Response to

Request for Additional Information No.35, Revision 0

8/01/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 02.05.02 - Vibratory Ground Motion
SRP Section: 02.05.04 - Stability of Subsurface Materials and Foundations
Application Section: FSAR Ch. 2
RGS1 Branch

Question 02.05.02-1:

In FSAR Tier 2 Section 2.5.2 "Vibratory Ground Motion," you state that "the certified seismic design response spectra (CSDRS) for the U.S. EPR are shown in Figure 3.7.1- 1— Design Response Spectra for EUR Control Motions (Hard, Medium, and Soft Soils)." It also states that "for soil-structure interaction (SSI) analysis for the U.S. EPR design certification, the assumed generic shear wave velocities in each profile are taken to be strain-compatible values during seismic events." Please clarify whether the soil degradation properties were considered in the site response analyses.

Response to Question 02.05.02-1:

Site response analysis is not needed because soil properties of the 10 generic soil profiles used in the SSI analysis for the U.S. EPR FSAR are taken to be strain-compatible (or degraded properties). The reconciliation process for COLA considers site-specific soil properties that are developed from a site response analysis and comparisons are made to the strain-compatible properties assumed for the FSAR as specified by guideline 5 of the COL item identified in U.S. EPR FSAR Tier 2, Section 2.5.2.6:

"A COL applicant that references the U.S. EPR design certification will 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 is 1000 fps, or greater. This comparison will confirm that the NI Common Basemat 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 demonstrate that the idealized 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.
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 10percent on a location-by-location basis. Comparisons will be made at the following key locations, defined in Section 3.7.2:
   A. Reactor Building Internal Structures (RBIS)—Reactor Vessel Support at elevation +16 ft, 10-3/4 in (Figures 3.7.2-74, 3.7.2-75, and 3.7.2-76) and steam generator supports at elevation +63 ft, 11-3/4 in (Figures 3.7.2-77, 3.7.2-78, and 3.7.2-79).
   B. Safeguards Building (SB) 1—elevation +26 ft, 7 in (Figures 3.7.2-80, 3.7.2-81, and 3.7.2-82) and +68 ft, 10-3/4 in (Figures 3.7.2-83, 3.7.2-84, and 3.7.2-85).
   C. SBs 2/3—elevation +26 ft, 7 in (Figures 3.7.2-86, 3.7.2-87, and 3.7.2-88) and +50 ft, 6-1/4 in (Figures 3.7.2-89, 3.7.2-90, and 3.7.2-91).
   D. SB 4—elevation +68 ft, 10-3/4 in (Figures 3.7.2-92, 3.7.2-93, and 3.7.2-94).
   E. Reactor Containment Building (RCB)—Polar crane support at elevation +123 ft, 4-1/4 in (Figures 3.7.2-95, 3.7.2-96, and 3.7.2-97) and top-of-dome at elevation +190 ft, 3-1/2 in (Figures 3.7.2-98, 3.7.2-99, and 3.7.2-100).
   F. Fuel Building (FB)—elevation + 12 ft, 1-2/3 in.
   G. Emergency Power Generator Building (EPGB)—basemat elevation. +0 ft, 0 in at Node 1172 (Figures 3.7.2-101, 3.7.2-102, and 3.7.2-103) and +51 ft, 6 in.
   H. Essential Service Water Building (ESWB)—Node 10385 on elevation +14 ft, 0 in (Figures 3.7.2-107, 3.7.2-108, and 3.7.2-109) and Node 12733 on elevation +63 ft, 0 in (Figures 3.7.2-104, 3.7.2-105, and 3.7.2-106).
9. Exceedances in excess of the limits discussed in step 8 will require additional evaluation to determine if safety-related structures, systems, and components of the U.S. EPR at the location(s) in question will be affected.

As a result of the reconciliation process described above, the applicant may redesign selected features of the U.S. EPR, as required. Redesigned features will be identified as exceptions to the FSAR and addressed by the COL applicant."

FSAR Impact:

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

Question 02.05.02-2:

In FSAR Tier 2 Section 2.5.2.6 "Ground Motion Response Spectrum," you state that "a COL applicant that references the U.S. EPR design certification will 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 Section 2.5.2 and Section 3.7.1 ……" You further state in guideline step 3 that "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." Because CSDRS for the three site groups (soft, medium and hard sites) are provided in the FSAR, please clarify: (1) the criteria for the applicant to determine which site group their specific site belongs to, and (2) whether the site- specific response spectrum must be enveloped by the CSDRS corresponding to that site group.

