Licensing Technical Report

Human Factors Engineering Treatment of Important Human Actions Results Summary Report

December 2022

Revision 0

Docket: 52-050

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Department of Energy Acknowledgement and Disclaimer

This material is based upon work supported by the Department of Energy under Award Number DE-NE0008928.

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Abstract

Treatment of important human actions is an important element of the Human Factors Engineering (HFE) Program. As part of its HFE Program, NuScale Power, LLC (NuScale) considers risk-important human actions contained in the Probabilistic Risk Assessment, and deterministic-important human actions derived from the transient and accident analysis and diversity and defense-in-depth coping analysis, to determine if any important human actions have been identifed. For the NuScale Power Plant US460 standard design, no IHAs are identified. This results summary report documents that no IHAs were identified at the time of the Standard Design Approval Application submittal. This report also discusses the process for the treatment of important human actions within the HFE Program. The process used in the treatment of important human actions analysis as an input to plant HFE design is consistent with the applicable provisions of Section 7 of NUREG-0711 (Reference 6.1.2).

Executive Summary

As part of its Human Factors Engineering (HFE) Program, NuScale Power, LLC (NuScale) evaluated the results of the NuScale Probabilistic Risk Assessment and the human reliability analysis for the NuScale Power Plant to identify if risk-important human actions are identified in the full-power internal events Probabilistic Risk Assessment. NuScale also evaluated the results of the plant safety analyses, which provides the basis for the transient accident analyses that are used as inputs to Chapter 15 of the Standard Design Approval Application and evaluated the results of the diversity and defense-in-depth coping analysis (Reference 6.2.9) to identify deterministic important human actions.

Consistent with the guidance of NUREG-0711 Section 7 (Reference 6.1.2), the treatment of important human actions (TIHA) analysis includes specific consideration of identified important human actions (IHAs) in designing the HFE aspects of the plant in the various elements of NUREG-0711, as described in the implementation plans and results summary reports for the following HFE Program elements: operating experience review, functional requirements analysis/function allocation, task analysis, staffing and qualifications, and human-system interface design. Important human actions are addressed by the various elements of the NuScale HFE Program, to ensure that the design minimizes the likelihood of human error and facilitates error-detection and recovery capability. This report documents NuScale's TIHA effort including the methodology used to determine the adequacy of how an IHA, if identified, is treated within the elements of the NuScale HFE Program. The process used in the TIHA is consistent with the applicable provisions of Section 7 of NUREG-0711. No IHAs are identified as part of the NuScale Power Plant US460 standard design.

This report is organized into six major sections and appendices. Section 1.0 describes the purpose and scope of TIHA. Section 2.0 provides an overview of the TIHA implementation process and a description of the TIHA team composition and responsibilities. Section 3.0 describes the methodology and specifies the criteria for performing an analysis of the TIHA. Section 4.0 provides a detailed summary of how the results of TIHA would be described if IHAs are identified. Section 5.0 provides a high-level conclusion derived from the experience of performing the TIHA analysis activities. The source and referenced documents applicable to and used in the TIHA effort are listed in Section 6.0. This report specifically covers the HFE analysis for the NuScale Power Plant US460 standard design.

1.0 Introduction

1.1 Purpose

This results summary report (RSR) provides the results for the treatment of important human actions (TIHA) element of the NuScale Power, LLC Human Factors Engineering (HFE) Program and includes the implementation approach for addressing the TIHA element and the methodology used to achieve the results. The inputs from other HFE Program elements are described, and the outputs from the TIHA element are identified.

The objective of the TIHA element is to identify and analyze how important human actions (IHAs) are treated within the plant design. The IHAs collectively include risk-important human actions (RIHAs) contained in the Probabilistic Risk Assessment (PRA) and deterministic-important human actions (DIHAs) derived from the transient accident analysis (TAA), and diversity and defense-in-depth coping analysis (D3CA).

Human actions (HA) are determined from the function allocation (FA) process. Related HAs are combined into groups to form a task. The HAs include manual controls, supervision of automated functions, manual back up of automated functions, and in some cases, communications.

