ArevaEPRDCPEm Resource

From: BRYAN Martin (EXT) [Martin.Bryan.ext@areva.com]
Sent: Thursday, May 20, 2010 4:24 PM
To: Tesfaye, Getachew
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); VAN NOY Mark (EXT); CORNELL Veronica (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 376, FSAR Ch. 3, Supplement 1
Attachments: RAI 376 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided a schedule for a technically correct and complete response to RAI No. 376 on April 26, 2010. The attached file, "RAI 376 Supplement 1 Response US EPR DC.pdf," provides technically correct and complete responses to 1 of the remaining 14 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 376 Question 03.08.03-23.

The response to one question, 03.08.05-30, cannot be provided at this time due to its dependence on path-to-closure related work-planning currently being rescheduled and reviewed by the NRC.

The following table indicates the respective pages in the response document, "RAI 376 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 376-03.08.03-23	2	2

A complete answer is not provided for 13 of the 14 questions. The schedule for a technically correct and complete response to these questions has been changed and is provided below.

Question #	Response Date
RAI 376-03.08.01-47	July 14, 2010
RAI 376-03.08.01-48	August 3, 2010
RAI 376-03.08.03-21	June 24, 2010
RAI 376-03.08.03-22	June 24, 2010
RAI 376-03.08.03-24	August 3, 2010
RAI 376-03.08.05-24	August 3, 2010
RAI 376-03.08.05-25	August 3, 2010
RAI 376-03.08.05-26	August 3, 2010
RAI 376-03.08.05-27	July 14, 2010
RAI 376-03.08.05-28	August 3, 2010
RAI 376-03.08.05-29	August 3, 2010
RAI 376-03.08.05-30	June 10, 2010
RAI 376-03.08.05-31	August 3, 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: Monday, April 26, 2010 12:49 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); VAN NOY Mark (EXT)
Subject: Response to U.S. EPR Design Certification Application RAI No. 376 (4355,4367,4377), FSAR Ch. 3

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 376 Response US EPR DC.pdf" provides a schedule since a technically correct and complete response to the 14 questions is not provided.

The following table indicates the respective pages in the response document, "RAI 376 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 376-03.08.01-47	2	2
RAI 376-03.08.01-48	3	4
RAI 376-03.08.03-21	5	6
RAI 376-03.08.03-22	7	7
RAI 376-03.08.03-23	8	8
RAI 376-03.08.03-24	9	10
RAI 376-03.08.05-24	11	12
RAI 376-03.08.05-25	13	13
RAI 376-03.08.05-26	14	14
RAI 376-03.08.05-27	15	16
RAI 376-03.08.05-28	17	19
RAI 376-03.08.05-29	20	20
RAI 376-03.08.05-30	21	21
RAI 376-03.08.05-31	22	22

A complete answer is not provided for 14 of the 14 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 376-03.08.01-47	July 14, 2010
RAI 376-03.08.01-48	August 3, 2010
RAI 376-03.08.03-21	June 24, 2010
RAI 376-03.08.03-22	June 24, 2010
RAI 376-03.08.03-23	May 20, 2010
RAI 376-03.08.03-24	August 3, 2010
RAI 376-03.08.05-24	August 3, 2010
RAI 376-03.08.05-25	August 3, 2010
RAI 376-03.08.05-26	August 3, 2010
RAI 376-03.08.05-27	July 14, 2010
RAI 376-03.08.05-28	August 3, 2010
RAI 376-03.08.05-29	August 3, 2010
RAI 376-03.08.05-30	May 20, 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: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Thursday, March 25, 2010 2:13 PM
To: ZZ-DL-A-USEPR-DL
Cc: Xu, Jim; Hawkins, Kimberly; Miernicki, Michael; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 376 (4355,4367,4377), FSAR Ch. 3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on March 11, 2010, and on March 24, 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: 1437

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB7106342EE2)

Subject: Response to U.S. EPR Design Certification Application RAI No. 376, FSAR Ch. 3, Supplement 1
Sent Date: 5/20/2010 4:24:15 PM
Received Date: 5/20/2010 4:24:19 PM
From: BRYAN Martin (EXT)

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

Recipients:
"DELANO Karen V (AREVA NP INC)" <Karen.Delano@areva.com>
Tracking Status: None
"ROMINE Judy (AREVA NP INC)" <Judy.Romine@areva.com>
Tracking Status: None
"BENNETT Kathy A (OFR) (AREVA NP INC)" <Kathy.Bennett@areva.com>
Tracking Status: None
"VAN NOY Mark (EXT)" <Mark.Vannoy.ext@areva.com>
Tracking Status: None
"CORNELL Veronica (EXT)" <Veronica.Cornell.ext@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	5400	5/20/2010 4:24:19 PM
RAI 376 Supplement 1 Response US EPR DC.pdf		128968

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

Response to

Request for Additional Information No. 376, Supplement 1

3/25/2010

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 03.08.01 - Concrete Containment
SRP Section: 03.08.03 - Concrete and Steel Internal Structures of Steel or Concrete Containments
SRP Section: 03.08.05 - Foundations
Application Section: 3.8

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

Question 03.08.03-23:

Follow-up to RAI 155, Question 03.08.03-6

The approach described in the RAI response, to address the impactive and impulsive loads for concrete and steel structures, is acceptable. However, the proposed change to the FSAR does not incorporate the description of this approach. Therefore, the applicant is requested to include in the proposed revision to the FSAR a description of the analytical approach and acceptance criteria which is stated to be in accordance with ACI 349 and AISC/N690, supplemented by the criteria in FSAR Section 3.5 for acceptable ductility limits.

