

## ArevaEPRDCPEm Resource

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**From:** Pederson Ronda M (AREVA US) [Ronda.Pederson@areva.com]  
**Sent:** Friday, December 12, 2008 6:35 PM  
**To:** Getachew Tesfaye  
**Cc:** DELANO Karen V (AREVA US); BENNETT Kathy A (OFR) (AREVA US); WELLS Russell D (AREVA US); NOXON David B (AREVA US)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 97(1296,1357,1389), FSAR Ch. 19, Supplement 1  
**Attachments:** RAI 97 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided responses to 10 of the 11 questions of RAI No. 97 on November 17, 2008. The attached file, "RAI 97 Supplement 1 Response US EPR DC" provides a technically correct and complete response to the remaining question, as committed.

The following table indicates the pages in the response document, "RAI 97 Supplement 1 Response US EPR DC" that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 97 — 19-223	2	6

This concludes the formal AREVA NP response to RAI No. 97, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

*Ronda Pederson*

[ronda.pederson@areva.com](mailto:ronda.pederson@areva.com)

Licensing Manager, U.S. EPR Design Certification

**AREVA NP Inc.**

An AREVA and Siemens company

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**From:** Pederson Ronda M (AREVA NP INC)  
**Sent:** Monday, November 17, 2008 4:57 PM  
**To:** 'Getachew Tesfaye'; 'John Rycyna'  
**Cc:** NOXON David B (AREVA NP INC); WELLS Russell D (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); SLIVA Dana (EXT)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 97(1296,1357,1389), FSAR Ch. 19

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 97 Response US EPR DC.pdf" provides technically correct and complete responses to 10 of the 11 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 97 Questions 19-220, 19-224, 19-225 and 19-226.

The following table indicates the respective pages in the response document, "RAI 97 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 97 — 19-215	2	15
RAI 97 — 19-217	16	16
RAI 97 — 19-218	17	17
RAI 97 — 19-219	18	18
RAI 97 — 19-220	19	19
RAI 97 — 19-221	20	20
RAI 97 — 19-222	21	23
RAI 97 — 19-223	24	24
RAI 97 — 19-224	25	25
RAI 97 — 19-225	26	26
RAI 97 — 19-226	27	27

A complete answer is not provided for one of the 11 questions. The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 97 — 19-223	December 12, 2008

Sincerely,

*Ronda Pederson*

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Licensing Manager, U.S. EPR Design Certification

New Plants Deployment

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**From:** Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]

**Sent:** Friday, October 17, 2008 2:25 PM

**To:** ZZ-DL-A-USEPR-DL

**Cc:** Hanh Phan; Theresa Clark; Edward Fuller; Lynn Mrowca; Joseph Colaccino; John Rycyna

**Subject:** U.S. EPR Design Certification Application RAI No. 97(1296,1357,1389), FSAR Ch. 19

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on October 6, 2008, and discussed with your staff on October 16, 2008. Draft RAI Question 19-216 was deleted and Draft RAI Questions 19-223 and 224 were modified 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:** 38

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RAI 97 Supplement 1 Response US EPR DC.pdf		134252

**Options**

**Priority:** Standard

**Return Notification:** No

**Reply Requested:** No

**Sensitivity:** Normal

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**Recipients Received:**

**Response to**

**Request for Additional Information No. 97 Supplement 1 (1296, 1357, 1389),  
Revision 0**

**10/17/2008**

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

**AREVA NP Inc.**

**Docket No. 52-020**

**SRP Section: 19 - Probabilistic Risk Assessment and Severe Accident Evaluation**

**Application Section: 19.1.5**

**QUESTIONS for PRA Licensing, Operations Support and Maintenance Branch 1  
(AP1000/EPR Projects) (SPLA)**

**Question 19-223:**

EPR FSAR Page 19.1-134 indicates that RES/OERAB/S02-01 was referenced as the basis for developing the fire ignition frequencies.

However, the estimated fire frequencies in this referenced report are based upon data solely from 1993 to 1999. Frequencies based only upon this data are much too limited since more years have passed than corresponds to the 1993 to 1999 period to which this data set pertains.

