ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Thursday, July 29, 2010 8:49 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (AREVA); ROMINE Judy (AREVA); BENNETT Kathy (AREVA); VAN NOY Mark (EXTERNAL AREVA); CORNELL Veronica (EXTERNAL AREVA)
Subject: Response to U.S. EPR Design Certification Application RAI No. 384, FSAR Ch. 3, Supplement 2 - Interim
Attachments: RAI 384 Supplement 2 Question 03.04.02-13 INTERIM Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responses to 9 of the 9 questions of RAI No. 384 on June 22, 2010. A correction to the table was made on July 7, 2010. AREVA NP submitted Supplement 1 to the response on July 29, 2010, to provide a final response to 1 of the remaining 8 questions. The attached file, "RAI 384 Supplement 2 Question 03.04.02-13 INTERIM Response US EPR DC.pdf" provides a technically correct and complete INTERIM response to 1 of the remaining 8 questions, as committed.

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 384 Question 03.04.02-13.

The following table indicates the respective pages in the response document, RAI 384 Supplement 2 Question 03.04.02-13 INTERIM Response US EPR DC.pdf," that contains AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 384 — 03.04.02-13	2	2

The schedule for technically correct and complete responses to the remaining 9 questions is unchanged and provided below:

Question #	Interim Response Date	Response Date
RAI 384 — 03.04.02-13	July 29, 2010 (Actual)	January 17, 2011
RAI 384 — 03.04.02-14	N/A	August 12, 2010
RAI 384 — 03.08.04-11	N/A	August 30, 2010
RAI 384 — 03.08.04-12	N/A	August 30, 2010
RAI 384 — 03.08.04-13	N/A	August 30, 2010
RAI 384 — 03.08.04-14	N/A	August 30, 2010
RAI 384 — 03.09.02-68	N/A	August 30, 2010
RAI 384 — 03.10-31	N/A	September 7, 2010

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 (EXT)
Sent: Thursday, July 29, 2010 6:21 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); CORNELL Veronica (EXT); VAN NOY Mark (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 384, FSAR Ch. 3, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for responses to 9 of the 9 questions of RAI No. 384 on June 22, 2010. An editorial correction to the table was provided on July 7, 2010.

The attached file, "RAI 384 Supplement 1 Response U.S. EPR DC.pdf" provides technically correct and complete response to Question 03.03.02-05.

The following table indicates the respective pages in the response document, "RAI 384 Supplement 1 Response U.S. EPR DC - .pdf," that contain AREVA NP's final response to the subject question.

Question #	Start Page	End Page
RAI 384 — 03.03-02-05	2	3

The schedule for technically correct and complete INTERIM (1) and FINAL (8) responses to the remaining questions is unchanged and provided below:

Question #	Interim Response Date	Response Date
RAI 384 — 03.04.02-13	July 29, 2010	January 17, 2011
RAI 384 — 03.04.02-14	N/A	August 12, 2010
RAI 384 — 03.08.04-11	N/A	August 30, 2010
RAI 384 — 03.08.04-12	N/A	August 30, 2010
RAI 384 — 03.08.04-13	N/A	August 30, 2010
RAI 384 — 03.08.04-14	N/A	August 30, 2010
RAI 384 — 03.09.02-68	N/A	August 30, 2010
RAI 384 — 03.10-31	N/A	September 7, 2010

Sincerely,

Martin (Marty) C. Bryan
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AREVA NP Inc.
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From: BRYAN Martin (EXT)
Sent: Wednesday, July 07, 2010 1:46 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); RYAN

Tom (AREVA NP INC); CORNELL Veronica (EXT); VAN NOY Mark (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 384, FSAR Ch. 3

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 384 Response US EPR DC.pdf" provides a schedule since a technically correct and complete response to the 9 questions is not provided.

