ArevaEPRDCPEm Resource

From: Pederson Ronda M (AREVA NP INC) [Ronda.Pederson@areva.com]
Sent: Friday, January 15, 2010 5:24 PM
To: Tesfaye, Getachew
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); PANNELL George L (AREVA NP INC); DUNCAN Leslie E (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 322, FSAR Ch. 18, Supplement 1
Attachments: RAI 322 Supplement 1 US EPR DC.pdf

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 322 Supplement 1 Response US EPR DC.pdf" provides technically correct and complete responses to the 1 of the 6 questions, which completes responses to 5 of the 6 questions in RAI 322.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 322 Supplement 1, Question 18-52.

The following table indicates the respective pages in the response document, "RAI 322 Supplement 1, Response US EPR DC.pdf" that contain AREVA NP's responses to the subject questions.

Question #	Start Page	End Page
RAI 322 — 18-52	2	2

A complete answer is not provided for the one remaining question. The schedule for technically correct and complete response to this question is unchanged as provided below.

Question #	Response Date
RAI 322 — 18-48	January 29, 2010

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
AREVA NP Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: WELLS Russell D (AREVA NP INC)
Sent: Thursday, December 17, 2009 6:35 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. 322, FSAR Ch 18

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 322 Response US EPR DC.pdf" provides technically correct and complete responses to 4 of the 6 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 322 Questions 18-49 and 18-50.

The following table indicates the respective pages in the response document, "RAI 322 Response US EPR DC.pdf" that contain AREVA NP's responses to the subject questions

Question #	Start Page	End Page
RAI 322 — 18-47	2	3
RAI 322 — 18-48	4	4
RAI 322 — 18-49	5	5
RAI 322 — 18-50	6	6
RAI 322 — 18-51	7	7
RAI 322 — 18-52	8	8

A complete answer is not provided for 2 questions. The schedule for technically correct and complete responses to these questions is provided below.

Question #	Response Date
RAI 322 — 18-48	January 29, 2010
RAI 322 — 18-52	January 18, 2010

Sincerely,

(Russ Wells on behalf of)
Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
New Plants Deployment
AREVA NP, Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Tuesday, November 17, 2009 4:05 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. 322 (3922, 3907),FSAR Ch. 18

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on October 30, 2009, and on November 17, 2009, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. 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: 1088

Mail Envelope Properties (5CEC4184E98FFE49A383961FAD402D31018D76A0)

Subject: Response to U.S. EPR Design Certification Application RAI No. 322, FSAR Ch. 18, Supplement 1
Sent Date: 1/15/2010 5:24:21 PM
Received Date: 1/15/2010 5:24:25 PM
From: Pederson Ronda M (AREVA NP INC)

Created By: Ronda.Pederson@areva.com

Recipients:
"BENNETT Kathy A (OFR) (AREVA NP INC)" <Kathy.Bennett@areva.com>
Tracking Status: None
"DELANO Karen V (AREVA NP INC)" <Karen.Delano@areva.com>
Tracking Status: None
"PANNELL George L (AREVA NP INC)" <George.Pannell@areva.com>
Tracking Status: None
"DUNCAN Leslie E (AREVA NP INC)" <Leslie.Duncan@areva.com>
Tracking Status: None
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	Size	Date & Time
MESSAGE	4361	1/15/2010 5:24:25 PM
RAI 322 Supplement 1 US EPR DC.pdf	154892	

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

Response to

Request for Additional Information No. 322 Supplement 1

11/17/2009

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 18 - Human Factors Engineering
Application Section: 18.11
Application Section: 18.2 Operating Experience Review

QUESTIONS for Operating Licensing and Human Performance Branch (AP1000/EPR Projects) (COLP)

Question 18-52:

Section 3.3 of NUREG-0711 states "The applicant should provide for staff review an implementation plan for conducting a review of operating experience."

AREVA NP has provided the NRC with an OER implementation plan; however, the implementation plan is not referenced in Revision 1 of the DCD.

Does AREVA plan to include this reference in future revisions of the DCD?

Response to Question 18-52:

As committed in the previous response to RAI 322 for submittal by January 18, 2010, enclosed are the FSAR markups which include the appropriate references.

