

**Enclosure 1:**

"Human Factors Engineering Staffing and Qualifications Implementation Plan," RP-0914-8538-NP,  
Revision 0, nonproprietary version

# **Human Factors Engineering Staffing and Qualifications Implementation Plan**

July 2015  
Revision 0  
Docket: PROJ0769  
NuScale Nonproprietary

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## CONTENTS

<b>1.0</b>	<b>Introduction .....</b>	<b>1</b>
1.1	Purpose .....	1
1.2	Scope .....	1
1.3	Abbreviations and Definitions .....	1
<b>2.0</b>	<b>Applicable Regulatory Guidance for Staffing and Qualifications .....</b>	<b>3</b>
2.1	Standard Review Plan Guidance on Staffing and Qualifications .....	3
2.2	Code of Federal Regulations Guidance on Staffing and Qualifications (10 CFR 50.54(m)) .....	3
<b>3.0</b>	<b>Staffing and Qualifications Methodology .....</b>	<b>5</b>
3.1	Task Analysis Inputs .....	5
3.2	Determining the Number and Qualifications of Licensed Operator Personnel .....	5
3.3	Iterative Nature of Staffing Analysis .....	5
3.4	Basis for Staffing and Qualification Levels .....	6
3.5	Baseline Assumptions .....	9
3.6	Evaluation of Staffing and Qualifications .....	9
<b>4.0</b>	<b>Staffing and Qualifications Results Summary Report .....</b>	<b>11</b>
<b>5.0</b>	<b>NUREG-0711 Conformance Evaluation .....</b>	<b>12</b>
<b>6.0</b>	<b>References .....</b>	<b>15</b>
6.1	Source Documents .....	15
6.2	Referenced Documents .....	16

## TABLES

Table 1-1	Abbreviations .....	1
Table 1-2	Definitions .....	2
Table 5-1.	Conformance with NUREG-0711 .....	12

## FIGURES

N/A

## 1.0 Introduction

### 1.1 Purpose

The objective of staffing and qualifications (S&Q) analysis is to determine the number and qualifications of licensed operator personnel required for safe and efficient NuScale plant operation under all operating conditions based on task and regulatory requirements.

### 1.2 Scope

Applicable licensed operator personnel numbers and qualification analyzed under S&Q activities are consistent with those of the overall human factors engineering (HFE) program as described in the HFE Program Management Plan (Reference 6.2.1) and in Section 3.2 below.

The numbers and qualifications of non-licensed operator personnel including technicians and maintenance staff are not in-scope and are not analyzed by the NuScale plant HFE program because that is a NuScale plant licensee responsibility.

### 1.3 Abbreviations and Definitions

Table 1-1 Abbreviations

Term	Definition
ANSI/ANS	American National Standards Institute/American Nuclear Society
CFR	code of federal regulations
DCD	design certification document
FA	function allocation
FRA	functional requirements analysis
HED	human engineering discrepancy
HFE	human factors engineering
HFEITS	Human Factors Engineering Issue Tracking System
HSI	human-system interface
I&C	instrumentation and controls
IHA	important human action
IP	implementation plan
ISV	integrated system validation
MCR	main control room
NRC	Nuclear Regulatory Commission
NUREG	Nuclear Regulatory Commission (technical report of the United States Nuclear Regulatory Commission)
OER	operating experience review
RIS	regulatory issue summary
RSR	results summary report
S&Q	staffing and qualifications
SME	subject matter expert

Term	Definition
TA	task analysis
TIHA	treatment of important human actions
V&V	verification and validation

Table 1-2 Definitions

N/A

## **2.0 Applicable Regulatory Guidance for Staffing and Qualifications**

### **2.1 Standard Review Plan Guidance on Staffing and Qualifications**

The organizational descriptions for the NuScale plant include position functions and responsibilities related to

- the management and technical support and the operations organizations in accordance with the guidance provided in NUREG-0800 Section 13.1.1 (Reference 6.1.2)
- licensed operator qualifications and shift staffing levels in accordance with the guidance provided in NUREG-0800 Section 13.1.2 (Reference 6.1.2)
- how the plant operating and technical staff participates in development, conduct, and participation in the initial test program, in reviewing test results and in the plant-specific test-program training

