Response to

Request for Additional Information No. 73 (726), Revision 0

9/30/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 03.07.04 - Seismic Instrumentation
Application Section: 3.7.4
RGS1 Branch

Question 03.07.04-1:

RG 1.12 states that the battery should be of sufficient capacity to power the instrumentation to sense and record 25 minutes of motion over a period of not less than the channel check test interval. RG 1.12 further states that this can be accomplished by providing enough battery capacity for a minimum of 25 minutes of system operation at any time over a 24-hour period, without recharging, in combination with a battery charger whose line power is connected to an uninterruptable power supply or a line source that is checked at least every 24 hours.

FSAR Section 3.7.4.2.3 states that each recorder is capable of operating autonomously for 25 minutes on its own backup battery power independent from other recorders. However, the battery charging capabilities are not described. Please provide additional information regarding the instrumentation battery charger.

Response to Question 03.07.04-1:

U.S. EPR FSAR, Tier 2, Section 3.7.4.2.5 states the following:

> "The system components are powered from the plant supplied, non-vital battery backed uninterruptible power supply (UPS) to provide continuous operation following a station blackout. A backup battery system is provided for each recorder adequate to supply to the equipment for a minimum of 25 minutes in a 24-hour period without charging. The system equipment cabinet includes an internal UPS and charger capable of operating the central controller and support equipment."

The charger refers to the instrumentation battery charger and this battery charger is considered a system component. The seismic monitoring system components including the battery charger receive power from the non-vital UPS as stated above, which is in compliance with RG 1.12.

FSAR Impact:

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

Question 03.07.04-2:

Regarding instrument maintenance, RG 1.12 (Regulatory Position 8.2) states that instruments are to be given channel checks every 2 weeks for the first 3 months of service after startup and after the initial 3-month period and 3 consecutive successful checks, monthly channel checks are sufficient.

FSAR Section 3.7.4.5 states that surveillance activities such as periodic channel checks, functional tests, and calibrations shall be performed at intervals required by plant or facility licensing commitments. However, specific details regarding these specific dates are not provided. Please provide additional information regarding the scheduled time intervals for channel checks.

Response to Question 03.07.04-2:

Periodic channel checks, functional tests, and calibration intervals will be in conformance with RG 1.12. The first sentence of the third paragraph in Section 3.7.4.5 of the U.S. EPR FSAR Tier 2 will be revised as follows:

> "Surveillance intervals for activities such as periodic channel checks, functional tests, and channel calibration shall not exceed the following:
>
> - Channel Check – Every two weeks for the first three months of service after startup. After the initial three-month period and three consecutive successful checks, monthly channel checks are sufficient. Battery checks shall be performed in conjunction with Channel Checks.
> - Functional Test – Every six months.
> - Channel Calibration – During refueling outages."

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 3.7.4.5 will be revised as described in the response and indicated on the enclosed markup.

Question 03.07.04-3:

Regulatory Position 1.1 of Regulatory Guide1.166 provides guidance regarding information related to seismic instrumentation that should be maintained.

FSAR Section 3.7.4.5 describes the instrument surveillance, however does not describe the provisions for a file containing the pertinent information on all the seismic instrumentation to be maintained. Please provide the information regarding the seismic instrumentation program as specified in Regulatory Position 1.1 of Regulatory Guide 1.166.

Response to Question 03.07.04-3:

A file containing information on all the seismic instrumentation will be maintained in conformance with RG 1.166. The first sentence of Section 3.7.4.6 of the U.S. EPR FSAR Tier 2 will be revised as follows:

> "A file containing seismic instrumentation information, such as instrument type, plan and vertical section views, service history and suitable earthquake time-history will be maintained on site in conformance with RG 1.166, Revision 2."

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 3.7.4.6 will be revised as described in the response and indicated on the enclosed markup.

Question 03.07.04-4:

RG 1.166 (Regulatory Position 4.1) describes the evaluation procedures to determine the exceedance of the OBE response spectrum. FSAR Section 3.7.4.4 states that the application of the OBE exceedance criteria is based on the response spectrum ordinate criterion, however does not provide sufficient detail regarding the criteria for shutdown based on the comparison of the OBE with the response spectrum of the recorded earthquake motion.

Please clarify whether all three components of the recorded motion (5 percent of critical damping response spectra) from the free-field sensor (or the foundation level sensor) will be compared with the OBE response spectrum. Please also provide additional details regarding the criteria for exceedance of the OBE response spectrum.

Response to Question 03.07.04-4:

All three components of the recorded motion (5 percent of critical damping response spectra) from the free-field sensor (or the foundation level sensor) will be compared with the OBE response spectrum. In addition, the criteria for exceedance of the OBE response spectrum is as stated in RG 1.166, Revision 2, Section 4.1.2.

The following paragraph will be added to the U.S. EPR FSAR, Tier 2, Section 3.7.4.4:

> "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 centimeters per second), whichever is greater, for frequencies between 1 and 2 Hz."

