

ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Wednesday, July 14, 2010 5:41 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (AREVA); ROMINE Judy (AREVA); BENNETT Kathy (AREVA); SLAY Lysa (AREVA); CORNELL Veronica (EXTERNAL AREVA); VAN NOY Mark (EXTERNAL AREVA); PATTON Jeff (AREVA); COLEMAN Sue (AREVA); RYAN Tom (AREVA); WILLIFORD Dennis (AREVA)
Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 381, FSAR Ch. 3 OPEN ITEM, Question 03.07.04-6
Attachments: RAI 381 Question 03.07.04-06 Response US EPR DC - DRAFT.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 381 on May 20, 2010. Supplement 1 to RAI 381 was submitted to NRC on June 24, 2010 to provide a revised schedule for 1 of the 4 questions (i.e., Question 03.07.04-06 with a final date of August 13, 2010). The attached file, "RAI 381 Question 03.07.04-06 Response US EPR DC - DRAFT.pdf" provides a technically correct and complete DRAFT response to the remaining 1 question, as committed. Please let me know if the staff has questions or if this response can be sent as a final response.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the DRAFT response to RAI 381 Question 03.07.04-6.

The following table indicates the page in the response document, "RAI 381 Question 03.07.04-06 Response US EPR DC - DRAFT.pdf," that contains AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 381 — 03.07.04-06	2	2

Sincerely,

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Response to

**Request for Additional Information No. 381(4421, 4529), Revision 1,
Question 03.07.04-6 - DRAFT**

4/21/2010

U. S. EPR Standard Design Certification

AREVA NP Inc.

Docket No. 52-020

SRP Section: 03.07.04 - Seismic Instrumentation

**SRP Section: 03.09.06 - Functional Design Qualification and Inservice Testing
Programs for Pumps, Valves, and Dynamic Restraints**

Application Section: FSAR Chapter 3

QUESTIONS for Geosciences and Geotechnical Engineering Branch 2 (RGS2)

QUESTIONS for Component Integrity, Performance, and Testing Branch 1

(AP1000/EPR Projects) (CIB1)

Question 03.07.04-6:**OPEN ITEM**

U.S. EPR FSAR Section 3.7.4.2.1 indicates that field mounted sensors of the triaxial type (i.e., three directional, x-y-z axes) are rigidly mounted at the following locations:

1. Free field, if a suitable location is available.
2. The primary containment structure (base foundation and two higher elevations).
3. An independent Seismic Category I structure (foundation and higher elevations) not influenced by or connected to the primary containment structure.

The FSAR further states that the in-structure instrumentation is placed at locations modeled as mass points in the building dynamic analysis so that the measured motion can be directly compared with the design spectra. In addition, the FSAR refers to the Cumulative Absolute Velocity (CAV) cited in RG 1.166 as an alternative criterion to shutdown an US EPR plant.

However, RG 1.12 specifies that a seismic instrument be located in the free-field and RG 1.166 states that the evaluation to determine whether the OBE has been exceeded should be performed using the ground motion recorded from a free-field instrument. As such, the staff asks the applicant to

1. clarify the criteria for a "suitable location" for installing a free field seismic sensor,
2. justify how the OBE exceedance will be determined by seismic instrument installed on structures and,
3. explain if CAV threshold of shutdown is still applicable if there is no free field sensor available (no suitable location).

Response to Question 03.07.04-6:

1. U.S. EPR FSAR Tier 2, Section 3.7.4.2.1 will be revised to remove text that implies that installation of a free-field seismic sensor may not be necessary if a "suitable location" does not exist. This revision conforms to guidance of RG 1.12.
2. The U.S. EPR FSAR change described in Item 1 requires installation of a free-field sensor in accordance with RG 1.12, which provides for determination of Operating Basis Earthquake (OBE) exceedance and consequent shutdown evaluation in accordance with RG 1.166. Thus, there is no departure from RG 1.12 and justification is not required.
3. U.S. EPR FSAR Tier 2, Table 1.8-2, Section 3.7.4.2.1, and Section 3.7.4.4 will be revised to require a free-field sensor. Shutdown evaluation is performed in accordance with guidance of RG 1.166.

FSAR Impact:

U.S. EPR FSAR Tier 2, Table 1.8-2, Section 3.7.4.2.1, and Section 3.7.4.4 will be revised as described in the response and indicated on the enclosed markup