### **2.2 Code of Federal Regulations Guidance on Staffing and Qualifications (10 CFR 50.54(m))**

The initial licensed operator staffing levels assumed in this implementation plan do not meet the requirements of code of federal regulation 10 CFR 50.54(m)(2)(iii) (Reference 6.1.3) for a separate licensed operator at the controls for each fueled nuclear power unit. 10 CFR 50.54(m)(2)(iii) states:

*When a nuclear power unit is in an operational mode other than cold shutdown or refueling, as defined by the unit's technical specifications, each licensee shall have a person holding a senior operator license for the nuclear power unit in the control room at all times. In addition to this senior operator, for each fueled nuclear power unit, a licensed operator or senior operator shall be present at the controls at all times.*

Due to NuScale's safe design, passive safety systems, simple operation, automation, and reduced licensed operator workload, NuScale plant licensees are anticipated to request an exemption from 10 CFR 50.54(m)(2)(iii) using the guidance of NUREG-1791, Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m). The NuScale plant is designed to operate up to twelve units from a single MCR, which is not specifically addressed in 10 CFR 50.54(m). The 10 CFR 50.54(m) regulation related to the *qualifications* of licensed operators and senior operators on duty is applied to the NuScale plant.

SECY-11-0098, Operator Staffing for Small or Multi-Module Nuclear Power Plant Facilities (Reference 6.1.15) recommends future rule-making for the number of qualified MCR staff for small modular reactors with multiple units operated from a single MCR, such as the NuScale plant. SECY-11-0098 also recognizes that analyses conducted as part of the overall HFE program, specifically task analysis, determine the appropriate and safe number of licensed MCR operators for different operating modes.

Staffing levels for the NuScale MCR are defined based on the analyses conducted as described in Section 3.0 below. The input assumptions for minimum MCR staffing are



described in the Human-System Interface Design Implementation Plan (IP) (Reference 6.2.6) and the NuScale Concept of Operations (Reference 6.2.9). Due to the NuScale plant's safe design, passive safety systems, simple operation, automation, and reduced licensed operator workload, a twelve unit NuScale plant is assumed to be operable with a minimum MCR shift contingent of three licensed reactor operators and three licensed senior reactor operators (covering the roles of shift manager, shift engineer, and control room supervisor). This assumption is subject to change following completion of the analyses described below. Any required changes to this minimum staffing number are tracked in HFEITS, resolved through iteration of analyses, and validated during human factors verification and validation (V&V).

### **3.0 Staffing and Qualifications Methodology**

#### **3.1 Task Analysis Inputs**

As described in the Human Factors Engineering Task Analysis (TA) Implementation Plan (Reference 6.2.4), TA results are used to determine sufficiency of the defined crew roles and responsibilities and the assumed crew size for all plant operating modes and conditions. Personnel tasks, addressed in TA, are assigned to staffing positions considering

- task characteristics, such as the knowledge and abilities required, relationships among tasks, time available, and time required to perform the task
- the operator's ability to maintain situation awareness within the area of assigned responsibility
- teamwork and team processes such as peer checking
- workload associated with each job within the crew

#### **3.2 Determining the Number and Qualifications of Licensed Operator Personnel**

The scope of S&Q analyses includes determining both the number of licensed operator personnel and their qualifications. For the purposes of this implementation plan, licensed operator personnel include licensed operators and senior operators as defined by code of federal regulation 10 CFR 55.4 (Reference 6.1.4) and MCR-specific personnel subject to the training program as described by 10 CFR 50.120 (Reference 6.1.5).

S&Q analyses define numbers and qualifications of licensed personnel for the full range of conditions and tasks including

- normal operations, startup, shutdown, and refueling
- abnormal and emergency conditions to include those in the design basis
- beyond design basis conditions for which emergency procedures define a clear action path
- plant maintenance tasks
- plant surveillances
- testing
- tasks related to plant safety and those that are not directly related to plant safety but which may cause an adverse effect on tasks directly related to plant safety (e.g., training, supervision)
- installation of additional modules during operation
- operation of up to twelve modules.

