BSC

Model Administrative Change Notice

Complete only applicable items.

1. Document Number:	MDL-MGR-GS-000003	2. Revision:	01	3. ACN:	01
4. Title:	Development of Earthquake Ground Motion Input for Preclosure Seismic Design and Postclosure Performance Assessment of a Geologic Repository at Yucca Mountain, NV				
5. No. of Pages Attached	9				

6. Approvals:

Preparer:	Richard C. Quittmeyer R.C. Quittmeyer Print name and sign	11/28/2005 Date
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Independent Technical Reviewer:	Jean Younker Jean L Younker Print name and sign	11-28-05 Date
Responsible Manager:	Paul Dixon Print name and sign	11-29-05 Date

7. Affected Pages	8. Description of Change:
6-84 through 6-87	Editorial changes to captures in Figures 6.2-1, 6.2-2, 6.2-3, and 6.2-4. As described in Condition Report 6134, the graphic componenets of Figures 6.2-1 through 6.2-4 are scrambled and need to be changed to agree with their captions, which are correct: • The graphic componenet of Figure 6.2-1 is exchanged with the graphic component of Figure 6.2-4 such that Figure 6.2-1 shows the hazard curve for Point A for peak horizontal ground acceleration and Figure 6.2-4 shows the hazard curve for Point A for peak horizontal ground velocity. • The graphic componenet of Figure 6.2-2 is exchanged with the graphic component of Figure 6.2-3 such that Figure 6.2-2 shows the hazard curve at Point A for 10 Hz horizontal spectral acceleration and Figure 6.2-3 show the hazard curve at Point A for 1 Hz horizontal spectral acceleration. This change was identified in CR 6134

