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conditions. Lee (2001) notes that the following vertical and horizontal modeling assumptions are made based on validations:

Vertical motions are modeled as a combination of pure SV-waves and SV-P converted waves arriving at the base of the soil/alluvium materials at inclined angles of incidence computed using ray tracing methods;

Horizontal component spectra are computed assuming pure S-waves arriving at vertical incidence;

Linear elastic analysis is assumed for computing the vertical motions;

Low strain behavior (i.e., no wave induced dynamic strain degradation) compressional and shear-wave site velocity profiles are used in computing vertical spectra;

Damping for computing vertical spectra is the low strain level damping used to compute horizontal spectra;

For computing horizontal motions, wave induced dynamic strain degradation of the shear-wave velocity and increased damping of the profile is permitted (in an equivalent linear analysis).

The consequence of these assumptions is that the model-derived V/H ratios (particularly for the MFFF site) may be conservatively high over some range of spectral frequencies and at high loading levels.

Lee (2001) directly presents final V/H ratios (i.e., the resulting $V/H_{CEUS,Soil}$ of Equation 2.5.2-6) for several magnitudes and distances. V/H ratios for **M**5.5 at 10 and 20 km and **M**6.0 at 10 and 20 km were interpolated to estimate the "near" V/H ratio for **M**5.6 at 12 km. V/H ratios for **M**7.0 at 100 km and **M**7.5 at 100 km were interpolated to estimate a "far" V/H ratio for **M**7.2 at 100 km. The distance of 100 km was the greatest considered in Lee (2001), but is considered adequate, if not slightly conservative, for a proxy of the 130 km desired for the "far" event.

Figure 2.5.2-42 is a plot of $V/H_{CEUS,Soil}$ of Equation 2.5.2-6 considering both "near" and "far" events. As before, given the observations made earlier with regard to the relative contributions of the deaggregation "near" and "far" events to the 10^{-4} and 10^{-5} hazards, and the relative contribution of these two hazard levels to the horizontal SSE design response spectrum, the "near" and "far" estimates of $V/H_{CEUS,Soil}$ are weighted approximately 1:3, resulting in the final $V/H_{CEUS,Soil}$ shown in Figure 2.5.2-42, as derived from the available results in Lee (2001).

2.5.2.7.1.3 Recommended V/H

The results of two studies have been used to guide in the development of best estimates of $V/H_{CEUS,Soil}$, as discussed above and summarized in Figure 2.5.2-43. The $V/H_{CEUS,Soil}$ developed from Lee (2001) gives a higher value V/H ratio than that developed from the available NUREG/CR-6728 results for frequencies greater than about 0.7 Hz. Both results give minimum

V/H values, particularly in the lower frequencies, which appear lower than engineering judgment may suggest acceptable in the current state-of- -knowledge.

Given the site specific nature of the Lee (2001) estimate, which would argue against considering an average of the two results, an approximate envelope of the results is recommended, wherein some smoothing is considered and a minimum V/H value of 0.5 is considered. The recommended final V/H ratio is shown in Figure 2.5.2-43. This V/H ratio is described as follows:

Frequencies	**V/H ratio**
≤ 1 Hz	0.5
1 to 15 Hz	log-log interpolate between 0.5 and 0.9
≥ 15 Hz	0.9

In Figure 2.5.2-43 the V/H ratio from RG 1.60 is shown for comparison. The recommended V/H ratio is marginally less than the Reg. Guide ratio at all frequencies.

2.5.2.7.2 Recommended Vertical SSE Spectrum

To develop the vertical SSE spectrum, the horizontal SSE spectrum is scaled by the recommended V/H ratios provided in 2.5.2.7.1.3. Figure 2.5.2-44 shows the resulting vertical and horizontal SSE spectra.

2.5.2.8 Operating Basis Earthquake Ground Motion

The Operating Basis Earthquake (OBE) ground motion spectra was not determined as part of the Vogtle ESP submittal. Requirements related to the OBE are provided in paragraph IV (a) (2) of Appendix S to 10 CFR Part 50, "Earthquake Engineering Criteria for Nuclear Power Plants." Under General Information in this appendix, the following statement is made: "This appendix applies to applications for the design certification or combined license pursuant to part 52 of this chapter or a construction permit…" Since OBE requirements are related to the design and performance of safety related systems, the OBE ground motion spectra will be determined during the COL stage as required under Appendix S.

