

ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Thursday, December 16, 2010 2:26 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (AREVA); ROMINE Judy (AREVA); BENNETT Kathy (AREVA); NOXON David (AREVA); PANNELL George (AREVA); Miernicki, Michael; Ford, Tanya
Subject: Response to U.S. EPR Design Certification Application RAI No. 426, FSAR Ch. 18, Supplement 4
Attachments: RAI 426 Supplement 4 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided a schedule for a technically correct and complete response to RAI 426 on September 2, 2010. On October 7, 2010, October 28, 2010, and November 29, 2010 a revised schedule was provided. The attached file, "RAI 426 Supplement 4 Response US EPR DC.pdf" provides technically correct and complete responses to the 10 questions, as committed.

The AREVA NP Initial Staffing Assumptions for the U.S. EPR supporting RAI 426, has been revised, and the plan is submitted under a separate cover letter.

The response to RAI 421 will revise the U.S. EPR Human Factors Verification and Validation (V&V) Implementation Plan to address RAI 426 Questions 18-182 thru 18-184.

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 426 Questions 18-183, 18-185, and 18-186.

The following table indicates the respective pages in the response document, "RAI 426 Supplement 4 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 426 — 18-182	2	2
RAI 426 — 18-183	3	3
RAI 426 — 18-184	4	4
RAI 426 — 18-185	5	6
RAI 426 — 18-186	7	7
RAI 426 — 18-187	8	8
RAI 426 — 18-188	9	9
RAI 426 — 18-189	10	10
RAI 426 — 18-190	11	11
RAI 426 — 18-191	12	12

This concludes the formal AREVA NP response to RAI 426, and there are no questions from this RAI for which AREVA NP has not provided responses.

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 (External RS/NB)
Sent: Monday, November 29, 2010 12:43 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); PANNELL George (CORP/QP)
Subject: Response to U.S. EPR Design Certification Application RAI No. 426, FSAR Ch. 18, Supplement 3

Getachew,

AREVA NP Inc. provided a schedule for a technically correct and complete response to RAI 426 on September 2, 2010. On October 7, 2010 and October 28, 2010, a revised schedule was provided. To allow additional time to interact with the staff, a revised schedule is provided.

The schedule for a technically correct and complete final response to these questions is changed and is provided below.

Question #	Response Date
RAI 426 18 - 182	December 16, 2010
RAI 426 18 - 183	December 16, 2010
RAI 426 18 - 184	December 16, 2010
RAI 426 18 - 185	December 16, 2010
RAI 426 18 - 186	December 16, 2010
RAI 426 18 - 187	December 16, 2010
RAI 426 18 - 188	December 16, 2010
RAI 426 18 - 189	December 16, 2010
RAI 426 18 - 190	December 16, 2010
RAI 426 18 - 191	December 16, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
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From: BRYAN Martin (External RS/NB)
Sent: Thursday, October 28, 2010 6:22 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); PANNELL George (CORP/QP)
Subject: Response to U.S. EPR Design Certification Application RAI No. 426, FSAR Ch. 18, Supplement 2

Getachew,

AREVA NP Inc. provided a schedule for a technically correct and complete response to RAI 426 on September 2, 2010. On October 7, 2010, a revised schedule was provided. To allow additional time to interact with the staff, a revised schedule is provided.

The schedule for a technically correct and complete final response to these questions is changed and is provided below.

Question #	Response Date
RAI 426 18 - 182	November 30, 2010
RAI 426 18 - 183	November 30, 2010
RAI 426 18 - 184	November 30, 2010
RAI 426 18 - 185	November 30, 2010
RAI 426 18 - 186	November 30, 2010
RAI 426 18 - 187	November 30, 2010
RAI 426 18 - 188	November 30, 2010
RAI 426 18 - 189	November 30, 2010
RAI 426 18 - 190	November 30, 2010
RAI 426 18 - 191	November 30, 2010

Sincerely,

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AREVA NP Inc.
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From: BRYAN Martin (External RS/NB)
Sent: Thursday, October 07, 2010 12:24 PM
To: 'Tefsaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); PANNELL George (CORP/QP)
Subject: Response to U.S. EPR Design Certification Application RAI No. 426, FSAR Ch. 18, Supplement 1

Getachew,

AREVA NP Inc. provided a schedule for a technically correct and complete response to RAI 426 on September 2, 2010. To allow additional time to interact with the staff, a revised schedule is provided.