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 18.1.1.6, 18.1.6, 18.2.4, 18.3.5, 18.4.4, 18.5.3, 18.5.4, 18.6.4, 18.7.1.1.1, 18.7.1.1.2, 18.7.2.3, 18.7.4, 18.7.4.3, 18.7.4.4, 18.7.8, 18.7.9, 18.8.4, 18.9.4, 18.10.3.7, 18.10.4, 18.11.5, and 18.12.4 will be revised as described in the Response to RAI 322 and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

- Electrical maintenance personnel.
- Mechanical maintenance personnel.
- Radiological protection technicians.
- Chemistry technicians.
- Engineering support personnel.

18.1.1.6 Effects of Modifications on Personnel Performance

The HFE program applies to the equipment supplied for the original configuration of the U.S. EPR. Modifications to the original interface configuration are required to adhere to the guidelines of Reference 1. Adverse effects caused by modifications on the overall system performance and the performance of personnel who use the equipment are minimized as described in Reference 1 and RG 1.174. Throughout the life of the plant, HFE issues resulting from plant modifications are documented and dispositioned as described in Section 18.12 and the human performance monitoring implementation plan (Reference 4).

18.52

18.1.2 Human Factors Engineering and Control Room Design Team Organization

The HFE and Control Room Design Team is the multi-disciplinary team responsible for implementing the HFE program. The HFE and Control Room Design Team is responsible for overseeing certain aspects of the design and construction of the nuclear facility in accordance with 10 CFR 50.34(f)(3)(vii), as described in SRP Section 13.1.1, Management and Technical Support Organization. A description of the responsibilities, organizational placement and authority, and composition and qualifications of the HFE and Control Room Design Team is provided in Section ~~5.4.2.1~~3.0 of the ~~Human Factors Topical Report~~U.S. EPR HFE Program Management Plan (Reference 2).

The HFE and Control Room Design Team is guided by the HFE program described herein for the proper development, execution, oversight, and documentation. The HFE and Control Room Design Team follows the same design processes as other engineering disciplines and is accountable for the quality of the HSI and control room layout to meet the requirements of the AREVA QAP Topical Report (Reference 3).

18.1.3 Human Factors Engineering Processes and Procedures

The HFE and control room design is performed in accordance with the U.S. EPR QAP described in Reference 3. As described in Section ~~5.1~~4.0 of the U.S. EPR HFE Program Management Plan (Reference 2), the AREVA NP generic design control process~~, as described in Section 5.1 of Reference 2,~~ is used to execute the HFE and control room

18.1.5.3 HFE Program Element Documentation

The U.S. EPR HFE program is described in Section 18.1. Section ~~2.2~~2.0 of the U.S. EPR HFE Program Management Plan (Reference 2) describes the general HFE requirements, standards, and specifications utilized in the design of the U.S. EPR. Section 18.10 of this FSAR and Section ~~6.0~~6.3 of the U.S. EPR HFE Program Management Plan (Reference 2) describe the uses of HFE facilities such as mockups and simulators as well as methods and tools employed for the various testing and validation techniques.

Sections 18.2 through 18.12 provide information on the types of documents generated as part of the U.S. EPR HFE program.

18.1.6 References

1. NUREG-0711, "Human Factors Engineering Program Review Model," Revision 2, U.S. Nuclear Regulatory Commission, 2004.

2. ~~ANP-10279, Revision 0, "U.S. EPR Human Factors Engineering Program Topical Report," AREVA NP Inc., January 2007.~~U.S. EPR HFE Program Management Plan, AREVA NP Inc., 2009.

18.52

3. ANP-10266-A, Revision 1, "AREVA NP Inc. Quality Assurance Plan (QAP) for Design Certification of the U.S. EPR," AREVA NP Inc., June 2007.

4. U.S. EPR Human Performance Monitoring Implementation Plan, AREVA NP Inc., 2009.

The multi-disciplinary composition, qualifications and experience level of the HFE and Control Room Design Team provides reasonable assurance that operating experience and the results of research relevant to safety are identified, reviewed and analyzed and that the lessons learned are incorporated into the HSI design.

18.2.3 Evaluation of Results

After an OER issue has been entered into the appropriate tracking database, it is evaluated by a cognizant human factors engineer for applicability. The evaluation includes determining if any lessons learned from the issue have already been incorporated into the design.