Table 2.5.2-1 Earthquakes 1985–2005, Update to the EPRI (NP-4726-A 1988) Seismicity Catalog with $Em_b \geq 3.0$, Within a 30° to 37° N, 78° to 86° W Latitude-Longitude Window, Incorporating the 200 mi (320 km) Radius Site Region

Year	Mo	Dy	Hr	Mn	Sec	Lat	Lon	Z(km)	Int	Emb	Smb	Rmb
1985	12	22	0	56	5.0	35.701	-83.720	13.4		3.25	0.30	3.35
1986	1	7	1	26	43.3	35.610	-84.761	23.1		3.06	0.30	3.17
1986	2	13	11	35	45.6	34.755	-82.943	5.0		3.50	0.10	3.51
1986	3	13	2	29	31.4	33.229	-83.226	5.0	4	3.30	0.25	3.37
1986	7	11	14	26	14.8	34.937	-84.987	13.0	6	3.80	0.10	3.81
1986	9	17	9	33	49.5	32.931	-80.159	6.7	4	3.30	0.25	3.37
1987	3	16	13	9	26.8	34.560	-80.948	3.0		3.06	0.30	3.17
1987	3	27	7	29	30.5	35.565	-84.230	18.5	6	4.20	0.10	4.21
1987	7	11	0	4	29.5	36.105	-83.816	25.1	5	3.79	0.10	3.80
1987	7	11	2	48	5.9	36.103	-83.819	23.8	4	3.43	0.10	3.44
1987	9	1	23	2	49.4	35.515	-84.396	21.1		3.06	0.30	3.17
1987	9	22	17	23	50.1	35.623	-84.312	19.4	5	3.50	0.10	3.51
1987	11	27	18	58	29.3	36.852	-83.110	26.8	5	3.50	0.10	3.51
1987	12	12	3	53	28.8	34.244	-82.628	5.0		3.00	0.10	3.01
1988	1	9	1	7	40.6	35.279	-84.199	12.2	4	3.30	0.25	3.37
1988	1	23	1	57	16.4	32.935	-80.157	7.4	5	3.50	0.25	3.57
1988	2	16	15	26	54.8	36.595	-82.274	4.0	4	3.30	0.10	3.31
1988	2	18	0	37	45.4	35.346	-83.837	2.4	4	3.50	0.10	3.51
1989	6	2	5	4	34.0	32.934	-80.166	5.8	4	3.30	0.25	3.37
1990	8	17	21	1	15.9	36.934	-83.384	0.6	5	4.00	0.10	4.01
1990	11	13	15	22	13.0	32.947	-80.136	3.4	5	3.50	0.10	3.51
1991	6	2	6	5	34.9	32.980	-80.214	5.0	5	3.50	0.25	3.57
1991	9	24	7	21	7.0	35.701	-84.117	13.3	4	3.30	0.10	3.31
1991	10	30	14	54	12.6	34.904	-84.713	8.1		3.06	0.30	3.17
1992	1	3	4	21	23.9	33.981	-82.421	3.3	5	3.50	0.25	3.57
1992	8	21	16	31	56.1	32.985	-80.163	6.5	6	4.10	0.10	4.11
1993	1	15	2	2	50.9	35.039	-85.025	8.1	4	3.30	0.10	3.31
1993	7	12	4	48	20.8	36.035	-79.823	5.0	4	3.30	0.10	3.31
1993	8	8	9	24	32.4	33.597	-81.591	8.5	5	3.50	0.10	3.51
1994	2	12	2	40	24.5	36.800	-82.000	5.0		3.42	0.41	3.61
1994	4	5	22	22	0.4	34.969	-85.491	24.3	5	3.50	0.10	3.51
1994	4	16	20	10	12.2	35.752	-83.968	1.8	5	3.50	0.25	3.57
1995	3	11	8	15	52.3	36.959	-83.133	1.0		3.80	0.10	3.81
1995	3	11	9	50	4.4	36.990	-83.180	1.0		3.30	0.10	3.31
1995	3	18	22	6	20.8	35.422	-84.941	26.0		3.25	0.30	3.35
1995	4	17	13	46	0.0	32.997	-80.171	8.4	6	3.90	0.10	3.91
1995	6	26	0	36	17.1	36.752	-81.481	1.8	5	3.40	0.10	3.41
1995	7	5	14	16	44.7	35.334	-84.163	10.0	4	3.70	0.10	3.71
1995	7	7	21	1	3.0	36.493	-81.833	10.0	4	3.06	0.10	3.08
1996	4	19	8	50	14.0	36.981	-83.018	0.0		3.90	0.10	3.91
1997	5	19	19	45	35.8	34.622	-85.353	2.7	4	3.06	0.10	3.08
1997	7	19	17	6	34.4	34.953	-84.811	2.8	4	3.61	0.10	3.62
1997	7	30	12	29	25.3	36.512	-83.547	23.0	5	3.80	0.10	3.81
1998	4	13	9	56	15.6	34.471	-80.603	6.6	5	3.90	0.10	3.91
1998	6	5	2	31	3.9	35.554	-80.785	9.4		3.34	0.10	3.35

Table 2.5.2-1 (cont). Earthquakes 1985–2005, Update to the EPRI (NP-4726-A 1988) Seismicity Catalog with $Em_b \geq 3.0$, Within a 30° to 37° N, 78° to 86° W Latitude-Longitude Window, Incorporating the 200 mi (320 km) Radius Site Region