U.S. EPR Final Safety Analysis Report Markups

DRAFT

Table 1.8-2—U.S. EPR Combined License Information Items
Sheet 15 of 54

Item No.	Description	Section	Action-Required by COL Applicant	Action-Required by COL Holder
3.7-1	A COL applicant that references the U.S. EPR design certification will confirm that the site-specific seismic response is within the parameters of section 3.7 of the U.S. EPR standard design.	3.7.2	✘	
3.7-2	A COL applicant that references the US EPR design certification will provide the site-specific separation distances for the access building and turbine building.	3.7.2.8	✘	
3.7-3	A COL applicant that references the U.S. EPR design certification will provide a description of methods used for seismic analysis of site-specific Category I concrete dams, if applicable.	3.7.3.13	✘	
3.7-4	A COL applicant that references the U.S. EPR design certification will determine whether essentially the same seismic response from a given earthquake is expected at each of the units in a multi-unit site or instrument each unit. In the event that only one unit is instrumented, annunciation shall be provided to each control room.	3.7.4.2	✘	
3.7-5	A COL applicant that references the U.S. EPR design certification will determine if a suitable location exists for the free-field acceleration sensor. The mounting location must be such that the effects associated with surface features, buildings, and components on the recordings of ground motion are insignificant. The acceleration sensor must be based on material representative of that upon which the Nuclear Island (NI) and other Seismic Category I structures are founded.	3.7.4.2.1	✘	
3.7-6	A COL applicant that references the US EPR design certification will provide the seismic design basis for the sources of fire protection water supply for safe plant shutdown in the event of a SSE.	3.7.2.8	✘	

← 03.07.04-6

Interconnecting cable between field sensors and the central equipment cabinet are routed in Seismic Class I raceways or conduits. The equipment cabinet is located in the computer room of Safeguards Building (SB) Division 2, which is a fully hardened building designed to provide protection from radiation, fire, chemicals, and internal missiles.

The in-structure instrumentation is placed at locations modeled as mass points in the building dynamic analysis so that the measured motion can be directly compared with the design spectra. Instrumentation that has sensors located in inaccessible areas contains provisions for data recording in an accessible location and provision for an external remote alarm to indicate actuation.

A COL applicant that references the U.S. EPR design certification will determine whether essentially the same seismic response from a given earthquake is expected at each of the units in a multi-unit site or instrument each unit. In the event that only one unit is instrumented, annunciation shall be provided to each control room.

3.7.4.2.1 Field Mounted Sensors

Field mounted sensors of the triaxial type (i.e., three-directional, x-y-z axes) are rigidly mounted at the following locations:

- Free-field, ~~if a suitable location is available (see below).~~
- The primary containment structure (base foundation and two higher elevations).
- An independent Seismic Category I structure (foundation and higher elevation) not influenced by or connected to the primary containment structure.

A COL applicant that references the U.S. EPR design certification will determine ~~if a suitable location exists~~ for the free-field acceleration sensor. ~~The mounting location must be~~ such that the effects associated with surface features, buildings, and

components on the recordings of ground motion are insignificant. The acceleration sensor must be based on material representative of that upon which the Nuclear Island (NI) and other Seismic Category I structures are founded.

The triaxial accelerometers (three elements supplied and mounted in a mutually orthogonal array) will produce a response that is proportional to the time varying acceleration at the location of the sensor. The accelerometers are chosen to respond to a maximum acceleration that is 1.2 times the SSE acceleration for the intended instrument location. The accelerometer outputs are then used by the seismic recorders to produce time-history accelerographs.

Information Center. The decision for a controlled shutdown will be based primarily on an assessment of the actual damage potential of the event (available within four hours) and on the results of plant inspections (available within eight hours). The purpose of these actions is to perform a preliminary assessment of the physical effect of the earthquake on structures, systems, and components (SSC) and to determine if shutdown of the plant is warranted based on the observed damage or because both the OBE response spectrum and CAV limits have been exceeded.

The OBE response spectrum is exceeded if any one of the three components (two horizontal and one vertical) of the 5 percent of critical damping response spectra generated using the free-field ground motion is larger than:

1. The corresponding design response spectral acceleration (OBE spectrum if used in the design, otherwise one-third of the SSE spectrum) or 0.2g, whichever is greater, for frequencies between 2 and 10 Hz, or
2. The corresponding design response spectral velocity (OBE spectrum if used in the design, otherwise one-third of the SSE spectrum) or a spectral velocity of 6 inches per second (15.24 cm per second), whichever is greater, for frequencies between 1 and 2 Hz.

The CAV limit is exceeded if the CAV value is greater than 0.16 g-second as calculated according to the procedures in EPRI Report TR-100082 (Reference 4).

An assessment of the damage potential of the event is performed within four-hours following the event using the OBE Exceedance Criteria developed by EPRI in reports NP-6695, (Reference 1), and NP-5930 (Reference 2), and endorsed by the NRC in RG 1.166. This criterion is based on a threshold response spectrum ordinate check and a CAV check. The indication of damage potential is provided by event-analysis software installed on the SMS described in Section 3.7.4.2. The assessment of damage potential is based on the recorded motion from the free-field sensor also described in

~~Section 3.7.4.2. If a free field sensor is not installed, the recorded motion from the nuclear island (NI) foundation basemat instrument shall be used, and procedures shall concede CAV exceedance and base the assessment of damage potential on the threshold response spectrum ordinate check.~~

Inspections of SSC in accessible areas of the plant are performed within eight-hours following the seismic event using the general guidance in Chapter 4 of EPRI NP-6695, Reference 1. These inspections include a check of the neutron flux monitoring sensors for changes and an inspection of the containment isolation system for continued containment integrity. The inspection findings are compared to data previously obtained from baseline inspections in order to obtain a clear understanding of any seismic-induced damage.

03.07.04-6