

## ArevaEPRDCPEm Resource

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**From:** BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]  
**Sent:** Tuesday, November 23, 2010 9:07 AM  
**To:** Tesfaye, Getachew  
**Cc:** DELANO Karen (AREVA); ROMINE Judy (AREVA); BENNETT Kathy (AREVA); PANNELL George (AREVA)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 440, FSARCh. 18, Supplement 2  
**Attachments:** RAI 440 Supplement 2 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided a schedule for a technically correct and complete response to RAI No. 440 on October 4, 2010. Supplement 1 response was sent on October 28, 2010 to provide a revised schedule for all questions. The attached file, "RAI 440 Supplement 2 Response US EPR DC.pdf" provides technically correct and complete responses to the 6 questions, as committed.

The following table indicates the respective pages in the response document, RAI 440 Supplement 2 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 440 - 18-231	2	2
RAI 440 - 18-232	3	3
RAI 440 - 18-233	4	5
RAI 440 - 18-234	6	7
RAI 440 - 18-235	8	8
RAI 440 - 18-236	9	9

This concludes the formal AREVA NP response to RAI 440, 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](mailto:Martin.Bryan.ext@areva.com)

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**From:** BRYAN Martin (External RS/NB)  
**Sent:** Thursday, October 28, 2010 6:30 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. 440, FSARCh. 18, Supplement 1

Getachew,

On October 4, 2010, AREVA NP Inc. provided a schedule for technically correct and complete responses to RAI 440. To allow additional time to interact with the NRC staff, a revised schedule is provided.

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

<b>Question #</b>	<b>Response Date</b>
RAI 440 - 18-231	November 30, 2010
RAI 440 - 18-232	November 30, 2010
RAI 440 - 18-233	November 30, 2010
RAI 440 - 18-234	November 30, 2010
RAI 440 - 18-235	November 30, 2010
RAI 440 - 18-236	November 30, 2010

Sincerely,

Martin (Marty) C. Bryan  
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AREVA NP Inc.  
Tel: (434) 832-3016  
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**From:** BRYAN Martin (External RS/NB)  
**Sent:** Monday, October 04, 2010 2:39 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. 440, FSARCh. 18

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 440 Response US EPR DC.pdf," provides the schedule for a technically correct and complete response to the questions.

The following table indicates the respective pages in the response document, "RAI 440 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

<b>Question #</b>	<b>Start Page</b>	<b>End Page</b>
RAI 440 — 18-231	2	2
RAI 449 — 18-232	3	3
RAI 440 — 18-233	4	4
RAI 440 — 18-234	5	5
RAI 440 — 18-235	6	6
RAI 440 — 18-236	7	7

A complete answer is not provided for 6 of the 6 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 440 - 18-231	October 29, 2010
RAI 440 - 18-232	October 29, 2010
RAI 440 - 18-233	October 29, 2010
RAI 440 - 18-234	October 29, 2010
RAI 440 - 18-235	October 29, 2010
RAI 440 - 18-236	October 29, 2010

Sincerely,

Martin (Marty) C. Bryan  
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**From:** Tesfaye, Getachew [<mailto:Getachew.Tesfaye@nrc.gov>]  
**Sent:** Thursday, September 02, 2010 4:34 PM  
**To:** ZZ-DL-A-USEPR-DL  
**Cc:** Marble, Julie; Junge, Michael; Eudy, Michael; Steckel, James; Colaccino, Joseph; ArevaEPRDCPEm Resource  
**Subject:** U.S. EPR Design Certification Application RAI No. 440 (4902), FSARCh. 18

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on August 20, 2010, and discussed with your staff on September 2, 2010. Draft RAI Question 18-237 was deleted 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:** 2292

**Mail Envelope Properties** (BC417D9255991046A37DD56CF597DB71085189EB)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 440, FSARCh.  
18, Supplement 2  
**Sent Date:** 11/23/2010 9:07:24 AM  
**Received Date:** 11/23/2010 9:07:27 AM  
**From:** BRYAN Martin (EXTERNAL AREVA)

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

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<b>Files</b>	<b>Size</b>	<b>Date &amp; Time</b>
MESSAGE	5158	11/23/2010 9:07:27 AM
RAI 440 Supplement 2 Response US EPR DC.pdf		90043

**Options**

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

**Response to**

**Request for Additional Information No. 440, Supplement 2**

**9/2/2010**

**U.S. EPR Standard Design Certification**

**AREVA NP Inc.**

**Docket No. 52-020**

**SRP Section: 18 - Human Factors Engineering**

**Application Section: Human Reliability Analysis IP**

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

**Question 18-231:****Follow-up to RAI 328; Question 18-56, Item 1:**

NUREG-0711 Section 7.4 (1) specifies that risk important actions be developed from the Level 1 (core damage) PRA for internal and external events. Section 3.1.1 of the HRA IP states that human errors are considered risk-significant if they meet defined RAW and FV values. Clarify that these will include human actions from both the "PRA for Operations at Power" and the "PRA for Other Modes of Operation," namely low power and shutdown operations.

