HFE program elements and/or HFE guidelines have been or will be applied to the design of HSIs used during module movement to help minimize the likelihood of operator errors that could result in significant safety consequences. It is not clear to the staff if the HSIs used for module

movement are considered VDU-based LCSs or vendor- supplied LCSs, or something other.

Additionally, the FSAR Tier 2, Section 18.11.2.1, “Aspects of the Human Factors Engineering Design not Verified During Verification and Validation,” says,

“Aspects of the HFE design that are not addressed in the HFE verification and validation include modifications to the standard design and the HFE aspects that cannot be performed in the simulated environment. This may include design characteristics, such as new or modified displays for plant-specific design features. Features that may not be accurately simulated include

- *ergonomic considerations, such as lighting and background noise.*
- *HSIs outside the MCR but within the plant HFE program scope, including the TSC, RSS, EOF, and certain LCSs.”*

Additional Information Requested

Please clarify which LCSs are considered “certain LCSs” as discussed in FSAR Tier 2, Section 18.11.2.1. Please explain how NuScale characterizes the HSIs used for module movement.

Please describe the extent to which the HFE program elements and/or HFE guidelines are or will be applied to the design of controls and indications used during module movement.

If none of the HFE program elements have been or will be applied to the design of these controls and indications, or if HFE guidelines will not applied to the design of these HSIs, please explain why it is not necessary.

NuScale Response:

In Section 4.6.4 of the Human-System Interface Design Results Summary Report, NuScale discusses two types of local control station (LCS) design, video display unit (VDU)-based and vendor-supplied. The term VDU-based is meant to cover LCS designs outside of the main control room (MCR) that are developed by NuScale. The vendor-supplied term is meant to cover any LCSs that are supplied by the vendor as part of their equipment such as a turbine generator LCS. Vendor supplied LCS’s are typically used to provide an interface from the equipment to the customers control network. In some cases, the vendor will also provide a graphical user interface (GUI) that can be used to communicate/provide information about the equipment. The vendor GUI is the location where the HFE program scope is limited to ensuring that interfaces adhere as closely as possible to the NuScale HSI Style Guide. The VDU-based (or NuScale provided) LCS’s are what the FSAR Tier 2, Section 18.11.2.1 considered “certain LCSs”.

The LCS HSI used for module movement are vendor-supplied. The HFE design for these controls will be developed by the vendor because the controls must reflect the specialized nature of crane operation. The NuScale HFE design team is working with engineering to

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develop procurement specifications that characterize the crane control function requirements. Implementation of the Style Guide standards will be included in the purchase specification to establish as much consistency with NuScale HFE design as possible but on a not to interfere basis with establishing the safety and control standards required by crane design. Since this effort is at an early stage of development and beyond the scope of the current MCR verification and validation (V&V) process, specific details on the scope of HFE related direction in the procurement specification cannot be addressed at this time.

In addition, Appendix I, “Plant Maintenance and Work Management”, was added to the HSI Style Guide in Revision 2. This addition was made to encompass areas of the plant where the NuScale HFE design team will provide support for the HSI portion of control system designs outside of the “Applicable Facilities” mentioned in Section 2.2.3 of the HFE Program Management Plan.

Impact on DCA:

There are no impacts to the DCA as a result of this response.

Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 9360
Date of RAI Issue: 04/23/2018

NRC Question No.: 18-43

Regulatory Basis

As established in the design certification rules in 10 CFR Part 52 Appendices A through D, information contained in the DCD is divided into three designations: Tier 1, Tier 2, and Tier 2*. These designations are described uniformly across the Part 52 appendices. Tier 1 information is the portion of design related information in the generic DCD that is approved and certified by the Part 52 appendices and requires prior NRC approval to change. Tier 1 information is derived from Tier 2 information. Information included in Tier 1 should be limited to information that is unlikely to change for the lifetime of the plant.

Application and Evaluation

FSAR Tier 1, Section 3.15.1, “Design Description,” says, “The HSI of the technical support center, the emergency operations facility, and local control stations (LCS) are derivatives of the main control room (MCR) HSI, and only their impact on licensed operator workload is assessed.” FSAR Tier 2, Section 18.1.1.4, “Applicable Facilities,” contains the same statement.