Upon completion of the evaluation, the human factors engineer updates the tracking database with appropriate information. Each issue that results in a design change will follow the design change process described in Section ~~5~~4.5.1 of the Human Factors Engineering Program Management Plan ~~Reference 1~~(Reference 2). When the issue has been incorporated into the design, it is closed out in the tracking database. The resolution will remain available for engineers to view.

OER results are a summary of the data captured and analyzed in the tracking database and the source materials that were evaluated using the methodology described in the implementation plan. The results summary also includes information on how selected issues were captured, maintained, evaluated, and incorporated in the final design.

18.2.4 References

18.52

1. ~~ANP-10279, Revision 0, "U.S. EPR Human Factors Engineering Program," AREVA NP Inc., January 2007.~~U.S. EPR Human Factors Operating Experience Review Implementation Plan, AREVA NP Inc., 2009.

2. U.S. EPR HFE Program Management Plan, AREVA NP Inc., 2009.

Next File

In addition to tabularizing system and component functions, each applicable system description document lists the type of control to which that function is allocated and the design basis for the allocation. A description of the personnel role with respect to functions and interfacing with automation is provided in the HFE Program Management Plan (Reference 5) concept of operations (see Section 18.7.2).

A specific objective of the V&V is to ~~verify~~validate that the automation design decisions have resulted in an interface that permits accomplishment of the safety functions within human capabilities and identifies as human engineering discrepancies (HEDs) any ineffective function allocation observed. This V&V approach verifies that the FA uses human strengths and avoids human limitations (Reference 2).

The FA report included in the V&V documentation:

- ~~Details the complete set of automation criteria used for the U.S. EPR including the established control hierarchy between automatic and manual actions.~~List of allocated functions for U.S. EPR
- List~~s the functions that are automated for predecessor EPRs and the differences between the predecessors and the U.S. EPR.~~of differences and similarities between predecessor EPR and the U.S. EPR.
- Explains the technical justification for each difference in functional ~~allocation~~automation.

18.3.4 Changes to Functional Analysis or Allocation

As the U.S. EPR design evolves, functions may be re-allocated in an iterative manner in response to developing design specifics, operating experience, and the outcome of analyses and industry research. As described in Section 18.12, changes and modifications to the initial HSI configuration are required to be evaluated for impact to FRA or FA design documentation. The complete set of automation criteria and other design documentation previously described are considered as part of any proposed change or modification.

18.3.5 References

1. NUREG-0711, "Human Factors Engineering Program Review Model," Revision 2, U.S. Nuclear Regulatory Commission, 2004.

2. NUREG-0800, Chapter 18, "Human Factors Engineering," Revision 2, U.S. Nuclear Regulatory Commission, 2004.

3. ~~ANP-10279P, "U.S. EPR Human Factors Engineering Program," AREVA NP Inc, January 2007~~U.S. EPR Functional Requirements and Functional Allocation Implementation Plan, AREVA NP Inc., 2009.

18.52

4. NUREG-0696, "Functional Criteria for Emergency Response Facilities," U.S. Nuclear Regulatory Commission, 1981.

18.52

5. U.S. EPR HFE Program Management Plan, AREVA NP Inc., 2009.

~~iterations of TA for procedure development, the procedures themselves, and training programs result in an HSI design that supports in-scope information, control, and support requirements.~~A summary report is generated describing the scope of TA and implementation details (e.g., qualification of individuals performing analysis, out of process issues, process outputs).

18.4.4 References

1. NUREG-0711, "Human Factors Engineering Program Review Model," Revision 2, U.S. Nuclear Regulatory Commission, February 2004.

2. ~~ANP-10279P, "U.S. EPR Human Factors Engineering Program Topical Report," AREVA NP Inc, January 2007.~~U.S. EPR Task Analysis Implementaion Plan, AREVA NP Inc., 2009.

18.52

18.5.3 Results

~~If it is determined from the integrated system validation that plant staffing and HSI design goals are not achieved, a decision is made to redesign the appropriate system, modify the roles and responsibilities of effected staff (taking into account the effect on plant safety and reliability), or adjust staffing numbers. A final check is then performed to verify that the staffing numbers and configuration are still in compliance with the requirements of 10 CFR 50.54 (i) through (m).~~ The staffing and qualification analysis is summarized within task analysis (Reference 2). ~~in conjunction with the V&V results (refer to Section 18.10)~~ and includes an evaluation of the number and qualifications of personnel needed to operate~~, maintain,~~ and test the U.S. EPR based on the HSI design features for normal, abnormal, and emergency conditions.

