

ArevaEPRDCPEm Resource

From: Pederson Ronda M (AREVA NP INC) [Ronda.Pederson@areva.com]
Sent: Thursday, September 17, 2009 4:58 PM
To: Tesfaye, Getachew
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); VAN NOY Mark (EXT); RYAN Tom (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 215, FSAR Ch 3, Supplement 2
Attachments: RAI 215 Supplement 2 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 2 of the 24 questions of RAI No. 215 on June 18, 2009. AREVA NP submitted Supplement 1 to the response on August 19, 2009, to address 6 of the remaining 22 questions. The attached file, "RAI 215 Supplement 2 Response US EPR DC.pdf" provides technically correct and complete responses to 2 of the remaining 16 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 215 Question 03.07.01-21

The following table indicates the respective pages in the response document, "RAI 215 Supplement 2 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 215 — 03.07.01-21	2	2
RAI 215 — 03.07.03-26	3	5

The schedule for technically correct and complete responses to the remaining 14 questions has been changed due to design change processing delays for several of the responses and is provided below:

Question #	Response Date
RAI 215 — 03.07.01-22	September 29, 2009
RAI 215 — 03.07.01-23	September 29, 2009
RAI 215 — 03.07.01-24	September 29, 2009
RAI 215 — 03.07.02-38	September 29, 2009
RAI 215 — 03.07.02-39	September 29, 2009
RAI 215 — 03.07.02-40	September 29, 2009
RAI 215 — 03.07.03-22	September 29, 2009
RAI 215 — 03.07.03-23	September 29, 2009
RAI 215 — 03.07.03-24	September 29, 2009
RAI 215 — 03.07.03-25	September 29, 2009
RAI 215 — 03.07.03-27	September 29, 2009
RAI 215 — 03.07.03-32	September 29, 2009
RAI 215 — 03.07.03-33	September 29, 2009
RAI 215 — 03.07.03-34	September 29, 2009

Sincerely,

Ronda Pederson

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Licensing Manager, U.S. EPR Design Certification

AREVA NP Inc.

An AREVA and Siemens company

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Phone: 434-832-3694

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From: Pederson Ronda M (AREVA NP INC)

Sent: Wednesday, August 19, 2009 4:51 PM

To: 'Tefaye, Getachew'

Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); VAN NOY Mark (EXT)

Subject: Response to U.S. EPR Design Certification Application RAI No. 215, FSAR Ch 3, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided responses to 2 of the 24 questions of RAI No. 215 on June 18, 2009. The attached file, "RAI 215 Supplement 1 Response US EPR DC.pdf" provides technically correct and complete responses to 6 of the remaining 22 questions, as committed.

The responses to three questions cannot be provided as originally committed at this time. Responses to RAI 215, Questions 03.07.01-24, 03.07.02-38, and 03.07.03-23 are being deferred due to their interdependence with other responses that are not scheduled to be submitted until September 29, 2009.

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 215 Questions 03.07.01-20, 03.07.02-42, 03.07.03-29, and 03.07.03-30.

The following table indicates the respective pages in the response document, "RAI 215 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 215 — 03.07.01-20	2	2
RAI 215 — 03.07.02-41	3	4
RAI 215 — 03.07.02-42	5	5
RAI 215 — 03.07.03-28	6	6
RAI 215 — 03.07.03-29	7	7
RAI 215 — 03.07.03-30	8	8

The schedule for technically correct and complete responses to the remaining 16 questions has been revised as provided below:

Question #	Response Date
RAI 215 — 03.07.01-21	September 18, 2009
RAI 215 — 03.07.01-22	September 18, 2009
RAI 215 — 03.07.01-23	September 29, 2009
RAI 215 — 03.07.01-24	September 29, 2009
RAI 215 — 03.07.02-38	September 29, 2009