#### **3.3 Iterative Nature of Staffing Analysis**

Human engineering discrepancies (HED) are generated during all aspects of the NuScale HFE program as described in the Human Factors Engineering Program Management Plan (Reference 6.2.1). HEDs generated during those HFE program elements described below which effect the S&Q analyses are resolved as part of S&Q when possible. These HEDs serve to establish the initial staffing goals for the MCR

crew. Initial staffing goals are modified in an iterative fashion through the use of the HED process as information from other HFE elements becomes available.

### **3.4 Basis for Staffing and Qualification Levels**

The initial staffing goals for the MCR crew are described in the Human-System Interface Design Implementation Plan (Reference 6.2.6) and the NuScale Concept of Operations (Reference 6.2.9). Initial staffing goals for the MCR crew are an input to all HFE program elements and are ultimately confirmed during human factors V&V (Reference 6.2.7).

#### **3.4.1 Operating Experience Review**

The NuScale plant is a new and innovative modular passive design with no commercial nuclear reactor considered as a direct predecessor. Nonetheless, the operating experience of current commercial nuclear power plants is analyzed as described in the operating experience review (OER) implementation plan (Reference 6.2.2) because many NuScale systems and components are also found in those designs. The NuScale design also has a high degree of automation. Therefore, initial staffing goals for the MCR crew and qualifications are based on staffing levels and qualifications from commercial nuclear power plants taking into account the passive features and degree of automation.

Operating experience at commercial nuclear power plants is reviewed as described in Reference 6.2.2 and includes

- operational strengths and weaknesses resulting from staffing levels
- initial staffing goals for the MCR crew and their bases, including staffing levels and a description of significant similarities and differences
- staffing considerations described in NRC Information Notice 95-48, "Results of Shift Staffing Study" (Reference 6.1.6)
- possible impact on staffing of requirements of work hour limits, required break times, and required days off, as specified in 10 CFR 26.205, Work Hours (Reference 6.1.7) as part of the Fitness-for-Duty rule
- Regulatory Issue Summary (RIS) 2009-10, Communications between the NRC and Reactor Licensees during Emergencies and Significant Events (Reference 6.1.8)
- automatic action crediting described in NRC Information Notice 97-78, "Crediting of Operator Actions in Place of Automatic Actions and Modifications of Operator Actions, Including Response Times" (Reference 6.1.9)
- NUREG/IA-0137, A Study of Control Room Staffing Levels for Advanced Reactors (Reference 6.1.16)

The OER identifies human performance errors that may indicate strengths or weaknesses in commercial nuclear power plant S&Q. Human performance errors are evaluated to determine if strengths are maintained and weaknesses are resolved by the NuScale design. OER bases related to S&Q are re-confirmed during S&Q analyses to ensure they remain valid.

### **3.4.2 Functional Requirements Analysis and Function Allocation**

The functional requirements analysis (FRA) determines plant functions performed to satisfy plant safety objectives and identifies the preferred normal and emergency success paths used to control those functions. The function allocation (FA) assigns these success paths to human, automated, or shared actions. The process for assigning or allocating success paths is described in the Functional Requirements Analysis / Function Allocation Implementation Plan (Reference 6.2.3) and includes consideration of the complexity and time criticality of controlling these success paths.

The initial FA allocates functions to an individual operator based on HFE criteria and may not fully consider the operating crew as a whole. S&Q analyses involve review of initial FA with the role of identifying where requirements for performing human-allocated actions may exceed the qualifications of the assigned staff or cause an overload which could be mitigated by sharing the actions among team members or changing the role of the assigned individual.

During S&Q analyses HEDs may be generated in order to bring about changes to FRA/FA during successive iterations.

### **3.4.3 Task Analysis**

The functions assigned to licensed operator personnel from FRA/FA define their roles and responsibilities for both manual actions and monitoring of or backup to automation. Human actions performed to accomplish these functions are grouped to obtain common objectives or goals. TA defines operator staffing and qualifications for each task and includes calculation of workload and time margins for task execution.