18.52

18.5.4 References

1. ~~ANP-10279P, "U.S. EPR Human Factors Engineering Program Topical Report," AREVA NP Inc, January 2007.~~U.S EPR HFE Program Management Plan, AREVA NP Inc., 2009.

2. U.S. EPR Task Analysis Implementation Plan, AREVA NP Inc., 2009.

18.52

Next File

18.6.4 References

1. ~~ANP-10279P, "U.S. EPR Human Factors Engineering Program Topical Report," AREVA NP Inc, January 2007.~~U.S. EPR Implementation Plan for the Integration of Human Reliability Analysis (HRA) with the Human Factors Engineering (HFE) Program, AREVA NP Inc., 2009.

2. NUREG-0711, "Human Factors Engineering Program Review Model," Revision 2, U.S, Nuclear Regulatory Commission, February 2004.

18.52

Next File

When a set of OER data is collected, it is classified with respect to its relevance and importance. Classification of OER data is important because it is only useful if it is accessible to members of the design team engaged in the relevant activities. Section ~~5.4.3~~3.3 of the ~~AREVA Human Factors Topical Report (Reference 2)~~ U.S. EPR Human Factors Operating Experience Review Implementation Plan (Reference 14) describes how OER information is screened. ~~OER items classified as highly relevant to the U.S. EPR HSI design are captured in the HFE Issues Tracking Database.~~ Issues not resolved in the current iteration of the HSI design are placed in the HFE issue tracking system to alert the applicable design organization of the relevant OER information. A review of the ~~HSI design implementation plan~~U.S. EPR Human System Interface Design Implementation Plan (Reference 15) and the HSI style guide (see Section 18.7.5) is performed so that the HFE principles cited in the OER event are applied to HSIs in the HSI design process. The HSI style guide documents how HFE principles from OER events are included in the HSI design and justifies the application of those principles.

18.52

18.7.1.1.2 Functional Requirement Analysis and Function Allocation

FRA and FA are performed as described in Section 18.3 and as described in the FRA and FA Implementation Plan (Reference 16). These analyses determine which operational functions are to be performed by automatic systems, by plant personnel, or by some combination of the two. The allocation is made based on the FRA after determining what is required to perform the function. FA evolves from FRA and results in allocating functions for the best overall accomplishment for that function.

A function is a process or activity required to achieve a desired operational goal. The term, function, may refer to those critical to plant safety (e.g., initiation of emergency feedwater) or to non-safety support equipment (e.g., a valve or information display). Functions are essentially hierarchical; for example, pressurized water reactors have evolved a natural hierarchical structure of functions, processes, systems, and components. High-level functions may be accomplished through a combination of lower-level system functions and may require human action (HA). Allocation of functions to humans may be appropriate at any level of the functional structure.

Operational requirements related to a given process function are better defined by breaking the function down into more basic components. At a low level, a function ~~can and must be~~is explicitly assigned to an available resource (i.e., hardware, software, human, or some combination thereof). The overall goal of FRA and FA is to define the requirements in detail so that the allocation can take advantage of human strengths and avoid human limitations to maximize overall function accomplishment.

Inputs to the FRA include the overall plant design and operational concept, HSI concept definition (i.e., accomplished via the U.S. EPR predecessor designs), and OER identified tasks associated with a high workload that would be more efficient if automated. The FRA inputs lead to the definition of concept of operations (see

~~purpose systems. These systems have important roles in the operation of the plant and require the users to have access to the I&CSC and the MCR.~~

18.7.2.3 Personnel Supervision of Plant Automation

In the event of incidents or accidents, functions are automated when analysis shows that immediate action is required sooner than the human response time. Operator action is not required for the first 30 minutes following a design basis event. The operator monitors the automatic operation of the control systems, intervening only in the event of malfunctions of the automatic control system during the initial stages, or to optimize plant parameters or configuration. When the situation is stabilized, the operator function then shifts back to active control. When feasible during abnormal or emergency situations, when conditions are stabilized or under control, the ~~SS~~SM, CRS, and RO physically reviews the appropriate procedure(s) to make sure that all steps were accurately performed.