The following table indicates the respective pages in the response document, "RAI 384 Response US EPR DC.pdf" that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 384 — 03.03.02-05	2	2
RAI 384 — 03.04.02-13	3	3
RAI 384 — 03.04.02-14	4	4
RAI 384 — 03.08.04-11	5	5
RAI 384 — 03.08.04-12	6	7
RAI 384 — 03.08.04-13	8	8
RAI 384 — 03.08.04-14	9	9
RAI 384 — 03.09.02-68	10	10
RAI 384 — 03.10-31	11	11

A complete answer is not provided for 9 of the 9 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Interim Response Date	Response Date
RAI 384 — 03.03.02-05	N/A	July 29, 2010
RAI 384 — 03.04.02-13	July 29, 2010	January 17, 2011
RAI 384 — 03.04.02-14	N/A	August 12, 2010
RAI 384 — 03.08.04-11	N/A	August 30, 2010
RAI 384 — 03.08.04-12	N/A	August 30, 2010
RAI 384 — 03.08.04-13	N/A	August 30, 2010
RAI 384 — 03.08.04-14	N/A	August 30, 2010
RAI 384 — 03.09.02-68	N/A	August 30, 2010
RAI 384 — 03.10-31	N/A	September 7, 2010

Sincerely,

Martin (Marty) C. Bryan
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From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Thursday, May 20, 2010 11:38 AM
To: ZZ-DL-A-USEPR-DL
Cc: Jeng, David; Kazi, Abdul; Hawkins, Kimberly; Wong, Yuken; Chen, Pei-Ying; Dixon-Herrity, Jennifer; Miernicki,

Michael; Patel, Jay; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 384(4350,4351,4469,4498,4527), FSAR Ch. 3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on March 23, 2010, and on May 18, 2010, 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: 1759

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB71070A936D)

Subject: Response to U.S. EPR Design Certification Application RAI No. 384, FSAR Ch. 3, Supplement 2 - Interim
Sent Date: 7/29/2010 8:49:04 PM
Received Date: 7/29/2010 8:49:07 PM
From: BRYAN Martin (EXTERNAL AREVA)

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

Recipients:
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Tracking Status: None
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Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	7098	7/29/2010 8:49:07 PM
RAI 384 Supplement 2 Question 03.04.02-13 INTERIM Response US EPR DC.pdf	118310	

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

Response to

Request for Additional Information No. 384, Supplement 2

5/20/10

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 03.03.02 - Tornado Loads
SRP Section: 03.04.02 - Analysis Procedures
SRP Section: 03.08.04 - Other Seismic Category I Structures
SRP Section: 03.09.02 - Dynamic Testing and Analysis of Systems Structures and Components
SRP Section: 03.10 - Seismic and Dynamic Qualification of Mechanical and Electrical Equipment

Application Section: FSAR Chapter 3

QUESTIONS for Structural Engineering Branch 2 (ESBWR/ABWR Projects) (SEB2)
QUESTIONS for Engineering Mechanics Branch 2 (ESBWR/ABWR Projects) (EMB2)

Question 03.04.02-13:

Follow-up to RAI 162, Question 03.04.02-1

U.S. EPR FSAR Section 2.5.4.2 identifies the coefficient of friction between concrete and dry soil as 0.7. However in response to RAI 162, Question 03.04.02-1, the applicant stated that to check the upper limit of sliding and uplift (including the effects of maximum water table and dynamic versus static coefficient of friction) the angle of internal friction is reduced to 27 degrees which corresponds to a coefficient of friction of 0.5. As this is a key parameter used in determining the stability of Seismic Category I structures, U.S. EPR FSAR Section 2.5.4.2 should be revised to include this value.

Response to Question 03.04.02-13:

The U.S. EPR design uses a coefficient of friction of 0.5. When Nuclear Island (NI) sliding and overturning analysis is complete, this coefficient of friction may be adjusted to calculate a more conservative bearing pressure. U.S. EPR FSAR Tier 2, Table 2.1-1, Section 2.5.4.2, and Section 3.8.5.6.1 will be revised to state that a coefficient of friction of 0.5 and an angle of internal friction of 26.6 degrees are used for stability analysis.

FSAR Impact:

U.S. EPR FSAR Tier 2, Table 2.1-1, Section 2.5.4.2, and Section 3.8.5.6.1 will be revised as described in the response and shown on the enclosed mark-ups.