Year	Mo	Dy	Hr	Mn	Sec	Lat	Lon	Z(km)	Int	Emb	Smb	Rmb
1998	6	17	8	0	23.9	35.944	-84.392	11.3	5	3.60	0.10	3.61
1999	1	17	18	38	5.1	36.893	-83.799	1.0	3	3.06	0.27	3.15
2000	1	18	22	19	32.2	32.920	-83.465	19.2	5	3.50	0.10	3.51
2001	3	7	17	12	23.8	35.552	-84.850	6.8	3	3.20	0.10	3.21
2001	3	21	23	35	34.9	34.847	-85.438	0.0	3	3.16	0.27	3.24
2001	6	11	18	27	54.3	30.226	-79.885	10.0		3.33	0.41	3.53
2001	7	26	5	26	46.0	35.971	-83.552	14.3	3	3.25	0.10	3.26
2002	11	8	13	29	3.2	32.422	-79.950	3.9		3.50	0.41	3.69
2002	11	11	23	39	29.7	32.404	-79.936	2.4		4.23	0.41	4.42
2003	3	18	6	4	24.2	33.689	-82.888	5.0		3.50	0.41	3.69
2003	4	29	8	59	38.1	34.445	-85.620	9.1	6	4.70	0.10	4.71
2003	5	2	10	48	43.5	34.512	-85.604	10.0		3.01	0.41	3.20
2003	5	5	10	53	49.9	33.055	-80.190	11.4		3.06	0.30	3.17
2003	7	13	20	15	17.0	32.335	-82.144	5.0		3.58	0.41	3.77
2004	7	20	9	13	14.4	32.972	-80.248	10.3		3.17	0.41	3.37
2004	9	17	15	21	43.6	36.932	-84.006	1.2		3.66	0.41	3.85

Table 2.5.2-2 Summary of Bechtel Seismic Sources

Source	Description	Pa[1]	Mmax (m_b) and Wts.[2]	Smoothing Options and Wts.[3]	Interdependencies[4]	New Information to Suggest Change in Source: Geometry?[5]	Mmax?[6]	RI?[7]
Sources within 200 mi (320 km) that contribute to 99% of hazard								
H	**Charleston Area**	0.50	6.8 [0.20] 7.1 [0.40] 7.4 [0.40]	1 [0.33] 2 [0.34] 4 [0.33]	P(H|N3)=0.15	**Yes[8]**	**Yes[8]**	**Yes[8]**
N3	**Charleston Faults**	0.53	6.8 [0.20] 7.1 [0.40] 7.4 [0.40]	1 [0.33] 2 [0.34] 4 [0.33]	P(N3|H)=0.16	**Yes[8]**	**Yes[8]**	**Yes[8]**
BZ4	Atlantic Coastal Region	1.00	6.6 [0.10] 6.8 [0.40] 7.1 [0.40] 7.4 [0.10]	1 [0.33] 2 [0.34] 3 [0.33]	Background; P_B=1.00	No	No	No
BZ5	S. Appalachians	1.00	5.7 [0.10] 6.0 [0.40] 6.3 [0.40] 6.6 [0.10]	1 [0.33] 2 [0.34] 3 [0.33]	Background; P_B=1.00	No	No	No
F	S.E. Appalachians	0.35	5.4 [0.10] 5.7 [0.40] 6.0 [0.40] 6.6 [0.10]	1 [0.33] 2 [0.34] 4 [0.33]	ME with G; ME with 13, 15, 16, 17	No	No	No
G	NW South Carolina	0.35	5.4 [0.10] 5.7 [0.40] 6.0 [0.40] 6.6 [0.10]	1 [0.33] 2 [0.34] 4 [0.33]	ME with F; ME with 13, 15, 16, 17	No	No	No
Other Sources within 200 mi (320 km) that do not contribute to 99% of hazard								
13	Eastern Mesozoic Basins	0.10	5.4 [0.10] 5.7 [0.40] 6.0 [0.40] 6.6 [0.10]	1 [0.33] 2 [0.34] 4 [0.33]	no overlap with H or N3; ME with all sources in BZ5	No	No	No
24	Bristol Trends	0.25	5.7 [0.10] 6.0 [0.40] 6.3 [0.40] 6.6 [0.10]	1 [0.33] 2 [0.34] 4 [0.33]	ME with 19, 25, 25A	No	No	No
15	Rosman Fault	0.05	5.4 [0.10] 5.7 [0.40] 6.0 [0.40] 6.6 [0.10]	1 [0.33] 2 [0.34] 4 [0.33]	ME with all other sources	No	No	No
16	Belair Fault	0.05	5.4 [0.10] 5.7 [0.40] 6.0 [0.40] 6.6 [0.10]	1 [0.33] 2 [0.34] 4 [0.33]	ME with all other sources	No	No	No