RAI 215 — 03.07.02-39	September 29, 2009
RAI 215 — 03.07.02-40	September 29, 2009
RAI 215 — 03.07.03-22	September 18, 2009
RAI 215 — 03.07.03-23	September 29, 2009
RAI 215 — 03.07.03-24	September 18, 2009
RAI 215 — 03.07.03-25	September 18, 2009
RAI 215 — 03.07.03-26	September 18, 2009
RAI 215 — 03.07.03-27	September 18, 2009
RAI 215 — 03.07.03-32	September 29, 2009
RAI 215 — 03.07.03-33	September 29, 2009
RAI 215 — 03.07.03-34	September 29, 2009

Sincerely,

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From: WELLS Russell D (AREVA NP INC)

Sent: Thursday, June 18, 2009 4:14 PM

To: 'Getachew Tesfaye'

Cc: Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)

Subject: Response to U.S. EPR Design Certification Application RAI No. 215, FSAR Ch 3

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 215 Response US EPR DC.pdf" provides technically correct and complete responses to 2 of the 24 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 215 Question 03.07.03-31.

The following table indicates the respective pages in the response document, "RAI 215 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 215 — 03.07.01-20	2	2
RAI 215 — 03.07.01-21	3	3
RAI 215 — 03.07.01-22	4	4
RAI 215 — 03.07.01-23	5	6
RAI 215 — 03.07.01-24	7	7

RAI 215 — 03.07.02-38	8	8
RAI 215 — 03.07.02-39	9	9
RAI 215 — 03.07.02-40	10	10
RAI 215 — 03.07.02-41	11	11
RAI 215 — 03.07.02-42	12	12
RAI 215 — 03.07.03-22	13	13
RAI 215 — 03.07.03-23	14	14
RAI 215 — 03.07.03-24	15	15
RAI 215 — 03.07.03-25	16	16
RAI 215 — 03.07.03-26	17	17
RAI 215 — 03.07.03-27	18	18
RAI 215 — 03.07.03-28	19	19
RAI 215 — 03.07.03-29	20	20
RAI 215 — 03.07.03-30	21	21
RAI 215 — 03.07.03-31	22	22
RAI 215 — 03.07.03-32	23	23
RAI 215 — 03.07.03-33	24	24
RAI 215 — 03.07.03-34	25	25
RAI 215 — 03.12-17	26	27

A complete answer is not provided for 22 of the 24 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 215 — 03.07.01-20	August 19, 2009
RAI 215 — 03.07.01-21	September 18, 2009
RAI 215 — 03.07.01-22	September 18, 2009
RAI 215 — 03.07.01-23	September 29, 2009
RAI 215 — 03.07.01-24	August 19, 2009
RAI 215 — 03.07.02-38	August 19, 2009
RAI 215 — 03.07.02-39	September 29, 2009
RAI 215 — 03.07.02-40	September 29, 2009
RAI 215 — 03.07.02-41	August 19, 2009
RAI 215 — 03.07.02-42	August 19, 2009
RAI 215 — 03.07.03-22	September 18, 2009
RAI 215 — 03.07.03-23	August 19, 2009
RAI 215 — 03.07.03-24	September 18, 2009
RAI 215 — 03.07.03-25	September 18, 2009
RAI 215 — 03.07.03-26	September 18, 2009
RAI 215 — 03.07.03-27	September 18, 2009
RAI 215 — 03.07.03-28	August 19, 2009
RAI 215 — 03.07.03-29	August 19, 2009
RAI 215 — 03.07.03-30	August 19, 2009
RAI 215 — 03.07.03-32	September 29, 2009
RAI 215 — 03.07.03-33	September 29, 2009
RAI 215 — 03.07.03-34	September 29, 2009

Sincerely,

(Russ Wells on behalf of)

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

Sent: Tuesday, May 19, 2009 9:33 PM

To: ZZ-DL-A-USEPR-DL

Cc: Manas Chakravorty; Jim Xu; Sujit Samaddar; Kaihwa Hsu; Anthony Hsia; Michael Miernicki; Jay Patel; Joseph Colaccino; ArevaEPRDCPEm Resource