U.S. EPR Final Safety Analysis Report Markups

Table 2.1-1—U.S. EPR Site Design Envelope
Sheet 3 of 7

U.S. EPR Site Design Envelope	
Soil Density	Saturated - 134 lb/ft^3 Moist - 128 lb/ft^3 Dry - 110 lb/ft^3
Maximum Ground Water	3.3 ft below grade
Minimum Coefficient of Static Friction (representative of soil basemat interface)	03.04.02-13 → 0.75
Inventory of Radionuclides Which Could Potentially Seep Into the Groundwater	
See Table 2.1-2—Bounding Values for Component Radionuclide Inventory	
Flood Level (Refer to Section 2.4)	
Maximum Flood (or Tsunami)	1 ft below grade
Wind (Refer to Section 3.3)	
Maximum Speed (Other than Tornado)	145 mph (Based on 3-second gust at 33 ft above ground level and factored for 50-yr mean recurrence interval)
Importance Factor	1.15 (Safety-related structures for 100-year mean recurrence interval.)
Tornado (Refer to Sections 3.3 and 3.5)	
Maximum Pressure and Rate of Drop	1.2 psi at 0.5 psi/s
Maximum Rotational Speed	184 mph
Maximum Translational Speed	46 mph

the requirements of 10 CFR 100.23 and of 10 CFR 50, Appendix S. If non-capable surface faulting is present under foundations for safety-related structures, the COL applicant will demonstrate that the faults have no significant impact on the structural integrity of safety-related structures, systems, or components.

2.5.4 Stability of Subsurface Materials and Foundations

The stability of subsurface materials under the and foundations for Seismic Category I structures is demonstrated in Section 3.8.5 for the U.S. EPR 10 generic soil profiles described in Section 3.7.1 and Section 3.7.2. As described in Section 3.8.5, lateral soil pressure loads under saturated conditions are considered for the design of below-grade walls. Soil loads are based on the parameters described in Section 2.5.4.2.

A COL applicant that references the U.S. EPR design certification will present site-specific information about the properties and stability of soils and rocks that may affect the nuclear power plant facilities under both static and dynamic conditions, including the vibratory ground motions associated with the CSDRS and the site-specific SSE.

2.5.4.1 Geologic Features

Geologic features are site specific and will be addressed by the COL applicant.

2.5.4.2 Properties of Subsurface Materials

The following soil properties are used for design of U.S. EPR Seismic Category I structures.

- Soil density:
  - Saturated soil = 134 lb/ft^3.
  - Moist soil = 128 lb/ft^3.
  - Dry soil = 110 lb/ft^3.
- Angle of internal friction = ~~35~~26.6 degrees.
- Coefficient of friction acting on foundation basemats and near surface foundations for Seismic Category I structures = 0.~~7~~5. 03.04.02-13

For a cohesionless soil site, the soil below and adjacent to the safety-related foundation basemat will have a friction angle in excess of ~~35~~26.6 degrees. For a cohesive soil site, the soil will have an undrained strength equivalent to or exceeding a drained strength of ~~35~~26.6 degrees (yielding a friction coefficient greater than 0.~~7~~5). 03.04.02-13

Section 2.5.4.5 discusses the use of mud mats under the foundation basemats to facilitate construction. When used, the governing friction value at the interface zone

is determined by a thin soil layer (soil-on-soil) under the mud mat. As indicated above, the underlying soil (expected to be compacted backfill) will have a friction angle greater than ~~35~~26.6 degrees. Typical values of friction coefficient between concrete and dry soil and rock are in the range of approximately 0.~~7~~5. Due to the interlock of concrete with soil as the concrete is placed, the friction between the mud mat and underlying soil media is generally higher than the friction resistance of soil-on-soil so that continuity of load transfer across the interface is maintained.

03.04.02-13

Earthquake induced soil pressures for the design of the U.S. EPR are developed in accordance with Section 3.5.3 of ASCE 4-98 (Reference 2). Maximum ground water and maximum flood elevations used for determining lateral soil loads for the U.S. EPR are as specified in Table 2.1-1.

A COL applicant that references the U.S. EPR design certification will reconcile the site-specific soil properties with those used for design of U.S. EPR Seismic Category I structures and foundations described in Section 3.8.