The schedule for a technically correct and complete final response to these questions is revised and provided below.

Question #	Response Date
RAI 426 18 - 182	October 29, 2010
RAI 426 18 - 183	October 29, 2010
RAI 426 18 - 184	October 29, 2010
RAI 426 18 - 185	October 29, 2010
RAI 426 18 - 186	October 29, 2010
RAI 426 18 - 187	October 29, 2010
RAI 426 18 - 188	October 29, 2010
RAI 426 18 - 189	October 29, 2010
RAI 426 18 - 190	October 29, 2010
RAI 426 18 - 191	October 29, 2010

Sincerely,

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

From: BRYAN Martin (External RS/NB)
Sent: Thursday, September 02, 2010 4:42 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); PANNELL George (CORP/QP)
Subject: Response to U.S. EPR Design Certification Application RAI No. 426, FSAR Ch. 18

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information RAI 426.

The following table indicates the respective pages in the response document, "RAI 426 US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 426 18 - 182	2	2
RAI 426 18 - 183	3	3
RAI 426 18 - 184	4	4
RAI 426 18 - 185	5	5
RAI 426 18 - 186	6	6
RAI 426 18 - 187	7	7
RAI 426 18 - 188	8	8
RAI 426 18 - 189	9	9
RAI 426 18 - 190	10	10
RAI 426 18 - 191	11	11

A complete answer is not provided for 10 of the 10 questions. The schedule for a technically correct and complete draft response to these questions is provided below.

Question #	Response Date
RAI 426 18 - 182	October 7, 2010
RAI 426 18 - 183	October 7, 2010
RAI 426 18 - 184	October 7, 2010
RAI 426 18 - 185	October 7, 2010
RAI 426 18 - 186	October 7, 2010
RAI 426 18 - 187	October 7, 2010
RAI 426 18 - 188	October 7, 2010
RAI 426 18 - 189	October 7, 2010
RAI 426 18 - 190	October 7, 2010
RAI 426 18 - 191	October 7, 2010

Sincerely,

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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Tuesday, August 03, 2010 2:23 PM
To: ZZ-DL-A-USEPR-DL
Cc: Marble, Julie; Walker, Jacqwan; Junge, Michael; Eudy, Michael; Steckel, James; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 426 (4796, 4825), FSAR Ch. 18

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on June 25, 2010, and discussed with your staff on July 8, 2010. No change is made to the draft RAI as a result of that discussion. 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: 2371

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB71086ED1F6)

Subject: Response to U.S. EPR Design Certification Application RAI No. 426, FSAR Ch. 18, Supplement 4
Sent Date: 12/16/2010 2:26:29 PM
Received Date: 12/16/2010 2:26:37 PM
From: BRYAN Martin (EXTERNAL AREVA)

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MESSAGE	8981	12/16/2010 2:26:37 PM
RAI 426 Supplement 4 Response US EPR DC.pdf		100956

Options

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

Response to

Request for Additional Information No. 426(4796, 4825), Revision 1, Supplement 4

8/3/2010

U. S. EPR Standard Design Certification

AREVA NP Inc.

Docket No. 52-020

SRP Section: 18 - Human Factors Engineering

Application Section: FSAR Chapter 18

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

Question 18-182:

NUREG-0711 section 11.4.3.2.2(8) states:

- (8) For important actions at complex HSIs remote from the main control room, where timely and precise human actions are required, the use of a simulation or mockup should be considered to verify that human performance requirements can be achieved. (For less risk-important HAs or where the HSIs are not complex, human performance may be assessed based on analysis such as task analysis rather than simulation.)

The staff requests for the applicant to clarify where this criterion is addressed in their application.

Response to Question 18-182:

The AREVA NP U.S. EPR Task Analysis (TA) Implementation Plan has been revised, and the proprietary plan is submitted under a separate cover letter associated with RAI 419 Question 18-171. Additional detail has been added to Sections 3.0 and 4.0 of the U.S. EPR Task Analysis Implementation Plan to address this question.

The AREVA NP U.S. EPR Human System Interface Design Implementation Plan has been revised, and the proprietary plan is submitted under a separate cover letter associated with RAI 419 Question 18-172. Additional detail has been added to Section 3.3 of the U.S. EPR Human System Interface Design Implementation Plan to address this question.