Subject: U.S. EPR Design Certification Application RAI No. 215 (2560, 2561,2565, 2588), FSAR Ch. 3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on April 14, 2009, and on May 19, 2009, you informed us that the RAI is clear but you needed clarification for Questions 3.7.3-26 and 3.7.3-31. To support the review schedule, we have decided to issue the RAI as is and conduct the clarification telecon at a later time. 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: 818

Mail Envelope Properties (5CEC4184E98FFE49A383961FAD402D31013C0875)

Subject: Response to U.S. EPR Design Certification Application RAI No. 215, FSAR Ch
3, Supplement 2
Sent Date: 9/17/2009 4:57:52 PM
Received Date: 9/17/2009 4:57:55 PM
From: Pederson Ronda M (AREVA NP INC)

Created By: Ronda.Pederson@areva.com

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Files	Size	Date & Time
MESSAGE	9616	9/17/2009 4:57:55 PM
RAI 215 Supplement 2 Response US EPR DC.pdf		403654

Options

Priority: Standard

Return Notification: No

Reply Requested: No

Sensitivity: Normal

Expiration Date:

Recipients Received:

Response to

Request for Additional Information No. 215, Supplement 2

5/19/2009

U.S. EPR Standard Design Certification

AREVA NP Inc.

Docket No. 52-020

SRP Section: 03.07.01 - Seismic Design Parameters

SRP Section: 03.07.02 - Seismic System Analysis

SRP Section: 03.07.03 - Seismic Subsystem Analysis

SRP Section: 03.12 - ASME Code Class 1, 2, and 3 Piping Systems and Piping

Components and Their Associated Supports

Application FSAR Ch. 3

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

QUESTIONS for AP1000 Projects Branch 1 (NWE1)

Question 03.07.01-21:**Follow-Up RAI to Question 03.07.01-4:**

In its response to Question 03.07.01-4, the applicant states that the COL applicant is required to compare the final iterated soil parameters with the standard plant generic soil parameters, as required by COL Information Item 2.5-3. The applicant also states that this COL item is further clarified in U.S. EPR FSAR Section 2.5.4.7 and 2.5.2.6, Step 5. COL Information Item 2.5-3 does not require the COL applicant to compare the final iterated soil parameters with the standard plant generic soil parameters nor is it required in either U.S. EPR FSAR Section 2.5.4.7 or Section 2.5.2.6, Step 5. The applicant is requested to add this requirement to COL Information Item 2.5-3 and to include reference to U.S. EPR FSAR Sections 2.5.4.7 in addition to the existing reference to U.S. EPR FSAR Section 2.5.2.6. The applicant is also requested to add to Guideline 5 of U.S. EPR FSAR Section 2.5.2.6, the requirement that the site soil profile that is compared to the U.S. EPR soil profile needs to be a strain-compatible soil profile.

Response to Question 03.07.01-21:

U.S. EPR FSAR Tier 2, Table 1.8-2 and Section 2.5.2.6 will be revised to clarify that the site soil profile must be strain-compatible.

U.S. EPR FSAR Tier 2, Table 1.8-2 will be revised to state:

A COL applicant that references the U.S. EPR design certification will compare the final site soil parameters with the U.S. EPR design generic soil parameters and verify that the site specific seismic parameters are enveloped by the CSDRS (anchored at 0.3 g PGA) and the 10 generic soil profiles addressed in Sections 2.5.2, 2.5.4.7, and 3.7.1 and summarized in Table 3.7.1-6.

FSAR Impact:

U.S. EPR FSAR Tier 2, Table 1.8-2 and Section 2.5.2.6 will be revised as described in the response and indicated on the enclosed markup.

