Enclosure 4:

"Human Factors Engineering Human Performance Monitoring Implementation Plan," RP-0914-8545-NP, Revision 0, nonproprietary version

Human Factors Engineering Human Performance Monitoring Implementation Plan

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Revision 0
Docket: PROJ0769
NuScale Nonproprietary

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1.0 Introduction

1.1 Purpose

This document provides the human performance monitoring (HPM) implementation plan (IP) for the NuScale plant human factors engineering (HFE) program. HPM provides an integrated strategy for monitoring human performance, identifying human performance degradation, and prompting related corrective actions to help ensure that human performance does not degrade to an unacceptable level over time or due to plant design changes after the plant becomes operational.

This HPM IP defines a set of activities needed to maintain the as-built human-system interface (HSI) (alarms, controls, indications, and procedures) and training program to HFE requirements as defined by the NuScale plant HFE program. This HPM IP interfaces with the plant's corrective actions program (CAP) to ensure that corrective actions are tracked to resolution in a timely manner.

1.2 Scope

The HPM program specifically applies to

- effective use of the HSI design which is in-scope for the NuScale plant HFE program (Reference 5.2.1) and validated during integrated system validation (ISV) (Reference 5.2.4)
  - the successful completion of important human actions (IHA), measured by time and task completion
  - correct diagnosis of the cause of abnormal plant events
  - accuracy of procedure execution
- changes made to the HSIs (alarms, controls, indications, and procedures) and the training program

The HPM program is applicable for operator actions on HFE program in-scope HSIs at the following locations (Reference 5.2.1) beginning after fuel load and provisional construction turnover

- main control room (MCR)
- remote shutdown facility (RSF)
- technical support center (TSC)
- emergency operations facility (EOF)
- local control stations (LCS)

1.3 Abbreviations and Definitions

Table 1-1. Abbreviations

Term	Definition
CAP	corrective actions program
EOF	emergency operating facility
HFE	human factors engineering

Term	Definition
HPM	human performance monitoring
HSI	human-system interface
IHA	important human action
INPO	Institute for Nuclear Power Operations
IP	implementation plan
LCS	local control station
MCR	main control room
OER	operating experience review
RSF	remote shutdown facility
SME	subject matter expert
TSC	technical support center

2.0 Human Performance Monitoring Program Goals

The goal of the HPM program is to provide reasonable assurance that plant personnel have acquired and maintain the skills required to complete needed actions, including when changes to the design of the HSIs and training program occur. Human performance problems are identified through HFE evaluation of data collected from actual plant events and from periodic training activities in the full-scope simulator that are specifically designed to monitor human performance degradation. Identified human performance deficiencies are analyzed using a combination of tools (see Reference 5.1.2) to determine their cause. After determining the cause, corrective action plans are developed and implemented to preclude or minimize recurrence of the human performance deficiency. Trends are identified in the corrective action program.

3.0 Human Performance Monitoring Program Structure

The HPM program includes

- identification of human performance problems
- methods for investigating known human performance issues
- determining root or apparent cause of human performance issues
- developing corrective action plans
- trending of human performance

3.1 Identifying Human Performance Problems and Causes

Multiple sources of information are used to collect plant and human performance data

- historic data from plant process computers
- plant process computer logged events
- operator logs
- simulator logs and administrator records
- documented observations from subject matter experts (SME) during normal operations, training exercises, and "post-event" debriefings
- corrective action program evaluations and apparent/root causes
- training program records
- industry operating experience
- expert opinion from structured human performance monitoring exercises

Information related to human performance is collected under actual operating conditions, in simulator exercises, and training class table top walk-throughs. A combination of these sources of information and a combination of observations/observers is used to evaluate events, determine corrective actions, and predict performance trends.

3.2 Investigation Methods for Human Performance

The purpose of investigating human performance problems is to identify causes and develop effective corrective actions. Tools that may be used during human performance problem investigations include

- Human Performance Tools for Engineers and Other Knowledge Workers, INPO-05-002 (Reference 5.1.3)
- Human Performance Tools for Managers and Supervisors, INPO 07-006 (Reference 5.1.4)
- INPO Excellence in Human Performance, September 1997 (Reference 5.1.5)
- Human Performance Tools for Workers, INPO 06-002 (Reference 5.1.6)
- Human Performance Reference Manual, INPO 06-003 (Reference 5.1.7)

Human performance investigations are adapted based on the significance of the event in which the error was noted or the potential for impact if the error indicates a trend. Errors determined to be root causes of an event are more significant than contributing causes. Investigations are conducted in a systematic manner as described in an appropriate process or procedure. A complete investigation identifies direct, contributing, and root or apparent causes of the human performance problem so that corrective actions can be developed to minimize recurrence. Multiple forms of evidence to support findings are preferred. The bases for findings are documented.

