## ArevaEPRDCPEm Resource

**From:** RYAN Tom (AREVA) [Tom.Ryan@areva.com]
**Sent:** Wednesday, June 15, 2011 8:19 AM
**To:** Tesfaye, Getachew
**Cc:** BENNETT Kathy (AREVA); DELANO Karen (AREVA); ROMINE Judy (AREVA); GUCWA Len (EXTERNAL AREVA); WILLIFORD Dennis (AREVA)
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 466, FSARCh. 6, Supplement 3
**Attachments:** RAI 466 Supplement 3 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided a response schedule for the 3 questions of RAI 466 on February 7, 2011. Supplement 1 was submitted to the NRC on March 31, 2011 to revise the response schedule for Questions 06.02.01.02-8, 06.02.01.02-9 and 06.02.01.02-10. Supplement 2 was submitted to the NRC on May 31, 2011 to provide a technically correct and complete response to one of the remaining 3 questions.

The attached file, "RAI 466 Supplement 3 Response US EPR DC.pdf" provides a technically correct and complete response to the remaining 2 questions.

The following table indicates the respective pages in the response document, "RAI 466 Supplement 3 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

| Question # | Start Page | End Page |
|---|---|---|
| RAI 466 — 06.02.01.02-9 | 2 | 5 |
| RAI 466 — 06.02.01.02-10 | 6 | 7 |

This concludes the formal AREVA NP response to RAI 466, and there are no questions from this RAI for which AREVA NP has not provided responses.

*Sincerely,*

***Tom Ryan for***
***Dennis Williford, P.E.***
***U.S. EPR Design Certification Licensing Manager***
**AREVA NP Inc.**
7207 IBM Drive, Mail Code CLT 2B
Charlotte, NC 28262
Phone: 704-805-2223
Email: Dennis.Williford@areva.com

---

**From:** WILLIFORD Dennis (RS/NB)
**Sent:** Tuesday, May 31, 2011 5:37 PM
**To:** Tesfaye, Getachew
**Cc:** BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); GUCWA Len (External RS/NB)
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 466, FSARCh. 6, Supplement 2

Getachew,

AREVA NP Inc. (AREVA NP) provided a response schedule for the 3 questions of RAI 466 on February 7, 2011. Supplement 1 was submitted to the NRC on March 31, 2011 to revise the response schedule for Questions 06.02.01.02-8, 06.02.01.02-9 and 06.02.01.02-10.
The attached file, "RAI 466 Supplement 2 Response US EPR DC.pdf" provides a technically correct and complete response to one (Question 06.02.01.02-8) of the remaining 3 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 466 Question 06.02.01.02-8.

The following table indicates the respective pages in the response document, "RAI 466 Supplement 2 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

| Question # | Start Page | End Page |
|---|---|---|
| RAI 466 — 06.02.01.02-8 | 2 | 3 |

AREVA NP is providing a revised schedule for responding to Questions 06.02.01.02-9 and 06.02.01.02-10. The schedule for technically correct and complete responses to these questions is provided below.

| Question # | Response Date |
|---|---|
| RAI 466 — 06.02.01.02-9 | **June 22, 2011** |
| RAI 466 — 06.02.01.02-10 | **June 22, 2011** |

*Sincerely,*

***Dennis Williford, P.E.***
***U.S. EPR Design Certification Licensing Manager***
**AREVA NP Inc.**
7207 IBM Drive, Mail Code CLT 2B
Charlotte, NC 28262
Phone: 704-805-2223
Email: Dennis.Williford@areva.com

---

**From:** WELLS Russell (RS/NB)
**Sent:** Thursday, March 31, 2011 3:23 PM
**To:** Tesfaye, Getachew
**Cc:** GUCWA Len (External RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 466, FSARCh. 6, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided a response schedule for the 3 questions of RAI 466 on February 7, 2011. To provide additional opportunity to interact with the NRC staff, the response schedule for the 3 remaining questions in RAI 466 is changed as shown below.

| Question # | Response Date |
|---|---|
| RAI 466 — 06.02.01.02-8 | May 31, 2011 |
| RAI 466 — 06.02.01.02-9 | May 31, 2011 |
| RAI 466 — 06.02.01.02-10 | May 31, 2011 |

*Sincerely,*

*Russ Wells*
*U.S. EPR Design Certification Licensing Manager*
***AREVA NP, Inc.***
*3315 Old Forest Road, P.O. Box 10935*
*Mail Stop OF-57*
*Lynchburg, VA 24506-0935*
*Phone: 434-832-3884 (work)*
*434-942-6375 (cell)*
*Fax: 434-382-3884*
*Russell.Wells@Areva.com*

---

**From:** BRYAN Martin (External RS/NB)
**Sent:** Monday, February 07, 2011 4:09 PM
**To:** Tesfaye, Getachew
**Cc:** DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); GUCWA Len (External RS/NB)
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 466, FSARCh. 6

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 466 Response US EPR DC.pdf" provides a schedule since a technically correct and complete response to the 3 questions is not provided.