AREVA Response: The list of risk-significant human actions is developed using the Fussell-Vesely (FV) and risk achievement worth (RAW) risk importance measures derived from the human actions modeled in the Level 1 and Level 2 analyses of the probabilistic risk assessment (PRA) for modes of operation. The FV and RAW values is calculated relative to the overall risk from both the PRA for operations at-power and the PRA for low power and shutdown (LPSD) operations. The importance measures are the sum of the at-power and LPSD values weighted according to their respective contribution to overall risk.

Separate calculations are made for core damage frequency (CDF) and large release frequency (LRF).

New Question: This information should be added to the HRA IP.

**Response to Question 18-231:**

The AREVA NP response quoted in the question was added to Rev. 004 of the U.S. EPR Implementation Plan for the Integration of Human Reliability Analysis (HRA) into the Human Factors Engineering (HFE) Program.

**FSAR Impact:**

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

**Question 18-232:**

**Follow-up to RAI 328, Question 18-56, Item 2:**

NUREG-0711 Section 7.4 (1) specifies that risk important actions be developed from the Level 1 (core damage) PRA for internal and external events. Section 3.1.1 of the HRA IP states that human errors are considered risk-significant if they meet defined RAW and FV values. Clarify that these will include human actions from the external events PRA.

Section 3.1.1 of the HRA IP states that human errors are considered risk-significant if they meet defined RAW and FV values. Please clarify that these will include human actions from the external events PRA.

AREVA Response: The list of risk-significant human actions (HAs) is derived from the HAs modeled in the Level 1 (CDF) and Level 2 (LRF) analyses of the PRA, including internal and external events. The PRA results for the individual hazard groups (e.g., internal events, flooding, fires) are combined to yield and risk importance measures relative to the overall CDF and LRF risk.

The PRA includes external events that are treated explicitly (internal fires and floods) and others that have been screened as negligible (e.g., airplane crash, tornado).

The U.S. EPR does not have a seismic PRA. The seismic analysis discussed in U.S. EPR FSAR Tier 2, Chapter 19 is a risk-based seismic margin assessment (SMA). The SMA methodology uses the existing PRA logic model for internal events and overlays seismic fragilities. Human error probabilities (HEP) and systems not qualified for seismic loadings are set to a failure probability of 1.0. The SMA is qualitative because it does not include quantification of CDF or LRF. No unique risk-significant HAs were identified by the SMA. The important SMA operator actions are the same as those in the internal events PRA.

New question: This information should be added to the HRA IP.

**Response to Question 18-232:**

The AREVA NP response quoted in the question was added to Rev. 004 the U.S. EPR Implementation Plan for the Integration of Human Reliability Analysis (HRA) into the Human Factors Engineering (HFE) Program.

**FSAR Impact:**

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

**Question 18-233:****Follow-up to RAI 328, Question 18-56, Item 3:**

Section 3.1 of the HRA IP states that “The HRA will be performed iteratively during the design process.” It also states that “New items analyzed during the design process determined through HRA to have *unacceptable risk* will be sent back through the HFE design process along with the applicable performance shaping factors as candidates for design changes.” Please provide the measure and threshold for *unacceptable risk* as used in this context.

AREVA Response: The NRC’s safety goal defines acceptable risk as a CDF less than 1E-4 per year (/yr) and a LRF less than 1E-6/yr. The U.S. EPR has a probabilistic design goal of a CDF less than 1E-05/yr and a LRF less than 1E-6/yr.

The HEPs for the risk-significant operator actions are not expected to jeopardize these goals.

As described in Section 3.4 of the HRA IP, the HRA iterative process continues until the HEP is acceptable “as determined by consensus of the Integration Design team.” This means that a balance is achieved between risk, operator burden, ergonomics, and other factors of operations and safety as determined by a consensus of the interdisciplinary team consisting of human reliability analysis (HRA) analyst(s), human factors engineering (HFE) specialist(s), operations specialist(s), and emergency procedure developer(s).

New Question: This response did not specifically answer the question. The response refers to words that deal with the acceptability of HEPs, but the question related to statements about risk, not HEPs. Risk is typically measured in CDF or LERF or via their related importance measures, not the HEP value. Please provide an updated response that gives the risk measure and threshold for *unacceptable risk*, as used in this context.

**Response to Question 18-233:**

The HRA process quantifies risk-significance using two different risk importance measures: Fussell-Vesely (FV) and Risk Achievement Worth (RAW). The results show that the risk is above or below the specified threshold. The term *unacceptable* was removed from this section of the HRA IP in order to avoid ambiguity. Those items that are above the specified thresholds are given greater scrutiny throughout the HFE design process. There is, therefore, no risk-significance that is *unacceptable*, unless the overall plant risk is above the probabilistic design goal (CDF of 1E-05/yr and LRF of 1E-6/yr).

The following information will be added to the HRA Implementation Plan to clarify the term “*unacceptable risk*.”