3.3 Root Cause Analysis

Detailed root cause analysis techniques are warranted when the significance of the error is high; low-significance errors may not justify the amount of time necessary to investigate. An effective root cause analysis includes

- a description of the problem
- data gathering about the problem
- identification of potential causes for the problem
- identification of which cause(s) should be removed or changed to prevent or minimize re-occurrence
- identification of solutions to remove or minimize the cause(s) in order to prevent or minimize re-occurrence

Techniques for root cause analysis include

- failure mode and effects analysis
- Pareto analysis
- fault tree analysis
- current reality tree
- fishbone, Ishikawa, or cause-and-effect diagrams

When human behavior problems are shown to be significant, an understanding of the nature and cause of the behavior is necessary to develop effective corrective actions to support problem resolution.

3.4 Corrective Action Plans

Corrective action plans can vary from correcting a single cause to a general organizational improvement plan. At a minimum, corrective actions address each of the causal factors identified from the investigation. For the purposes of the HPM program, corrective actions may consist of

- HSI modifications (e.g., hardware/software)
- procedure changes
- training program changes

Corrective action plans should

- define objectives
- assign individuals for implementation
- state measures for determining completeness of corrective actions
- establish a method for monitoring on-going effectiveness of the action(s).

3.5 Continuous Human Performance Improvement Process

Human performance errors can occur at all levels of an organization and a poor human performance culture can create adverse trends that affect plant safety. An effective human performance improvement process includes defenses, barriers, controls and safeguards. A human performance improvement process has the following elements

- Operating experience review (OER) is continuous over the life of the plant rather than just during design of the plant. OER is used effectively and systematically to provide relevant "just-in-time" operating experience information to appropriate levels of the operating plant staff (operators, engineers, trainers, procedure writers/owners, work planning, etc.).
- Licensed operators, non-licensed operators, technicians and maintenance workers have a thorough understanding of the knowledge and skills associated with their particular job. The ability to maintain situation awareness and to practice a questioning attitude is strengthened when plant personnel know their equipment and its operation. Training programs ensure that people are qualified to perform their jobs. Training program effectiveness is enhanced by use of a systematic approach that addresses individual and organizational needs as well as performance issues.
- Design changes are managed by a process that contains checks and balances to catch errors and reduce the potential for latent errors.
- The plant simulator model is kept up-to-date and is used to validate a design change before it is implemented to identify and correct problems with the change.
- Independent reviews and audits are employed throughout the plant operating organization to find errors and potential sources of errors.

4.0 NUREG-0711 Conformance Evaluation

Table 4-1 indicates where each NUREG-0711, Revision 3 criterion is met in this IP.

Table 4-1. Conformance with NUREG-0711

Review Criteria Stated in NUREG-0711, Rev. 3	HPM IP Section No. and paragraph
13.4 Review Criteria (1) The scope of the applicant's performance monitoring program should provide reasonable assurance that: • personnel can use the design effectively, including within the control room and between the control room, local control stations, and support centers • changes made to the HSIs, procedures, and training do not adversely affect human performance, e.g., they do not interfere with previously trained skills • important human actions can be accomplished within the criteria for time and performance • an acceptable level of performance, established during ISV, is maintained	Section 1.2, all paragraphs
(2) The applicant should develop and document a human performance monitoring program. The program should: • be able to trend human performance after the plant is operational, or after modifications were made to demonstrate that performance is consistent with that assumed in the various analyses that were conducted to justify the change • begin at initial loading of the plant's fuel *Additional Information:* Applicants may integrate, or coordinate, their performance monitoring for risk-informed changes, made using RG 1.174, with existing programs for monitoring personnel performance, such as the program for licensed operator training, and the corrective action program. Also, if a plant change requires monitoring of actions that were not included in existing training programs, it may be advantageous to adjust the existing program rather than to develop additional monitoring programs for risk-informed purposes.	Section 2.0, all paragraphs