Typically, inputs to task analysis (TA) include IHAs, which are evaluated as part of operating experience review (OER) to determine if other operating nuclear plants or systems with similar human-system interface (HSI) technology have experienced related error-causing conditions. The IHAs are used in succeeding HFE Program elements (e.g., TA, staffing and qualification (S&Q), and HSI design) to define the roles and responsibilities of plant personnel and to produce interfaces designed to minimize human error probabilities.

1.2 Scope

The scope of the HFE Program element TIHA is the identification and treatment of IHAs in the overall HFE Program. Specific treatment of IHAs in the HFE Program elements of OER, functional requirements analysis/function allocation (FRA/FA), TA, S&Q, and HSI design is described in the implementation plans and RSRs associated with those elements (Reference 6.2.2 through Reference 6.2.6). NuScale is not producing RSRs for the Procedure Development and Training Program Development elements, as described in NUREG-0711, Sections 9 and 10.

This RSR includes the methodology used to evaluate and treat IHAs within the overall scope of the HFE Program (Section 3.0), as well as a description of the results of evaluation of the TAA and D3CA (Section 4.2).

1.3 Abbreviations

Table 1-1 Abbreviations

Term	Definition
DBE	design-basis event
DI	design implementation
DIHA	deterministically-important human actions
D3CA	diversity and defense-in-depth coping analysis
FA	function allocation
FRA/FA	functional requirements analysis / function allocation
HA	human action
HED	human engineering discrepancy
HFE	Human Factors Engineering
HFEITS	Human Factors Engineering issue tracking system
HRA	human reliability analysis
HSI	human-system interface
I&C	instrumentation & control
IHA	important human action
ISV	integrated system validation
LCS	local control station
NRC	Nuclear Regulatory Commission
OER	operating experience review
PRA	Probabilistic Risk Assessment
RIHA	risk-important human action
RSR	results summary report
S&Q	staffing and qualifications
SDAA	Standard Design Approval Application
SME	subject matter expert
TA	task analysis
TAA	transient accident analysis
TIHA	treatment of important human actions
V&V	verification and validation

Table 1-2 Definitions

Term	Definition
basic event	An element of the PRA model for which no further decomposition is performed, because it is at the limit of resolution consistent with available information. There are typically two types of basic events: equipment unavailabilities and human errors.
subject matter expert (SME)	A person that has completed the NuScale HFE and Operations initial company training program, has previous licensed operating nuclear plant experience, and has performed task analysis or NuScale system reviews to establish familiarity with the NuScale Power Plant design.

2.0 Implementation

2.1 Treatment of Important Human Actions Process Overview

Important human actions are identified during PRA and human reliability analysis (HRA) as described in Section 3.1, and in the D3CA and TAA, as described in Section 3.2. For the purposes of the HFE Program and treatment of IHAs, no distinction is made between RIHAs from the PRA and DIHAs from the D3CA and TAA.

As previously mentioned, IHAs are considered during OER, FRA/FA, TA, HSI design, S&Q, procedure development, training program development, and HFE verification and validation (V&V). Section 3.3 (3.3.1 through 3.3.8) describes how IHAs are treated during the relevant HFE Program elements. Section 4.0 provides a summary of the results of those activities.

The HFE Program itself is iterative in that elements of the program are inputs to other elements and some design issues are only resolved by changing assumptions or re-analyzing based on new data.

The HFE Program activities, including TIHA, fall within the design control process as described in the Human Factors Engineering Program Management Plan, TR-130414 (Reference 6.2.1), which includes provisions for design changes and revision control for NuScale Power Plant systems. Proposed design changes are screened for acceptability and processed in accordance with department and project procedures. The design change request process includes an evaluation of the impact on the HFE analyses and directs modification as appropriate.

2.2 Treatment of Important Human Actions Team Composition and Responsibilities

The HFE team is responsible for the TIHA. The qualifications of the HFE team members supporting this HFE Program element are stipulated in the current NuScale HFE Program Management Plan (Reference 6.2.1).