Response to Question 03.08.03-23:

U.S. EPR FSAR Tier 2, Section 3.8.3.4.1 and Section 3.8.4.4.1 will be revised to include the approach and acceptance criteria for acceptable ductility limits as written in the Response to RAI 155, Question 03.08.03-6.

FSAR Impact:

U.S. EPR FSAR Tier 2 Section 3.8.3.4.1 and Section 3.8.4.4.1 will be revised as described in the response and indicated on the enclosed markups.

U.S. EPR Final Safety Analysis Report Markups

maintained elastic for normal and extreme loadings in their respective combinations. Local yielding is permitted for abnormal loadings (e.g., pipe break accident loadings).

03.08.03-23

A local analysis and design of concrete members will be performed for impactive and impulsive loads according to ACI 349, with exceptions noted in RG 1.142. A local analysis and design of steel members will be performed for impactive and impulsive loads according to ANSI/AISC N690.

It is acceptable to assume non-linear (elasto-plastic) response of structural members for evaluation of the response of reinforced concrete and steel structures subject to impactive or impulsive loads. Deformation under impactive and impulsive loads is controlled by limiting the ductility ratio, μ_d, which is defined as the ratio of maximum acceptable displacement, χ_m (or maximum strain, ε_m), to the displacement at the effective yield point, χ_y (or yield strain, ε_y), of the structural member. In addition to the specified deformation limits, maximum deformation will not result in the loss of intended function of the structural member nor impair the design basis safety function of other systems and components.

Regarding structural capacity, a structural member will retain its ability to perform its design basis function when ductility limits for concrete and steel members presented in Table 3.5-3 are satisfied. As deformation limits of the member may be governed by attached structures, systems and components (SSC), the member will also satisfy deformation limits imposed by attached SSC to prevent loss of design basis function.

3.8.3.4.2 Local Analysis and Design

Local analyses are performed for concrete and steel structural elements and members by using sub-models expanded from the overall analysis model and by using manual techniques, in combination with overall model analysis results. Sub-models are performed by refining the element mesh in the overall ANSYS model. Local discontinuities (e.g., openings, thickened areas, local loads, and changes in member cross-section) are included in the sub-models.

Local analysis and design consider the same member and element forces and moments as described for overall design. In addition, local effects (e.g., punching shear and transfer of anchorage loads to the structure) are considered. Local analyses also are used for design of secondary structures (e.g., platforms, equipment supports, crane supports).

The recommendations of ACI 349-2001 and its appendices, including the exceptions in RG 1.142, are followed for concrete element and member local design (GDC 1).

Design of concrete embedments and anchors conforms to ~~Appendix B of~~ ACI 349-~~2001~~06 (Appendix D with exception stated in Section 3.8.1.2.1) and guidelines of

Design and analysis procedures described in the following sections also apply to the design of supports for Seismic Category I distribution systems (i.e., pipe supports, equipment supports, cable tray supports, conduit supports, HVAC duct supports, and other component supports) and to Seismic Category I platforms and miscellaneous steel structures located within other Seismic Category I buildings and structures.

3.8.4.4.1 General Procedures Applicable to Other Seismic Category I Structures

Other Seismic Category I concrete structural elements and members are designed in accordance with the requirements of ACI 349-2001 and its appendices (GDC 1). Exceptions to code requirements specified in RG 1.142 are incorporated into the design and are accommodated in the loading combinations described in Section 3.8.4.3.2 for concrete structures.

The design of concrete walls, floors, and other structural elements for other Seismic Category I structures is performed using the strength-design methods described in ACI 349-2001, with the exceptions that the shear strength reduction factor of 0.85 is used as allowed in ACI 349-~~20~~06. Use of this shear strength reduction factor is acceptable because the loss of strength and stiffness due to cyclic inelastic loading in structural members of nuclear structures is smaller when compared to that of a conventional building structure, where a lower reduction factor is used. The ductility requirements of ACI 349-2001 are satisfied to provide a steel reinforcing failure mode and prevent concrete failure for design basis loadings.

The design of anchors and embedments conforms to the requirements of ~~Appendix B of~~ ACI 349-~~2001~~06 (Appendix D with exception stated in Section 3.8.1.2.1) and RG 1.199 (with exception described in Section 3.8.1.4.10). ~~Ductility is provided by designing anchorage systems such that a steel failure mode controls the design.~~ The requirements of Appendix C of ACI 349-2001 are followed for impulsive and impactive loading conditions (e.g., loading combinations that include pipe break missile impact loads or tornado-generated missile impact loads).