Frequencies developed from the state of art PRA methodology documented in NUREG/CR-6850 use a much more extensive fire event database, and supersede those from other sources. Only fire event data which have the potential to cause damage constitute fire frequencies in this methodology. In addition, the staff noted (Page 19.1-134) that the method described in NUREG/CR-6850, which is a preferable approach, was used for three PRA fire areas (PFAs), i.e., transformer yard, MS/MFW valve room, and containment pressurizer area. Sources of information for identifying the fire sources within these fire areas included: a) plant-specific spatial database, b) general arrangement drawings, and c) fire hazard analysis.

Accordingly, the staff has determined that fire frequencies developed from RES/OERAB/S02-01 are inappropriate for this application. Please explain why using RES/OERAB/S02-01 is appropriate for developing EPR fire ignition frequencies, especially since a plant-specific spatial database, general arrangement drawings, and fire hazard analyses were used in the development of fire ignition frequencies for some of the PFAs.

**Response to Question 19-223:**

In the process of developing U.S. EPR fire-PRA (probabilistic fire risk assessment) frequencies, AREVA NP did not anticipate that RES/OERAB/S02-01 frequencies would be considered inappropriate or not conservative. Even though these frequencies are based on data less extensive database than NUREG/CR-6850, the fire protection standards are improving, and a decreasing trend is expected in the fire area frequencies.

RES/OERAB/S02-01 is selected as a source of fire ignition frequencies because it limits the uncertainties associated with the amount of information available in the design certification phase in areas such as:

1. Structures and equipment locations in the non-nuclear island (NI) locations.
2. Locations for certain equipment in NI locations (cables, junction boxes, lighting panels, radiation panels, etc.).
3. Design for electrical switchgears, load centers, motor control centers and panels (vertical sections, number of breaker cubicles, etc.).

Based on the above limitations, the selection of RES/OERAB/S02-01 as a primary fire frequency source is prudent. For the three fire-PRA areas noted in the question, NUREG/CR-6850, "EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities" method is used because the fire frequency for these areas is not available in RES/OERAB/S02-01.

To address possible differences between fire frequencies obtained from RES/OERAB/S02-01 and NUREG/CR-6850, a sensitivity study is performed where fire ignition frequencies are

derived from NUREG/CR-6850. The distribution of ignition sources between fire areas is estimated based on information available in this phase of design. Transient sources are estimated following the method of NUREG/CR-6850, Task 6, with reasonable assumptions on maintenance, storage, and occupancy.

Table 19-223-1—Derivation of Fire Frequencies from NUREG/CR-6850 for Selected U.S. EPR Locations shows the assumed distribution of ignition sources between the different fire areas and the resulting fire ignition frequencies. Table 19-223-1 also compares the results of the NUREG/CR-6850 sensitivity evaluation with the current fire frequencies derived from RES/OERAB/S02-01 for different PRA fire areas and for generic locations.

The results of this comparison show that RES/OERAB/S02-01 underestimates the total fire frequency in switchgear rooms, overestimates the frequency for the control room, and gives comparable frequencies for the Auxiliary Building, Turbine Building, solid waste system (SWS) pumphouse, and battery room. A comparison is not performed for the cable spreading rooms because of the limited amount of information available on cable loads and junction boxes at this phase of design. Also, the fire frequencies for the three areas where the NUREG/CR-6850 method was originally used are not changed.

The difference in the switchgear room frequencies are mainly attributed to a high frequency for electrical cabinets fires ( $4.5E-02/\text{yr}$ ) in NUREG/CR-6850. All fire events used in derivation of this frequency are reviewed. Even though the selected fire events are already screened for potential severity, only a limited number of these events lasted longer than 10 minutes or had a potential for propagation. To assess the impact of the NUREG/CR-6850 frequency increase on the fire core damage frequency (CDF), potential consequences of the electrical cabinet fires are evaluated based on the following guidance in NUREG/CR-6850:

- NUREG/CR-6850 Appendix S, Section S.1: *Fire Propagation to Adjacent Cabinets*: Assume no fire spread if (1) cabinets are separated by a double wall with an air gap.
- NUREG/CR-6850 Appendix E, Section E.1: *Severity Factor Determination*: Based on the discretized distribution presented in Table E-2, the probability to have a heat release rate larger than 75 Btu/sec. (from a vertical cabinet with qualified cable and fire in one cable bundle) is equal to 0.2.