The “Human Factors Engineering Program Management Plan” (HFE PMP), is incorporated by reference in FSAR Tier 2. Section 2.2.3, “Applicable Facilities,” says,

The scope of the NuScale HFE program includes the alarms, controls, indications, and procedures applicable to the main control room (MCR) and the remote shutdown station (RSS). The HSI at the RSS are derived from the HSI in the MCR. The HSI of the TSC, the EOF, and local control stations (LCS) are also included implicitly since their HSI are derivatives of the MCR HSI. The EOF and the technical support center (TSC) will comply with the guidance of NUREG-0696, Functional Criteria for Emergency Response Facilities. The HSI in the TSC and EOF are derivatives of the MCR HSI and comply with the HSI style guide; however, these HSI are for information display only. No control functions are provided in any of the emergency response facilities. For these facilities, the program scope is limited to defining the plant data and their HSI impact on licensed operator workload.

COL Item 13.3-2 addresses the responsibility of the COL applicant that references the NuScale Power Plant design certification to provide a description of a near-site emergency operations facility for management of overall licensee emergency response and which complies with the

guidance in NUREG-0696, “Functional Criteria for Emergency Response Facilities.”

The information in FSAR Tier 1, Section 3.15.1 and FSAR Tier 2, Section 18.1.1.4 is not consistent with the information in the HFE PMP, Section 2.2.3 and the COL item. Given that (1) the COL is to provide a description of an emergency operations facility that complies with NUREG-0696, and that FSAR Chapter 7 identifies information to be provided to the EOF, and (2) the HSIs at LCSs are derived from the MCR HSI, it is not clear to staff why HSI design of these facilities is related to licensed operator workload. Information in Tier 1 that is not addressed during the design certification review must later be changed by exemption; therefore, it is prudent to clarify Tier 1 information that is inaccurate or ambiguous.

Additional Information Requested

Please revise FSAR Tier 1, Section 3.15.1 such that statement about the HSI of emergency response facilities and LCSs is consistent with the Tier 2 HFE PMP. Please also revise FSAR Tier 2, Section 18.1.1.4 for consistency.

NuScale Response:

The intent of the FSAR emergency response facilities HFE information was to show that the NuScale design covered important aspects of the plant such as the facilities data system and nuclear data link for the COL to consider. The COL can either use the state-of-the-art control system design or implement another interface system design following the NUREG-0696 guidance. A description of this interface is provided in FSAR Chapter 7 Section 7.2.13.7, "Other Information Systems".

FSAR Tier 1, Section 3.15.1, FSAR Tier 2, Section 18.1.1.4 and the Human Factors Engineering Program Management Plan, Section 2.2.3 statements about the HSI of emergency response facilities and LCSs being related to licensed operator work load will be removed.

It is recognized that the EOF and TSC were established to minimize operator work load during emergencies. The impact of the emergency plan during the initial stages of an event (event declaration, immediate actions, and communications) are addressed during the Integrated System Validation and results will be summarized in the Verification and Validation Results Summary Report.

Impact on DCA:

Tier 1, Section 3.15.1, Tier 2, Section 18.1, and the Human Factors Engineering Program Management Plan have been revised as described in the response above and as shown in the markup provided with this response.

Human Factors Engineering

Program Management Plan

~~10/18/2017~~

Draft Revision 54

Docket: 52-048

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Executive Summary

The HFE program incorporates 12 HFE elements under four general activities in accordance with the guidance of NUREG-0711:

- planning and analysis
  - HFE program management
  - operating experience review
  - functional requirements analysis and function allocation
  - task analysis
  - staffing and qualifications
  - treatment of important human actions

- design
  - human-system interface design
  - procedure development
  - training program development

- verification and validation
  - human factors verification and validation

- implementation and operation
  - design implementation
  - human performance monitoring

The HFE program management element falls under the planning and analysis activity, and its purpose is to ensure that the HFE program is properly developed, executed, overseen, and documented. This PMP describes NuScale's overall plan to accomplish this goal. Consistent with the guidance of NUREG-0711, the topics of discussions in this PMP include the HFE program scope, team, processes and procedures, and tracking of HFE issues.

This PMP also provides a summary of the remaining eleven HFE elements, and identifies the elements that are beyond the scope of design certification. Specifically, activities associated with procedures development, training program development, and human performance monitoring elements are the responsibility of a combined license applicant. More details on the implementation methodology and the results of analyses for the applicable HFE elements are contained in the associated implementation plans and/or the results summary reports.

(I&C) maintenance; health physics; chemistry; engineering; or information technology), or activities associated with the technical support center (TSC), emergency operations facility (EOF), operations support center (OSC), or any other emergency response facilities are included only if they are determined to impact licensed operator workload. When licensed operator workload is impacted, then the area of concern is analyzed to a degree sufficient to quantify the impact to licensed operator workload or staffing, and develop any human-system interface (HSI) or staffing adjustments required to address the specific task and associated staffing requirements.