Question 03.07.03-26:**Follow-Up RAI to Question 03.07.03-6:**

The response to Question 03.07.03-6 requires additional information. Linear, frame-type subsystems, such as piping, HVAC, cable tray, and conduit are likely to have horizontal bends, changes in elevation and, in the case of piping and conduit, contain branch connections. These types of sub-systems are usually modeled seismically from anchor-point to anchor-point, which normally do not lie in straight line. The applicant is requested to provide the criteria and procedures used in neglecting some of the degrees of freedom, including the rotational degrees of freedom, in seismic analysis and provide examples of applications to various types of subsystems.

Response to Question 03.07.03-26:

In general, the six degrees-of-freedom are considered at all nodes of the subsystem models. However, the following considerations are applied:

- All three translational degrees-of-freedom of all nodes are considered.
- On case-by-case basis, some rotational degrees-of-freedom are neglected based on justification.
- When linear frame-type subsystems such as straight runs of HVAC ducts, cable trays, or conduits are considered, local rotational responses of these subsystems have negligible influence on overall system dynamic response, provided that no external forces are applied in the local rotational degrees-of-freedom. Thus, such degrees-of-freedom can be neglected. This is consistent with the Response to Question 03.07.03-6.
- When the subsystems are complex, the six degrees-of-freedom are included in the dynamic analysis such as with subsystems having directional coupling at the nodes and with subsystems having horizontal bends or changes in elevations.
- In some cases, preliminary simplified models will be analyzed to determine which rotational degree-of-freedom can be neglected.

The following subsystem configurations are provided as examples:

- Figure 3.7.3-26-1(a) and Figure 3.7.3-26-1(b) show straight runs of subsystem which are modeled as simply supported with distributed mass and lumped mass, respectively. In the lumped-mass case, local rotational degrees-of-freedom can be neglected, provided that no external forces are applied in the local rotational degrees-of-freedom. Example 9.10 by Chopra in "Dynamics of Structures," 3rd Edition, Pearson Prentice Hall, Upper Saddle River, New Jersey, 2007 provides a calculation of such a lumped-mass model.
- Rotational responses of the following models may not be negligible when subjected to external forces and, thus, all six degrees-of-freedom are considered at all nodes:
 - Subsystems with changes in elevation (see Figure 3.7.3-26-2(a) and Figure 3.7.3-26-2(b)).
 - Subsystems with an intersection between horizontal members and vertical member (see Figure 3.7.3-26-3).

- Subsystems with changes in elevation and horizontal bend (see Figure 3.7.3-26-4 where Member 3 lies in the out-of-plane direction).

Figure 3.7.3-26-1—Subsystems with Straight Run Modeled as (a) Distributed Mass and (b) Lumped Mass