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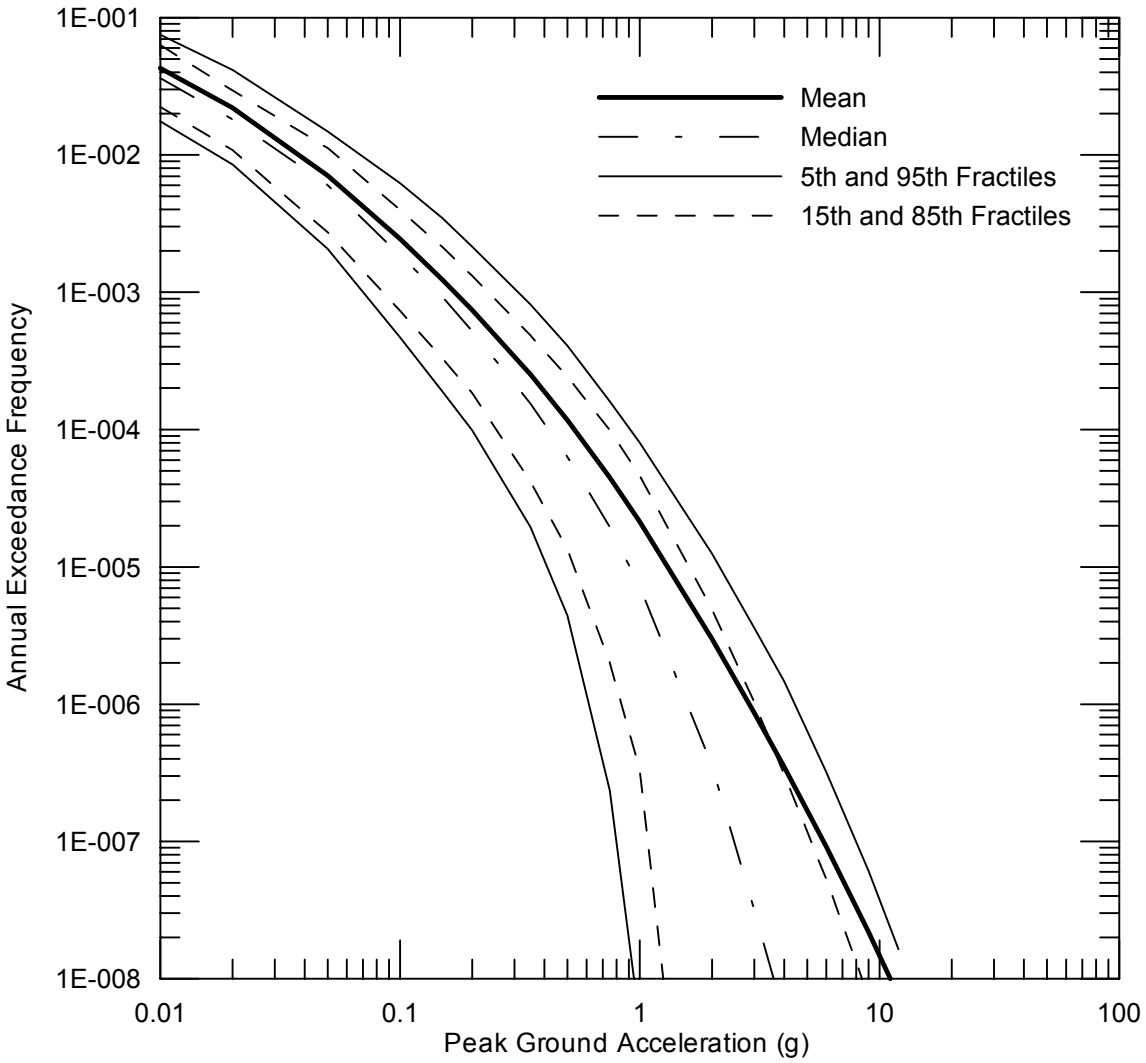
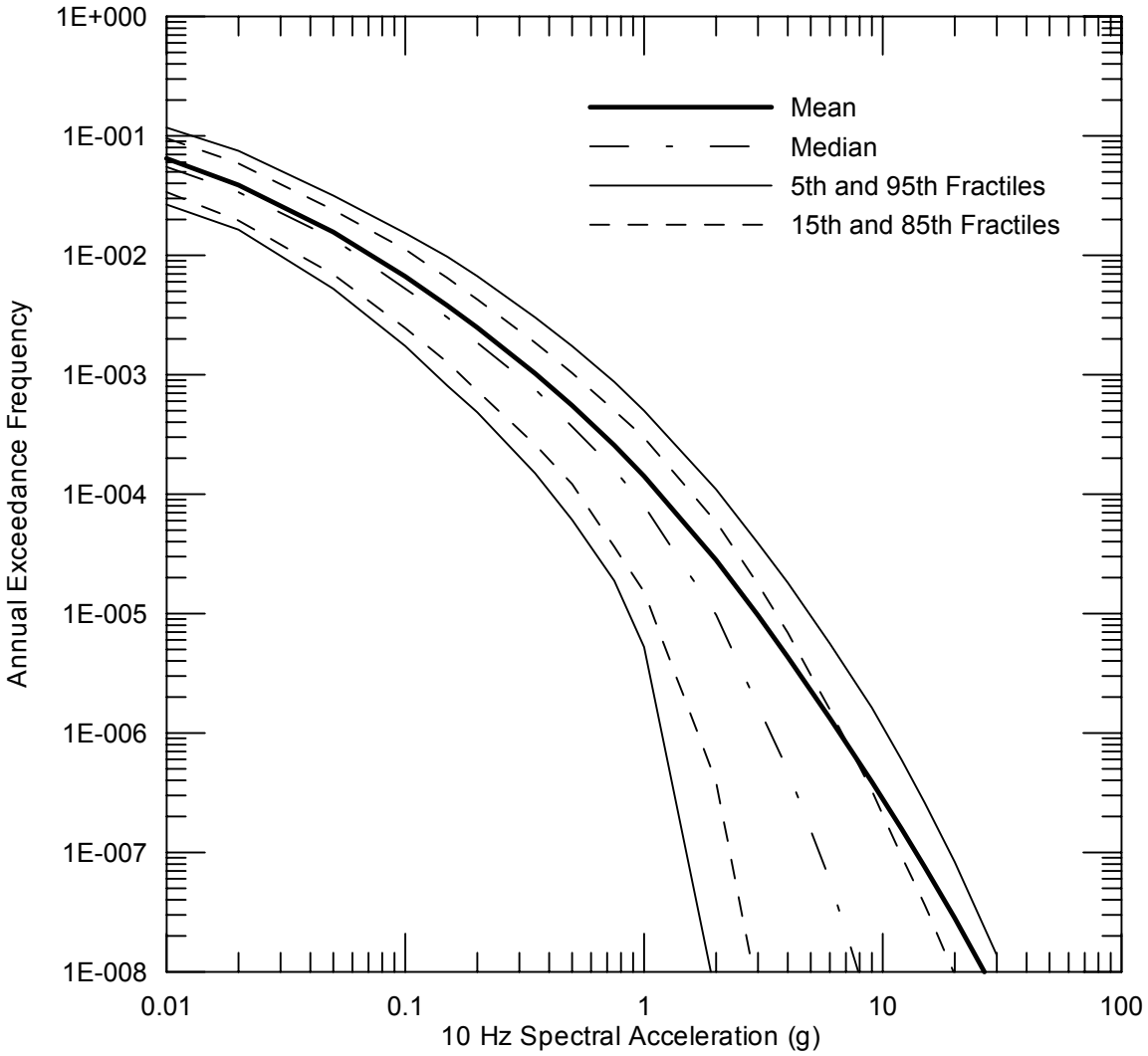
6-282	Text added for clarification Section 6.3.2.3.2 "1x10-7 Annual Exceedance Frequency Motions", for completeness, a brief discussion of a set of spectrally matched time histories with a 10^{-7} annual exceedance frequency for Point B, which were originally described in Revision 00 of the report, a subsection is added: **Spectrally Matched Time Histories** As described in an earlier version of this report (BSC 2004 [DIRS 168780], Section 6.3.2.4.2), spectral matching was used to develop one set of three-component time histories for an annual exceedance frequency of 10^{-7} at Point B. Spectral matching was carried out as described in Section 6.3.2.1. If only one set of time histories is to be used in an analysis, the spectrally-matched time histories should be used. The spectrally matched time histories at 10^{-7} annual exceedance frequency have been submitted to TDMS and have DTN MO0301TMHSB107.000. Note: Revision 01 contains no changes to these data. This change was self-identified
8-2	Section 8 "**CONCLUSIONS**", 3rd paragraph on page 8-2, last line, change: DTN TBD To MO0409MWDGMMIO.000 This change was self-identified
9-4	Citation update Section 9.1 "**DOCUMENTS CITED**", add new reference with DIRS number 168780 to reflect new citation on page 6-282, add to read: BSC (Bechtel SAIC Company) 2004. *Development of Earthquake Ground Motion Input for Preclosure Seismic Design and Postclosure Performance Assessment of a Geologic Repository at Yucca Mountain, NV*. MDL-MGR-GS-000003 REV 00 [Errata 001]. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20031201.0001; DOC.20040401.0004 This change was self-identified



