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TECHNICAL ASSESSMENT OF STRUCTURAL DEFORMATION AND SEISMICITY AT YUCCA MOUNTAIN, NEVADA

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3.2.5 Seismic Hazard of Bare Mountain Fault

The Bare Mountain fault has been identified as an important source of seismicity and one that would contribute to the total seismic hazard at the proposed geologic repository at Yucca Mountain. The level of seismic ground motion produced by Bare Mountain at the proposed Yucca Mountain repository is determined by its geometric and kinematic characteristics. To evaluate the uncertainties and importance of the geometric and kinematic characteristics of the Bare Mountain fault, a sensitivity study was conducted. The sensitivity of ground motion level at the proposed Yucca Mountain repository to the maximum magnitude, dip angle, and slip rate of Bare Mountain was evaluated using probabilistic seismic hazard analysis software EZ-FRISK™ Version 4.4 produced by Risk Engineering, Inc. Table 3-1 gives the input parameters for twelve cases analyzed (Figure 3-2). Maximum magnitudes were estimated from two variations of fault surface extension (trace length or surface rupture) using the empirical relationships given by Wells and Coppersmith (1994). The surface trace length of Bare Mountain fault was assumed to be 40 km in the first set of cases (labeled BML in Table 3-1) and 20 km in the second set of

Table 3-1. Sensitivity of Fault Geometry and Fault Slip Rate on the Seismic Hazard of the Bare Mountain Fault

Cases	Extension (km)	Maximum Magnitude	Dip Angle (degree)	Slip Rate (mm/yr)
BML_1a	40	6.94	60	0.01
BML_1b				0.10
BML_1c				1.00
BML_2a			70 to 40 (at 7.5 km)	0.01
BML_2b				0.10
BML_2c				1.00
BML_3a			70 to 10 (at 10 km)	0.01
BML_3b				0.10
BML_3c				1.00
BMS_1a	20	6.59	60	0.01
BMS_1b				0.10
BMS_1c				1.00
BMS_2a			70 to 40 (at 7.5 km)	0.01
BMS_2b				0.10
BMS_2c				1.00
BMS_3a			70 to 10 (at 10 km)	0.01
BMS_3b				0.10
BMS_3c				1.00

cases (labeled BMS in Table 3-1). This difference led to 0.35**M** difference in M_{max}. Two variations of dip angle were considered: (i) a constant dip angle of 60° (planar fault) and (ii) a dip angle changing from the initial value of 70° to a shallow depth of 10° at 7.5 km depth (a listric fault). Three slip rates were considered for each set of geometric data, slip rate estimates from Global Positioning System data (1.0 mm/yr, Wernicke, et al., 1998), geological rates over the last 1 million years (0.1 mm/yr, Stamatakos, et al., 1997a), and trenching results (0.01 mm/yr, Klinger and Anderson, 1994).

Analysis of the results (Figure 3-2) shows that seismic hazard is most sensitive to slip rate. Increasing slip rate by one order of magnitude increases the annual frequency of exceedance of the same peak ground acceleration by one order of magnitude. At the frequency of