TA inputs to S&Q analyses include

- time available/required to perform a task and the workload involved
- knowledge, skills, and abilities for personnel
- personnel communication and coordination, including interactions between individuals for diagnosing, planning, and controlling the plant, and interactions between personnel for administrative, communications, and reporting activities
- the job requirements resulting from the sum of all tasks allocated to each individual inside and outside the MCR
- potential decreases in the ability of personnel to coordinate their work due to changes to the plant
- availability of personnel considering other work that may be ongoing, and for which operators may be responsible outside the MCR (e.g., fire brigade)

S&Q analyses consider tasks from the full scope of TA (i.e., the full range of plant operating modes, including startup, normal operations, low-power and shutdown conditions, transient conditions, abnormal conditions, emergency conditions, and severe accident conditions)(see Reference 6.2.4). This range of operating modes includes actions identified in

- 10 CFR 50.47, Emergency Plans (Reference 6.1.10)

- NUREG-0654, Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants (Reference 6.1.11)
- procedures to implement an initial accident response in key functional areas as denoted in the emergency plan

S&Q related HEDs which may be generated during TA are resolved prior to establishing the initial staffing goals for the MCR crew which is further evaluated during S&Q.

#### **3.4.4 Treatment of Important Human Actions**

Important human actions (IHA) are identified as described in the Treatment of Important Human Actions (TIHA) Implementation Plan (Reference 6.2.5). TA confirms

- the assumptions that IHAs can be conducted within the time available by the minimum licensed MCR staff for all plant operating modes and conditions
- the effect of overall licensed MCR staffing levels on plant safety and reliability
- coordination of personnel associated with the use of advanced technology considering secondary tasks
- availability, degree of clarity, and indication cues for manipulation of the human-system interface (HSI)

S&Q analyses consider the findings in NUREG/CR-6753 (Reference 6.1.12) related to the contribution of human performance to risk.

S&Q analyses examine IHAs considering the minimum licensed MCR staff available. Evaluating IHAs with related tasks identifies adverse workload or synergistic effects created by the combination of primary and secondary task loading.

S&Q related HEDs identified as IHAs are evaluated during TA are resolved prior to establishing the initial staffing goals for the MCR crew which is further evaluated during S&Q.

#### **3.4.5 Procedure Development**

{{

}}<sup>3(a)-(c)</sup>

S&Q related HEDs identified during procedure development are entered into the HED database. Procedure development related HEDs which affect sample human factors V&V scenarios (Reference 6.2.7) are resolved prior to integrated system validation (ISV). Other procedure development related HEDs may be resolved prior to completion of design implementation (Reference 6.2.8).

#### **3.4.6 Training Program Development**

S&Q analyses provide input the training program development related to knowledge, skills, and abilities to be attained and maintained. As S&Q analyses encompass licensed operator personnel, they provide input essential to coordinating actions

between individuals inside and outside the MCR. The training program includes this set of coordination knowledge, skill, and abilities.

S&Q related HEDs identified during training program development are entered into the HED database. Training program development related HEDs are resolved during human factors V&V (Reference 6.2.7) or design implementation (Reference 6.2.8) as applicable.

### **3.5 Baseline Assumptions**

Prior to completion of staffing analyses, a twelve unit NuScale plant is assumed to be operable with a MCR shift contingent of three licensed reactor operators and three licensed senior reactor operators (covering the roles of shift manager, shift engineer, and control room supervisor). TA determines the minimum MCR shift contingent for various module configurations and operating modes including shutdown and refueling modes through workload analysis. S&Q analyses are conducted to validate these initial staffing goals for the MCR crew. Maximum MCR staffing is related to capacity of ventilation systems or considerations such as lighting or ambient noise and, as such, is not analyzed during S&Q activities. TA defines *constraints* for lighting or noise. Ventilation system capacity is determined by another engineering discipline. Prior to S&Q analyses, the initial staffing goals for the MCR crew reflect the resolution of staffing-related HEDs from OER, FRA/FA, TA and TIHA.

Qualifications requirements (education and job experience) for the licensed operator personnel are described in ANSI/ANS 3.1, Selection, Qualification, and Training of Personnel for Nuclear Power Plants (Reference 6.1.13).

### **3.6 Evaluation of Staffing and Qualifications**

Bases for licensed operator personnel staffing are established as described in Section 3.4 using input from other HFE program elements to establish the initial staffing goals for the MCR crew (numbers and qualifications baseline) described in Section 3.5. S&Q evaluations confirm or modify those baselines to achieve the final staffing and qualifications. The human factors V&V element verifies that the HFE design conforms to the HFE design principles and that it enables licensed operator personnel to successfully perform their tasks to assure plant safety and operational goals including the verification that staffing levels are adequate and workloads are manageable.