Response to Question 02.05.02-2:

(1) and (2):

As specified per the COL item identified in U.S. EPR FSAR Tier 2, Section 2.5.2.6 (see response to Question 02.05.02-1), the COL applicant will reconcile both the foundation input response spectra (FIRS) and the site-specific soil profile with the certified seismic design response spectra (CSDRS) and the 10 generic soil profiles used for the U.S. EPR FSAR. A COL applicant will compare the site-specific FIRS at the bottom of the foundation elevation with the CSDRS as stated in the U.S. EPR FSAR Section 2.5.2.6, guideline 3. The COL applicant will also compare the site-specific soil profile with the 10 generic soil profiles as stated in Section 2.5.2.6, guideline 5. The COL applicant's site is acceptable for a U.S. EPR if its FIRS is enveloped by any one of the CSDRS and the site-specific soil profile is bounded by the corresponding soil conditions analyzed with that CSDRS.

FSAR Impact:

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

Question 02.05.02-3:

In FSAR Tier 2 Section 2.5.2.6 “Ground Motion Response Spectrum,” you state, in guideline step 8, that comparison of structural seismic responses of the CSDRS with detailed site-specific SSI analyses will be made at some key locations as defined in Section 3.7.2. Please verify the control point elevation for the fuel building (FB) as defined in Section 2.5.2.6 compared with that described in Section 3.7.2.

Response to Question 02.05.02-3:

A response to this question will be provided by October 7, 2008.

Question 02.05.02-4:

FSAR Tier 1, Table 5.0-1 “Site Parameters for the U.S. EPR Design,” lists the parameter for seismology as “Seismology (SSE response spectra using figures),” but in “Value(s)” it does not mention any corresponding figures. Please specify.

Response to Question 02.05.02-4:

U.S. EPR FSAR Tier 2, Figure 3.7.1-1 will be added to U.S. EPR FSAR, Tier 1 Chapter 5, and identified as Figure 5.0-1. U.S. EPR FSAR Tier 1, Table 5.0-1 will be updated to reference this figure.

FSAR Impact:

U.S. EPR FSAR Tier 1, Table 5.0-1 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR FSAR Tier 1, Figure 5.0-1 will be added as described in the response and indicated on the enclosed markup.

Question 02.05.04-1:

Please clarify the restrictions with regard to soil liquefaction specified in DCD Tier 2, Table 2.1.1, which states only “none.”

Response to Question 02.05.04-1:

The U. S. EPR FSAR Tier 2, Section 2.5.4.8 states that: “The design of the U.S. EPR assumes that the plant is not founded on liquefiable materials.” Liquefaction is therefore not addressed in the standard design of Seismic Category I structures which is the reason for stating “none” in Table 2.1-1.

A COL applicant will address site-specific liquefaction potential per the COL item identified in U.S. EPR FSAR Tier 2, Section 2.5.4.8:
“The COL applicant will address site-specific liquefaction potential. As stated in Section 2.5.2, the evaluation of liquefaction is performed for the seismic level of the site-specific SSE.”

FSAR Impact:

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

Question 02.05.04-2:

FSAR Tier 2 Section 2.5.4.10.1, states that "the maximum bearing pressure under static loading conditions for the foundation basemat beneath the NI Common Basemat Structures is 22,000 lb/ft^2," and "the maximum bearing pressure under safe shutdown earthquake loads combined with other loads, as described in Section 3.8.5, is 25,000lb/ft^2." Please explain how the maximum dynamic/seismic bearing pressure was determined and justify this value with comparing maximum static bearing pressure. Please also explain why there is no maximum dynamic/seismic bearing pressure related parameter in the Tier I document.

Response to Question 02.05.04-2:

A response to this question will be provided by October 7, 2008.

Question 02.05.04-3:

Ten COL Information Items are listed in Table 1.8.2 “U.S. EPR Combined License Information Items” corresponding to FSAR Section 2.5. There is no mention of this table in Section 2.5. Please add a sentence to Section 2.5 to mention that the COL Information Items that need to be addressed by COL applicants corresponding to this section are listed in Table 1.8.2.

Response to Question 02.05.04-3:

The COL items required to be addressed by each COL applicant are identified within the individual sections of the U.S. EPR FSAR. The COL items are required to be addressed in the sections where they are created - in this case Section 2.5. Consistent with common practice in design certification FSARs or Design Control Documents, Section 1.8 contains the summary list of all COL items and an explicit reference to the complete list of COL items is not included in each instance that a COL item is identified in the text.