A TIHA team and TIHA team lead are selected by the HFE supervisor from available HFE team members to conduct the TIHA analysis. The TIHA team lead is responsible for

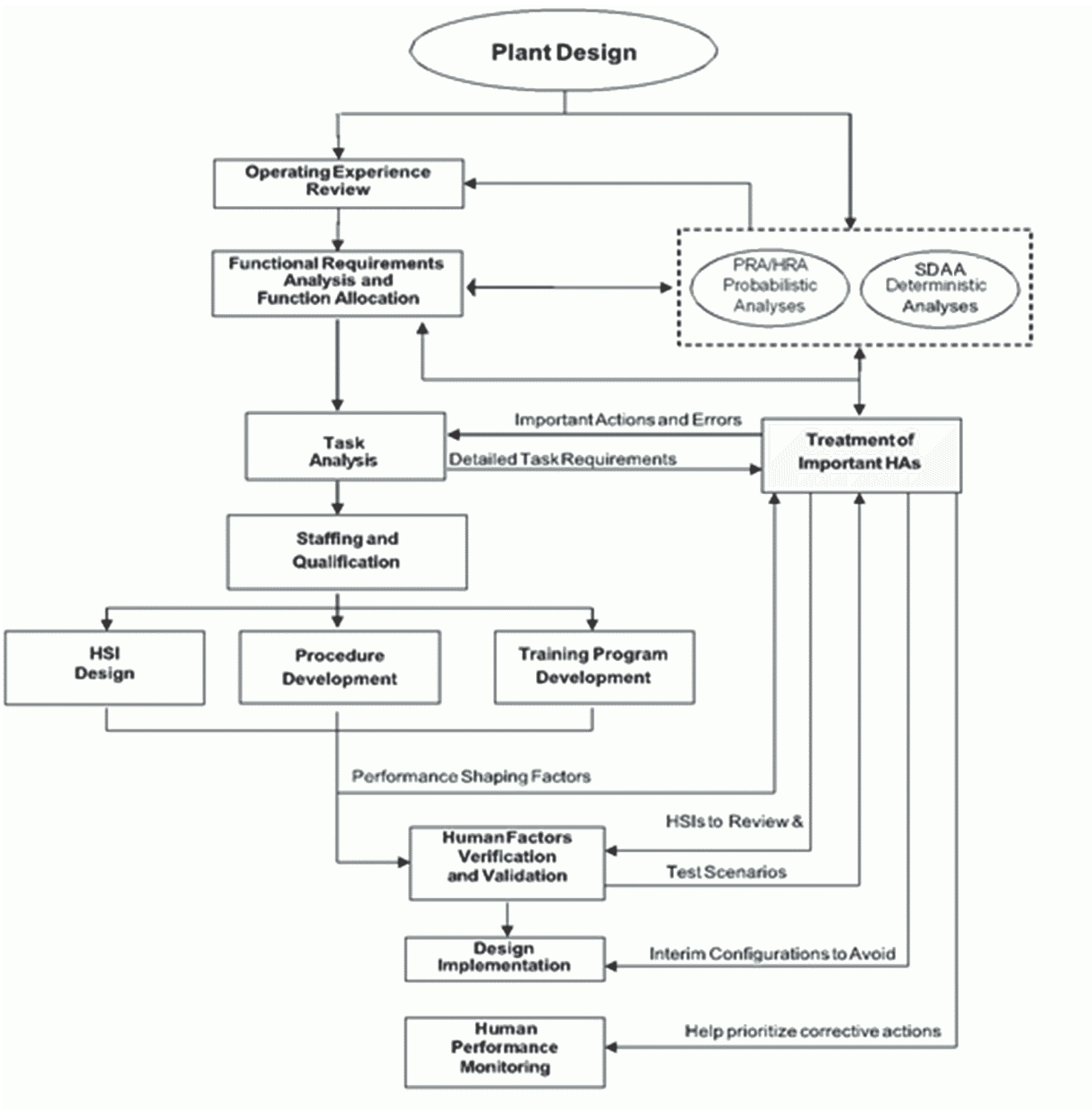
- organizing the TIHA team.
- assigning team member responsibilities.
- managing resources and schedule review.
- ensuring that TIHA issues are completed with supporting documentation and entered into the Human Factors Engineering issues tracking system (HFEITS) as necessary.
- ensuring that TIHA results are provided to other HFE Program element teams and design organizations.