A revision to the AREVA NP U.S. EPR Human Factors Verification and Validation (V&V) Implementation Plan will be included in the response to RAI Batch 421 and will address this question.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 18-183:

NUREG-0711 section 11.4.3.2.3(2) states:

- (2) To properly account for human variability, a sample of participants should be used. The sample should reflect the characteristics of the population from which the sample is drawn. Those characteristics that are expected to contribute to system performance variation should be specifically identified and the sampling process should provide reasonable assurance that variation along that dimension is included in the validation. Several factors that should be considered in determining representativeness include: license and qualifications, skill/experience, age, and general demographics.

The staff requests for the applicant to reconcile the inconsistency in the FSAR of not selecting participants on the basis of license and qualifications while only using qualified operators. The staff also requests for the applicant to clarify the V&V IP statements that only licensed operators (who will not yet exist) will be used (see section 3.6.3.1; 4.3.1.13). In addition, the staff requests for the applicant to define the techniques (e.g., give the sample bounds) that will ensure that the sample age and demographics are representative of the overall population.

Response to Question 18-183:

A revision to the AREVA NP U.S. EPR Human Factors Verification and Validation (V&V) Implementation Plan will be included in the response to RAI Batch 421 and will address this question.

U.S. EPR FSAR Tier 2, Section 18.10.3.6.5 will be revised to remove the statement that sample participants are chosen randomly in regards to "operator license and qualification." Sample participants will have the minimum qualification of an operating license for a nuclear power plant. Other attributes such as age, experience, and demographics are randomly chosen as detailed in U.S. EPR FSAR Tier 2, Section 18.10.3.6.5.

FSAR Impact:

U.S. EPR FSAR, Tier 2, Section 18.10.3.6.5 will be revised as described in the response and indicated on the enclosed markup.

Question 18-184:

NUREG-0711 section 11.4.3.2.3(4) states:

- (4) To prevent bias in the sample, the following participant characteristics and selection practices should be avoided:
- participants who are part of the design organization
 - participants in prior evaluations
 - participants who are selected for some specific characteristic, such as using crews that are identified as good or experienced.

The staff requests for the applicant to identify the sampling practices used to identify participants. In addition, please verify that participants will not be part of the design organization.

Section 3.6.3.1 states that 'if the level of experience is considered to be an important variable in the evaluation results, the evaluators may selectively seek out AREVA or industry personnel with the requisite requirements to participate...'. The staff requests for the applicant to verify that the normal selection practice will not be biased toward selecting participants who are identified as good or experienced and that if the impact of experience must be assessed, to avoid a biased sample the effect of experience will be assessed statistically from the overall sample and not via selection practices. If an alternative method will be used, then please include a description and justification.

Response to Question 18-184:

A revision to the AREVA NP U.S. EPR Human Factors Verification and Validation (V&V) Implementation Plan will be included in the response to RAI Batch 421 and will address this question.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 18-185

The staff reviewed the documentation related to the Staffing & Qualification (S&Q) program and found the following issues/inconsistencies:

- a. FSAR Sec. 18.4 and 18.5 refer to a withdrawn AREVA Topical Report (ANP-10279P). Also, the FSAR refers to ANP-10279P for a discussion of certain items (e. g., roles and responsibilities of operators on page 18.5-2 of FSAR). These items will need to be addressed/described in some other fashion.
- b. FSAR Sec. 18.4 and 18.5 use the words “may” and “such as” which are not appropriate in a licensing document and lead to uncertainty regarding commitments
- c. There is no S&Q Implementation Plan (IP) and the AREVA RAI responses refer to the Task Analysis (TA) IP for S&Q analyses. The TA IP does describe staffing analyses in a number of places, but this use of the TA IP is not supported by the descriptions in FSAR Sec. 18.4 and 18.5. For example, Sec. 18.5, S&Q, does not refer to the TA IP. And Section 18.4, Task Analysis, does not mention S&Q in its objective section (18.4.1) nor in the TA results summary section (18.4.3).
- d. Section 18.5.3 states that “the S&Q analysis is summarized in conjunction with the V&V results (refer to Section 18.10).” However Section 18.10.3.7, Results, does not mention specifically a full S&Q analysis. And the AREVA RAI responses refer to TA not V&V for S&Q analyses.
- e. COL item 18.5-1 specifies that a COL applicant will confirm that actual staffing levels and qualifications remain bounded by regulatory requirements and results of the S&Q analyses. But it is not clear what results are referred to or where they are documented.
- f. The wording of Tier 1, ITAAC 5 in Table 3.4-1 on S&Q does not fully agree with the arrangement and sequence of analyses for staffing or with the TA IP. For example it states that “The S&Q analysis includes ..”, however based on the documents reviewed there does not seem to be a S&Q analysis per se. ITAAC 5 also states that “an analysis of the V&V activities driven by initial staffing assumptions for the U.S. EPR has been performed.” But per the TA IP the initial staffing assumptions are an input to the TA, which may modify them based on many other inputs. It is then the output staffing from the TA that feeds V&V, not the initial staffing assumptions. Further, ITAAC 5 refers to an “output summary report of the U.S. EPR staffing and qualifications.” It is not clear what report this is, since it is not mentioned in the FSAR or the TA IP, and there is no S&Q IP.
- g. NUREG-0711, Section 6.3 specifies that the applicant should provide an IP for S&Q analysis and upon completion a results summary report should be submitted. If the combination of the Initial Staffing Assumptions, the TA IP, and the results summary report of Section 5.0 of the TA IP are to serve this purpose for S&Q, that should be clearly stated and the TA IP clarified to accomplish it.