All cables to the U.S. EPR switchgear rooms will enter and exit the area on the floor, and will not be exposed to a direct impact of a fire (within flame, plume, or a ceiling jet). Therefore, it is evaluated that a heat release rate of 75 Btu/sec will not have the potential to disable an entire area.

To complete this sensitivity evaluation, the fire scenarios from the fire-PRA are quantified with the NUREG/CR-6850-based fire frequencies, with the following assumptions:

- A. 20 percent of the electrical cabinet fires are assumed to have the potential to disable all areas (based on direction in NUREG/CR-6850, Table 8-1, this is also applicable to dry transformers).
- B. 80 percent of the electrical cabinet fires/transformers fires disable a single bus (similar to internal initiating event 31BDA).
- C. Correction factors are not used because components are explicitly accounted for.

- D. In the Switchgear Building, automatic suppression in the station blackout (SBO) diesel room is credited by applying a 0.1 factor to the diesel generator contribution to the ignition frequency.

The results of the fire scenario CDF comparison are presented in Table 19-223-2—Fire CDF for Sensitivity Analysis. As shown in Table 19-223-2, the use of the NUREG/CR-6850 fire frequency method results in a total fire CDF increase of 5 percent.

An update to the fire-PRA results presented in the U.S. EPR FSAR is not necessary, based on the following:

- An estimated change in the fire CDF will not be significant enough (it is less than 10 percent) to change the conclusion that the overall CDF is below the NRC goal of  $1E-4/\text{yr}$  or the U.S. EPR probabilistic design goal of  $1E-5/\text{yr}$ .
- Large uncertainties will be introduced in the results because of the amount of information available at this phase of design.

**FSAR Impact:**

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



**Table 19-223-1—Derivation of Fire Frequencies from NUREG/CR-6850 for Selected U.S. EPR Locations**

Plant Location	Ignition Source Frqcy (1/yr)	Main Control Board	Pump	Electric Motor	Electric Cabinet	Transformers (Dry)	Diesel Generator	Battery Charger	Battery	HVAC Sub-system	Transients (Aux Bldg)	Transients (Plant Wide)	Total Turbine Bldg	Area Fire Frequency (NUREG/CR-6850) (1/yr)	Area Fire Frequency (RES/OERAB/S02-01)/S02-01) (1/yr)
		2.5E-03	2.1E-02	4.6E-03	4.5E-02	9.9E-03	2.1E-02	1.8E-03	7.5E-04	7.4E-03	1.4E-02	1.5E-02	5.1E-02		
SB4-AC				10%	10%						0.5%			5.6E-03	1.0E-03
SB2-AC				10%	10%						0.5%			5.6E-03	1.0E-03
SB4-DC				2%				20%			0.5%			1.3E-03	2.6E-04
SB2-DC				2%				20%			0.5%			1.3E-03	2.6E-04
SWGR				20%	30%	33%	20%	50%			0.0%	5%		2.0E-02	3.1E-03
<b>Total "Switchgear Rooms"</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>68%</b>	<b>70%</b>	<b>33%</b>	<b>100%</b>	<b>50%</b>	<b>0%</b>	<b>4%</b>	<b>5%</b>	<b>0%</b>	<b>4.8E-02</b>	<b>5.1E-03</b>	
SB4-MECH		5%	5%	1%						5%	1%			2.2E-03	5.0E-03
FB		10%	15%	1%						20%	20%			7.4E-03	5.0E-03
<b>Total "Aux. Building"</b>	<b>0%</b>	<b>40%</b>	<b>50%</b>	<b>6%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>60%</b>	<b>44%</b>	<b>0%</b>	<b>0%</b>	<b>2.4E-02</b>	<b>2.7E-02</b>	
BATT-4								13%			0.5%			1.6E-04	2.8E-04
<b>Total "Battery Room"</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>50%</b>	<b>0%</b>	<b>2%</b>	<b>0%</b>	<b>0%</b>	<b>6.5E-04</b>	<b>8.4E-04</b>	
ESW4		2%	1%	2%	2%					1%	1%			1.8E-03	3.6E-03
<b>Total "SWS Pumphouse"</b>	<b>0%</b>	<b>8%</b>	<b>4%</b>	<b>8%</b>	<b>8%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>4%</b>	<b>4%</b>	<b>0%</b>	<b>0%</b>	<b>7.1E-03</b>	<b>7.2E-03</b>	
TB		25%	5%	1%						4%			100%	5.7E-02	4.1E-02
MCR	100%										1%			2.6E-03	7.2E-03
<b>Rest of the Plant<sup>1</sup></b>	<b>0%</b>	<b>27%</b>	<b>41%</b>	<b>17%</b>	<b>22%</b>	<b>67%</b>	<b>0%</b>	<b>0%</b>	<b>32%</b>	<b>45%</b>	<b>95%</b>	<b>0%</b>			