The role of plant automation and how operators interact with it is described in the concept of operations. ~~Criteria for defining automation are shown in Section 5.4.4.3 of Reference 2. An~~The U.S. EPR Human System Interface Design Implementation Plan ~~HSI design implementation plan~~ (Reference 15) specifies how the automation criteria and the role of operators as supervisors of automation are translated into the design guidance for the HSI.

18.52

18.7.2.4 Use of Main Control Room

Use of the MCR during normal operations, during operational occurrences such as loss of PICS or electronic operating procedures, and during emergency or accident scenarios is described in Section~~s 4.2 and 4.3~~2.2.2.2 of the EPR HFE Program Management Plan ~~(~~Reference 2).

18.7.2.5 Crew Member Coordination Methods

The following sections describe how the operations staff interacts within the MCR and other areas. Also included are descriptions detailing how MCR operators communicate and interact with the NLOs and other personnel such as maintenance technicians, engineers, and emergency support staff. A description of the security measures used to control access to control rooms and to the HSI is also provided.

18.7.2.5.1 Forms of Communication and Expected Use

MCR operator communication is essential for the safe operation of the plant. The RO or other MCR operators are required to communicate with operations staff such as NLOs, technicians, engineers, and emergency support staff regarding periodic maintenance, equipment repairs, and abnormal operating conditions. The design of the HSI considers task loading for each individual operator as well as the time it takes

TSC and RSS

The RSS is generally not occupied except in the event of an MCR evacuation. The ~~SS~~SM or CRS shall authorize access to the RSS as necessary.

The TSC is part of an integrated operations area which is normally in use during power operations. When the TSC is activated during an emergency, all other uses of the integrated operations area are suspended. The emergency coordinator assumes responsibility for controlling access to the TSC when it is activated.

I&CSC

The I&CSC is not continuously occupied. It is staffed by I&C engineers and technicians, I&C system administrators, and trained and authorized personnel designated to operate specialized systems such as the loose parts, vibration monitoring, leakage monitoring, and the Aeroball and PowerTrax core monitoring systems. Several forms of communication are provided in the I&CSC allowing operators immediate communication with the technicians. Access to the I&CSC is controlled by the CRS.

18.7.3 Functional Requirements Specification

As described in Section ~~5.3~~4.5 of the EPR HFE Program Management Plan (Reference 2), design documents are produced for each of the control rooms (i.e., MCR, TSC, RSS, I&CSC) and HSIs (i.e., PICS and SICS) to track requirements and design specifications. These design documents capture the functional requirements as well as the HFE requirements and provide a uniform philosophy and design consistency among HSIs, including screen style and layout guide, hierarchy of and navigation between screens, alarm system operation, electronic procedure system, plant information system, and hard-wired control integration in panels and workstations.

Section 18.7.4.3 describes how the inventory of alarms, displays, and controls needed to operate the U.S. EPR is determined.

18.7.4 HSI Concept Design

The U.S. EPR implements a modern I&C design based on experience gained internationally in new plant designs and retrofits in existing plants with digital I&C equipment. The HSI concepts are further based on predecessor designs and utilize similar control of system functions and I&C concepts. The concepts for the HSI design for the U.S. EPR are described in Section 7.5, ~~and in~~ Section ~~3.2~~2.2.1.2 of the EPR HFE Program Management Plan (Reference 2), and Section 5.1.2 of the U.S. EPR Human System Interface Design Implementation Plan (Reference 15).

18.52

18.7.4.1 Safety Parameter Display System

The parameters required to be displayed as part of the SPDS are made available on the PICS and SICS. For more details refer to Section 7.5.

18.7.4.2 Operation and Control Centers System

The MCR, TSC, RSS, I&CSC and the HSIs (i.e., PICS and SICS) including the bases for layout of the control rooms and organization of the HSIs within them are described in Section ~~3~~2.2 of the EPR HFE Program Management Plan (Reference 2).

18.7.4.3 Inventory of Alarms, Displays, and Controls

The process data inventory, setpoints, and equipment layout needed to operate the U.S. EPR is determined by the system engineers for each piping and instrumentation system and documented in various piping and instrumentation diagrams (P&IDs) or one-line diagrams. The corresponding design documents capture the functions and functional requirements as well as the design basis for each function.