The overall Staffing & Qualification (S&Q) program is not clearly and consistently defined as note above. Please clarify the S&Q program and ensure a complete and consistent description in the various pertinent documents.

Response to Question 18-185:

The AREVA NP U.S. EPR Task Analysis (TA) Implementation Plan has been revised and the proprietary plan is submitted under a separate cover letter associated with RAI 419 Question 18-171 to support the response to this question.

The AREVA NP U.S. EPR HFE Program Management Plan has been revised and the proprietary plan is submitted under a separate cover letter associated with RAI 348 Question 18-90 to support the response to this question.

The words “may” and “such as” will be revised or replaced as indicated in the enclosed FSAR markup.

U.S. EPR FSAR Tier 2, Section 18.4.1 and 18.4.3 will be updated to clarify the staffing and qualification is included as a part of task analysis.

The acceptance criteria for Tier 1 Table 3.4, Element 4.0, task analysis, will be updated to be consistent with the results summary section of the TA implementation plan.

FSAR Impact:

U.S. EPR FSAR, Tier 1 Table 3.4 and Tier 2, Sections 18.4 will be revised as described in the response and indicated on the enclosed markup.

Question 18-186:

Sections 4.3 and 4.4 of the TA IP refer to the “the staffing and qualification assumptions.” The report “Initial Staffing Assumptions for the U.S. EPR” addresses staffing assumptions but does not appear to include qualification assumptions. The staff requests for the applicant to clarify where these are defined. In addition, please clarify where the final qualification determinations will be documented.

Response to Question 18-186:

The AREVA NP U.S. EPR Task Analysis (TA) Implementation Plan has been revised and the proprietary plan is submitted under a separate cover letter associated with RAI 419 Question 18-171. Additional detail has been added to Sections 3.0 and 4.0 of the U.S. EPR Task Analysis Implementation Plan to address this question.

The AREVA NP Initial Staffing Assumptions for the U.S. EPR has been revised and the document is submitted under a separate cover letter. Additional clarifying changes are made to U.S. EPR FSAR Tier 2, Section 18.5 to reflect the revised Initial Staffing Assumptions.

FSAR Impact:

U.S. EPR FSAR, Tier 2, Section 18.5 will be revised as described in the response and indicated on the enclosed markup.

Question 18-187:

FSAR Section 18.5.1 states that the initial staffing assumption is based on predecessor designs. NUREG-0711, OER, states in part that S&Q analyses should address “initial staffing goals and their bases including staffing levels of predecessor systems and a description of significant similarities and differences between predecessor and current systems.” The staff requests for the applicant to specify where the analysis is documented that presents the predecessor differences and staff numbers, and then modifies them for the U.S. EPR. It does not appear to be discussed in the report “Initial Staffing Assumptions for the U.S. EPR” or in the OER sections on the TA IP.

In addition, the staff requests for the applicant to provide the document(s) that modify the predecessor differences and staff numbers and provides the U.S. EPR adjusted information. If this information is not available at this time, then please provide a timeframe for when it will be available for staff review.