Table 2.5.2-2 (cont.) Summary of Bechtel Seismic Sources

1 Pa = probability of activity; (from EPRI NP-6452-D 1989)
2 Maximum Magnitude (Mmax) and weights (wts.); (from EPRI NP-6452-D 1989)
3 Smoothing options are defined as follows (from EPRI NP-6452-D 1989):
1 = constant a, constant b (no prior b);
2 = low smoothing on a, high smoothing on b (no prior b);
3 = low smoothing on a, low smoothing on b (no prior b);
4 = low smoothing on a, low smoothing on b (weak prior of 1.05).
Weights on magnitude intervals are [1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0].
4 ME = mutually exclusive; PD = perfectly dependent
5 No, unless (1) new geometry proposed in literature or (2) new seismicity pattern
6 No, unless (1) new data suggests Mmax exceeds or differs significantly from the EPRI Mmax distribution or (2) exceeded by historical seismicity.
7 RI = recurrence interval; assumed no change if no new paleoseismic data or rate of seismicity has not significantly changed
8 Replace this source with the Updated Charleston Seismic Source (UCSS) Model

Table 2.5.2-3 Summary of Dames & Moore Seismic Sources

Source	Description	Pa[1]	Mmax (m_b) and Wts.[2]	Smoothing Options and Wts.[3]	Interdependencies[4]	New Information to Suggest Change in Source: Geometry?[5]	Mmax?[6]	RI?[7]
Sources within 200 mi (320 km) that contribute to 99% of hazard								
54	**Charleston Seismic Zone**	1.00	6.6 [0.75] 7.2 [0.25]	1 [0.22] 2 [0.08] 3 [0.52] 4 [0.18]	none	**Yes[8]**	**Yes[8]**	**Yes[8]**
52	Charleston Mesozoic Rift	0.46	4.7 [0.75] 7.2 [0.25]	3 [0.75] 4 [0.25]	ME with 47 thru 50, 65; ME with 52	No	No	No
53	S. Appalachian Mobile Belt (Default Zone)	0.26	5.6 [0.80] 7.2 [0.20]	1 [0.75] 2 [0.25]	Default for 47 thru 52, 65	No	No	No
41	S. Cratonic Margin (Default Zone)	0.12	6.1 [0.80] 7.2 [0.20]	1 [0.75] 2 [0.25]	Default for 42, 43, and 46	No	No	No
20	S. Coastal Margin	1.00	5.3 [0.80] 7.2 [0.20]	1 [0.75] 2 [0.25]	none	No	No	No
Other Sources within 200 mi (320 km) that do not contribute to 99% of hazard								
4	Appalachian Fold Belts	0.35	6.0 [0.80] 7.2 [0.20]	1 [0.75] 2 [0.25]	ME with 4A, 4B, 4C, 4D	No	No	No
4A	Kink in Fold Belt	0.65	5.0 [0.75] 7.2 [0.25]	3 [0.75] 4 [0.25]	ME with 4	No	No	No
49	Jonesboro Basin	0.28	6.0 [0.75] 7.2 [0.25]	3 [0.75] 4 [0.25]	PD with 47, 48, 50, 51, 65; ME with 52	No	No	No
50	Buried Triassic Basins	0.28	6.0 [0.75] 7.2 [0.25]	3 [0.75] 4 [0.25]	PD with 47, 48, 49, 51, 65; ME with 52	No	No	No
51	Florence Basin	0.28	6.0 [0.75] 7.2 [0.25]	3 [0.75] 4 [0.25]	PD with 47 thru 50, 65; ME with 52	No	No	No
65	Dunbarton Triassic Basin	0.28	5.9 [0.75] 7.2 [0.25]	3 [0.75] 4 [0.25]	PD with 47 thru 51; ME with 52	No	No	No
C01	Combination zone 4-4A-4B-4C-4D	NA	6.0 [0.80] 7.2 [0.20]	1 [0.75] 2 [0.25]	NA	No	No	No

Table 2.5.2-3 (cont.) Summary of Dames & Moore Seismic Sources

1 Pa = probability of activity; (from EPRI NP-6452-D 1989)
2 Maximum Magnitude (Mmax) and weights (wts.); (from EPRI NP-6452-D 1989)
3 Smoothing options are defined as follows (from EPRI NP-6452-D 1989)
1 = No smoothing on a, no smoothing on b (strong prior of 1.04);
2 = No smoothing on a, no smoothing on b (weak prior of 1.04);
3 = Constant a, constant b (strong prior of 1.04);
4 = Constant a, constant b (weak prior of 1.04).
Weights on magnitude intervals are [0.1, 0.2, 0.4, 1.0, 1.0, 1.0, 1.0]
4 ME = mutually exclusive; PD = perfectly dependent
5 No, unless (1) new geometry proposed in literature or (2) new seismicity pattern
6 No, unless (1) new data suggests Mmax exceeds or differs significantly from the EPRI Mmax distribution or (2) exceeded by historical seismicity.
7 RI = recurrence interval; assumed no change if no new paleoseismic data or rate of seismicity has not significantly changed
8 Replace this source with the Updated Charleston Seismic Source (UCSS) Model