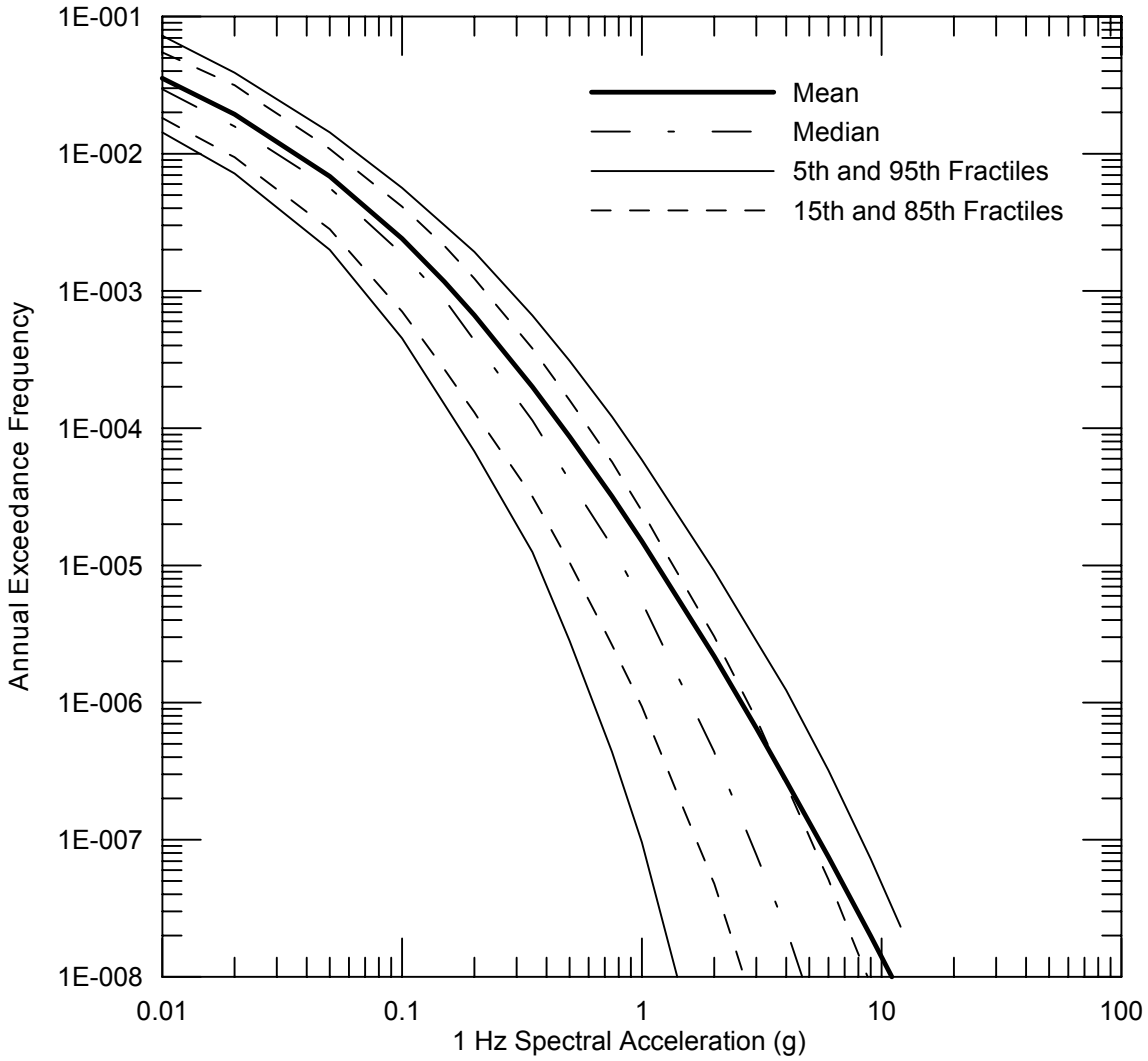
DTN: MO03061E9PSHA1.000 [DIRS 163721]

