ArevaEPRDCPEm Resource

From: BRYAN Martin (EXT) [Martin.Bryan.ext@areva.com]
Sent: Friday, April 23, 2010 3:57 PM
To: Tesfaye, Getachew
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); PANNELL George L (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 328, FSAR Ch 18, Supplement 5
Attachments: RAI 328 Supplement 5 Response - 118-9051755-003.pdf

Getachew,

AREVA NP Inc. (AREVA NP) responded to RAI 328 Supplement 3, Question 18-57 on February 26, 2010 and provided a schedule of April 24, 2010 for the submittal of "U.S. EPR Human Performance Monitoring Implementation Plan 118-9051755-003."

The " U.S. EPR Human Performance Monitoring Implementation Plan 118-9051755-003" is submitted via this e-mail response as committed in RAI 328 Supplement 3.

As a result of the recent rework of the HFE implementation plans and based on additional consideration of overall HFE program documentation context, we have reclassified this implementation plan as non-proprietary. This complete plan, even if combined with other redacted versions of the HFE plans, would not create criteria (b) issues within 10 CFR 2.390.

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Friday, April 16, 2010 5:10 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); PANNELL George L (AREVA NP INC); BUDZIK Dennis M (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 328, FSAR Ch 18, Supplement 4

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 18 of the 18 questions of RAI No. 328 in RAI 328 Supplement 3 on March 4, 2010. In RAI 328 Supplement 3, a date of April 17, 2010 was provided for submittal of the " U.S. EPR Implementation Plan for the Integration of Human Reliability Analysis (HRA) into the Human Factors Engineering (HFE) Program."

A revised date is provided below to allow time to evaluate information requested in subsequent related RAI questions.

This submittal provides a new date, show in the table below, for submitting the " U.S. EPR Implementation Plan for the Integration of Human Reliability Analysis (HRA) into the Human Factors Engineering (HFE) Program."

Question #	Document Number	Commitment Date
RAI 328 — 18-55	U.S. EPR Implementation Plan for the Integration of Human Reliability Analysis (HRA) into the Human Factors Engineering (HFE) Program	5/10/2010
RAI 328 — 18-56		

Sincerely,

Martin (Marty) C. Bryan
Licensing Advisory Engineer
AREVA NP Inc.
Tel: (434) 832-3016
Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Thursday, March 04, 2010 6:31 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); ROMINE Judy (AREVA NP INC); PANNELL George L (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 328, FSAR Ch 18, Supplement 3

Getachew,

The proprietary and non-proprietary versions of the response to RAI No. 328, Supplement 3 are submitted via AREVA NP Inc. letter, “Response to U.S. EPR Design Certification Application RAI No. 328 Supplement 3,” NRC 10:013 dated March 4, 2010. The enclosure to that letter provides technically correct and complete responses to 18 of the 18 remaining questions of RAI No. 328. An affidavit to support withholding of information from public disclosure, per 10CFR2.390(b), is provided as an enclosure to that letter.

The following table indicates the respective page(s) in the response document that contain AREVA NP’s response to the subject questions. Note that pages 103 to 121 contain references for the responses to RAI 328.

Question #	Start Page	End Page
RAI 328 —18-53	2	2
RAI 328 —18-54	3	3
RAI 328 —18-55	4	4
RAI 328 —18-56	5	9
RAI 328 —18-57	10	11

RAI 328 —18-58	12	13
RAI 328 —18-59	14	14
RAI 328 —18-60	15	15
RAI 328 —18-61	16	16
RAI 328 —18-62	17	65
RAI 328 —18-63	66	67
RAI 328 —18-64	68	77
RAI 328 —18-65	78	79
RAI 328 —18-66	80	81
RAI 328 —18-67	82	89
RAI 328 —18-68	90	92
RAI 328 —18-69	93	95
RAI 328 —18-70	96	102

This concludes the formal AREVA NP response to RAI 328, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Martin (Marty) C. Bryan
Licensing Advisory Engineer
AREVA NP Inc.
Tel: (434) 832-3016
Martin.Bryan@areva.com

From: DUNCAN Leslie E (AREVA NP INC)
Sent: Friday, February 26, 2010 1:57 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); ROMINE Judy (AREVA NP INC); BRYAN Martin (EXT); PANNELL George L (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 328, FSAR Ch 18, Supplement 2

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for 18 of the 18 questions of RAI No. 328 on December 16, 2009. AREVA NP submitted Supplement 1 to the response on February 12, 2010 to provide a revised schedule.