Table 2.5.2-4 Summary Law Engineering Seismic Sources

Source	Description	Pa[1]	Mmax (m_b) and Wts.[2]	Smoothing Options and Wts.[3]	Interdependencies[4]	New Information to Suggest Change in Source: Geometry?[5]	Mmax?[6]	RI?[7]
Sources within 200 mi (320 km) that contribute to 99% of hazard								
35	**Charleston Seismic Zone**	0.45	6.8 [1.00]	2a [1.00]	Overlaps 8 and 22	**Yes[8]**	**Yes[8]**	**Yes[8]**
17	Eastern Basement	0.62	5.7 [0.20] 6.8 [0.80]	1b [1.00]	none	No	No	No
22	Reactivated E. Seaboard Normal	0.27	6.8 [1.00]	2a [1.00]	ME with 8 and 21; overlaps 24, 35, and 39	No	No	No
108	Brunswick, NC Background	1.00	4.9 [0.50] 5.5 [0.30] 6.8 [0.20]	2a [1.00]	Background; P_B=0.42	No	No	No
C09	Mesozoic Basins (8 - Bridged)	NA	6.8 [1.00]	2a [1.00]	NA	No	No	No
C10	8-35	NA	6.8 [1.00]	2a [1.00]	NA	No	No	No
C11	22 - 35	NA	6.8 [1.00]	2a [1.00]	NA	No	No	No
M33	Mafic Pluton	0.43	6.8 [1.00]	5 [1.00]	none	No	No	No
M36	Mafic Pluton	0.43	6.8 [1.00]	5 [1.00]	none	No	No	No
M37	Mafic Pluton	0.43	6.8 [1.00]	5 [1.00]	none	No	No	No
M38	Mafic Pluton	0.43	6.8 [1.00]	5 [1.00]	none	No	No	No
M39	Mafic Pluton	0.43	6.8 [1.00]	5 [1.00]	none	No	No	No
M40	Mafic Pluton	0.43	6.8 [1.00]	5 [1.00]	none	No	No	No
M41	Mafic Pluton	0.43	6.8 [1.00]	5 [1.00]	none	No	No	No
M42	Mafic Pluton	0.43	6.8 [1.00]	5 [1.00]	none	No	No	No

Table 2.5.2-4 (cont.) Summary Law Engineering Seismic Sources

Source	Description	Pa[1]	Mmax (m_b) and Wts.[2]	Smoothing Options and Wts.[3]	Interdependencies[4]	New Information to Suggest Change in Source: Geometry?[5]	Mmax?[6]	RI?[7]
Other Sources within 200 mi (320 km) that do not contribute to 99% of hazard								
217	Eastern Basement Background	1.00	4.9 [0.50] 5.7 [0.50]	1b [1.00]	Background; P_B=0.29; same geometry as 17	No	No	No
107	Eastern Piedmont	1.00	4.9 [0.30] 5.5 [0.40] 5.7 [0.30]	1a [1.00]	Background; P_B=0.42	No	No	No
GC13	22 - 24 - 35	NA	6.8 [1.00]	2a [1.00]	NA	No	No	No
GC12	22 - 24	NA	6.8 [1.00]	2a [1.00]	NA	No	No	No
8	Mesozoic Basins	0.27	6.8 [1.00]	a and b values calculated for C09	ME with 22; overlaps with 35	No	No	No

1 Pa = probability of activity; (from EPRI NP-6452-D 1989)
2 Maximum Magnitude (Mmax) and weights (wts.); (from EPRI NP-6452-D 1989)
3 Smoothing options are defined as follows: (from EPRI NP-6452-D 1989)
1a = High smoothing on a, constant b (strong prior of 1.05);
1b = High smoothing on b, constant b (strong prior of 1.00);
1c = High smoothing on a, constant b (strong prior of 0.95);
1d = High smoothing on a, constant b (strong prior of 0.90);
1e = High smoothing on a, constant b (strong prior of 0.70);
2a = Constant a, constant b (strong prior of 1.05);
2c = Constant a, constant b (strong prior of 0.95);
2d = Constant a, constant b (strong prior of 0.90).
Weights on magnitude intervals are all 1.0 for above options.
3a = High smoothing on a, constant b (strong prior of 1.05).
Weights on magnitude intervals are [0.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0] for option 3a.
4 ME = mutually exclusive; PD = perfectly dependent
5 No, unless (1) new geometry proposed in literature or (2) new seismicity pattern
6 No, unless (1) new data suggests Mmax exceeds or differs significantly from the EPRI Mmax distribution or (2) exceeded by historical seismicity.
7 RI = recurrence interval; assumed no change if no new paleoseismic data or rate of seismicity has not significantly changed
8 Replace this source with the Updated Charleston Seismic Source (UCSS) Model