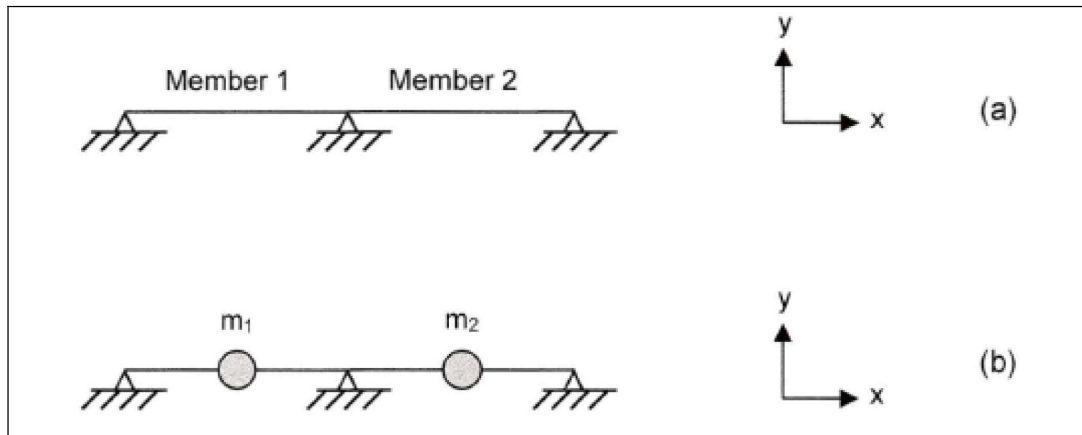


Figure 3.7.3-26-2—Subsystems with Changes in Elevation

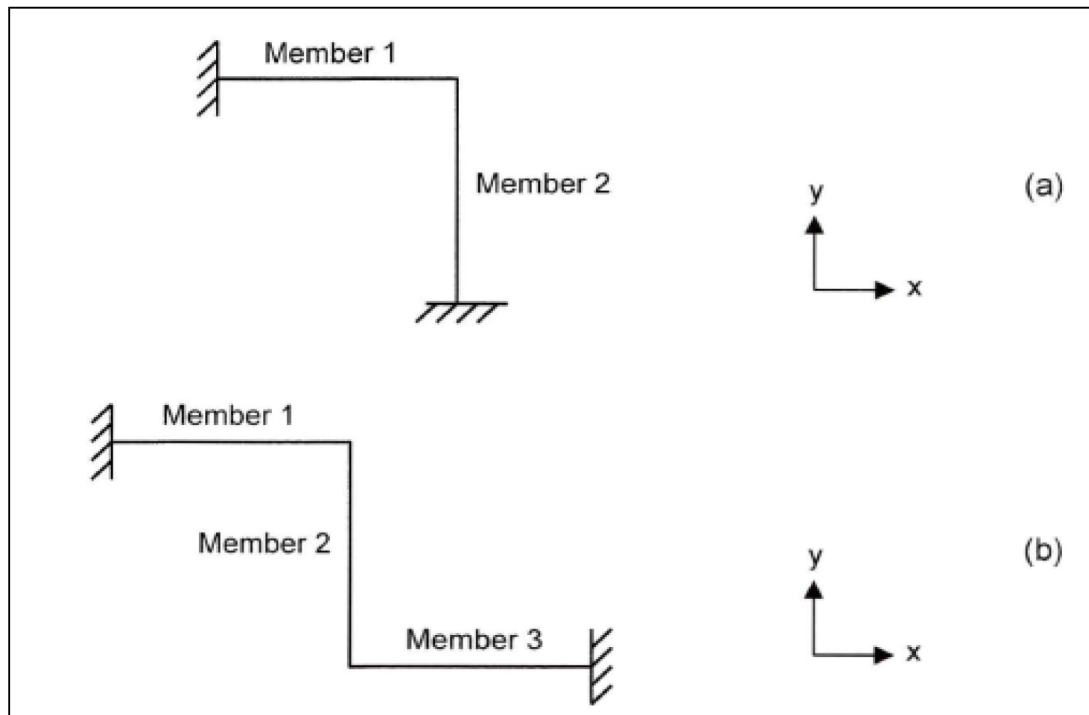


Figure 3.7.3-26-3—Subsystems with Intersection Between Horizontal and Vertical Members