AREVA NP is unable to provide a response to the 18 questions with a commitment date of February 26, 2010. The commitment date for these questions has been changed to March 9, 2010 to allow time to prepare proprietary and non-proprietary versions of the response. The revised schedule for technically correct and complete responses to the remaining questions is provided below:

Question #	**Response Date**
RAI 328 —18-53	March 9, 2010
RAI 328 —18-54	March 9, 2010
RAI 328 —18-55	March 9, 2010
RAI 328 —18-56	March 9, 2010
RAI 328 —18-57	March 9, 2010
RAI 328 —18-58	March 9, 2010
RAI 328 —18-59	March 9, 2010

RAI 328 —18-60	March 9, 2010
RAI 328 —18-61	March 9, 2010
RAI 328 —18-62	March 9, 2010
RAI 328 —18-63	March 9, 2010
RAI 328 —18-64	March 9, 2010
RAI 328 —18-65	March 9, 2010
RAI 328 —18-66	March 9, 2010
RAI 328 —18-67	March 9, 2010
RAI 328 —18-68	March 9, 2010
RAI 328 —18-69	March 9, 2010
RAI 328 —18-70	March 9, 2010

Sincerely,

Les Duncan
Licensing Engineer
AREVA NP Inc.
An AREVA and Siemens Company
Tel: (434) 832-2849
Leslie.Duncan@areva.com

From: DUNCAN Leslie E (AREVA NP INC)
Sent: Friday, February 12, 2010 1:20 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); PANNELL George L (AREVA NP INC); ROMINE Judy (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 328, FSAR Ch 18, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for 18 of the 18 questions of RAI No. 328 on December 16, 2009. The schedule for technically correct and complete responses to the RAI questions has been changed and is provided below:

Question #	Response Date
RAI 328 —18-53	February 26, 2010
RAI 328 —18-54	February 26, 2010
RAI 328 —18-55	February 26, 2010
RAI 328 —18-56	February 26, 2010
RAI 328 —18-57	February 26, 2010
RAI 328 —18-58	February 26, 2010
RAI 328 —18-59	February 26, 2010
RAI 328 —18-60	February 26, 2010
RAI 328 —18-61	February 26, 2010
RAI 328 —18-62	February 26, 2010
RAI 328 —18-63	February 26, 2010
RAI 328 —18-64	February 26, 2010
RAI 328 —18-65	February 26, 2010
RAI 328 —18-66	February 26, 2010
RAI 328 —18-67	February 26, 2010
RAI 328 —18-68	February 26, 2010
RAI 328 —18-69	February 26, 2010

RAI 328 —18-70	February 26, 2010

Sincerely,

Les Duncan
Licensing Engineer
AREVA NP Inc.
An AREVA and Siemens Company
Tel: (434) 832-2849
Leslie.Duncan@areva.com

From: WELLS Russell D (AREVA NP INC)
Sent: Wednesday, December 16, 2009 6:08 PM
To: 'Getachew Tesfaye'
Cc: Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 328, FSAR Ch 18

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 328 Response US EPR DC.pdf" provides a schedule since technically correct and complete responses to the 18 questions are not provided.

The following table indicates the respective pages in the response document, "RAI 328 Response US EPR DC.pdf" that contain AREVA NP's responses to the subject questions.

Question #	Start Page	End Page
RAI 328 — 18-53	2	2
RAI 328 — 18-54	3	3
RAI 328 — 18-55	4	4
RAI 328 — 18-56	5	6
RAI 328 — 18-57	7	7
RAI 328 — 18-58	8	8
RAI 328 — 18-59	9	9
RAI 328 — 18-60	10	10
RAI 328 — 18-61	11	11
RAI 328 — 18-62	12	13
RAI 328 — 18-63	14	15
RAI 328 — 18-64	16	17
RAI 328 — 18-65	18	18
RAI 328 — 18-66	19	19
RAI 328 — 18-67	20	21
RAI 328 — 18-68	22	22
RAI 328 — 18-69	23	24
RAI 328 — 18-70	25	25

A complete answer is not provided for the 18 questions. The schedule for technically correct and complete responses to these questions is provided below.