Figure 6.2-1. Hazard Curve at Point A for Peak Horizontal Ground Acceleration



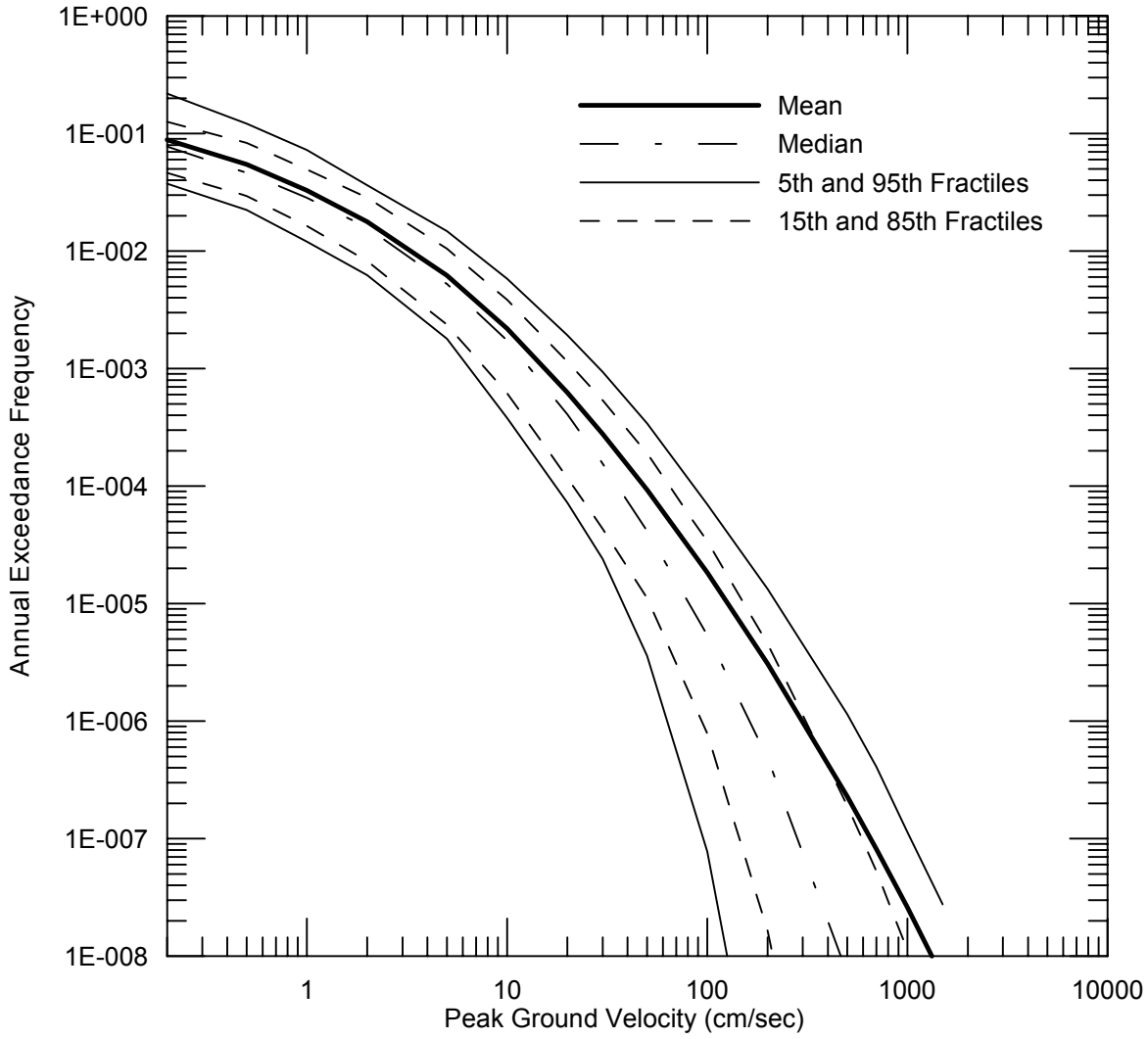
DTN: MO03061E9PSHA1.000 [DIRS 163721]

Figure 6.2-2. Hazard Curve at Point A for 10 Hz Horizontal Spectral Acceleration



DTN: MO03061E9PSHA1.000 [DIRS 163721]

Figure 6.2-3. Hazard Curve at Point A for 1 Hz Horizontal Spectral Acceleration



DTN: MO03061E9PSHA1.000 [DIRS 163721]

Figure 6.2-4. Hazard Curve at Point A for Peak Horizontal Ground Velocity

a "weak" spectral match. A "weak" match of the original strong motion records to the target spectra created 17 sets of time histories "conditioned" to Point B, but maintaining realistic frequency-to-frequency, record-to-record, and component-to-component variability. The resulting time history, baseline corrected, is used as input to the scaling to PGV. This approach is similar to the development of the spectrally conditioned to Point A 10^{-6} time histories, except that the expected Point B target spectra are used instead of the Point A spectra. The time histories were scaled to PGV maintaining the variability between the horizontal and vertical components, as described in 6.3.2.3.1 for the spectrally conditioned 10^{-6} time histories.

Figure 6.3-140 shows individual horizontal-component 5%-damped response spectra while Figure 6.3-141 shows the median and ± 1σ spectra. Similar plots for the vertical component time histories are shown on Figures 6.3-142 and 6.3-143. The individual acceleration, velocity, and displacement spectrally conditioned to Point B scaled time histories at 10^{-7} annual exceedance frequency are presented in Appendix II, Figures II-196 through II-246 (MO0301TMHSB107.000 [DIRS 164207]).