Table 2.5.2-5 Summary of Roundout Seismic Sources

Source	Description	Pa[1]	Mmax (m_b) and Wts.[2]	Smoothing Options and Wts.[3]	Interdependencies[4]	New Information to Suggest Change in Source: Geometry?[5]	Mmax?[6]	RI?[7]
Sources within 200 mi (320 km) that contribute to 99% of hazard								
24	**Charleston**	1.00	6.6 [0.20] 6.8 [0.60] 7.0 [0.20]	1 [1.00] (a=-0.710, b=1.020)	none	**Yes[8]**	**Yes[8]**	**Yes[8]**
26	South Carolina	1.00	5.8 [0.15] 6.5 [0.60] 6.8 [0.25]	1 [1.00] (a=-1.390, b=0.970)	none	No	No	No
Other Sources within 200 mi (320 km) that do not contribute to 99% of hazard								
49	Appalachian	1.00	4.8 [0.20] 5.5 [0.60] 5.8 [0.20]	2 [1.00]	Background; P_B=1.00	No	No	No
C01	Background 49	NA	4.8 [0.20] 5.5 [0.60] 5.8 [0.20]	3 [1.00]	none	No	No	No
C09	49+32	NA	4.8 [0.20] 5.5 [0.60] 5.8 [0.20]	3 [1.00]	none	No	No	No
50	Grenville	1.00	4.8 [0.20] 5.5 [0.60] 5.8 [0.20]	2 [1.00]	Background; P_B=1.00	No	No	No
C02	Background 50	NA	4.8 [0.20] 5.5 [0.60] 5.8 [0.20]	3 [1.00]	does not contain 12 or 13	No	No	No
C07	50 (02) + 12	NA	4.8 [0.20] 5.5 [0.60] 5.8 [0.20]	3 [1.00]	none	No	No	No
25	Southern Appalachians	0.99	6.6 [0.30] 6.8 [0.60] 7.0 [0.10]	1 [1.00] (a=-0.630, b=1.150)	none	No	No	No
27	Tennessee-VA Border Zone	0.99	5.2 [0.30] 6.3 [0.55] 6.5 [0.15]	1 [1.00] (a=-1.120, b=0.930)	none	No	No	No

Table 2.5.2-5 (cont.) Summary of Roundout Seismic Sources

1 Pa = probability of activity; (from EPRI NP-6452-D 1989)
2 Maximum Magnitude (Mmax) and weights (wts.); (from EPRI NP-6452-D 1989)
3 Smoothing options are defined as follows: (from EPRI NP-6452-D 1989)
1, 6, 7, 8 = a, b values as listed above, wth weights shown;
3 = Low smoothing on a, constant b (strong prior of 1.0);
5 = a, b values as listed above, with weights shown.
4 ME = mutually exclusive; PD = perfectly dependent
5 No, unless (1) new geometry proposed in literature or (2) new seismicity pattern
6 No, unless (1) new data suggests Mmax exceeds or differs significantly from the EPRI Mmax distribution or (2) exceeded by historical seismicity.
7 RI = recurrence interval; assumed no change if no new paleoseismic data or rate of seismicity has not significantly changed
8 Replace this source with the Updated Charleston Seismic Source (UCSS) Model

Table 2.5.2-6 Summary of Weston Seismic Sources

Source	Description	Pa[1]	Mmax (m_b) and Wts.[2]	Smoothing Options and Wts.[3]	Interdependencies[4]	New Information to Suggest Change in Source: Geometry?[5]	Mmax?[6]	RI?[7]
Sources within 200 mi (320 km) that contribute to 99% of hazard								
25	**Charleston Seismic Zone**	0.99	6.6 [0.90] 7.2 [0.10]	1b [1.00]	none	**Yes[8]**	**Yes[8]**	**Yes[8]**
26	South Carolina	0.86	6.0 [0.67] 6.6 [0.27] 7.2 [0.06]	1b [1.00]	none	No	No	No
104	Southern Coastal Plain	1.00	5.4 [0.24] 6.0 [0.61] 6.6 [0.15]	1a [0.20] 2a [0.80]	Background; P_B=1.00	No	No	No
C19	103-23-24	NA	5.4 [0.26] 6.0 [0.58] 6.6 [0.16]	1a [1.00]	NA	No	No	No
C20	104-22	NA	6.0 [0.85] 6.6 [0.15]	1a [0.30] 2a [0.70]	NA	No	No	No
C21	104-25	NA	5.4 [0.24] 6.0 [0.61] 6.6 [0.15]	1a [0.30] 2a [0.70]	NA	No	No	No
C23	104-22-26	NA	5.4 [0.80] 6.0 [0.14] 6.6 [0.06]	1a [0.50] 2a [0.50]	NA	No	No	No
C24	104-22-25	NA	5.4 [0.80] 6.0 [0.14] 6.6 [0.06]	1a [0.50] 2a [0.50]	NA	No	No	No
C26	104-28BCDE-22	NA	5.4 [0.24] 6.0 [0.61] 6.6 [0.15]	1a [0.30] 2a [0.70]	NA	No	No	No
C27	104-28BCDE-22-25	NA	5.4 [0.30] 6.0 [0.70]	1a [0.70] 2a [0.30]	NA	No	No	No