The following table indicates the respective pages in the response document, "RAI 466 Response US EPR DC.pdf," that contains AREVA NP's response to the subject questions.

| Question # | Start Page | End Page |
|---|---|---|
| RAI 466 — 06.02.01.02-8 | 2 | 2 |
| RAI 466 — 06.02.01.02-9 | 3 | 3 |
| RAI 466 — 06.02.01.02-10 | 4 | 5 |

A complete answer is not provided for 3 of the 3 questions. The schedule for a technically correct and complete response to these questions is provided below.

| Question # | Response Date |
|---|---|
| RAI 466 — 06.02.01.02-8 | April 28, 2011 |
| RAI 466 — 06.02.01.02-9 | April 28, 2011 |
| RAI 466 — 06.02.01.02-10 | April 28, 2011 |

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:** Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
**Sent:** Wednesday, January 05, 2011 9:17 PM
**To:** ZZ-DL-A-USEPR-DL

**Cc:** Jensen, Walton; Jackson, Christopher; McKirgan, John; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
**Subject:** U.S. EPR Design Certification Application RAI No. 466 (5296), FSARCh. 6

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on December 21, 2010, and on January 4, 2011, 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:** 3123

**Mail Envelope Properties** (8D609EE2F807714CBF5297D9BA8602FB012EF4BD)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 466, FSARCh. 6, Supplement 3
**Sent Date:** 6/15/2011 8:19:16 AM
**Received Date:** 6/15/2011 8:19:20 AM
**From:** RYAN Tom (AREVA)

**Created By:** Tom.Ryan@areva.com

**Recipients:**
"BENNETT Kathy (AREVA)" <Kathy.Bennett@areva.com>
Tracking Status: None
"DELANO Karen (AREVA)" <Karen.Delano@areva.com>
Tracking Status: None
"ROMINE Judy (AREVA)" <Judy.Romine@areva.com>
Tracking Status: None
"GUCWA Len (EXTERNAL AREVA)" <Len.Gucwa.ext@areva.com>
Tracking Status: None
"WILLIFORD Dennis (AREVA)" <Dennis.Williford@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 | 7009 | 6/15/2011 8:19:20 AM |
| RAI 466 Supplement 3 Response US EPR DC.pdf | 90022 | |

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

**Response to**

**Request for Additional Information No. 466, Supplement 3**

**1/05/2011**

**U. S. EPR Standard Design Certification**
**AREVA NP Inc.**
**Docket No. 52-020**
**SRP Section: 06.02.01.02 - Subcompartment Analysis**
**Application Section: 6.02.01.02**

**QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)**

**Question 06.02.01.02-9:**

**Follow-up to RAI 266, Question 06.02.01.02-3**

U.S. EPR FSAR Rev. 2 Table 6.2.1-10 provides peak pressures calculated for seven critical subcompartments. Table 06.02.01.02-3-1 of Response to RAI 266, Question 06.02.01.02-3, Supplement 8, lists subcompartment peak pressures for 21 critical subcompartments for which the revised calculations result in pressures in excess of 5.0 psig. There are only four subcompartments with results available from both, the FSAR Rev. 2 calculations and the revised calculations. The revised calculations use the SRP recommended break flow models, which are expected to predict higher break flow rates and higher subcompartment pressure than the FSAR calculations. Two of the rooms, the pressurizer cavity and the pressurizer relief valve cavity, show increased pressures, as expected. However, the peak calculated pressures of the two steam generator loop cavities (23-004 and 29-004) are reduced. The pressures are smaller in the revised calculations.

a. Explain the reduction in peak pressure calculated for the steam generator loop cavities, make corrections if needed. The requirement is to perform a conservative subcompartment analysis. If the FSAR calculations provide higher peak subcompartment pressures in some cases, then which of the two values (FSAR or revised calculation) is used for subcompartment design? Justify selection of the peak subcompartment pressure used for design. Also, please provide a complete list of all subcompartments where peak pressure calculated with the FSAR methodology exceeds the value calculated with the revised method. Include in the listing the peak subcompartment pressures calculated with both methods.

b. Explain why those subcompartments listed in FSAR Rev. 2 Table 6.2.1-10 as critical are missing from the revised calculation Table 06.02.01.02-3-1 of critical subcompartments.

**Response to Question 06.02.01.02-9:**

a) The pressure response from the analyses presented in response to RAI 266, Question 06.02.01.02-3 will be used for the subcompartment design. These revised analyses comply with SRP 6.2.1.2, specifically questions raised in RAI 82, Question 06.02.01.02-1. The rooms in which the Rev. 2 method produced peak pressures higher than the revised method are listed in Table 06.02.01.02-9-1 and described below. However, before comparing the pressure response for each room the similarities and differences in the approaches used are highlighted.