Question #	Response Date
RAI 328 — 18-53	February 12, 2010
RAI 328 — 18-54	February 12, 2010

RAI 328 — 18-55	February 12, 2010
RAI 328 — 18-56	February 12, 2010
RAI 328 — 18-57	February 12, 2010
RAI 328 — 18-58	February 12, 2010
RAI 328 — 18-59	February 12, 2010
RAI 328 — 18-60	February 12, 2010
RAI 328 — 18-61	February 12, 2010
RAI 328 — 18-62	February 12, 2010
RAI 328 — 18-63	February 12, 2010
RAI 328 — 18-64	February 12, 2010
RAI 328 — 18-65	February 12, 2010
RAI 328 — 18-66	February 12, 2010
RAI 328 — 18-67	February 12, 2010
RAI 328 — 18-68	February 12, 2010
RAI 328 — 18-69	February 12, 2010
RAI 328 — 18-70	February 12, 2010

Sincerely,

(Russ Wells on behalf of)
Ronda Pederson

ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
New Plants Deployment
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An AREVA and Siemens company
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Lynchburg, VA 24506-0935
Phone: 434-832-3694
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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Tuesday, November 17, 2009 4:37 PM
To: ZZ-DL-A-USEPR-DL
Cc: Walker, Jacqwan; Keefe, Molly; Marble, Julie; Bongarra, James; Pieringer, Paul; Junge, Michael; Steckel, James; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 328 (3961, 3963,3965), FSAR Ch. 18

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on November 5, 2009, and discussed with your staff on November 17, 2009. Draft RAI Question 18-60 was modified as a result of that discussion. In addition, the staff has deleted Draft Question 18-69(4) and modified Draft RAI Questions 18-64(1) and (2), 18-66(2), 18-68(2), and 18-69(1) to eliminate duplication, correct typographical errors and/or provide clarification. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP

(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 1338

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB7105EEAE48)

Subject: Response to U.S. EPR Design Certification Application RAI No. 328, FSAR Ch 18, Supplement 5
Sent Date: 4/23/2010 3:56:53 PM
Received Date: 4/23/2010 3:56:56 PM
From: BRYAN Martin (EXT)

Created By: Martin.Bryan.ext@areva.com

Recipients:
"DELANO Karen V (AREVA NP INC)" <Karen.Delano@areva.com>
Tracking Status: None
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Tracking Status: None
"BENNETT Kathy A (OFR) (AREVA NP INC)" <Kathy.Bennett@areva.com>
Tracking Status: None
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Tracking Status: None
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	12032	4/23/2010 3:56:56 PM
RAI 328 Supplement 5 Response - 118-9051755-003.pdf	206447	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

AREVA NP Inc.,

an AREVA and Siemens company

Implementation Plan

Document No.: 118 - 9051755 - 003

U.S. EPR Human Performance Monitoring Implementation Plan

Safety Related? ☐ YES ☒ NO

Does this document contain assumptions requiring verification? ☐ YES ☒ NO

Does this document contain Customer Required Format? ☐ YES ☒ NO

Signature Block

Name and Title/Discipline	Signature	P/LP, R/LR, A/A-CRF, A/A-CRI	Date	Pages/Sections Prepared/Reviewed/ Approved or Comments
Daniel Laughman HFE Principle Engineer		P	4/22/10	ALL
Denise Brooks, Ph.D. HFE Engineer	Denise M Brooks	R	22 Apr 10	ALL
Jeffrey Jones HFE Manager		A	4/22/10	ALL

Note: P/LP designates Preparer (P), Lead Preparer (LP)
R/LR designates Reviewer (R), Lead Reviewer (LR)
A/A-CRF designates Approver (A), Approver of Customer Requested Format (A-CRF)
A/A-CRI designates Approver (A), Approver - Confirming Reviewer Independence (A-CRI)

Record of Revision

Revision No.	Pages/Sections/ Paragraphs Changed	Brief Description / Change Authorization
000	N/A	Initial Issue
001	ALL	Revised to support DCD
002	References	Deleted document numbers for internal references. Added trademark to EPR
003	Section 1.4	Clarification of Plan Objective IAW RAI 328
003	Section 1.4	Additions to Objectives and Scope IAW NUREG-0711
003	Section 1.5	Clarification of Responsibilities
003	Section 3.0	Entire section was relabeled and rearranged
003	Section 3.2.3	Relabeled section as Performance Indicators

Table of Contents

Page

1.0 INTRODUCTION

1.1 Applicability

This plan applies to New Plants (NP) Engineering Instrumentation and Controls Engineering.

1.2 Owner

Program Manager, Human Factors Engineering (HFE) is responsible for providing this implementation plan.