Response to Question 18-187:

The AREVA NP Initial Staffing Assumptions for the U.S. EPR has been revised and the document is submitted under a separate cover letter.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 18-188:

NUREG-0711 Section 6.4(2) and Section 2.4.1(5) specify the scope of personnel that should be considered in staffing analyses. FSAR Section 18.5.1 identifies all of these except engineering support personnel. The Initial Staffing Assumptions report, however, does not include numbers or assumptions regarding any group except the operations shift staff. The TA IP does not identify the scope/types of personnel that are included in the staffing analyses. The staff requests for the applicant to address the concerns raised above. If the information is not available at this time, then please provide a timeframe for when the information will be available for staff review.

Response to Question 18-188:

The AREVA NP U.S. EPR Task Analysis (TA) Implementation Plan has been revised and the proprietary plan is submitted under a separate cover letter associated with RAI 419 Question 18-171. Additional detail has been added to Sections 3.0 and 4.0 of the U.S. EPR Task Analysis Implementation Plan to address this question.

The AREVA NP Initial Staffing Assumptions for the U.S. EPR has been revised and the document is submitted under a separate cover letter.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 18-189:

NUREG-0711, Section 6.4(4), the Task Analysis bullet states in part that S&Q analyses should address “availability of personnel considering other activities that may be ongoing and for which operators may take on responsibilities outside the control room (e.g., fire brigade).” The TA IP does not appear to include this aspect of staffing analysis. The staff requests for the applicant to provide this information.

Response to Question 18-189:

The AREVA NP U.S. EPR Task Analysis (TA) Implementation Plan has been revised and the proprietary plan is submitted under a separate cover letter associated with RAI 419 Question 18-171. Additional detail has been added to Sections 3.0 and 4.0 of the U.S. EPR Task Analysis Implementation Plan to address this question.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 18-190:

NUREG-0711, Section 6.4(4), the bullet related to Task Analysis, states in part that S&Q analyses should address “personnel communication and coordination, including interactions between them for diagnosis, planning, and control activities, and interactions between personnel for administrative, communications, and reporting activities.” Section 6.4(4), HSI design, states that S&Q analyses should address “coordinated actions between individuals.” And Section 6.4(4), the training program development bullet states in part that S&Q analyses should address “crew coordination concerns that are identified during the development of training.” The TA IP mentions communication briefly but does not appear to include the coordination aspects of staffing analysis. The staff requests for the applicant to provide this information for staff review.

Response to Question 18-190:

The AREVA NP U.S. EPR Task Analysis (TA) Implementation Plan has been revised and the proprietary plan is submitted under a separate cover letter associated with RAI 419 Question 18-171. Additional detail has been added to Sections 3.0 and 4.0 of the U.S. EPR Task Analysis Implementation Plan to address this question.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 18-191:

NUREG-0711, Section 6.4(4), the Task Analysis bullet states in part that S&Q analyses should address “actions... and procedures to meet an initial accident response ...as identified in the emergency plan.” The TA IP does not appear to include the emergency plan aspects of staffing analysis. The staff requests for the applicant to provide this information for staff review.

Response to Question 18-191:

The AREVA NP U.S. EPR Task Analysis (TA) Implementation Plan has been revised and the proprietary plan is submitted under a separate cover letter associated with RAI 419 Question 18-171. Additional detail has been added to Sections 3.0 and 4.0 of the U.S. EPR Task Analysis Implementation Plan to address this question.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

U.S. EPR Final Safety Analysis Report Markups

Table 3.4-1—Human Factors Engineering ITAAC (8 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.0	A task analysis is performed in accordance with the prescribed process described in the U.S. EPR Task Analysis (TA) Implementation Plan.	An analysis of the output summary report has been performed. {{DAC}}	<p>a. The output summary report exists and includes a description of how iterations of TA for procedure development, the procedures themselves, and training programs result in an HSI design that supports in-scope control, information, and support requirements.</p> <p><u>This includes:</u></p> <ul style="list-style-type: none"> • <u>Identified specific tasks that are needed to accomplish the analyzed functions that are allocated to personnel covering the modes of operation.</u> • <u>Information, control, and support requirements defined for each task.</u> • <u>An inventory of alarms, displays, and controls necessary for operators to perform the tasks.</u> • <u>Identification of risk-significant HAs and their incorporation into the design.</u> • <u>Determination of necessary number and skill levels of crew members.</u> • <u>Documentation of necessary changes to the crew compliment as specified in the initial staffing assumption for the U.S. EPR design.</u> • <u>Allocation of monitoring and control tasks for crew members.</u> <p>RAI 426, Q 18-185 →</p> <p>[[DAC]]</p>