The numbers and qualifications of nonlicensed operator personnel, including technicians and maintenance staff, are the responsibility of a NuScale plant licensee, and are not analyzed by the NuScale plant HFE program.

Reference 8.2.11 provides more information on the methodology and results of staffing evaluations.

2.2.2 HFE Program Duration

The NuScale HFE program is applicable from the start of conceptual design through completion of plant startup testing. After plant turnover to the owner, an established human performance monitoring program maintains the NuScale HFE program design data and appropriate processes.

2.2.3 Applicable Facilities

The scope of the NuScale HFE program includes the alarms, controls, indications, and procedures applicable to the main control room (MCR) and the remote shutdown station (RSS). The HSI at the RSS are derived from the HSI in the MCR. The HSI of the TSC, the EOF, and local control stations (LCS) are also included implicitly since their HSI are derivatives of the MCR HSI. The EOF and the technical support center (TSC) will comply with the guidance of NUREG-0696, Functional Criteria for Emergency Response Facilities. The HSI in the TSC and EOF are derivatives of the MCR HSI and comply with the HSI style guide; however, these HSI are for information display only. No control functions are provided in any of the emergency response facilities. For these facilities, the program scope is limited to defining the plant data. ~~and their HSI impact on licensed operator workload.~~

2.2.4 Applicable Human-System Interfaces, Procedures, and Training

The HSI design process represents the translation of function, allocation, and task requirements into HSI characteristics and implementation strategies. HSI design inputs include the following:

- operating experience review (OER)
- functional requirements analysis and function allocation (FRA/FA)
- task analysis (TA)
- staffing and qualifications (S&Q)

3.15 Human Factors Engineering

3.15.1 Design Description

System Description

The human factors engineering (HFE) program design process is employed to design the control rooms and the human-system interfaces (HSIs) and associated equipment while relating the high-level goal of plant safety into individual, discrete focus areas for the design.

The HFE and control room design team establish design guidelines, define program-specific design processes, and verify that the guidelines and processes are followed. The scope of the HFE program includes the following:

- location and accessibility requirements for the control rooms and other control stations
- layout requirements of the control rooms, including requirements regarding the locations and design of individual displays and panels
- basic concepts and detailed design requirements for the information displays, controls, and alarms for HSI control stations
- coding and labeling conventions for control room components and plant displays
- HFE design requirements and guidelines for the screen-based HSI, including the actual screen layout and the standard dialogues for accessing information and controls
- requirements for the physical environment of the control rooms (e.g., lighting, acoustics, heating, ventilation, and air conditioning)
- HFE requirements and guidelines regarding the layout of operator workstations and work spaces
- corporate policies and procedures regarding the verification and validation of the design of HSI

RAI 18-43

The HFE program applies to the design of the main control room (MCR) and the remote shutdown station. The HSI of the technical support center, the emergency operations facility, and local control stations (LCS) are derivatives of the main control room (MCR) HSI~~, and only their impact on licensed operator workload is assessed~~. The design of local control station is accomplished concurrently with the applicable system design and follows guidelines established by the HFE and control room design team.

Design Commitments

- The MCR design incorporates HFE principles that reduce the potential for operator error.
- The as-built MCR HSI is consistent with the final design specifications validated by the integrated system validation test.

Analysis of the numbers and qualifications of non-licensed operator personnel, including technicians and maintenance staff, are the responsibility of a NuScale Power Plant licensee.

18.1.1.3 Human Factors Engineering Program Duration

The HFE program is in effect from the start of the plant conceptual design through completion of startup testing. After plant turnover to the owner, a human performance monitoring (HPM) program is established by the owner to maintain the HFE program design data and appropriate processes throughout the life of the plant. The HPM program is an element of the HFE program and is discussed in Section 18.12.

18.1.1.4 Applicable Facilities

RAI 18-43

The scope of the NuScale HFE program includes the MCR and the remote shutdown station (RSS). The HSI of the technical support center, the emergency operations facility, and local control stations are derivatives of the MCR human-system interface~~ and only their impact on licensed operator workload is assessed~~.

18.1.1.5 Applicable Human-System Interfaces, Procedures, and Training

The HSI design inputs and interfaces include the following:

- operating experience review
- functional requirements analysis (FRA) and function allocation
- task analysis
- staffing and qualifications (S&Q)
- treatment of important human actions (TIHAs)
- concept of operations
- instrumentation and controls systems design
- system requirements
- HSI style guide

The HFE program supports procedure and training program development for normal operating, abnormal operating, emergency operating, alarm response, and accident management activities performed or supervised by operational personnel.

The HFE program provides inputs to the training programs for the personnel identified in 10 CFR 50.120 as appropriate.