Table 2.5.2-6 (cont.) Summary of Weston Seismic Sources

Source	Description	Pa[1]	Mmax (m_b) and Wts.[2]	Smoothing Options and Wts.[3]	Interdependencies[4]	New Information to Suggest Change in Source: Geometry?[5]	Mmax?[6]	RI?[7]
C33	26-25		6.6 [0.90] 7.2 [0.10]	1b [1.00]	NA	No	No	No
C35	104-28BE-25	NA	5.4 [0.24] 6.0 [0.61] 6.6 [0.15]	1a [0.20] 1b [0.80]	NA	No	No	No
Other Sources within 200 mi (320 km) that do not contribute to 99% of hazard								
C22	104-26	NA	5.4 [0.24] 6.0 [0.61] 6.6 [0.15]	1a [0.30] 1b [0.70]	NA	No	No	No
C34	104-28BE-26	NA	5.4 [0.24] 6.0 [0.61] 6.6 [0.15]	1a [0.20] 1b [0.80]	NA	No	No	No
C25	104-28BCDE	NA	5.4 [0.24] 6.6 [0.61] 6.6 [0.15]	1a [0.30] 2a [0.70]	NA	No	No	No
C28	104-28BCDE-22-26	NA	5.4 [0.30] 6.0 [0.70]	1a [0.70] 2a [0.30]	NA	No	No	No
28B	Zone of Mesozoic Basin	0.26	5.4 [0.65] 6.0 [0.25] 6.6 [0.10]	1b [1.00]	PD with 28C, 28D, and 28E	No	No	No
C01	28A thru E	NA	5.4 [0.65] 6.0 [0.25] 6.6 [0.10]	1b [1.00]	NA	No	No	No
103	Southern Appalachians	1.00	5.4 [0.26] 6.0 [0.58] 6.6 [0.16]	1a [0.20] 2a [0.80]	Background; P_B=1.00	No	No	No

Table 2.5.2-6 (cont.) Summary of Weston Seismic Sources

Source	Description	Pa[1]	Mmax (m_b) and Wts.[2]	Smoothing Options and Wts.[3]	Interdependencies[4]	New Information to Suggest Change in Source: Geometry?[5]	Mmax?[6]	RI?[7]
C17	103-23	NA	5.4 [0.26] 6.0 [0.58] 6.6 [0.16]	1a [0.70] 2a [0.30]	NA	No	No	No
C18	103-24	NA	5.4 [0.26] 6.0 [0.58] 6.6 [0.16]	1a [0.70] 1b [0.30]	NA	No	No	No
28D	Zone of Mesozoic Basin	0.26	5.4 [0.65] 6.0 [0.25] 6.6 [0.10]	1b [1.00]	PD with 28B, 28C, and 28E	No	No	No
28E	Zone of Mesozoic Basin	0.26	5.4 [0.65] 6.0 [0.25] 6.6 [0.10]	1b [1.00]	PD with 28B, 28C, and 28D	No	No	No
102	Appalachian Plateau	1.00	5.4 [0.62] 6.0 [0.29] 6.6 [0.09]	1a [0.20] 2a [0.80]	Background; P_B=1.00	No	No	No
24	New York-Alabama-Clingman	0.90	5.4 [0.26] 6.0 [0.58] 6.6 [0.16]	1b [1.00]	Contained in 103	No	No	No

1 Pa = probability of activity; (from EPRI NP-6452-D 1989)
2 Maximum Magnitude (Mmax) and weights (wts.); (from EPRI NP-6452-D 1989)
3 Smoothing options are defined as follows: (from EPRI NP-6452-D 1989)
1a = Constant a, constant b (medium prior of 1.0);
1b = Constant a, constant b (medium prior of 0.9);
1c = Constant a, constant b (medium prior of 0.7);
2a = Medium smoothing on a, medium smoothing on b (medium prior of 1.0);
2b = Medium smoothing on a, medium smoothing on b (medium prior of 0.9);
2c = Medium smoothing on a, medium smoothing on b (medium prior of 0.7).
4 ME = mutually exclusive; PD = perfectly dependent
5 No, unless (1) new geometry proposed in literature or (2) new seismicity pattern
6 No, unless (1) new data suggests Mmax exceeds or differs significantly from the EPRI Mmax distribution or (2) exceeded by historical seismicity.
7 RI = recurrence interval; assumed no change if no new paleoseismic data or rate of seismicity has not significantly changed
8 Replace this source with the Updated Charleston Seismic Source (UCSS) Model