#### **3.6.1 Plant Conditions Selection**

Scenarios selected for S&Q analyses are identified from other HFE program elements

- OER identifies situations and technologies which effect human performance and evaluates these for effects on crew size or qualifications.
- FRA/FA identifies success paths to determine best allocation of functions. FRA/FA also identifies associated workload to control those success paths while maintaining critical functions (including monitoring of automatic functions).
- TA identifies constraints where time required to conduct a task is less than time available. Secondary tasks, distractions, and process delays (e.g., valve stroke time or digital processing time) are considered within time required constraints. Licensed

operator workload is determined by the collective time required/time available calculation. S&Q identifies a sample size of the tasks which have highest workload conditions and a sample size of those which have the lowest workload conditions.

S&Q analyses are also conducted for scenarios that, in subject matter expert (SME) judgment, would challenge the baseline operating crew (initial staffing goals for the MCR) in terms of numbers or qualifications. {{

}}<sup>3(a)-(c)</sup> Scenarios selected for S&Q analysis and any resulting changes to the initial staffing goals for the MCR crew are validated during human factors V&V.

### **3.6.2 Licensed Operator Personnel Crew S&Q Evaluation**

To evaluate the initial staffing goals for the MCR crew, operating procedures are preferred but the information and control needs for operator instructions resulting from TA (Reference 6.2.4) are sufficient for tabletop walkthroughs. {{

}}<sup>3(a)-(c)</sup> If it is determined that any scenario or condition cannot be managed by the baseline MCR crew, an HED is generated. An HED evaluation (see Reference 6.2.1) determines if the scenario or condition could be better managed with a change in staff numbers or qualifications or if an HSI design or usage change is necessary. An S&Q HED might also be resolved during procedure or training program development.

#### **4.0 Staffing and Qualifications Results Summary Report**

Results of S&Q are compiled in a results summary report (RSR). The S&Q RSR includes

- a description of the process used to determine initial and final staffing levels
- the plant conditions for which the initial staffing goals for the MCR crew were evaluated, including the basis for selecting those conditions
  - scenarios derived from OER findings
  - scenarios from FRA/FA in which success paths for functions allocated to humans may exceed the qualifications of the assigned staff or cause an overload
  - scenarios from TA in which time required to conduct a task is less than time available
  - scenarios which, in SME judgment, would challenge the baseline licensed operator personnel crew in terms of numbers or qualifications
- execution results
  - a description of any changes to initial staffing goals for the MCR crew numbers based on analyses including how conclusions were reached
  - a description of any changes to initial staffing goals for the MCR crew qualifications based on the analyses including how conclusions were reached
  - HEDs generated during previous HFE elements resolved during S&Q
  - HEDs generated or generated and resolved during S&Q for plant conditions which cannot be managed by the initial staffing goals for the MCR crew



## 5.0 NUREG-0711 Conformance Evaluation

Table 5-1 indicates where each NUREG-0711, Revision 3 criterion is met in this IP.

Table 5-1. Conformance with NUREG-0711

Review Criteria Stated in NUREG-0711, Rev. 3	S&Q IP Section No. and paragraph
<p><b>6.4 Review Criteria</b></p> <p>(1) The applicant should address the applicable staffing and qualifications guidance in NUREG-0800 Section 13.1.</p> <p><i>Additional Information:</i> The NRC's reviewers for Chapter 18 of NUREG-0800 should verify that the reviews of Section 13.1 were completed.</p>	Section 2.1, all paragraphs
<p>(2) The applicant should address the applicable staffing and qualifications guidance in 10 CFR 50.54.</p> <p><i>Additional Information:</i> As part of their verification, the Chapter 18 reviewers should assure that staffing meets the requirements of 10 CFR 50.54. For plant staffing levels that require an exemption from 10 CFR 50.54, the NRC's reviewers should use the guidance in NUREG-1791 (Persensky et al., 2005) and NUREG/CR-6838 (Plott et al., 2004).</p>	Section 2.2, all paragraphs
<p>(3) The applicant should use the results of the task analysis as an input to the staffing and qualification analyses. Personnel tasks, addressed in task analysis, should be assigned to staffing positions to ensure that jobs are defined considering:</p> <ul style="list-style-type: none"> <li>the task characteristics, such as the knowledge and abilities required, relationships among tasks, time required to perform the task, and estimated workload</li> <li>the person's ability to maintain situation awareness within the area of assigned responsibility</li> <li>teamwork and team processes, such as peer checking</li> </ul>	Section 3.1, all paragraphs