1.3 Purpose

Monitoring of human performance is performed throughout the life of the plant. Human performance is monitored to ensure that the results of the integrated system validation are maintained throughout the life of the plant, operator performance does not degrade over time, issues discovered by personnel are noted, tracked, and corrected before plant safety is compromised, and changes made to the design do not result in a degradation of human performance. The U.S. EPR™ Human Performance Monitoring (HPM) Implementation Plan provides the strategy for monitoring, tracking, and trending human performance.

1.4 Objectives and Scope

The objectives of the human performance monitoring program are to ensure that:

- The design is effectively used by personnel, within the control room and among the control room and local control stations and support centers
- Changes made to the Human-System Interfaces (HSIs), procedures, and training do not adversely affect personnel performance
- Human actions are accomplished within the time frame and performance criteria defined by task analysis
- The acceptable level of performance established during the integrated system verification is maintained.
- Degrading human performance is detected before plant safety is compromised.
- Identified errors in the design and associated corrective actions are resolved in a timely manner
- Monitoring for Human Actions (HAs) is commensurate with their safety significance.

The scope of the performance monitoring strategy applies to areas of the plant that require human actions. This includes the following:

- Main control room (MCR)
- Remote shutdown station (RSS)

- Technical support center (TSC)
- Other local control stations (LCSs) important to plant safety

Operation, testing, and maintenance actions during all plant modes are also monitored for human performance.

1.5 Responsibilities

AREVA NP HFE engineers are responsible for providing input to the licensee's HPM program along with the results of verification and validation activities. The licensee is responsible for maintaining the HPM program throughout the life of the plant.

1.5.1 AREVA NP Engineering

- Approves the AREVA NP Human Performance Monitoring Implementation Plan.
- Provides input to the licensee's HPM program.
- Provides baseline human performance criteria established during V&V
- Collects and reviews operational issues associated with the EPR design

1.5.2 U.S. EPR™ Licensee

- Maintains a corrective action program
- Monitors and trends human performance throughout the life of the plants
- Updates HRA/PRA after major HSI design change
- Maintain a design control process which includes HFE evaluations
- Maintains the structures, systems, and components (SSCs) commensurate with 10CFR50.64
- Maintains summaries of human performance monitoring issues to the industry and experts including the NRC, INPO, EPRI and AREVA NP
- Notification to AREVA NP of any HSI changes, operating events, or other issues that potentially impact the standard design of the U.S.EPR™

1.6 Definitions

Human Reliability Analysis (HRA): The HRA is a structured approach used to identify potential human failure events and to systematically estimate the probability of the occurrence of those errors using data, models, or expert judgment.

Human System Interface (HSI): The HSI is a system of devices, including hardware and software, used by personnel to control, monitor, and interact with the plant including the alarms, displays, controls, and decision support aids.

Validation: Describes a process by which integrated system design (consisting of hardware, software, and personnel elements) is evaluated to determine whether it acceptably supports safe operation of the plant.

Verification: The process of checking and ensuring each step of the design process was implemented appropriately.

1.7 Acronyms

CAP	Corrective Action Program
EOF	Emergency Operating Facility
EPR™	Trademarked brand name for AREVA's evolutionary PWR reactor design
FSS	Full Scope Simulator
HA	Human Action
HFE	Human Factors Engineering
HSI	Human System Interface
HPM	Human Performance Monitoring
HRA	Human Reliability Analysis
LCS	Local Control Station(s)
MCR	Main Control Room
NP	New Plants
NRC	Nuclear Regulatory Commission
NUREG	Publications prepared by the NRC staff
PRA	Probabilistic Risk Assessment
RSS	Remote Shutdown Station
SSC	Structures, Systems, and Components

TSC	Technical Support Center
V&V	Verification and Validation

2.0 CODES, STANDARDS, AND REGULATIONS

The following guidance was used in the development of this document.

2.1 Regulatory Guidance

- 10 CFR 50.65, “Requirements for monitoring the effectiveness of maintenance at nuclear power plants”
- NUREG-1764, "Guidance for the Review of Changes to Human Actions" (NRC 2004).
- NUREG-0700, "Human-System Interface Design Review Guidelines" (NRC, 2002).
- NUREG-0711, "Human Factors Engineering Program Review Model" Rev. 2 (NRC, 2004).
- NUREG-0800, "Standard Review Plan, Chapter 18 Human Factors Engineering" (NRC, 2004).
- NUREG/CR-6751, "THE HUMAN PERFORMANCE EVALUATION PROCESS: A Resource for Reviewing the Identification" (NRC, 2001).
- NUREG/CR-6775, "Human Performance Characterization in the Reactor Oversight Process and Resolution of Human Performance Problems", (NRC, 2002).