   The two methods were similar in the use of GOTHIC lumped parameter modeling and 1 node HELB room to calculate the peak subcompartment pressure. The two methods were different in the methodologies used to demonstrate peak pressure convergence. In Rev. 2, the nodalization sensitivity used lumped parameter modeling to demonstrate peak pressure convergence. The sensitivity was limited to a single iteration that increased the number of nodes modeling the HELB room from 1 to 4. A pressure penalty was applied based on this sensitivity to envelope convergence and obtain accident pressure, as described in the response to RAI 82, Question 06.02.01.02-1b.1.

   In the revised calculation, the nodalization sensitivity used subdivided modeling to demonstrate peak pressure convergence. The sensitivity study was pursued until full convergence of peak pressure was achieved which occurred at 2x2x2 meshing of the high

energy line breaks (HELB) room (i.e., 8 cells). The sensitivity study confirmed the convergence of the 1-node room model peak pressure results.

The comparison of peak pressures calculated by the Rev. 2 and revised calculations is made below for the 1-node room models because they were shown to be converged in the revised calculation. In order to make this comparison, the pressure penalty applied in Rev. 2 was removed, as seen in Table 06.02.01.02-9-1.

***Rev. 2 versus Revised Calculation - Room UJA11004***

The Rev. 2 and revised analyses obtained practically identical peak pressures as a result of using identical M&E blowdown. As noted in Table 06.02.01.02-9-1, both calculations used the SRP recommended break flow models in the analysis of this room. Instituting the same SRP conservatisms related to break flow in Rev. 2 as in the revised calculations, resulted in similar subcompartment pressurization.

***Rev. 2 versus Revised Calculation – Rooms UJA23004 and UJA29004***

The Rev. 2 peak pressure for room UJA23004 exceeds the revised result by less than 1 psi (22.7 – 22.3 = 0.4 psi) and for UJA29004, by 1.5 psi (26.7 – 25.2 = 1.5 psi), as seen in Table 06.02.01.02-9-1. The change in pressure response is primarily driven by eliminating an overconservatism that was applied to the mass and energy release rates in the Rev. 2 analyses. In the Rev. 2 analyses, the pressure boundary condition applied to the break employed the pressure from the neighboring volume instead of the break volume. This effectively results in an artificial increase in the steam releases as GOTHIC applied this pressure to determine the amount of water that must vaporize to reach thermal equilibrium in the volume (See Chapter 22 of the GOTHIC Users Manual).

***Rev. 2 Versus Revised Calculation – Room UJA11006***

The Rev. 2 peak pressure exceeds the revised result by less than 1 psi (15.7 – 15.6 = 0.1 psi), as seen in Table 06.02.01.02-9-1. The change in pressure response is primarily driven by eliminating an overconservatism that was applied to the mass and energy release rates in the Rev. 2 analyses as described for Rooms UJA23004 and UJA29004.

***Rev. 2 Versus Revised Calculation – Room UJA15006***

The Rev. 2 peak pressure exceeds the revised result by 4.9 psi (23.3 – 18.4 = 4.9 psi), as seen in Table 06.02.01.02-9-1. This pressure difference results from a change in the break configuration: Rev. 2 assumed double-ended break, and the revised calculation assumed single-ended break. The revised analysis included only a single-ended break because this residual heat removal (RHR) line is stagnant during normal operation containing ambient fluid. Therefore, only the cold leg side of the break was considered in the HELB analysis.

b) As stated in the response to part (a) above, Table 06.02.01.02-3-1 of Response to RAI 266, Question 06.02.01.02-3, Supplement 8, provides calculated peak pressures for the subcompartments for which the revised calculations resulted in pressures in excess of 5.0 psig.

Four of the 11 rooms reanalyzed with the revised method resulted in peak pressures in excess of 5 psig. These are the two steam generator loop 2 cavities, UJA23004 and UJA29004; and the two pressurizer cavities, UJA29019 and UJA34019. The peak pressure results for these rooms are included in Table 06.02.01.02-3-1 of Response to RAI 266, Question 06.02.01.02-3, Supplement 8.

Six of the 7 remaining rooms reanalyzed with the revised method resulted in peak pressures less than 5 psig. These are the three SG loop 2 cavities, UJA11004, UJA15004, and UJA18004; SI valve room for loop 3, UJA11027; and the two RCP loop 3 cavities, UJA11006 and UJA15006. The peak pressure results for these rooms are not included in Table 06.02.01.02-3-1 of Response to RAI 266, Question 06.02.01.02-3, Supplement 8.

SG loop 2 cavity, UJA34004, was not reanalyzed with the revised method because it contains small bore pipes, as noted in Table 06.02.01.02-9-1.