FSAR Impact:

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

Question 03.07.04-5:

RG 1.166 provides guidance regarding how to perform a CAV check for each component. While FSAR Section 3.7.4.4 states that the OBE exceedance criterion is based on a threshold response spectrum ordinate check and CAV check, the specific details regarding the CAV check are not provided. Please provide additional details regarding the CAV check including the criteria for shutdown based on CAV.

Response to Question 03.07.04-5:

The criteria for exceedance of the CAV limit is consistent with the guidance provided in RG 1.166, Revision 2, Section 4.2.

The following sentence will be added to the U.S. EPR FSAR Tier 2, Section 3.7.4.4:

> "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)."

The following reference will be added to the U.S. EPR FSAR Tier 2, Section 3.7.4.7:

4. "EPRI Report TR-100082, "Standardization of the Cumulative Absolute Velocity," December 1991."

FSAR Impact:

U.S. EPR FSAR Tier 2, Sections 3.7.4.4 and 3.7.4.7 will be revised as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

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~~has~~ been exceeded.

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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.

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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 ~~SSCs~~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.

Once the results of the inspection and the assessment of damage potential of the event are available, the operators will determine: 1) if a controlled shutdown is required, and 2) the condition of the equipment needed to safely achieve shutdown. If the assessment of damage potential indicates that the OBE exceedance criteria were not met, and the inspection results are favorable, the plant will continue to operate.

To satisfy the requirements of 10 CFR Part 50, Appendix S, paragraph IV(a)(2)(A), for applications that involve the use of a certified design, the application of OBE Exceedance Criteria is based on the following:

i. For the certified design portion of the plant, the OBE ground motion is one-third of the certified seismic design response spectra (CSDRS).

ii. For the safety-related noncertified design portion of the plant, the OBE ground motion is one-third of the site-specific SSE design motion response spectra, as described in Section 3.7.1.

iii. The threshold response spectrum ordinate criterion to be used in conjunction with RG 1.166 is the lowest of (i) and (ii).

Post-shutdown actions, including retrieval of data, recalibration of seismic instruments, and comparison of measured and predicted responses are based on the guidance in Chapters 5 and 6 of EPRI Report NP-6695, Reference 1, and RG 1.167.

3.7.4.5 Instrument Surveillance

The system components incorporate features for periodic maintenance, inspection and repair; the purpose of which is to minimize the occurrence of system failures and to increase the availability of the system.

The plant maintenance program for the equipment will provide reasonable assurance that seismic instrumentation is available during all modes of plant operation, including periods of plant shutdown. Maintenance procedures shall be developed that address maintenance in conjunction with the surveillance requirements. The system is modular and capable of troubleshooting, testing, and maintenance of a single channel or instrument without disabling the remainder of the system. Manufacturer recommendations shall also be evaluated and incorporated into maintenance and surveillance procedures as appropriate.

03.07.04-2

~~Surveillance activities such as periodic channel checks, functional tests, and calibrations shall be performed at intervals required by the plant or facility licensing commitments.~~Surveillance intervals for activities such as periodic channel checks, functional tests, and channel calibration shall not exceed the following:

- Channel Check – Every two weeks for the first three months of service after startup. After the initial three-month period and three consecutive successful

checks, monthly channel checks are sufficient. Battery checks shall be performed in conjunction with Channel Checks.

- Functional Test – Every six months.
- Channel Calibration – During fueling outages.

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Surveillance procedures will include provisions that the CAV shutdown threshold is calibrated per the manufacturer recommendations of the instrument. In the event that an earthquake is recorded at the plant site, all calibrations, including that of the CAV, will be performed to demonstrate that the system was functioning properly at the time of the earthquake and to confirm calibration data used for the event-analysis software.

3.7.4.6 Program Implementation

A file containing seismic instrumentation information, such as intrument type, plan and vertical section views, service history and suitable earthquake time-history will be maintained onsite in conformance with RG 1.166, Revision 2. Operator responses to a seismic event including retrieval of data, recalibration of seismic instruments, comparison of measured and predicted responses, assessment of OBE exceedance, and post-shutdown actions are described in Sections 3.7.4.4 and 3.7.4.5. Responses to seismic events and post-shutdown actions are controlled by plant procedures developed prior to initial fuel loading. Alarm response procedures provide operators with guidance for immediate actions and follow up actions including determination of validity of the event and need for walkdowns and inspections; and post event actions based on magnitude of event and the severity of damage. Post event inspection procedures provide guidance for determining the extent of damage to vital plant equipment and provide acceptance criteria for determination of equipment acceptability for continued operation.

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3.7.4.7 References

1. EPRI Report NP-6695, "Guidelines for Nuclear Plant Response to an Earthquake," Electric Power Research Institute, December 1989.

2. EPRI Report NP-5930, "A Criterion for Determining Exceedance of the Operating Basis Earthquake," Electric Research Power Institute, July 1988.

3. IEEE 344-2004, "Recommended Practices for Seismic Qualification of 1E Equipment for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 2004.

4. EPRI Report TR-100082, "Standardization of the Cumulative Absolute Velocity," December 1991.

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