Spectrally Matched Time Histories

As described in an earlier version of this report (BSC 2004 [DIRS 168780], Section 6.3.2.4.2), spectral matching was used to develop one set of three-component time histories for an annual exceedance frequency of 10^{-7} at Point B. Spectral matching was carried out as described in Section 6.3.2.1. If only one set of time histories is to be used in an analysis, the spectrally-matched time histories should be used. The spectrally matched time histories at 10^{-7} annual exceedance frequency have been submitted to TDMS and have DTN: MO0301TMHSB107.000.

6.3.2.3.3 1x10^{-5} Annual Exceedance Frequency Motions

For postclosure performance assessments at 10^{-5} annual exceedance frequency, 17 sets of three-component time histories were developed by spectrally conditioning input time histories to Point B and scaling the resulting motions to the expected Point B PGV. Inputs to this analysis for these motions are summarized in Table 6.3-31.

Table 6.3-31. Analysis Inputs for Development of Spectrally Conditioned Time Histories with an Annual Exceedance Frequency of 10^{-5} for Point B

Analysis Input	Source
17 strong ground motion earthquake recordings	Section 6.3.2, Table 6.3-19 Numbers 1-17; NUREG-CR-6728 (McGuire et al. 2001 [DIRS 157510], Appendix B)
Seismic peak ground velocity results for an annual exceedance frequency of 10^{-5} at Point B	Section 6.3.1.4.1, Table 6.3-14; peak ground velocity results at 10^{-5} have DTN MO0401SEPPGVRL.022 [DIRS 169099]
Seismic magnitude and distance deaggregation of PGV at Point A at 10^{-5} annual exceedance frequency	Point A PGV deaggregation results have DTN MO0208PGVDEAG6.001 [DIRS 164203]
Response spectra for Point A at 10^{-5} annual exceedance frequency	Section 6.3.1.4.1, response spectra have DTN MO0312SEPRSRLB.019 [DIRS 170427]
Generic western U.S. rock velocity profile	Silva et al. (1996 [DIRS 110474], Figure 3.8)

Software used in the analysis for this case is the same used for the spectrally conditioned 10^{-6} annual exceedance frequency time histories (Section 6.3.2.1.3). Microsoft Excel 2000 was used to compute the scale factors for PGV scaling (see Appendix I). The analysis is documented in scientific notebook SN-M&O-SCI-037-V2 (Wong and Silva 2004a [DIRS 170443], pages 79-82, 89, 101, 103 and supplemental records 86, 89, 90, 92, 94, 100, and 104-106).

The input strong ground motion recordings are Numbers 1 through 17 in Table 6.3-19, chosen based on the deaggregation of the PGV hazard. Note that these input strong ground motion recordings are identical to those used for the 10^{-6} and 10^{-7} time histories. The development

vertical ground motion, the Point F response spectrum exceeds the design response spectrum for frequencies less than about 30 Hz with the response spectral ratio ranging from about 1.0 to 1.15.

This report also describes ground motion inputs associated with potential igneous dike intrusions at Yucca Mountain. A deterministic analysis is carried out based on an assessed range of maximum magnitude earthquakes (**M** 4.8, **M** 5.8, and **M** 6.2) for an igneous dike intrusion and using the site-specific ground motion attenuation results from the PSHA for Yucca Mountain. Acceleration response spectra are documented in Section 6.5. Using median ground motion results from the PSHA, horizontal PGA ranges from 0.14 g for an **M** 4.8 earthquake to 0.39 g for an **M** 6.2 earthquake. If 84th percentile ground motions are used, the corresponding values are 0.28 g and 0.70 g.

Intermediate and final results developed during this modeling activity that have been submitted to the TDMS are summarized in Table 8-2. These data were developed using scientific notebooks and were submitted to the TDMS as they were developed. They are, therefore, not Product Output of this report. Some intermediate results discussed in Section 6.2 were deemed inappropriate for submittal to the TDMS. One data submittal derived from this modeling and analysis work is considered Product Output. That data submittal consists of the input and output files produced during the modeling and analysis activities and is submitted as Model Warehouse Data (DTN MO0409MWDGMMIO.000).

