REQUEST FOR ADDITIONAL INFORMATION
Volume 2 – Preclosure
Chapter 2.1.1.4, Set 7 – Identification of Event Sequences
(RAI #1–7)

The following questions pertain to DOE's evaluation of seismic events described in SAR Sections 1.7.1.4, 1.7.2.4, and 1.7.3. This information is needed to assess whether or not DOE has demonstrated compliance with 10 CFR 63.21 (c)(5), 10 CFR 63.112(b), §63.111(a) and (b). In addition to the SAR, these questions also refer to other references on the docket.

RAI #1

Provide information on the acceptable structural behavior, or Limit States of the facility structures, considered in calculating potential event sequences initiated by failure of mechanical and other systems. Also identify for each important to safety building the Limit States used for performance evaluation and associated technical basis.

According to BSC (2007ba, Section B1), failure Limit State A is used in general for performance evaluations and failure Limit State C is applicable where confinement is necessary to maintain a negative pressure. However, it is not clear which Limit states were used for each ITS building.

RAI #2

Provide information on how the DOE plans to ensure that design assumptions, for example seismic restraint capacity must not govern the seismic event sequences for the canister transfer machine (BSC 2008bg, Section 6.2.2.12), will be satisfied in the final design.

In Section 6.2.2.12 of BSC 2008bg, DOE has stated that "In the detailed design of the CHC [Cask Handling Crane] the seismic restraints must not control the crane fragility as noted in Table 6.2-2 above. This could be accomplished by increasing the load factor by two for the seismic design loads for the restraints." DOE has, however, not provided information on how this and similar requirements will be implemented in the design basis for CTM and CHC or other structures, systems, and components in Table 1.9-3.

RAI #3

Provide the following information:

a) Technical basis for seismic failure probabilities of structures, systems, and components used for a basic event in the SAPHIRE analysis.

   The failure probabilities used in the SAPHIRE analysis are not consistent with those shown in Tables 6.2.1 and 6.2.2 of BSC 2008bg. For example, in Table 6.2-1 of BSC 2008a, the

probability value for CRCF building collapse is 7.8×10^{-7}. However, the cut-set report in SAPHIRE for event sequence 03 for event tree S-060-CRCF-S-IE-TWP shows a value of 3.311×10^{-9} for basic event S-060-STR-COLLAPSE.

b) Technical basis of the statement in Page 41/42 (BSC 2008bg), "seismic failure probabilities listed by the basic event circles represent the conditional probability of failure at the design basis ground motion (DBGM2)-2 ground motions, and do not represent the seismic failure probability for event sequences".

SAR Section 1.7.1.4 states that the quantification of event sequences starts with the calculation of the mean annual frequency of failure of the SSC obtained by convolution of the site-specific seismic hazard curve with the fragility curve of the SSC. Mean annual frequency is then multiplied with total exposure time over the preclosure period to calculate expected number of seismic failure of the SSCs. The statement quoted from BSC 2008bg is in contradiction with the SAR Section 1.7.1.4.

c) Significance and technical basis for the input parameter "Screening G-Level" in the basic event data base in the SAPHIRE software. In addition, provide validation and verification of seismic hazard and SSC fragility convolution calculations in the SAPHIRE software.

DOE has provided discussion (p 66, BSC 2008bg) on how the seismic hazard curve data and fragility parameters for SSCs are entered into SAPHIRE 7.27 software. However, clarification is needed on the significance and basis for the data entered in "Screening G-Level" (see for example, basic event S-060-STR-COLLAPSE).

RAI #4

Provide basis for not considering seismic event sequences related to collapse of Emergency Diesel Generator Facility building which contains ITS power supply system (e.g., diesel generators, switchgear, train cables, raceways, etc).

DOE has discussed seismic failures of one item to physically impact another in Section 4.4.6 (BSC 2008bg). DOE, however, has not addressed impact of seismic events causing failure of the Emergency Diesel Generator Facility on the ITS power supply system.

RAI #5

Provide information on DOE's plans to verify that the final equipment design and its seismic fragility are consistent with those used in the SAR for the preclosure safety analysis, and docket the relevant documents.

This information is needed to verify DOE's statement in BSC (2008bg) (Section 4.3.2.2) that the equipment fragility calculations are based on preliminary design information and expect that the final design would provide conservative seismic margin over the preliminary design.

RAI #6

Provide technical basis for the horizontal aging module seismic fragility parameters, shown in Table 6.2-1 (BSC 2008bg).

DOE indicates in Table 6.2-1 (BSC, 2008bg) that the fragility parameter estimate for horizontal aging module is "based on other ITS structures." It is not clear how DOE developed the estimate of the fragility parameter, and whether or not it is consistent with the horizontal aging module design information in SAR Section 1.2.7.

RAI #7

Provide the following reference:

BSC 2008a, *Development of Equipment Seismic Fragilities at Yucca Mountain Surface Facilities*, 000-PSA-MRG0-02200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company.

This document is needed to verify the equipment fragility used for seismic event sequence in analysis and compliance with 10 CFR 63.112.

References:

BSC 2008a, *Development of Equipment Seismic Fragilities at Yucca Mountain Surface Facilities*, 000-PSA-MRG0-02200-000-00A. Las Vegas, Nevada: Bechtel SAIC Company.

BSC 2008bg, *Seismic Event Sequence Quantification and Categorization Analysis*, 000-PSA-MGR0-01100-000-00A. Las Vegas, Nevada: Bechtel SAIC Company, LLC.

BSC. 2007ba. "Seismic Analysis and Design Approach Document." 000–30R–MGR0–02000–000–001. ACN 01. Las Vegas, Nevada: Bechtel SAIC Company, LLC.