Review Criteria Stated in NUREG-0711, Rev. 3	S&Q IP Section No. and paragraph
<p>(4) The applicant's staffing analysis should determine the number and qualifications of operations personnel for the full range of plant conditions and tasks, including operational tasks (under normal, abnormal, and emergency conditions), plant maintenance, plant surveillance, and testing.</p> <p><i>Additional Information:</i> The staffing analysis should address how the activities performed by personnel listed in Section 2.4.1, General HFE Program Goals and Scope, Criterion (5) impact and/or interface with the MCR. A reasonable approach is using predecessor plant data as a starting point for the analysis and adjusting the staffing numbers in accord with information from the new plant's design.</p>	Section 3.2, all paragraphs
<p>(5) The applicant's staffing analysis should be iterative; that is, the initial staffing goals should be modified as information from the HFE analyses from other elements becomes available.</p>	Section 3.3, all paragraphs
<p>(6) The applicant should address the basis for staffing and qualification levels considering the specific staffing-related issues noted below. These considerations may be identified in other HFE elements or in related source documents as follows:</p> <ul style="list-style-type: none"> <li>• Operating Experience Review <ul style="list-style-type: none"> <li>– operational problems and strengths resulting from staffing levels in predecessor designs</li> <li>– initial staffing goals and their bases, including staffing levels of predecessor designs and a description of significant similarities and differences between predecessor and current designs</li> <li>– staffing considerations described in NRC Information Notice 95-48, "Results of Shift Staffing Study"</li> <li>– possible impact on staffing of requirements of limits to work hours, required break times, and required days off, as specified in 10 CFR 26.205, Work Hours, as part of the Fitness for Duty Rule</li> <li>– Regulatory Issue Summary (RIS) 2009-10, Communications Between the NRC and Reactor Licensees During Emergencies and Significant Events</li> </ul> </li> </ul>	<p>Section 3.4</p> <p>Section 3.4.1, all paragraphs</p>
<ul style="list-style-type: none"> <li>• Functional Requirements Analysis and Function Allocation <ul style="list-style-type: none"> <li>– potential mismatches between functions allocated to personnel and their qualifications</li> <li>– changes to the roles of personnel due to modifying the plant's systems and HFE aspects</li> </ul> </li> </ul>	Section 3.4.2, all paragraphs

Review Criteria Stated in NUREG-0711, Rev. 3	S&Q IP Section No. and paragraph
<ul style="list-style-type: none"> <li>• Task Analysis <ul style="list-style-type: none"> <li>– time needed to perform a task, and the workload involved</li> <li>– personnel communication and coordination, including interactions between individuals for diagnosing, planning, and controlling the plant, and interactions between personnel for administrative, communications, and reporting activities</li> <li>– the job requirements resulting from the sum of all tasks allocated to each individual inside and outside the control room</li> <li>– potential decreases in the ability of personnel to coordinate their work due to changes to the plant</li> <li>– availability of personnel considering other work that may be ongoing, and for which operators may be responsible outside the control room (e.g., fire brigade)</li> <li>– actions identified in 10 CFR 50.47, NUREG-0654, and procedures to implement an initial accident response in key functional areas, as denoted in the emergency plan</li> <li>– staffing considerations described by the application of ANSI/ANS 58.8-1994, "Time Response Design Criteria for Safety-Related Operator Actions" (ANS, 1994), if used by the applicant</li> </ul> </li> </ul>	Section 3.4.3, all paragraphs
<ul style="list-style-type: none"> <li>• Treatment of Important Human Actions <ul style="list-style-type: none"> <li>– the effect of staffing levels on the performance of the identified important HAs</li> <li>– the effect of staffing levels on personnel coordination for important HAs</li> <li>– NUREG/CR-6753, Review of Findings for Human Performance Contribution to Risk in Operating Events</li> </ul> </li> </ul>	Section 3.4.4, all paragraphs
<ul style="list-style-type: none"> <li>• Procedure Development <ul style="list-style-type: none"> <li>– staffing demands resulting from requirements to concurrently use multiple procedures</li> <li>– personnel knowledge, abilities, and authorities identified in the procedures</li> </ul> </li> </ul>	Section 3.4.5, all paragraphs
<ul style="list-style-type: none"> <li>• Training Program Development <ul style="list-style-type: none"> <li>– concerns about coordinating personnel that are identified during the development of training</li> </ul> </li> </ul>	Section 3.4.6, all paragraphs