FSAR Impact:

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

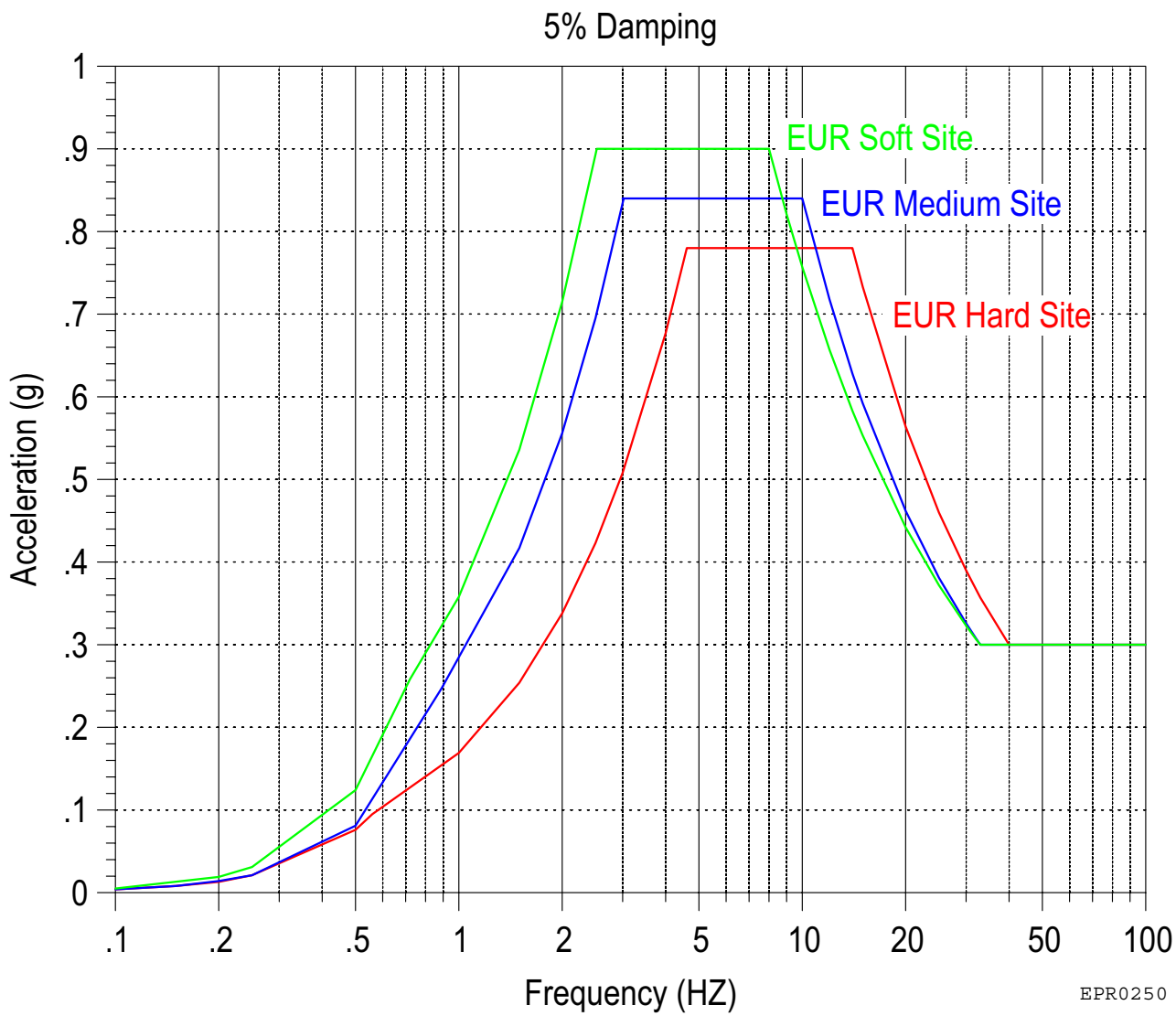
U.S. EPR Final Safety Analysis Report Markups

Table 5.0-1—Site Parameters for the U.S. EPR Design (5 Sheets)

Parameter	Value(s)
Precipitation	
Rainfall rate ~~(for roof design)~~	Maximum site rainfall rate of 19.4 inches per hour.
Snow & Ice Load ~~(for roof design)~~	Maximum snow and ice load of 100 psf extreme live load.
Seismology	
Seismology (SSE response spectra ~~using figures~~)	Horizontal design ground motion shall be the certified seismic design response spectra shapes anchored to a peak ground acceleration of 0.3 g (see Figure 5.0-1). Vertical spectra shall be the same as the horizontal spectra (see Figure 5.0-1).
Flood Level	
Maximum flood or tsunami	Maximum flood or tsunami level is no more than 1 ft below grade.
Temperature	
Design ambient temperature	The 0% exceedance maximum ambient temperature is 115°F Dry Bulb and 80°F Wet Bulb coincident. The 0% exceedance minimum ambient temperature is -40°F. The 1% exceedance maximum ambient temperature is 100°F Dry Bulb and 77°F Wet Bulb, coincident. The 1% exceedance minimum ambient temperature is -10°F.
Wind	
Maximum ~~sustained speed~~Speed (Other than Tornado)	The normal maximum wind speed is 145 mph.

02.05.02-4

Figure 5.0-1—Design Response Spectra for EUR Control Motions (Hard, Medium and Soft Sites)



02.05.02-4