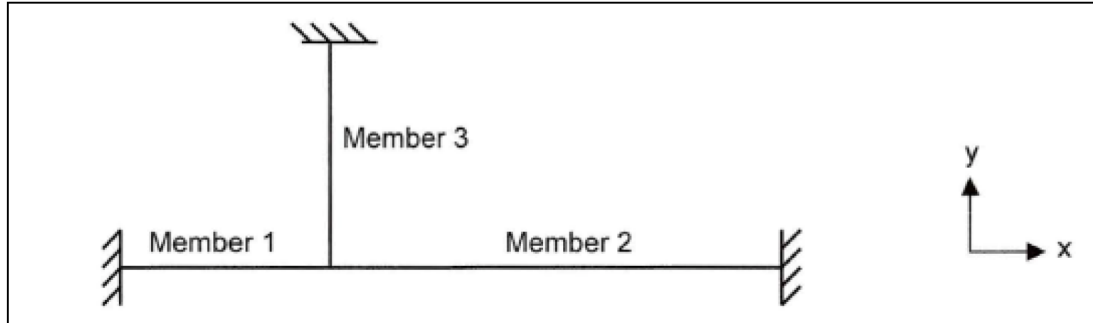
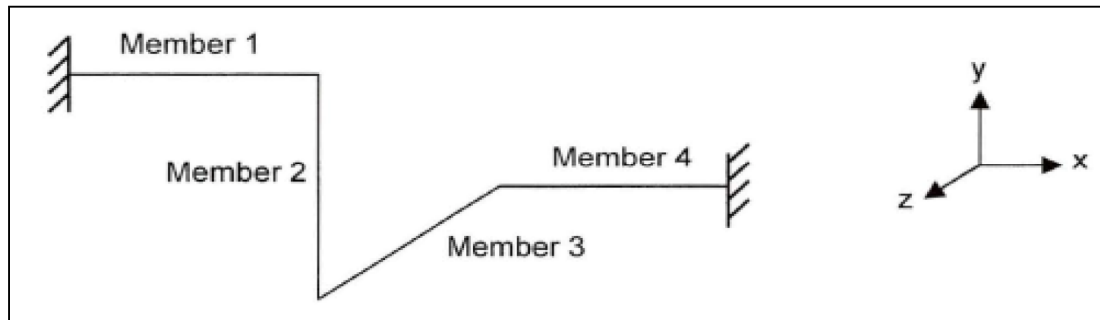


Figure 3.7.3-26-4—Subsystem with Horizontal Bend



FSAR Impact:

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

U.S. EPR Final Safety Analysis Report Markups

Table 1.8-2—U.S. EPR Combined License Information Items
Sheet 8 of 46

Item No.	Description	Section	Action Required by COL Applicant	Action Required by COL Holder
2.4-15	A COL applicant that references the U.S. EPR design certification will describe any emergency measures required to implement flood protection in safety-related facilities and to verify there is an adequate water supply for shutdown purposes.	2.4.14	Y	
2.5-1	A COL applicant that references the U.S. EPR design certification will use site-specific information to investigate and provide data concerning geological, seismic, geophysical, and geotechnical information.	2.5.1	Y	
2.5-2	A COL applicant that references the U.S. EPR design certification will review and investigate site-specific details of seismic, geophysical, geological, and geotechnical information to determine the safe shutdown earthquake (SSE) ground motion for the site and compare site-specific ground motion to the Certified Seismic Design Response Spectra (CSDRS) for the U.S. EPR.	2.5.2	Y	
2.5-3	A COL applicant that references the U.S. EPR design certification will <u>compare the final site soil parameters with the U.S. EPR design generic soil parameters and</u> verify that the site-specific seismic parameters are enveloped by the CSDRS (anchored at 0.3 g PGA) and the 10 generic soil profiles discussed in Sections 2.5.2, <u>2.5.4.7</u> and 3.7.1 and summarized in Table 3.7.1-6.	2.5.2.6 <u>2.5.4.7</u>	Y	
2.5-4	A COL applicant that references the U.S. EPR design certification will verify that site-specific foundation soils beneath the foundation basemats of Seismic Category I structures have the capacity to support the bearing pressure with a factor of safety of 3.0 under static conditions.	2.5.4.10.1	Y	

03.07.01-21 →

velocities in each profile are taken to be strain-compatible values during seismic events.

Refer to Section 3.7.1 and Section 3.7.2 for additional description of soil-structure interaction analyses performed for the U.S. EPR. Liquefaction of soils and stability of slopes is addressed in Section 2.5.4.8 and Section 2.5.5, respectively.

2.5.2.1 Seismicity

Seismicity is site specific and will be addressed by the COL applicant.

2.5.2.2 Geologic and Tectonic Characteristics of the Site and Region

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

The guidance of RG 1.208 and RG 1.165 will be met, as appropriate, in performing the required studies to determine the SSE using probabilistic seismic hazard analyses.