18.4 Task Analysis

The functions allocated to plant personnel define their roles and responsibilities; human actions (HA) accomplish these functions. HAs can be further divided into tasks or groups of related activities which have common objectives or goals. Task analysis (TA) identifies requirements for accomplishing these tasks; specifically, for the displays, data processing, controls, and job support aids needed to accomplish tasks. The results of the TA are identified as inputs in ~~many HFE~~several activities in accordance with NUREG-0711 (Reference 1), ~~such as~~as listed:

- Job design, and training.
- Human system interface (HSI), procedure, and training program design.
- Defining task support verification and validation criteria.

The scope and methodology for TA for the U.S. EPR are summarized in the U.S. EPR Task Analysis Implementation Plan (Reference 2).

18.4.1 Task Analysis Objectives and Scope

The objective of the U.S. EPR TA is to identify the specific tasks needed to accomplish the safety significant functions that are allocated to personnel. The TA also identifies the information, control, and support requirements for those tasks. TA is used to develop the inventory of alarms, displays, and controls necessary for operators to perform tasks, and to evaluate the number and qualifications of personnel. The scope of personnel is defined in Section 18.1.1.5.

The TA considers a full range of plant operating modes (i.e., startup, normal power, abnormal and emergency operations, as well as transient, low-power, and shutdown conditions) including selected representative and important tasks from the areas of operations, maintenance, test, inspection, and surveillance that directly support critical safety function. The TA also considers HAs that involve monitoring and backup of automatic functions. Risk important HAs are identified via the probabilistic risk assessment (PRA) Level I and II analyses (see Sections 18.6 and Chapter 19). Also included in the scope of the TA are the analyses of tasks with automated critical functions, including monitoring the automated system and executing backup actions if the system fails.

RAI 426, Q
18-185

18.4.2 Task Analysis Methodology

TA is performed on functions identified during the FRA/FA process which includes the automatic actions and operator backup to the automation. A graded approach to TA coupled with a screening process is used to select functions to be subject to TA as described in the TA Implementation Plan. ~~A sampling process similar to the operational conditional sampling process described in Section 18.10 (verification and~~

18.4.3

Results SummaryRAI 426 Q
18-185

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). These outputs include:

- Identified specific tasks that are needed to accomplish the analyzed functions that are allocated to personnel covering the modes of operation.
- Information, control, and support requirements defined for each task.
- An inventory of alarms, displays, and controls necessary for operators to perform the tasks.
- Identification of risk-significant HAs and their incorporation into the design.
- Determination of necessary number and skill levels of crew members.
- Documentation of necessary changes to the crew compliment as specified in the initial staffing assumption for the U.S. EPR design.
- Allocation of monitoring and control tasks for crew members.

18.4.4

References

1. NUREG-0711, "Human Factors Engineering Program Review Model," Revision 2, U.S. Nuclear Regulatory Commission, February 2004.
2. U.S. EPR Task Analysis Implementation Plan, AREVA NP Inc., ~~2009~~2010.

18.5 Staffing and Qualifications

Initial staffing assumptions are listed in the Human Factors Engineering (HFE) Program Management Plan (Reference 1). Analysis of actual staffing numbers is an iterative process inherent in task analysis. Initial assumptions are reviewed, validated, and modified as necessary following analyses.

A COL applicant that references the U.S. EPR design will confirm that actual staffing levels and qualifications of plant personnel specified in Section 13.1 of the COL application remain bounded by regulatory requirements and results of the staffing and qualifications analysis.

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18.5.1 Objectives and Scope of Analysis

For developing the conceptual design for HSIs, and considering the minimum staffing requirements established in 10 CFR 50.54 (i) through (m), and as defined in Section 18.1.1.5, a U.S. EPR design goal is to design the plant and the HSI so that three licensed operators can safely monitor and control the plant from the MCR under all operating conditions, including normal operation, startup, shutdown, abnormal operation, and accidents. Because of the levels of automation inherent in the instrumentation and controls (I&C) architecture, only one licensed operator is needed at the controls during normal power operations. A second licensed operator is required by law to be on shift to provide defense in depth; the second licensed operator is not required to be continuously at the controls. In addition, a senior reactor operator (SRO) licensed control room supervisor shall remain present or readily available at all times in accordance with 10 CFR 50.54 (m). U.S. EPR design input assumptions also require that each operating crew include an SRO licensed shift manager (SM) and a number of non-licensed operators (NLO).