Review Criteria Stated in NUREG-0711, Rev. 3	HPM IP Section No. and paragraph
(3) The applicant should structure the program such that: • the level of monitoring human actions is commensurate with their safety importance • feedback of information and corrective actions are accomplished in a timely manner • degradations in performance can be detected and corrected before they compromise plant safety (e.g., by use of the plant's simulator during periodic training exercises)	Sections 3.1, 3.2, all paragraphs
(4) The performance of the plant or personnel under actual design basis conditions may not be readily measurable. When these conditions cannot be simulated, monitored, or measured, the applicant should use available information that most closely approximates performance data under actual conditions.	Section 3.1, 4th & 5th bullets Section 3.5, 4th bullet
(5) The applicant should include in the program provisions for determining the specific cause of performance degradation and failures, undertaking corrective actions, and trending them. Specifically, the program should: • define and address the significance of failure, the circumstances surrounding failure or degraded performance, characteristics of the failure, and whether the failure is isolated or has generic or common-cause implications • for significant failures and degradations, the program should identify the cause and stipulate the corrective actions necessary to preclude repetitions • identify and ensure the implementation of any corrective actions necessary to preclude the recurrence of unacceptable failures or degraded performance. • contain provisions for trending performance degradation and failures	Sections 3.3, 3.4 , all paragraphs

5.0 References

5.1 Source Documents

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

5.1.2 U.S. Nuclear Regulatory Commission, "The Human Performance Evaluation Process: A Resource for Reviewing the Identification and Resolution of Human Performance Problems," NUREG/CR-6751, June 2009.

5.1.3 Institute of Nuclear Power Operations, "Human Performance Tools for Engineers and Other Knowledge Workers," INPO 05-002.

5.1.4 Institute of Nuclear Power Operations, "Human Performance Tools for Managers and Supervisors," INPO 07-006.

5.1.5 Institute of Nuclear Power Operations, "Excellence in Human Performance," September 1997.

5.1.6 Institute of Nuclear Power Operations, "Human Performance Tools for Workers," INPO 06-002.

5.1.7 Institute of Nuclear Power Operations, "Human Performance Reference Manual," INPO 06-003, 2006.

5.2 Referenced Documents

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

5.2.2 NuScale Human Factors Engineering Treatment of Important Human Actions Implementation Plan, RP-0914-8539.

5.2.3 NuScale Human Factors Engineering Human-System Interface Design Implementation Plan, RP-0914-8540.

5.2.4 NuScale Human Factors Engineering Verification and Validation Implementation Plan, RP-0914-8543.

Enclosure 7:

Affidavit, AF-0715-15977

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AFFIDAVIT of José N. Reyes, Jr.

STATE OF OREGON

CITY OF CORVALLIS

I, José N. Reyes, Jr., state as follows:

(1) I am the Chief Technology Officer of NuScale Power, LLC (NuScale), and as such I am authorized to apply for withholding of information transmitted with this letter from public disclosure and to execute this affidavit on behalf of NuScale.

(2) I am knowledgeable of the criteria and procedures used by NuScale in designating confidential commercial information as proprietary and have been specifically delegated the function of reviewing the information described in this affidavit that NuScale seeks to have withheld from public inspection.

(3) The harm that would result if the information sought to be withheld is disclosed to the public is as follows:

(a) The reports disclose information about the NuScale human factors engineering (HFE) program processes, tools, methods, or other trade secrets by which NuScale develops and implements elements of its HFE program. NuScale has performed significant research and evaluation to develop a basis for these processes, tools, methods, or other trade secrets and has invested significant human and financial resources in such development.

(b) NuScale's unique process, tool, method, or other trade secrets provide NuScale with a competitive economic advantage over other companies. Public disclosure of the information would cause substantial harm to NuScale's competitive position and reduce or foreclose opportunities for NuScale to generate a return on its investment in research and development. Although the exact financial value of the information is difficult to quantify, it is a key element of the design basis for a NuScale plant and, therefore, has substantial value to NuScale.

(c) If the information were disclosed to the public, NuScale's competitors would have access to the information without having been required to undertake a similar expenditure of resources. Such disclosure would constitute a misappropriation of NuScale's intellectual property, would unfairly provide NuScale's competitors with a windfall, and would deprive NuScale of the opportunity to seek an adequate return on its investment.

(4) The information sought to be withheld is contained in the enclosure to NuScale letter from Steven Mirsky, dated July 31, 2015, to the NRC, "NuScale Power, LLC submittal of Second Set of Human Factors Engineering (HFE) Implementation Plans (NRC Project No. 0769". The enclosures, RP-0914-8538 and RP-0914-8539, contain the designation "NuScale Confidential - Proprietary Class 2" 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 trade secrets and commercial or financial information that are privileged and confidential. 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) With respect to the considerations set forth in 10 CFR § 2.390(b)(4):

(a) The information sought to be withheld 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 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 08/04/2015.

José N. Reyes, Jr.