<sup>1</sup> Includes EPG Buildings, Nuclear Auxiliary Building, Radwaste Building, Access Building, etc.

**Table 19-223-2—Fire CDF for Sensitivity Analysis**

Fire Scenario	Corresponding PFA fire frequency (1/yr)	PFA frequency adjusted for fire severity (1/yr)	Number of PFAs in scenario	Suppression	Fire Scenario Frequency (1/yr)	CCDP	CDF (1/yr)	FSAR Chapter 19 Fire CDF (1/yr)	Relative Change
Fire-SB14-AC	5.6E-03	1.2E-03	2	No	2.3E-03	4.0E-05	9.2E-08	7.9E-08	17%
Fire-SB23-AC	5.6E-03	1.2E-03	2	No	2.3E-03	2.5E-07	5.9E-10	5.1E-10	17%
Fire-SB14-DC	1.3E-03	6.1E-04	2	No	1.2E-03	3.5E-07	4.3E-10	1.8E-10	138%
Fire-SB23-DC	1.3E-03	6.1E-04	2	No	1.2E-03	4.3E-08	5.3E-11	2.2E-11	138%
Cabinet fires resulting in a loss of single bus	N/A	4.4E-03	4	No	1.8E-02	1.4E-07	2.5E-09	N/A	N/A
Fire-SB-MECH	2.2E-03	1.9E-03	4	No	7.5E-03	8.1E-07	6.1E-09	1.6E-08	-62%
Fire-BATT	1.6E-04	1.6E-04	4	No	6.5E-04	3.4E-07	2.2E-10	3.8E-10	-42%
Fire-FB	7.4E-03	7.1E-03	1	No	7.1E-03	8.5E-09	6.0E-11	4.2E-11	43%
Fire-ESW	1.8E-03	9.0E-04	4	No	3.6E-03	6.6E-08	2.4E-10	9.5E-10	-75%
Fire-TB	5.7E-02	5.7E-02	1	0.1	5.7E-03	1.2E-07	6.8E-10	5.0E-10	38%
Fire-SWGR	2.0E-02	4.6E-03	1	No <sup>2</sup>	4.6E-03	6.9E-06	3.2E-08	2.2E-08	47%
Fire-MCR	2.6E-03	2.6E-03	1	0.1	2.6E-04	7.0E-05	1.9E-08	2.5E-08	-27%
Fire-CSR	-	-	-	-	4.20E-04	1.5E-06	6.5E-10	6.5E-10	0%
Fire-xFYard	-	-	-	-	7.20E-03	8.5E-09	6.1E-11	6.1E-11	0%
Fire-MS-VR	-	-	-	-	5.20E-04	6.6E-05	3.4E-08	3.4E-08	0%
Fire-PZR	-	-	-	-	1.90E-05	8.7E-05	1.7E-09	1.7E-09	0%
					<b>Total Fire CDF</b>		1.9E-07	1.8E-07	+5%

<sup>2</sup> Partial suppression is credited for the SBO DG area, in calculation of the fire severity