“New items analyzed during the design process determined, through HRA, to have a risk-significance value that is higher than the indicated threshold levels in Section 3.1.1 will be sent back through the HFE design process along with the applicable performance shaping factors as candidates for design changes.”

Additional information clarifying the threshold levels was included in Rev.004 of the HRA IP.

**FSAR Impact:**

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

**Question 18-234:****Follow-up to RAI 328, Question 18-56, item 4:**

NUREG-0711 Section 7.4 (1) specifies that risk important actions should be developed. Section 1.5 of the HRA IP in the definition of risk-significant human actions states that the initial list of these actions is located in Appendix B; but App. B is not included in Rev. 2. Appendix A of the HRA IP contains a Table titled U.S. EPR HRA Risk-Significant Human Actions, but it is blank and notes that "list to be developed by PRA/HRA." It appears that there are currently HFE activities in progress that need the list as input. Review of FSAR, Chap. 19, Rev. 0 shows tables of HAs with RAW and FV values. Please provide a copy of the most current consolidated list of risk-significant human actions.

AREVA Response: Table 18-56-1 provides lists the risk-significant HAs. Table 18-56-1 corresponds to the HRA IP, Appendix A, Table titled "U.S. EPR HRA Risk-Significant Human Actions." The shaded cells in Table 18-56-1 identify the calculated FV and RAW values that are risk-significant using the criteria defined in the Response to Question 18-55.

The risk-significant HAs are derived from the PRA described in U.S. EPR FSAR Tier 2, Chapter 19, Revision 1. The tables of risk-importance measures (RAW and FV) in U.S. EPR FSAR Tier 2, Chapter 19 are calculated relative to the CDF or LRF of the individual analysis areas (internal events at power, flooding, fires, and shutdown). The consolidated list of risk-significant HAs generated for the HRA IP calculates the risk importance measures relative to the overall CDF or LRF, including the hazard groups and operating modes as described in Part 1 and Part 2 of this response.

New Question: The response provides the requested information. The list provided in Table 18-56-1 was reviewed for reasonableness and completeness by comparing with other reactor lists of HAs and by reviewing related information in the Chap. 19 of the DCD, PRA and Severe Accident. The following areas were reviewed:

- various CDF and LRF values
- tables of R-S HAs by RAW and FV for the various internal and external PRAs and at power and shutdown PRAs
- tables of dominant cutsets
- distribution figures

One apparent discrepancy was noted. The human action OPF-SGTR-4H, Operator fails to isolate blowdown line for SGTR, is listed in DCD Table 19.1-33, R-S HAs, Level 2, Internal Events, with a RAW value of 41.3, but is not on the Integrated R-S HA Table 18-56-1. Please explain or add to the Table.

**Response to Question 18-234:**

The apparent discrepancy is the result of an oversight. The table of risk-significant human actions has been amended to include the human action OPF-SGTR-4H. No other human actions were excluded as a result of this oversight.

The omission of OPF-SGTR-4H resulted from use of an incorrect truncation limit during the merging of the composite cut sets for the response to Question 18-56. Correction of this error also results in slight changes of the large release frequency (LRF) importance measures for some of the other risk-significant human actions listed in Table 18-56.

The corrected risk significant HA table was included in the revision 004 of the HRA IP.

**FSAR Impact:**

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

**Question 18-235:**

**Follow-up to RAI 328, Question 18-56, item 5:**

NUREG-0711 Section 7.4 (2) specifies that risk-important HAs should be addressed in (among others) task analyses (TA). Section 1.2.1.4 of the HRA IP addresses input to TA from the HRA. Please clarify the HRA IP to specify that there will be a task analysis performed for each R-S HA.

AREVA Response: Task analysis to addresses the risk-significant HAs.

New Question: The commitment is acceptable. However, please correct typo and include in the HRA or TA IP.

**Response to Question 18-235:**

Section 1.5 of the previously submitted U.S. EPR Task Analysis Implementation Plan Rev. 001 defines the scope of task analysis and includes all risk-significant HAs identified by the probabilistic risk assessment (PRA) level I and II analyses.

**FSAR Impact:**

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

**Question 18-236:**

**Follow-up to RAI 328, Question 18-56, Item 6:**

NUREG-0711 Section 7.4 (2) specifies that risk-important HAs should be addressed in (among others) procedure development. Please clarify the HRA IP to specify that each R-S HA will be addressed in the EPR procedure system.

AREVA Response: The Procedure Implementation Plan will be revised to specify that it addresses risk significant HAs.

New Question: The commitment is acceptable. However, please correct typo and include in the Procedure IP.

**Response to Question 18-236:**

Section 5.3.1.1 of the previously submitted U.S. EPR Human Factors Procedure Implementation Plan Rev. 001 addresses risk significant human actions and states:

“All Risk Significant Human Actions identified in the Human Reliability Analysis are individually addressed during the procedure drafting process. A determination will be made as to whether the risk significant item warrants addition of information to the procedure (e.g. extra procedure steps, tables, warning or caution statements, etc.) to mitigate the risks associated with it.”

**FSAR Impact:**

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