2.2 Codes and Standards

- IEEE-845-1999, "IEEE Guide for the Evaluation of Human-System Performance in Nuclear Power Generating Stations"
- EPRI 1008122, "Human Factors Guidance for Control Room and Digital Human-System Interface Design and Modification: Guidelines for Planning, Specification, Design, Licensing, Implementation, Training, Operation, and Maintenance", EPRI, Palo Alto, CA, the U.S. Department of Energy, Washington, DC: 2004.

3.0 METHOD

Human performance monitoring is performed by observing personnel activities (during training and actual operation). Also interviews, self-initiated feedback, and walkthroughs are conducted. The corrective action program and tracking database ensure that design errors, design issues, operator workarounds, operator burdens, or inefficiencies identified are documented and addressed. Programs such as a corrective action program (CAP), HFE issue tracking system (HITS), design change control process, performance indicators, and maintenance rule

are in place to ensure human performance does not degrade. These tools are in place to create a human performance monitoring strategy that meets the requirements of NUREG 0711, rev. 2.

3.1 Monitoring

3.1.1 Plant Operation

User activities are observed during simulator training and periodically during actual plant operation. The licensed operator training program allows easy monitoring of human performance and trending. Operator actions during training provide insight to potential operator workarounds, operator errors, and design inefficiencies. Risk-significant human actions (HAs) identified in the task analysis, HRA, and probabilistic risk assessment (PRA) are observed more frequently to ensure the safety of the plant. HAs are monitored to ensure they agree with the established time and performance criteria established during the integrated system validation. These performance measures from the integrated system validation are used as the baseline to determine any change in efficiency of user actions or their ability to perform tasks in a timely manner. These changes along with any discovered design errors and decline in performance are entered into the licensee's CAP. These issues are analyzed and areas of improvement are developed and used as input into human performance trending.

Other activities, such as communication among the control room and other areas of the plant, are also included in human performance monitoring and trending. Any inefficiencies, design errors, or failures detected are entered into the licensee's CAP. These issues are analyzed for possible areas of improvement and used as input into human performance trending.

3.1.2 Overall Design Control Process

The design control process ensures that modifications made to the HSI design do not adversely affect human performance. This is accomplished by using well-defined and structured methods for design change, design verification, and analysis activities. This process facilitates the translation of high level requirements to lower level requirements, design inputs to design outputs, and high level design features to lower level subsystem and component design features. Procedures are established to promote adequacy and accuracy of the design change documentation. These procedures govern the preparation and review of design documents and also establish methods for the identification and control of design interfaces, the coordination among participating design organizations, and the review, approval, release, distribution, and revision of documents.

Once a need arises to change or modify the existing design, the plant design project management establishes the scope, objectives, requirements, and safety classification. The appropriate engineering organization prepares, reviews, approves, and verifies design documents for items and services. The following are types of design documents that support facility design, construction, and operation:

- Plant technical requirements
- System design requirements
- System design descriptions
- Design drawings

- Design analyses, including HFE review and evaluations
- Computer program documentation
- Specifications and procedures

Use of a design review board and a design checklist ensures that the design change is adequate, accomplishes the goal of the design change, and does not cause an adverse impact on other aspects of the design. The use of the entire change process ensures that sufficient information and design feedback loops exist for data collection, monitoring, tracking, and trending.

3.2 HPM Tracking and Trending

3.2.1 Corrective Action Program and HFE Issues Tracking System

The licensee has a CAP in place. To ensure that HFE-related issues are captured, the corrective action program may use an HFE Issues Tracking System to document and track HFE-related issues. The licensee may choose to use a separate HFE Issues Tracking System or the current corrective action database. Inputs to the database include:

- HSI design errors
- HSI design inefficiencies
- User workarounds
- Discrepancies between the full scope simulator and the actual control room (FSS fidelity)
- Changes to the HSI design that create an adverse affect on other aspects of the design
- Operating experience reports

To ensure that all issues are captured, plant personnel are encouraged to report errors, deficiencies, workarounds, and design inefficiencies. Once an issue is entered into the database, a cognizant engineer performs an analysis to determine safety-significance. Those issues with a high safety-significance are analyzed and corrective actions generated promptly to ensure that plant safety is not compromised.