The TIHA team members conduct and support the analyses or evaluate the analyses performed by other engineering disciplines (e.g., PRA, HRA, Safety Engineering, and Instrumentation and Control (I&C) Engineering) and identify the IHAs. Their responsibilities include evaluating the results of the HRA, TAA, and D3CA. They also interface with other HFE Program element teams and design organizations to ensure that IHAs are addressed (e.g., impacts are considered in TA and are accorded appropriate attention in HSI design and Human Factors Engineering V&V activities).

3.0 Methodology

The following section describes the methodology used to identify, evaluate, and address how important human actions are treated within the NuScale HFE Program. The methodology is designed to implement an approach that conforms to the guidance described in NUREG-0711, Section 7 (Reference 6.1.2), as represented in the overview provided in Figure 3-1, below.

Figure 3-1 Role of Important Human Actions in the Human Factors Engineering Program



3.1 Risk-Important Human Action Identification

Risk-important human actions (or risk-significant human actions) are those human actions that meet the criteria specified in the Risk Significance Determination Topical Report (Reference 6.2.8).

The methodology for identifying RIHAs is in conformance with the "Handbook of Human Reliability Analysis with Emphasis on Nuclear Power Plant Applications," NUREG/CR-1278 (Reference 6.1.10), in that RIHAs have the following characteristics:

- developed from the Level 1 (core damage) PRA and Level 2 (release from containment) PRA, for power operation and low power and shutdown operations, including both internal and external events
- developed using selected importance measures and PRA sensitivity analyses to provide reasonable assurance that an important action (or multiple actions in the same scenario) is not overlooked because of the selection of the measure or the use of a particular assumption in the analysis

Risk-importance measures, HRA and PRA sensitivity analyses, and threshold criteria (including bases) are used to identify the risk-important HAs. The initial PRA and HRA results and the potentially risk-important human interactions are analyzed to identify RIHAs. The initial PRA and HRA and the set of important HAs are updated as the design progresses, and finalized when the design of the plant and HSI are complete.

Specific criteria for determining RIHAs are in accordance with Risk Significance Determination, TR-0515-13952-NP-A (Reference 6.2.8), which defines a "basic event" as, "An element of the PRA model for which no further decomposition is performed, because it is at the limit of resolution consistent with available information. There are typically two types of basic events: equipment unavailabilities and human errors."

In combination, the approach used for identifying candidate RIHAs consists of

- identifying situations in the PRA where an operator can function as a backup to an automatic actuation.
- identifying situations where an operator can place into service a nonsafety backup to a safety-related system.
- understanding the context for successful execution of the action.
- assessing the time available for the operator to accomplish the action using thermal-hydraulic simulations of bounding scenarios.
- verifying accessibility of the equipment needed to be accessed.
- quantifying the likelihood of the operator failing to accomplish the human action.
- evaluating the importance of the human action in the full-scope, all operating modes PRA.

The results summary is provided in Section 4.0.

The RIHAs are developed in a collaborative manner with the PRA group. As the PRA model matures and is updated, the resulting potential RIHAs are reviewed with the Operations group and TA is performed. Depending on the complexity and location of a task, the following reviews are performed:

- tabletop reviews with HFE engineers, Operations subject matter experts (SMEs), system engineers, and PRA engineers
- simulator walkthroughs
- modeling of in-plant transit times based on expected locations, transit distances, doors and stairs, and other access requirements

These reviews provide task context for the PRA group to develop valid assumptions with regards to operator actions and for the Operations group to provide input as to the feasibility and difficulty of the proposed actions.