The objective of the workload analyses is to demonstrate that the HSI design and the number, roles, and responsibilities of the plant operating staff is able to adequately meet the demands of the processes of the plant. The initial assumption for the roles and responsibilities of operators during a full range of operating conditions is documented in Section 2.2.2.1 of the HFE Program Management Plan (Reference 1).

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The initial staffing assumption is based on operational experience for similar PWR designs ~~from the U.S. EPR predecessor designs (i.e., European N4 and Konvoi pressurized water reactor (PWR) designs which are in turn based upon Westinghouse-designed PWRs currently operating in the U.S.).~~

To obtain an optimum staffing level for the U.S. EPR, factors associated with other elements of the HFE program are considered. For example:

- The operating experience review (OER), Section 18.2, identifies staffing level related aspects of operating plants of similar design under various conditions and operating modes.

- Functional allocation (FA) decisions, Section 18.3, are evaluated to achieve maximized performance without placing excessive demands upon the operators, and to determine the monitoring tasks required of operators when functions are automated.
- Task analysis (TA), Section 18.4, provides input to the MCR staffing levels by including workload analysis as part of the overall TA process. The objective is to verify that the control room HSI adequately supports operator performance. Workload analysis must carefully consider assumed roles and responsibilities and qualification requirements of operators.
- Human reliability analyses (HRA), Section 18.6, provides input to the consideration of staffing levels on plant safety and reliability. In particular, risk-significant or time critical human actions (HA) are examined during the TA to determine the need for reassignment, changes to operator roles, or the need to change the number of operators required.
- The role of the operator is an important consideration in the HSI design process. Section 18.7 addresses the engineering process of optimizing coordinated operator actions, such as the demand on operators during the use of control elements and display elements concurrently, and the design of effective support.

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18.5.2 Staffing and Qualifications Analysis Methodology

To obtain an optimum staffing level, the initial staffing assumption (Reference 1) may ~~is~~ be iterated as a result of task analysis. Initially, tasks are assigned to crew members based on U.S. EPR predecessor operating experience and on established roles and responsibilities as noted in Reference 1. The process then builds on these assumptions. Changes in team roles and responsibilities may result from the adjustments to individual crew member responsibilities. Finally, individual team member qualification requirements may evolve with changes in team and individual roles.

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18.5.3 Results

The staffing and qualification analysis is summarized within task analysis (Reference 2) and includes an evaluation of the number and qualifications of personnel needed to operate and test the U.S. EPR based on the HSI design features for normal, abnormal, and emergency conditions.

18.5.4 References

1. U.S EPR HFE Program Management Plan, AREVA NP Inc., 2009~~2010~~.
2. U.S. EPR Task Analysis Implementation Plan, AREVA NP Inc., 2009~~2010~~.

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2009~~2010~~.

2009~~2010~~.

- Validate the ability of the HSI to support the staff in accomplishing their tasks.
- Validate staffing goals.
- Validate the adequacy of computer-based procedures ~~and operating instructions~~.
- Validate the dynamic aspect of HSI for task accomplishment.
- Validate HRA assumptions.
- Evaluate and demonstrate that systems are error-tolerant to human and system failures.
- Validate that normal and minimum staff configurations are considered.

18.10.3.6.5 Strategy

ISV is performed on a high-fidelity simulator and includes the following steps:

- Develop detailed test objectives.
- Verify that the test bed meets the requirements in 10 CFR 50.34(f)(2)(i).
- Verify that previously generated HEDs have been addressed or are tracked for further consideration.
- Select participants:
 - Test participants are qualified operators that represent plant personnel who will interact with the HSI (e.g., operators currently licensed on similar plant designs rather than training or engineering personnel).
 - Test conductors are trained and qualified in the usage of test procedures, error introduction by inaccurate testing procedures, and importance of testing documentation.
 - Normal crew configuration is present for the test (see Section 18.7.2).
 - Sample participants for the validation test are randomly chosen to avoid significant overlap with regard to:

• ~~Operator license and qualification.~~

- Age.
- Skill and experience.
- General demographics.
- Test participants:

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