2.5.2.3 Correlation of Earthquake Activity with Seismic Sources

Correlation of earthquake activity with seismic sources is site specific and will be addressed by the COL applicant, consistent with the guidance of RG 1.208 and RG 1.165, as appropriate.

2.5.2.4 Probabilistic Seismic Hazard Analysis and Controlling Earthquake

The probabilistic seismic hazard analysis is site specific and will be addressed by the COL applicant, consistent with the guidance of NUREG/CR-6372 (Reference 1), RG 1.165, and RG 1.208, as appropriate.

2.5.2.5 Seismic Wave Transmission Characteristics of the Site

Seismic wave transmission characteristics are site specific and will be addressed by the COL applicant.

03.07.01-21

2.5.2.6 Ground Motion Response Spectrum

A COL applicant that references the U.S. EPR design certification will compare the final site soil parameters with the U.S. EPR design generic soil parameters and verify that the site-specific seismic parameters are enveloped by the CSDRS (anchored at 0.3g PGA) and the 10 generic soil profiles discussed in Section 2.5.2 and Section 3.7.1 and summarized in Table 3.7.1-6. The applicant develops site-specific ground motion response spectra (GMRS) and foundation input response spectra (FIRS). The applicant will also describe site-specific soil conditions and evaluate the acceptability of the U.S. EPR standard design described in Section 3.7.1 for the particular site. In making this comparison, the applicant will refer to Sections 3.7.1 and 3.7.2 for a description of the

soil-structure interaction analyses performed for the U.S. EPR in addressing the following evaluation guidelines.

1. The applicant will confirm that the peak ground acceleration for the GMRS is less than 0.3g.
2. The applicant will confirm that the low-strain, best-estimate, value of shear wave velocity at the bottom of the foundation basemat of the NI Common Basemat Structures and other Seismic Category I structures is 1000 fps, or greater. This comparison will confirm that the NI Common Basemat Structures and other Seismic Category I structures are founded on competent material.
3. The applicant will demonstrate that the FIRS are enveloped by the CSDRS for the U.S. EPR using the guidance provided in Section 3.7.1.1.1.
4. The applicant will demonstrate that the site-specific profile is laterally uniform by confirming that individual layers with the profile have an angle of dip no greater than 20 degrees.
5. The applicant will compare the final site soil parameters with the U.S. EPR design generic soil parameters and demonstrate that the idealized strain-compatible site soil profile is similar to or bounded by the 10 generic soil profiles used for the U.S. EPR. The 10 generic profiles include a range of uniform and layered site conditions. The applicant also considers the assumptions used in the SSI analyses, as described in Section 3.7.1 and Section 3.7.2. Site soil properties of soil columns beneath Category I structures must be bounded by design soil properties listed in Tables 3.7.1-6 and 3.7.2-9. The soil column beneath the embedded NI Common Basemat and the soil column, starting at grade, for the EPGB and ESWB must meet this requirement.
6. If the conditions of steps one through five are met, the characteristics of the site fall within the site parameters for the U.S. EPR and the site is acceptable.
7. If the conditions of steps one through five are not met, the applicant will demonstrate by other appropriate means that the U.S. EPR is acceptable at the proposed site. The applicant may perform intermediate-level additional studies to demonstrate that the particular site is bounded by the design of the U.S. EPR. An example of such studies is to show that the site-specific motion at top-of-basemat level, with consideration of the range of structural frequencies involved, is bounded by the U.S. EPR design.
8. If the evaluations of step 7 are not sufficient, the applicant will perform detailed site-specific SSI analyses for the particular site. This site-specific evaluation will include dynamic seismic analyses and development of in-structure response spectra (ISRS) for comparison with ISRS for the U.S. EPR. These analyses will be performed in accordance with the methodologies described in Section 3.7.1 and Section 3.7.2. Results from this comparison will be acceptable if the amplitude of the site-specific ISRS do not exceed the ISRS for the U.S. EPR by greater than 10 percent on a location-by-location basis. Comparisons will be made at the following key locations, defined in Section 3.7.2:

03.07.01-21