Early in the design process, the Plant Operations and PRA groups agreed upon actions assumed in the PRA that were the most likely candidates for RIHAs. The I&C and Safety Analysis engineering groups were also consulted, and it was determined, based on preliminary analysis, that the NuScale design would not rely on any DIHAs; therefore, no DIHAs were included in this list. Task analysis was performed on these potential RIHAs so that they could be more thoroughly investigated. Some of these actions were eliminated from the PRA assumptions as they were judged not to be significant compared to their capability to reduce risk.

3.2 Deterministically Important Human Action Identification

Deterministically important human actions are identified as part of the TAA and D3CA. The DIHAs are operator actions that are directly credited in the plant safety analyses or TAA, to prevent or mitigate an abnormal event and achieve plant stabilization and those human actions credited in the D3CA for accomplishing required safety functions.

Branch Technical Position 7-19 for Chapter 7 of NUREG-0800, (Reference 6.1.3) addresses software common cause failures of digital I&C in a nuclear power plant. A D3CA is performed to demonstrate that the NuScale design adequately addresses vulnerabilities to common cause failures. Additional best-estimate defense-in-depth analyses are performed by Safety Engineering to address the impact of potential Type 3 sensor failures. The D3CA may identify backup systems or HAs necessary for accomplishing the required safety functions. These HAs are treated as important human actions in the HFE Program.

Operator actions to confirm automatic actions, required for long-term decay heat removal or reactivity control, or needed to maintain a stable plant condition for the long term, are not DIHAs even though they may be identified in the TAA or D3CA. None of these operator actions are required to ensure reactivity control, core heat removal, or containment integrity.

The HFE team SMEs review each event scenario described in the TAA and D3CA to identify DIHAs.

3.3 Addressing Important Human Actions in Other Human Factors Engineering Program Elements

Important human actions, if identified are considered during OER, FRA/FA, TA, S&Q, HSI design, procedure development, training program development, and Human Factors Engineering V&V. The following sections (3.3.1 through 3.3.8) explain how IHAs are addressed in the other HFE Program elements. Further details on their methodologies are provided in IPs and RSRs for the specific program elements (Reference 6.2.2, Reference 6.2.3, Reference 6.2.4, Reference 6.2.5, and Reference 6.2.6, respectively).

Procedure development and training program development are the responsibility of a license applicant. Activities similar to those used for procedure and training program development are included in the NuScale HFE Program during TA and S&Q analysis to evaluate IHAs in detail. The applicant evaluates IHAs in their procedure development and training program development activities in accordance with NUREG-0800 Chapter 13. Human Factors Engineering V&V methodology, is described in the Human Factors Engineering Verification and Validation Implementation Plan (Reference 6.2.7).

The HFE Program itself is iterative in that elements of the program are input to other elements and some design issues are only resolved by changing assumptions or re-analyzing based on new data. The IHA-related issues discovered during HFE analyses are tracked in HFEITS as HFE issues, resolved during HFE design activities (e.g., HSI design, procedure development, and training program development), and verified during HFE verification and validation and design implementation (DI) activities. Resolution of IHA-related HFE issues may result in changes to or re-work of HFE analyses.

The HFE Program activities, including TIHA, fall within the design control process as described in the Human-System Interface Design Review Guidelines, NUREG-0700 (Reference 6.2.1), which includes provisions for design changes and revision control for NuScale Power Plant systems. Proposed design changes are screened for acceptability and processed in accordance with department and project procedures. The design change request process includes an evaluation of the impact on the HFE analyses and directs modification as appropriate.

3.3.1 Addressing Important Human Actions during Operating Experience Review

Potential IHAs are determined early in the NuScale design process as described in Section 3.1. These potential IHAs are recorded in the OER database (Reference 6.2.2) so that the information is available during the issue analysis and review portion of OER. Each operating experience item analyzed and entered into the OER database is evaluated against the list of potential IHAs. The OER issues that indicate a potential to impact IHAs are tracked as HFE issues in the HFEITS for resolution during appropriate HFE Program elements.