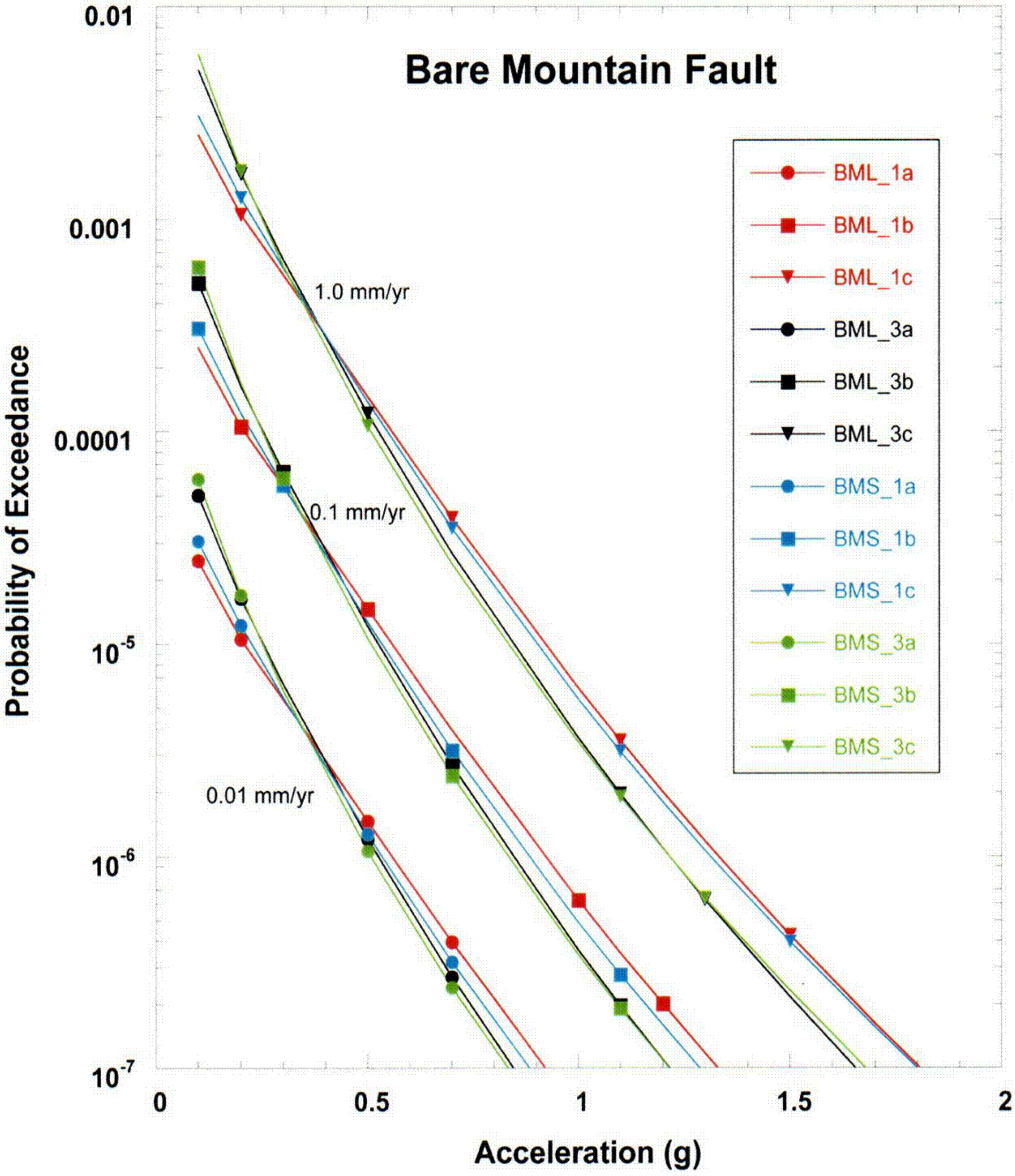

Figure 3-2. Seismic Hazard Results for the Bare Mountain Fault Based on Alternative Assumptions of Fault Geometry and Fault Activity. The 12 Cases are Defined in Table 3-1.

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exceedance of 10^{-5} (return period of 100,000 years), increasing slip rate by one order of magnitude increases the peak ground acceleration by about 0.35 g. Computed seismic hazard is much less sensitive to geometric parameters. An increase in the length of the fault by twofold only slightly increases the long return period ground motions and decreases short return period ground motions. This change is expected because the longer fault generates larger but more infrequent earthquakes. Changing the fault geometry from planar to listric also decreases the short return period ground motion and increases long return period ground motions. As with a longer fault, the listric geometry is capable of larger magnitude but less frequent earthquakes.

These sensitivity results were based on analyses using the attenuation equation proposed by Abrahamson and Silva (1997) rather than the entire suite of Yucca Mountain attenuation equations. The Abrahamson and Silva (1997) equation is one of the attenuation relations used by the probabilistic seismic hazard analysis expert elicitation to develop the ground motion equations for the Yucca Mountain probabilistic seismic hazard analysis (CRWMS M&O, 1998).