2.5.4.3 Foundation Interfaces

03.04.02-13

Foundation interfaces with underlying materials are site specific and will be addressed by the COL applicant. The COL applicant will confirm that the site soils have (1) sliding coefficient of fiction equal to at least 0.~~7~~5, (2) adequate shear strength to provide adequate static and dynamic bearing capacity, (3) adequate elastic and consolidation properties to satisfy the limits on settlement described in Section 2.5.4.10.2, and (4) adequate dynamic properties (i.e., shear wave velocity and strain-dependent modulus-reduction and hysteretic damping properties) to support the Seismic Category I structures of the U.S. EPR under earthquake loading.

2.5.4.4 Geophysical Surveys

Geophysical surveys are site specific and will be addressed by the COL applicant.

2.5.4.5 Excavations and Backfill

Excavations and backfill are site-specific and will be addressed by the COL applicant. Mud mats may be provided under foundations for ease of construction. Mud mats may be designed as structural plain concrete elements on a site-specific basis in accordance with ACI 318 (Reference 3).

2.5.4.6 Ground Water Conditions

Ground water conditions are described in Section 2.4 and provided in Table 2.1-1 for the U.S. EPR. Ground water conditions are considered in the structural design of the U.S. EPR, as described in Section 3.8. However, groundwater conditions are not explicitly considered in the SSI analyses described in Section 3.7.1 and Section 3.7.2.

- Materials for the portion of the foundation basemat that supports the RCB/RSB are the same as described in Section 3.8.1.6.

- Structural concrete used in the construction of Seismic Category I foundations has a minimum compressive strength of 4000 psi (f'_c) at 90 days.

- Concrete exposed to aggressive environments, as defined in ACI 349-01, Chapter 4, shall meet the durability requirements of ACI 349-01 Chapter 4 or ASME Section III, Division 2, Article CC-2231.7, as applicable. In addition, epoxy coated reinforcing steel will be considered, on a site specific basis, for use in foundations subjected to aggressive environments. For epoxy coated reinforcing steel, the required splice length is increased in accordance with ACI 349-01 specifications. ~~Epoxy coated reinforcing steel will be considered, on a site-specific basis, for use in foundations when groundwater may adversely affect the long-term durability of the concrete foundation. This may be waived if the groundwater level is below the foundation level due to either natural site conditions or provision of a site-specific permanent dewatering system. For epoxy coated reinforcing steel, the required splice length is increased in accordance with ACI 349-01 specifications.~~

- The waterproofing system of all below-grade Seismic Category I structures subjected to aggressive environments, as defined according to ACI 349-01, Chapter 4, shall be evaluated for use in such environments. ~~Use of waterproofing membrane, a textured geo-synthetic material, will be considered on a site-specific basis for use around foundations on sites with a high water table. Where this material is used under Seismic Category I foundations it will be embedded within the mud mat as shown in Figure 3.8-117—Geosynthetic Water Proofing Membrane.~~

03.04.02-13

The waterproofing system will provide adequate frictional characteristics, $\mu \geq 0.5$, at its interface with concrete. This characteristic will be demonstrated by vendor testing. The contact surface between the waterproofing system and the concrete will be finished in accordance with manufacturer recommendations.

~~The textured waterproofing membrane will provide adequate frictional characteristics, m>0.7, at its interface with concrete. This characteristic will be demonstrated by vendor testing. The contact surface between the membrane and the concrete will be finished in accordance with manufacturer recommendations. The membrane is not a safety-related component as its failure would not result in core melt or a release of radioactivity to the environment.~~

A COL applicant that references the U.S. EPR design certification will evaluate the use of epoxy coated rebar for foundations subjected to aggressive environments, as defined in ACI 349-01, Chapter 4. In addition, the waterproofing system of all Seismic Category I foundations subjected to aggressive environments will be evaluated for use in aggressive environments. Also, the concrete of Seismic Category I foundations subjected to aggressive environments will meet the durability requirements of ACI 349-01, Chapter 4 or ASME, Section III, Division 2, Article CC-2231.7, as applicable.