If an adverse trend is detected, a root cause analysis is performed by a cognizant HFE engineer to determine if human performance was a contributor. This analysis ensures a thorough understanding of the underlying problem so that appropriate corrective actions are taken. The results of the root cause analysis are used to categorize the issue. Trends are established and used to deter future degradations or to mitigate the effects of declining performance.

Industry and self-identified operating experience results contribute to enhancing human performance and preventing potential reduction in human performance. The operating experience review program tracks self-identified as well as industry issues. These issues are screened for human performance issues and analyzed for

applicability to the plant. Preventative measures are taken for those issues that have the potential for negative impact on human performance.

3.2.2 Design Change Process

Before a design change that has a significant impact on HSIs, procedures, or training is implemented in the plant, the change is modeled on the engineering (part task) simulator. Human performance is monitored using applicable scenarios developed during the integrated system validation. These scenarios are limited to only those which use tasks affected by the design change. This allows analysis of performance efficiency, degradation, or improvement. During simulation, user actions are observed for their ability and efficiency to perform tasks with the new design. The results are verified against the existing trend of human performance to verify performance was not degraded by the design change.

Any degradation in performance resulting from the design change is entered into the licensee's corrective action program for analysis. Significant impacts on human performance require the design change modification. If no degradation in performance is observed, the design is implemented and results of the HPM entered into the current trend. The design change process follows the overall design process as described in section 3.1.2.

Once an approved design change has been implemented, performance is observed and users interviewed. The interviews with users are performed to determine any operator workarounds, HSI inefficiencies, or design errors that may have resulted from the design change. The interview questions are centered on tasks that are affected by the design change. It is crucial to monitor the user actions during their initial use of the new design to note any adverse affect on performance, confirm the design change is performing its intended function, and view any operator workarounds. The significance of the design change impact determines the amount of monitoring necessary.

3.2.3 Performance Indicators

Performance Indicators are used to trend performance of operator's day to day activities. Indicators are used to exhibit the level of performance and risk associated with different operational activities. The level of the indicator is based on operator performance for that activity (e.g. Red = Bad, Yellow = Caution, Normal = White, and Green = Good).

Operational activities include the following:

- Operator workarounds
- Operator burdens
- Control room correctives
- Control room annunciates
- Worker/maintenance tagouts greater then 90 days
- Caution tagouts greater then 90 days

- Active fire protection impairment due to problem component
- Corrective maintenance inventory
- Plant election maintenance inventory
- Temporary modifications

The indicators are updated periodically with a rolling average used to show the trend in the indicators. Any adverse trends are entered into the CAP. Further analysis (e.g. root cause or operator interviews) may be required to understand the adverse trend and to identify effective corrective actions.

3.2.4 Human Reliability Analysis and Probabilistic Risk Assessment

HRA and PRA models are used when plant or personnel performance cannot be simulated, monitored, or measured. Performance data from modeled risk-significant HAs are used to evaluate the risk of the proposed design change on human performance during different operation modes. The licensee maintains the HRA/PRA model. After a design change, the HRA/PRA model is updated to reflect the new design. All risk-significant human actions are addressed through this monitoring program.

3.2.5 Existing Plant Maintenance and Inspection Programs

Additional plant programs are used to support human performance. Barriers, including the in-service inspection/in-service testing program and the maintenance rule, are used to prevent a negative impact on human performance. To maintain acceptable human performance, the SSCs are maintained in proper working order. Routine testing and inspecting of SSCs are performed to ensure deficiencies are corrected before they become ineffective or inoperable.

Proper notification that an SSC is out of commission for maintenance is also important for monitoring human performance. Notification to operators of which SSCs are out of commission prevents operators from using that inoperable SSC. Use of an inoperable SSC is tracked as an error in human performance. These errors give a false trend to human performance leading to misinterpretations about true human performance issues.

4.0 RESULTS AND DOCUMENTATION

HPM is continued throughout the life of the plant. It is expected that monitoring programs remain in place for the life of the plant. Operating conditions determine the necessary frequency of these summary reports. The licensee maintains an HPM program which meets the intent and spirit of regulatory guidance. Documentation of HPM summarizes the following.

- Baseline human performance criteria established during V&V
- HPM implementation strategy
- Any trends in human performance
- Performance Indicators

- Human performance-related issues, resolution, implementation status, and operating results.
- Determination if specific human performance issues can be applied to the standard U.S. EPR™ plant.

5.0 REFERENCES

1. AREVA NP Document, "US EPR Human Factors Verification and Validation Implementation Plan".