18.52

The HFE and Control Room Design Team translates the functions from the P&IDs, one-line diagrams, and design documents into the required inventory of alarms, displays, and controls. ~~An~~The ~~HSI design implementation plan~~U.S. EPR Human System Interface Design Implementation Plan (Reference 15) describes how the HFE and Control Room Design Team organizes and presents the alarms, displays, and controls on the HSIs in an effective context so that the operators can safely and efficiently operate the plant. Hardware and software requirements to implement this inventory and the subsequent HSI designs are verified as described in Section 18.10.

18.7.4.4 Minimum Inventory of Main Control Room Fixed Alarms, Displays, and Controls

Minimum inventory is defined as the credited set of alarms, displays, and controls needed to implement the plant emergency operating procedures (EOP) (refer to Section 15.0), bring the plant to a safe condition, and to carry out those operator actions shown to be risk important by the applicant's probabilistic risk assessment.

The MCR minimum inventory includes the readily accessible HSIs that the operator needs to:

- Monitor the status of fission product barriers.
- Perform and confirm a reactor trip.
- Perform and confirm a controlled shutdown of the reactor using the normal or preferred safety means.

- Actuate safety-related systems that have the critical safety function of protecting the fission product barriers.
- Analyze failure conditions of the PICS while maintaining the current plant operating condition and power level until the PICS can be restored in accordance with applicable regulatory requirements.
- Implement the plant emergency operating procedures.
- Bring the plant to a safe condition.
- Carry out those operator actions shown to be risk important by the applicant's probabilistic risk assessment.

The PICS is the primary non-safety-related HSI normally used for plant monitoring and control. Because the PICS is not credited for performance of safety-related functions, the minimum inventory includes alarms, displays, and controls that are required in addition to the PICS. Thus, the minimum inventory is the portion of the SICS inventory credited for EOP actions to bring the plant to a safe condition or to carry out risk-important operator actions that readily accessible to the operators and does not need to be selected from a menu or screen hierarchy. The SICS performs the functions described in Section 7.1 including both hardwired functions and QDS functions.

A list of the minimum inventory on the MCR SICS is included in Table 18.7-1—Minimum Inventory of Main Control Room Fixed Alarms, Displays, and Controls. The methodology for selecting the final minimum inventory is described in the ~~HSI design implementation plan~~U.S. EPR Human System Interface Design Implementation Plan (Reference 15) and includes a description of:

18.52

- The selection criteria.
- How the functions and tasks that need to be supported by the SICS minimum inventory are identified.
- The technical requirements that apply to the design of the SICS minimum inventory including those imposed by regulatory requirements, and particularly address requirements related to qualification, independence, and accessibility.
- How the plant-specific probabilistic risk assessment is used to identify operator actions or tasks that are risk important.
- How the guidance provided in RG 1.97 relating to defining postaccident monitoring variables is addressed (see Section 7.5).
- The operator actions credited in the safety analysis or plant-specific EOPs for safety and non-safety success paths.

- Are complete and operable.
- Conform to standard HFE principles and requirements.
- Are free of safety issues and human performance issues.
- Implement the design accurately in the final design output documentation.

Testing and evaluation is conducted throughout the HSI design at various stages of development so that the complex HSI design functions properly before the design process is resolved and validation occurs (see Figure 18.1-2).

Activities such as concept testing, mock-up activities, trade-off evaluations, and performance-based tests are utilized at various stages of the design. The criteria used to decide which type of testing or evaluation technique is applicable are described in ~~a V&V implementation plan~~the U.S. EPR Human Factors Verification and Validation Implementation Plan (Reference 17). 18.52

18.7.8 HSI Design Results and Documentation

As described in Section ~~5.4.8.7~~4.5 of EPR HFE Program Management Plan (Reference 2), the HSI designs are documented using specific design control process requirements. The various configuration management, design change controls, design verification, and design quality control tools are also described in Reference 1.

18.7.9 References

1. ANP-10266NPA, Revision ~~1~~0, "AREVA NP Inc. Quality Assurance Plan (QAP) for Design Certification of the U.S. EPR," AREVA NP Inc., ~~April 2007~~December 2008.
2. ~~ANP-10279, Revision 0, "U.S. EPR Human Factors Engineering Program," AREVA NP Inc., January 2007.~~U.S. EPR HFE Program Management Plan, AREVA NP Inc., 2009. 18.52
3. NUREG-0737, "Clarification of TMI Action Plan Requirements," U.S. Nuclear Regulatory Commission, November 1980.
4. NUREG-0711, "Human Factors Engineering Program Review Model," Rev. 2, U.S. Nuclear Regulatory Commission, February 2004.
5. ANP-~~10284~~10304, Revision 0, "U.S. EPR Instrumentation and Controls Diversity and Defense-in-Depth Methodology Technical Report," AREVA NP Inc., ~~June 2007~~May 2009.
6. NUREG-0700, "Human-System Interface Design Review Guidelines," Revision 2, U.S. Nuclear Regulatory Commission, May 2002.
7. NUREG/CR-6633, "Advanced Information Systems: Technical Basis and Human Factors Review Guidance," U.S. Nuclear Regulatory Commission, March 2000.