**Table 06.02.01.02-9-1 – Subcompartment Peak HELB Pressure Comparisons for Selected Rooms**

| Room Name | Calculated Subcompartment Peak Pressure[a] (psia) | | Rev. 2 Accident Pressure[b] (psia) | Room Description | Notes |
|---|---|---|---|---|---|
| | Rev. 2 | Revised Calculation | | | |
| UJA11004 | 17.1 | 17.0 | 20.8 | JEA20 (SG) Supports Area | 1 |
| UJA11006 | 15.7 | 15.6 | N/A | JEB30 (RCP) Oil Collection Tank Area | 2, 5 |
| UJA15006 | 23.3 | 18.4 | 29.0 | JEB30 Pump (RCP) Room | 2, 3 |
| UJA23004 | 22.7 | 22.3 | 28.4 | JEA20 (SG) Room | 2 |
| UJA29004 | 26.7 | 25.2 | 31.1 | JEA20 (SG) Room | 2 |
| UJA34004 | 14.7 | N/A | N/A | JEA20 (SG) Room | 2, 4, 5 |

a. Calculated using the respective lumped parameter GOTHIC models:
(i) 1-node room model, from Rev. 2, used to obtain the values in column 2 of table (values rounded off to 1 decimal place)
(ii) revised calculation's 1-node room model obtained the values in column 3 of table; these values are also provided in Table 06.02.01.02-3-1 of Response to RAI 266, Question 06.02.01.02-3, Supplement 8.

b. In the Rev. 2 method, penalty applied to the calculated subcompartment peak pressures (i.e., column 2 of table) to obtain accident pressures or converged peak pressures (i.e., column 4 of table, rounded off to 1 decimal place).

**Notes:**

1. Identical pipe, HELB conditions (i.e., pressure and temperature), break configuration (i.e., single-ended versus double-ended) and SRP recommended break flow models used in both Rev. 2 and revised calculation.
2. Steam partial pressure in a neighboring subcompartment rather than in the blowdown ubcompartment used as the boundary condition pressure for the M&E in the Rev. 2 method.
3. Rev. 2 assumed double-ended break whereas the revised calculation assumed single-ended break.
4. The pipe in this room is a small bore pipe (JEA20BBR302) and for this reason was not analyzed in the revised calculation. All lines in this room are either small bore pipes or in the leak before break category.
5. No accident pressure is reported in Rev. 2 because of negligible pressurization in these rooms.

**FSAR Impact:**

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

**Question 06.02.01.02-10:**

**Follow-up to RAI 266, Question 06.02.01.02-2**

The Response to RAI 266, Question 06.02.01.02-2, Supplement 8 Table 06.02.01.02-2-1 lists 87 subcompartments with high energy lines. The staff understands that the resulting potential pipe rupture pressures for some these subcompartments were calculated using one of two GOTHIC models which were provided to the NRC staff: one model for the equipment space and a model for the service space.

a. The staff notes that several of the subcompartments of Table 06.02.01.02-2-1 do not appear in either GOTHIC model. These subcompartments are:

   7-18
   7-20
   7-21
   7-22
   7-23
   7-24
   7-26
   7-27
   7-28
   7-29
   18-13
   29-8
   29-19
   29-23
   34-14
   34-15

   Explain how the pressure from potential pipe breaks was evaluated for these compartments and justify their omission from the GOTHIC containment subcompartment models.

b. The staff notes that the “Room Volume” given in Table 06.02.01.02-2-1 for several of the subcompartments does not match the volume input to the subcompartment in the GOTHIC input. These subcompartments are:

   7-13
   7-14
   7-15
   7-16
   11-4
   11-14
   11-15
   11-16
   11-18
   11-20
   11-22
   11-23
   11-24
   11-25

11-26
11-27
11-28
18-2
18-3
18-4
18-5
18-7
18-8
18-9
18-14
18-15
18-16
23-2
23-3
23-4
23-5
23-7
23-8
23-13
23-15
23-16
29-3
29-4
29-7
29-14
29-15
29-16
34-7
34-19

Provide justification as to why the room volumes of Table 06.02.01.02-2-1 do not match the GOTHIC input. Which values are correct?

**Response to Question 06.02.01.02-10:**

The control volume descriptions in the GOTHIC models do not correspond to the UJA room names from the general arrangement drawings. A key to convert from a room name to the corresponding room number used in the GOTHIC model was provided in RAI 457 Supplement 4 as Table 06.02.01.02-5-1 for the Equipment Area Model and as Table 06.02.01.02-5-2 for the Service Area Model.

The models include all of the rooms that contain High Energy Lines described above and the volume provided for the rooms is consistent with that represented in U.S. EPR FSAR Tier 2 Table 6.2.1-16

**FSAR Impact:**

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