3.3.2 Addressing Important Human Actions during Functional Requirements Analysis and Function Allocation

As described in the NuScale Human Factors Engineering Functional Requirements Analysis and Functional Allocation Implementation Plan, TR-124333 (Reference 6.2.3), FRA identifies functions to be performed to satisfy plant goals. FRA is a top-down analysis starting with plant goals and high-level functions that are then decomposed into success paths addressing operating modes and conditions. Function allocation is the allocation of the monitoring and control associated with each high-level function to human, machine, or shared. Function allocation is performed to ensure that the plant HSI design and the allocation of monitoring and control functions, support operator vigilance, while maintaining acceptable workload levels. Once potential IHAs are identified, their FA is revisited to determine whether the original allocation is correct, or if based on its classification as an important human action, it could be allocated to some level of automation. The FRA/FA verifies that the IHAs are appropriately allocated (e.g., manual, automatic, or shared). Human engineering discrepancies (HEDs) are generated for IHAs for which evaluation criteria such as workload and time margin are not met, in accordance with the Human Factors Engineering Verification and Validation Implementation Plan, TR-130415 (Reference 6.2.7).

3.3.3 Addressing Important Human Actions during Task Analysis

As described in the TA Implementation Plan (Reference 6.2.4), tasks involving IHAs receive detailed TA including time validation of the assumptions. The TA confirms the assumptions about human performance shaping factors (e.g., workload and adequate training), used in the PRA to determine human error probabilities and the assumptions used in the TAA and D3CA to conclude that operators can execute IHAs within the time available. The final TA results in a complete inventory of alarms, controls, and indications to be implemented on the HSIs. The availability of HSIs to conduct IHAs, the associated situation and performance-shaping factors, the action complexity, and instances where adverse effects are created by a combination of primary and secondary tasks are also confirmed during TA. The TA assesses operator workload during execution of the IHA (for individual or multiple operating crew members, as appropriate) and provides additional assurance that the IHA can be carried out within the time available. The TA generates HFEITS for any IHAs that result in excessive workload conditions or any IHA that cannot be executed with adequate margin between the time available and the time required.

3.3.4 Addressing Important Human Actions during Staffing and Qualifications

During S&Q analyses completed using the NuScale Human Factors Engineering Staffing and Qualifications Results Summary Report, TR-130412 (Reference 6.2.5), potential IHAs were evaluated to ensure that staffing levels and staff qualifications are sufficient to execute the IHAs, including consideration of time requirements.

During the performance of control room staffing plan validation activities, potential IHAs were included in the scenarios that evaluate task performance, workload, and situational awareness using quantitative and qualitative criteria. Those validations confirm that potential IHAs can be carried out within the time available. The S&Q staffing analysis included examination of how effective the HSI is in support of successful staff execution of potential IHAs considering the minimum licensed main control room staff available. The analysis of potential or identified IHA task requires an evaluation for any potential negative impact on task performance from interactions with secondary tasks, high workload, or loss of situational awareness, when considering their impact to operator staffing and qualifications. As previously stated, no IHAs are identified as part of the NuScale Power Plant US460 standard design.

3.3.5 Addressing Important Human Actions during Human-System Interface Design

During HSI design (Reference 6.2.6), assumptions regarding HSI characteristics for IHAs are verified (e.g., reduction of time required for human actions via simplified or reduced navigation or by development of spatially dedicated continuously visible HSI or by establishing alarms associated with IHAs).

The following HSI design considerations are included to reduce the probability of human errors for IHAs:

- A minimum of two actions are required for all visual display unit controls (e.g., an action to call up the control function on the visual display unit and an action after peer checking to actuate the control).
- Tasks associated with a single IHA are conducted from a single display screen wherever possible; task-based displays are created as necessary.
- When a local control station (LCS) is required for conducting an IHA, that LCS human-system interface is designed using the same HSI Style Guide as the main control room human-system interfaces. This process ensures human-system interface design consistency, training efficiency, clear labeling, easy accessibility, and avoidance of hazardous locations.

After the HSI design for the alarms, indications, controls, and procedures are developed based on input from the plant design and the TA, Operations and Human Factors Engineering SMEs conduct performance-based testing, using part-task HSI simulation or tabletop analysis (screen based or LCS) to assess those designs against the list of IHAs.