Table 8-2. Results of Modeling Activity Submitted to the Technical Data Management System

Description	Data Tracking Number	Report Section
Intermediate Results		
Extended Hazard Curves for the PSHA Reference Rock Outcrop (Point A)	MO03061E9PSHA1.000	6.2.2.2
Uniform Hazard Spectra	MO0401MWDRPSHA.000 [DIRS 166962] (10^{-3}, 10^{-4}) MO0208UNHZ5X10.000 [DIRS 163722] ($5x10^{-4}$) MO0308UNHAZ105.000 [DIRS 170425] (10^{-5}) MO0206UNHAZ106.001 [DIRS 163723] (10^{-6}) MO0209UNHAZ107.000 [DIRS 163724] (10^{-7})	6.2.2.3
Reference Earthquakes and Associated Response Spectra	MO0211REDES103.000 [DIRS 170424] (10^{-3}) MO0208UNHZ5X10.000 [DIRS 163722] ($5x10^{-4}$) MO0211DERES104.000 [DIRS 170423] (10^{-4}) MO0308UNHAZ105.000 [DIRS 170425] (10^{-5}) MO0206UNHAZ106.001 [DIRS 163723] (10^{-6}) MO0209UNHAZ107.000 [DIRS 163724] (10^{-7})	6.2.2.4

164519 BSC (Bechtel SAIC Company) 2004d. *D&E/PA/C IED Subsurface Facilities.* 800-IED- WIS0-00101-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20040309.0026.

170017 BSC (Bechtel SAIC Company) 2004e. *Features, Event, and Processes: Disruptive Events.* ANL-WIS-MD-000005, Rev. 02. Las Vegas, Nevada: Bechtel SAIC Company.

167083 BSC (Bechtel SAIC Company) 2004f. Structural Calculations of Waste Package Exposed to Vibratory Ground Motion. 000-00C-WIS0-01400-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20040217.0008.

168385 BSC (Bechtel SAIC Company) 2004g. *Additional Structural Calculations of Waste Package Exposed to Vibratory Ground Motion*. 000-00C-WIS0-01700-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20040318.0011.

166107 BSC (Bechtel SAIC Company) 2004h. *Drift Degradation Analysis.* ANL-EBS-MD-000027 REV 03. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20040915.0010.

169734 BSC (Bechtel SAIC Company) 2004i. *Yucca Mountain Site Description*. TDR-CRW-GS-000001 Rev 02 ICN01. Two volumes. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20040504.0008.

168030 BSC (Bechtel SAIC Company) 2004j. *Characterize Framework for Seismicity and Structural Deformation at Yucca Mountain, Nevada*. ANL-CRW-GS-000003 REV 00 [Errata 001]. Las Vegas, Nevada: Bechtel SAIC Company. ACC: MOL.20000510.0175; DOC.20040223.0007.

169980 BSC (Bechtel SAIC Company) 2004k. *Characterize Eruptive Processes at Yucca Mountain, Nevada*. ANL-MGR-GS-000002, Rev. 02. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20041004.0006.

169989 BSC (Bechtel SAIC Company) 2004l. *Characterize Framework for Igneous Activity at Yucca Mountain, Nevada*. ANL-MGR-GS-000001, Rev. 02. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20041015.0002.

169183 BSC (Bechtel SAIC Company) 2004m. *Seismic Consequence Abstraction.* MDL-WIS-PA-000003, Rev. 01. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20041025.0004

170029 BSC (Bechtel SAIC Company) 2004n. *Geologic Framework Model (GFM2000).* MDL-NBS-GS-000002 REV 02. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20040827.0008.

168780 BSC (Bechtel SAIC Company) 2004. *Development of Earthquake Ground Motion Input for Preclosure Seismic Design and Postclosure Performance Assessment of a Geologic Repository at Yucca Mountain, NV*. MDL-MGR-GS-000003 REV 00 [Errata 001]. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20031201.0001; DOC.20040401.0004

163348 Buchen, P.W. 1971. "Plane Waves in Linear Viscoelastic Media." *Geophysical Journal of the Royal Astronomical Society,* 23, (5), 531-542. Oxford, England: Blackwell Scientific Publications. TIC: 254651.