18.1.1.6 Applicable Operations Personnel

The HFE program analyzes and defines the minimum number and qualifications of licensed control room operators. This is further described in the staffing and qualifications element of the HFE program (Section 18.5).

Enclosure 3:

Affidavit of Zackary W. Rad, AF-0618-60568

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NuScale Power, LLC

AFFIDAVIT of Zackary W. Rad

I, Zackary W. Rad, state as follows:

1. I am the Director, Regulatory Affairs of NuScale Power, LLC (NuScale), and as such, I have been specifically delegated the function of reviewing the information described in this Affidavit that NuScale seeks to have withheld from public disclosure, and am authorized to apply for its withholding on behalf of NuScale.
2. I am knowledgeable of the criteria and procedures used by NuScale in designating information as a trade secret, privileged, or as confidential commercial or financial information. This request to withhold information from public disclosure is driven by one or more of the following:
    a. The information requested to be withheld reveals distinguishing aspects of a process (or component, structure, tool, method, etc.) whose use by NuScale competitors, without a license from NuScale, would constitute a competitive economic disadvantage to NuScale.
    b. The information requested to be withheld consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), and the application of the data secures a competitive economic advantage, as described more fully in paragraph 3 of this Affidavit.
    c. Use by a competitor of the information requested to be withheld would reduce the competitor's expenditure of resources, or improve its competitive position, in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.
    d. The information requested to be withheld reveals cost or price information, production capabilities, budget levels, or commercial strategies of NuScale.
    e. The information requested to be withheld consists of patentable ideas.
3. Public disclosure of the information sought to be withheld is likely to cause substantial harm to NuScale's competitive position and foreclose or reduce the availability of profit-making opportunities. The accompanying Request for Additional Information response reveals distinguishing aspects about the method by which NuScale develops its human factors engineering.

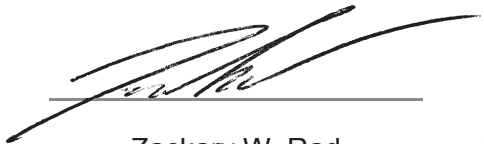
    NuScale has performed significant research and evaluation to develop a basis for this method and has invested significant resources, including the expenditure of a considerable sum of money.

    The precise financial value of the information is difficult to quantify, but it is a key element of the design basis for a NuScale plant and, therefore, has substantial value to NuScale.

    If the information were disclosed to the public, NuScale's competitors would have access to the information without purchasing the right to use it or having been required to undertake a similar expenditure of resources. Such disclosure would constitute a misappropriation of NuScale's intellectual property, and would deprive NuScale of the opportunity to exercise its competitive advantage to seek an adequate return on its investment.

4. The information sought to be withheld is in the enclosed response to NRC Request for Additional Information No. 428, eRAI No. 9360. The enclosure contains the designation "Proprietary" at the top of each page containing proprietary information. The information considered by NuScale to be proprietary is identified within double braces, "{{ }}" in the document.
5. The basis for proposing that the information be withheld is that NuScale treats the information as a trade secret, privileged, or as confidential commercial or financial information. NuScale relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC § 552(b)(4), as well as exemptions applicable to the NRC under 10 CFR §§ 2.390(a)(4) and 9.17(a)(4).
6. Pursuant to the provisions set forth in 10 CFR § 2.390(b)(4), the following is provided for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld:
    a. The information sought to be withheld is owned and has been held in confidence by NuScale.
    b. The information is of a sort customarily held in confidence by NuScale and, to the best of my knowledge and belief, consistently has been held in confidence by NuScale. The procedure for approval of external release of such information typically requires review by the staff manager, project manager, chief technology officer or other equivalent authority, or the manager of the cognizant marketing function (or his delegate), for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside NuScale are limited to regulatory bodies, customers and potential customers and their agents, suppliers, licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or contractual agreements to maintain confidentiality.
    c. The information is being transmitted to and received by the NRC in confidence.
    d. No public disclosure of the information has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or contractual agreements that provide for maintenance of the information in confidence.
    e. Public disclosure of the information is likely to cause substantial harm to the competitive position of NuScale, taking into account the value of the information to NuScale, the amount of effort and money expended by NuScale in developing the information, and the difficulty others would have in acquiring or duplicating the information. The information sought to be withheld is part of NuScale's technology that provides NuScale with a competitive advantage over other firms in the industry. NuScale has invested significant human and financial capital in developing this technology and NuScale believes it would be difficult for others to duplicate the technology without access to the information sought to be withheld.

I declare under penalty of perjury that the foregoing is true and correct. Executed on June 20, 2018.



Zackary W. Rad