3.3.6 Addressing Important Human Actions during Procedure Development

Final procedure development is the responsibility of the applicant and includes consideration of the transition of procedure development guidance from Standard Review Plan of Safety Analysis for Nuclear Power Plants, NUREG-0800 Chapter 18 (Reference 6.1.6), Human Factors Engineering Program Review Model, NUREG-0711 Section 9 and Section 11 (Reference 6.1.2), including the requirement to address IHAs in operating procedures. The DI element of NUREG-0711 ensures consistency between the procedures used in integrated system validation (ISV) with those in place in the completed plant, including any IHAs.

3.3.7 Addressing Important Human Actions during Training Program Development

Section 13.2.1 of NUREG-0800, Standard Review Plan, Reactor Operator Requalification Program; Reactor Operator Training (Reference 6.1.8) outlines guidance that the Licensed Operator Training Program provides qualified personnel to operate and to maintain the facility in a safe and efficient manner, as well as to keep the facility in compliance with its license, technical specifications, and applicable regulations. Training includes normal, abnormal, and emergency operating procedures, which contain any IHAs. Ultimately, training program development is the responsibility of the licensee.

3.3.8 Addressing Important Human Actions during Human Factors Engineering Verification and Validation

The adequacy of the HSI design to support operator performance of IHAs is confirmed in the ISV process (Reference 6.2.7). Consideration of IHAs during ISV involves defining simulator scenario initiating events with system and component failures, which challenge the operators to bring the plant to a safe state while following procedures. The scenarios considered in the ISV address the IHAs, dominant sequences, systems, and events.

The ISV assesses whether the necessary task-support HSIs are present and whether the HSIs comply with the governing HFE guidelines to support successful performance of IHAs. The ISV assesses the successful performance of the integrated crew and the HSI for IHAs. The HEDs are processed when discrepancies are found for any IHA.

The ability of operators to execute actions associated with a set of scenarios within the time available as defined in the analyses that identified the IHA is an ISV acceptance criterion. The V&V program element (Reference 6.2.7) is not considered complete until the ISV acceptance criteria are met. Other issues identified during the V&V related to IHAs are documented as HEDs and are resolved during V&V.

4.0 Summary of Results

4.1 Identification of Risk Important Human Actions from the Probabilistic Risk Assessment and Human Reliability Analysis

Applying the methodology described in Section 3.0, a review was performed of accident analysis associated with the transient and accident analysis to identify IHAs. No operator action is identified that is assumed to mitigate an anticipated operational occurrence, infrequent event, accident or special event. Chapter 15 states that, “There are no operator actions credited in evaluation of NuScale Power Plant US460 standard design DBEs,” so no further evaluation is needed.

The review also considered RIHAs contained in the PRA, or DIHAs derived from the TAA and D3CA, to determine if any IHAs have been identified. No RIHAs and no DIHAs were identified so no further evaluation is needed.

4.2 Identification of Deterministically-Important Human Actions from Transient and Accident Analysis and from the Diversity and Defense-in-Depth Coping Analysis

4.2.1 Transient and Accident Analysis

The NuScale design does not credit operator actions for accident mitigation in deterministic accident analysis. A review was performed of the accident analyses associated with the TAA to identify any IHAs. No operator action is identified that is assumed to mitigate any anticipated operational occurrence, infrequent event, accident or special event. Chapter 15 states that there are no operator actions credited in the evaluation of NuScale Power Plant US460 standard design DBEs. After a DBE, automated actions place the module in a safe-state and it remains in the safe-state condition for at least 72 hours without operator action, even with assumed failures.

4.2.2 Diversity and Defense-in-Depth Coping Analysis

There are no IHAs resulting from the D3CA. The TIHA team SME has reviewed each event scenario described in the D3CA to identify IHAs. Based on the best-estimates analyses performed by Safety Engineering to address the impact of potential Type 3 sensor failures no additional IHAs were identified.