8. NUREG/CR-6634, "Computer-Based Procedure Systems: Technical Basis and Human Factors Review Guidance," U.S. Nuclear Regulatory Commission, March 2000.

9. NUREG/CR-6635, "Soft Controls: Technical Basis and Human Factors Review Guidance," U.S. Nuclear Regulatory Commission, March 2000.

10. NUREG/CR-6636, "Maintainability of Digital Systems: Technical Basis and Human Factors Review Guidance," U.S. Nuclear Regulatory Commission, March 2000.

11. NUREG-0696, "Functional Criteria for Emergency Response Facilities," U.S. Nuclear Regulatory Commission, February 1981.

12. NUREG-0835, "Human Factors Acceptance Criteria for the Safety Parameter Display System," U.S. Nuclear Regulatory Commission, October 1981.

13. NUREG-1342, "A Status Report Regarding Industry Implementation of Safety Parameter Display Systems," U.S. Nuclear Regulatory Commission, April 1989.

18.52

14. U.S. EPR Human Factors Operating Experience Review Implementation Plan, AREVA NP Inc., 2009.

15. U.S. EPR Human System Interface Design Implementation Plan, AREVA NP Inc., 2009.

16. U.S. EPR Functional Requirements Analysis and Functional Allocation Implementation Plan, AREVA NP Inc., 2009.

17. U.S. EPR Human Factors Verification and Validation Implementation Plan, AREVA NP Inc., 2009.

18.8.2.3 Electronic Procedures

Operating procedures are implemented in a screen-based format that provides access to process information by direct links. These electronic procedures also provide access to related information and direct the operator to the appropriate control screens. Refer to Section ~~2.2.9~~6.2.9 of the U.S. EPR Human Factors Program Management Plan (Reference 1) for further details on the development of electronic procedures.

Paper-based procedures serve as backup to screen-based (i.e., electronic) procedures and contain the same guidance and format. Hard copy backups of operating procedures are provided in the main control room (MCR), remote shutdown station (RSS), and the Technical Support Center (TSC) in the event that a failure of the operating procedure computer occurs. Aside from differences in how electronic and hard copy procedures are used (i.e., the navigation and layout) as well as the availability of live data, electronic and hard copy procedures contain the same information in the same format. Adequate space is provided at appropriate workstations in the MCR and RSS for operators to display paper-based procedures, when required.

18.8.3 Results

A results summary report addresses the final set of procedures and support equipment developed using the established methodology. The results summary report includes:

- The results of verification and validation (V&V) activities as they relate to procedure development.
- How procedures will be maintained and updates controlled.
- A description of how operators access and use procedures, especially during operational events including:
  - Storage of procedures.
  - Ease of operator access to the correct procedures.

18.8.4 References

18.52

1. ~~ANP-10279, Revision 0, "U.S. EPR Human Factors Engineering Program," AREVA NP Inc., January 2007.~~U.S. EPR Human Factors Procedure Implementation Plan, AREVA NP Inc., 2009.

Next File

- Methods used to evaluate effectiveness of the program.

18.9.4 References

18.52

1. ~~ANP-10279, Revision 0, "U.S. EPR Human Factors Engineering Program," AREVA NP Inc., January 2007.~~U.S. EPR Human Factors Training Implementation Plan, AREVA NP Inc., 2009.

Next File

- Other - HEDs that do not fit Priority 1 or Priority 2. These HEDs may not require correction.

18.10.3.6.2 HED Design Solution Development

For each HED that requires correction, a design solution is developed. The design solution follows the design process steps (i.e., OER, FRA, TA, and HSI design) from the original design. Changes to the original design may not cause deviations from design requirements.