Other Seismic Category I steel members and assemblies are designed in accordance with ANSI/AISC N690-1994 (R2004, including Supplement 2) (GDC 1). Steel member design uses the allowable stress design methods of ANSI/AISC N690.

The design of bolted connections is in accordance with ANSI/AISC N690, Section Q1.16 and AISC 348-~~04~~00/~~2004~~2000 RCSC, "Specification for Structural Joints Using ASTM A325 and A490 Bolts." Bolted connections are designed to be fully tensioned (e.g., slip critical) unless justified otherwise.

The design of welded connections is in accordance with AWS D1.1 or AWS D1.6.

The design of bolted connections in combination with welded connections is in accordance with Section Q.15.10 of ANSI/AISC N690.

Loads and load combinations defined in Section 3.8.4.3 are used to determine strength requirements of members and elements of other Seismic Category I structures. Abnormal pipe break accident loads only apply to limited areas of structures located on the NI Common Basemat Structure. The following criteria apply for load combinations for concrete and steel other Seismic Category I structures:

- ~~The one-third increase in allowable stresses for concrete and steel members due to seismic (E') or wind (W and Wt) loadings is not permitted.~~
- Where any load reduces the effects of other loads, the corresponding coefficient for that load is 0.9 if it can be demonstrated that the load occurs simultaneously with other loads.
- Where the structural effects of differential settlement, creep, or shrinkage may be significant, they are included with the dead load (D) as applicable.
- For load combinations in which a reduction of the maximum design live load (L) has the potential to produce higher member loads and stresses, multiple cases are considered where the live load (L) is varied between its maximum design value and zero.
- Roofs with a slope of less than 0.25 inches per foot are analyzed for adequate stiffness to preclude progressive deflection as water ponding is created from the snow load or from rainfall on the surface. The analysis considers the potential blockage of the primary drainage system of the area that is subject to ponding loads. The analysis uses the larger of the snowmelt depth or rain load.
- ~~For steel members, thermal loads may be neglected when it can be shown that they are secondary and self limiting in nature.~~
- For load combinations including the loads P_a, T_a, R_a, R_{rr}, R_{rj}, or R_{rm}, the maximum values of these loads, including a dynamic load factor, are used unless a time-history analysis is performed to justify otherwise.
- For load combinations including loads R_{rr}, R_{rj}, R_{rm}, or W_m, these load combinations are first satisfied with these loads set to zero. However, when considering these concentrated loads, local section strength capacities may be exceeded under the effect of these concentrated loads, provided there is not a loss of intended function of the structural member or a loss of function of any safety-related SSC.
- ~~Twenty-five percent of the design live load is considered during static analysis with seismic load combinations. The full potential live load is used for the local analysis of structural members.~~
- Tornado loads are applied to roofs and exterior walls of other Seismic Category I structures. If tornado pressure boundaries are not established at the exterior walls, interior walls are designed as tornado pressure boundaries.

- For load combinations that include a tornado load (W_t), the tornado load parameter combinations described in Section 3.3 are used.

Concrete and steel structural elements and members are designed for axial tension and compression forces, bending moments, torsion, and in-plane and out-of-plane shear forces for the controlling loading combinations that are determined from analysis. Concrete and steel members and elements remain elastic for loadings other than impact. Local yielding is permitted for localized areas subjected to tornado-generated missile loads, pipe break accident loadings, and beyond design basis loadings. The structural integrity of members and elements is maintained for the loading combinations described in Section 3.8.4.3.

03.08.03-23

A local analysis and design of concrete members will be performed for impactive and impulsive loads according to ACI 349, with exceptions noted in RG 1.142. A local analysis and design of steel members will be performed for impactive and impulsive loads according to ANSI/AISC N690.

It is acceptable to assume non-linear (elasto-plastic) response of structural members for evaluation of the response of reinforced concrete and steel structures subject to impactive or impulsive loads. Deformation under impactive and impulsive loads is controlled by limiting the ductility ratio, μ_d, which is defined as the ratio of maximum acceptable displacement, χ_m (or maximum strain, ε_m), to the displacement at the effective yield point, χ_y (or yield strain, ε_y), of the structural member. In addition to the specified deformation limits, maximum deformation will not result in the loss of intended function of the structural member nor impair the design basis safety function of other systems and components.

Regarding structural capacity, a structural member will retain its ability to perform its design basis function when ductility limits for concrete and steel members presented in Table 3.5-3 are satisfied. As deformation limits of the member may be governed by attached structures, systems and components (SSC), the member will also satisfy deformation limits imposed by attached SSC to prevent loss of design basis function.

Analysis and design of other Seismic Category I structures are performed using a combination of computer models and local analyses. Computer models are used to perform overall analysis of major structures. The loads and loading combinations described in Section 3.8.4.3 are applied to the overall computer model to design for global effects of the loadings. Local analyses and designs are performed using refined computer submodels and manual calculations. Local analyses and designs are used to account for local discontinuities (e.g., openings, thickened areas, local loads, punching shear checks, and changes in member cross-section). Local analyses are also used to determine designs for items such as component supports, embedments, anchors, platforms, and other miscellaneous structural items. Techniques used for major structures are described in Sections 3.8.4.4.2 through 3.8.4.4.5.