4.3 Treatment of Important Human Actions in Human Factors Program Activities

Each of the HFE Program elements previously described in Section 3.0 of this document contain guidance on the treatment of IHAs, however, because no IHAs were identified for the SDA, that guidance has not been exercised.

5.0 Analysis of Conclusions

NuScale's integrated design approach resulted in a close collaboration among PRA and HRA practitioners, safety analysis engineers, I&C engineers, operations personnel, and human factors engineers. This collaboration drove multidisciplinary analyses to complex design decisions early in the conceptual design. In the case of identification of IHAs, the design was developed with the goal to minimize reliance on human action.

Within the HFE Program, human factors activities such as OER, FRA / FA, TA, and HSI design were being developed as near parallel activities. This process provided the opportunity to develop and evaluate relatively mature design alternatives for evaluation of complex concepts.

This process is exemplified by the eventual result of no important human actions identified from the PRA, or from the DIHAs derived from the TAA and D3CA.

6.0 References

6.1 Source Documents

6.1.1. U.S. Nuclear Regulatory Commission, “Human-System Interface Design Review Guidelines,” NUREG-0700, Rev. 3, July 2020.

6.1.2. U.S. Nuclear Regulatory Commission, “Human Factors Engineering Program Review Model,” NUREG-0711, Rev. 3, November 2012.

6.1.3. U.S. Nuclear Regulatory Commission, “Standard Review Plan,” Chapter 7, Rev. 6, “Instrumentation and Controls,” BTP 7-19, Rev. 6, “Guidance for Evaluation of Diversity and Defense-in-Depth in Digital Computer-Based Instrumentation and Control Systems,” NUREG-0800, July 2012.

6.1.4. U.S. Nuclear Regulatory Commission, “Standard Review Plan,” Chapter 15, Rev. 3, Transient and Accident Analysis, NUREG-0800.

6.1.5. U.S. Nuclear Regulatory Commission, “Standard Review Plan,” NUREG-0800, Chapter 18, Rev. 3, Human Factors Engineering.

6.1.6. U.S. Nuclear Regulatory Commission, “Standard Review Plan,” NUREG-0800, Chapter 19, Rev. 3, Probabilistic Risk Assessment and Severe Accident Evaluation for New Reactors.

6.1.7. U.S. Nuclear Regulatory Commission, “Standard Review Plan,” NUREG-0800, Chapter 13.5.2.1, Rev. 2, Operating and Emergency Operating Procedures.

6.1.8. U.S. Nuclear Regulatory Commission, “Standard Review Plan,” NUREG-0800, Chapter 13.2.1, Rev. 4, Reactor Operator Requalification Program; Reactor Operator Training.

6.1.9. U.S. Nuclear Regulatory Commission, “Guidance for the Review of Changes to Human Actions,” NUREG-1764, Rev. 1, September 2007.

6.1.10. U.S. Nuclear Regulatory Commission, “Handbook of Human Reliability Analysis with Emphasis on Nuclear Power Plant Applications,” NUREG/CR-1278, August 1983.

6.1.11. U.S. Nuclear Regulatory Commission, “Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants,” Regulatory Guide 1.97, Rev. 5, April 2019.

6.2 Referenced Documents

6.2.1. Human Factors Engineering Program Management Plan, TR-130414, Revision 0.

6.2.2. Human Factors Engineering Operating Experience Review Implementation Plan TR-130409, Revision 0.

6.2.3. NuScale Human Factors Engineering Functional Requirements Analysis and Function Allocation Implementation Plan, TR-124333, Revision 0.

6.2.4. NuScale Human Factors Engineering Task Analysis Implementation Plan, TR-130413, Revision 0.

6.2.5. NuScale Human Factors Engineering Staffing and Qualifications Results Summary Report, TR-130412, Revision 0.

6.2.6. Human Factors Engineering Human-System Interface Design Implementation Plan, TR-130417, Revision 0.

6.2.7. Human Factors Verification and Validation Implementation Plan, TR-130415, Revision 0.

6.2.8. Risk Significance Determination, TR-0515-13952-NP-A, Revision 0.