18.10.3.6.3 HED Design Solution Evaluation

The proposed design solution is evaluated to establish that it:

- Adequately corrects the HED.
- Does not adversely impact other aspects of the design.
- Is consistent with HFE guidelines and that ISV can be conducted to evaluate its usability.

18.10.3.7 Results

Procedures and expected documentation requirements for various V&V activities are summarized in the preceding sections. A results summary report addresses the following:

- Demonstrates that V&V was performed in accordance with the prescribed process described in the V&V ~~i~~Implementation ~~p~~Plan (Reference 4).
- Demonstrates that the design conforms to the HFE design principles.
- Demonstrates that the design enables plant personnel to successfully perform ther task to achieve plant safety and other operation goals.
- Provides results of V&V activites and conclusions from those activities.

18.52

18.10.4 References

1. NUREG-0700, "Human-System Interface Design Review Guidelines," Revision 2, U.S. Nuclear Regulatory Commission, May 2002.
2. NUREG-6393, "Integrated System Validation: Methodology and Review Criteria," U.S. Nuclear Regulatory Commission, September 1995.
3. U.S. EPR Human System Interface Design Implementation Plan, AREVA NP Inc., 2009.
4. U.S. EPR Human Factors Verification and Validation Implementation Plan, AREVA NP Inc., 2009.

18.11.3.1 Verification that HFE Issues Tracking Database Items Have Been Addressed

This verification process confirms that HEDs being tracked are adequately addressed. This is accomplished by reviewing the database, verifying that HEDs have been addressed, and addressing any remaining HEDs as necessary. In some cases, there are HEDs that require a design change, but are not implemented by the time design implementation is finished and closed. Those HEDs are turned over to the U.S. EPR operator for implementation or closure at a later date.

18.11.4 Results Summary

Throughout the design implementation, the HFE Issues Tracking Database is updated as new HEDs are discovered during the process. Resolution for these HEDs is also updated in the HFE Issues Tracking Database. A results summary report is generated detailing the status of HEDs tracked including any that remain unresolved and concludes HFE issues have been adequately addressed. The results summary report concludes the design implementation was performed in accordance with the prescribed process for validating that the as built design conforms to the standard design resulting from the HFE V&V process. Also included are the methods and criteria used during the design implementation process and the results of the verification. This report becomes part of the final design documentation owned by the U.S. EPR operator.

18.11.5 References

1. NUREG-0711, "Human Factors Engineering Program Review Model," U.S. Nuclear Regulatory Commission, 1994.

18.52

2. ~~ANP-10279, Revision 0, "U.S. EPR Human Factors Engineering Program," AREVA NP Inc, January 2007.~~U.S. EPR HFE Program Management Plan, AREVA NP Inc., 2009.

3. ANP-10266A, Revision 1, "AREVA NP Inc. Quality Assurance Plan (QAP) for Design Certification of the U.S. EPR," AREVA NP Inc., April 2007.

4. NUREG-0700, "Human-System Interface Design Review Guidelines," Revision 2, U.S. Nuclear Regulatory Commission, May 2002.

5. U.S. EPR Human Factors Engineering (HFE) Design Implementation Plan, AREVA NP Inc., 2009.

Next File

inoperable SSC could potentially be tracked as an error in human performance and indicate a false trend.

18.12.3 Results Summary

HPM is continued throughout the life of the plant. Reports summarizing human performance-related issues, resolution of those issues, implementation status, and operating experience results are maintained for trending purposes. Operating conditions determine the necessary frequency of these summary reports.

A U.S. EPR operator shall maintain an HPM program which meets the intent given in this section. Documentation of HPM summarizes the following:

- Baseline human performance criteria established during V&V.
- HPM implementation strategy.
- Any trends in human performance.
- Operator focus index.
- Human performance-related issues, resolution, implementation status, and operating results.
- Specific human performance issues that can be applied to the standard U.S. EPR plant.

18.12.4 References

1. NUREG-0711, "Human Factors Engineering Program Review Model," U.S. Nuclear Regulatory Commission, 2004.

18.52

2. ~~ANP-10279, Revision 0, "U.S. EPR Human Factors Engineering Program," AREVA NP Inc, January 2007.~~U.S. EPR HFE Program Management Plan, AREVA NP Inc., 2009.

3. U.S. EPR Human Performance Monitoring Implementation Plan, AREVA NP Inc., 2009.