## **6.0 References**

### **6.1 Source Documents**

- 6.1.1 NUREG-0711, Rev. 3. Human Factors Engineering Program Review Model, November 2012.
- 6.1.2 NUREG-0800, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition, March 2007.
- 6.1.3 U.S. Code of Federal Regulations, "Conditions of licenses," Section 50.54, Part 50, Title 10, "Energy," (10 CFR 50.54).
- 6.1.4 U.S. Code of Federal Regulations, "Definitions," Section 55.4, Part 55, Title 10, "Energy," (10 CFR 55.4).
- 6.1.5 U.S. Code of Federal Regulations, "Additional Standards for Licenses, Certifications, and Regulatory Approvals," Section 50.120, Part 50, Title 10, "Energy," (10 CFR 50.120).
- 6.1.6 Results of Shift Staffing Study, Information Notice 95-48, U.S. Nuclear Regulatory Commission, 1995.
- 6.1.7 U.S. Code of Federal Regulations, "Work Hours," Section 26.205, Part 26, Title 10, "Energy," (10 CFR 26.205).
- 6.1.8 Regulatory Issue Summary (RIS) 2009-10, Communications between the NRC and Reactor Licensees during Emergencies and Significant Events.
- 6.1.9 Crediting of Operator Actions in Place of Automatic Actions and Modifications of Operator Actions, Including Response Times, Information Notice 97-78, U.S. Nuclear Regulatory Commission, 1997.
- 6.1.10 U.S. Code of Federal Regulations, "Emergency Plans," Section 50.47, Part 50, Title 10, "Energy," (10 CFR 50.47).
- 6.1.11 NUREG-0654, Rev. 1. Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, November 1980.
- 6.1.12 NUREG/CR-6753, Review of Findings for Human Performance Contribution to Risk in Operating Events, March 2002.
- 6.1.13 Selection, Qualification, and Training of Personnel for Nuclear Power Plants, ANSI/ANS 3.1, Revision.1, 1999.
- 6.1.14 NUREG/CR-6400, Human Factors Engineering (HFE) Insights for Advanced Reactors Based Upon Operating Experience, 1996.

6.1.15 SECY-11-0098, Operator Staffing for Small or Multi-Module Nuclear Power Plant Facilities, July 2011.

6.1.16 NUREG/IA-0137, A Study of Control Room Staffing Levels for Advanced Reactors, November 2000.

## **6.2 Referenced Documents**

6.2.1 NuScale Human Factors Engineering Program Management Plan, RP-0914-8534.

6.2.2 NuScale Human Factors Engineering Operating Experience Review Implementation Plan, RP-0914-8535.

6.2.3 NuScale Human Factors Engineering Functional Requirements Analysis / Function Allocation Implementation Plan, RP-0914-8536.

6.2.4 NuScale Human Factors Engineering Task Analysis Implementation Plan, RP-0914-8537.

6.2.5 NuScale Human Factors Engineering Treatment of Important Human Actions Implementation Plan, RP-0914-0839.

6.2.6 NuScale Human Factors Engineering Human System Interface Design Implementation Plan, RP-0914-0840.

6.2.7 NuScale Human Factors Engineering Verification and Validation Implementation Plan, RP-0914-0843.

6.2.8 NuScale Human Factors Engineering Design Implementation Implementation Plan, RP-0914-0844.

6.2.9 NuScale Concept of Operations, RP-0215-10815.