Table 2.5.2-7 Summary of Woodward-Clyde Seismic Sources

Source	Description	Pa[1]	Mmax (m_b) and Wts.[2]	Smoothing Options and Wts.[3]	Interdependencies[4]	New Information to Suggest Change in Source: Geometry?[5]	Mmax?[6]	RI?[7]
Sources within 200 mi (320 km) that contribute to 99% of hazard								
30	**Charleston (includes NOTA)**	0.573	6.8 [0.33] 7.3 [0.34] 7.5 [0.33]	2 [0.10] 3 [0.10] 4 [0.10] 5 [0.10] 9 [0.60] (a = -1.005, b = 0.852)	ME with 29, 29A	**Yes[8]**	**Yes[8]**	**Yes[8]**
29	**S. Carolina Gravity Saddle (Extended)**	0.122	6.7 [0.33] 7.0 [0.34] 7.4 [0.33]	2 [0.25] 3 [0.25] 4 [0.25] 5 [0.25]	ME with 29A, 29B, and 30	**Yes[8]**	**Yes[8]**	**Yes[8]**
29A	**SC Gravity Saddle No. 2 (Combo C3)**	0.305	6.7 [0.33] 7.0 [0.34] 7.4 [0.33]	2 [0.25] 3 [0.25] 4 [0.25] 5 [0.25]	ME with 29, 29B, and 30	**Yes[8]**	**Yes[8]**	**Yes[8]**
29B	SC Gravity Saddle No. 3 (NW Portion)	0.183	5.4 [0.33] 6.0 [0.34] 7.0 [0.33]	2 [0.25] 3 [0.25] 4 [0.25] 5 [0.25]	ME with 29, 29A	No	No	No
	Vogtle Background		5.8 [0.33] 6.0 [0.34] 6.6 [0.33]		None	No	No	No

Table 2.5.2-7 (cont.) Summary of Woodward-Clyde Seismic Sources

Other Sources within 200 mi (320 km) that do not contribute to 99% of hazard

31	Blue Ridge Combo	0.024	5.9 [0.33] [0.34] [0.33]	6.3 7.0	2 [0.25] 4 [0.25]	3 [0.25] 5 [0.25]	ME with 31A	No	No	No
31A	Blue Ridge Combination - Alternate Configuration	0.211	5.9 [0.33] [0.34] [0.33]	6.3 7.0	2 [0.25] 4 [0.25]	3 [0.25] 5 [0.25]	ME with 31	No	No	No

1 Pa = probability of activity; (from EPRI NP-6452-D 1989)
2 Maximum Magnitude (Mmax) and weights (wts.); (from EPRI NP-6452-D 1989)
3 Smoothing options are defined as follows: (from EPRI NP-6452-D 1989)
1 = Low smoothing on a, high smoothing on b (no prior);
2 = High smoothing on a, high smoothing on b (no prior);
3 = High smoothing on a, high smoothing on b (moderate prior of 1.0);
4 = High smoothing on a, high smoothing on b (moderate prior of 0.9);
5 = High smoothing on a, high smoothing on b (moderate prior of 0.8);
6 = Low smoothing on a, high smoothing on b (moderate prior of 1.0);
7 = Low smoothing on a, high smoothing on b (moderate prior of 0.9);
8 = Low smoothing on a, high smoothing on b (moderate prior of0.8).
Weights on magnitude intervals are all 1.0.
9 = a and b values as listed.
4 ME = mutually exclusive; PD = perfectly dependent
5 No, unless (1) new geometry proposed in literature or (2) new seismicity pattern
6 No, unless (1) new data suggests Mmax exceeds or differs significantly from the EPRI Mmax distribution or (2) exceeded by historical seismicity.
7 RI = recurrence interval; assumed no change if no new paleoseismic data or rate of seismicity has not significantly changed
8 Replace this source with the Updated Charleston Seismic Source (UCSS) Model

Table 2.5.2-8 Summary of USGS Seismic Sources (Frankel et al. 2002)

Source	Mmax (Mw) and Wts.	Largest Mmax Value Considered by USGS	
		Mw	mb[1]
Sources within 200 mi (320 km)			
Extended Margin Background	7.5 [1.00]	7.5	7.2
Charleston	**6.8 [0.20]** **7.1 [0.20]** **7.3 [0.45]** **7.5 [0.15]**	**7.5**	**7.2**
Eastern Tennessee	7.5 [1.00]	7.5	7.2
Selected Sources Beyond 200 mi (320km)			
New Madrid	7.3 [0.15] 7.5 [0.20] 7.7 [0.50] 8.0 [0.15]	8.0	7.5
Stable Craton Background	7.0 [1.00]	7.0	6.9

1 m_b converted from Mw using average of Atkinson and Boore (1995), Frankel et al (1996), and EPRI (TR-102293 1993) relations

Table 2.5.2-9 Chapman and Talwani (2002) Seismic Source Zone Parameters

Charleston Characteristic Sources	Mean Recurrence	Mmax[2] m_{blg}	Mmax[2] M
Charleston Area Source	550 years	nr	7.1 [.2] 7.3 [.6] 7.5 [.2]
ZRA Fault Source (Zone of River Anomalies)	550 years	nr	7.1 [.2] 7.3 [.6] 7.5 [.2]
Ashley River-Woodstock Fault Source (modeled as 3 parallel faults)	550 years	nr	7.1 [.2] 7.3 [.6] 7.5 [.2]

Non-Characteristic Background Sources		a[1]	b[1]	m_{blg}	M
1.	Zone1	0.242	0.84	6.84	7.00
2.	Zone2	-0.270	0.84	6.84	7.00
3.	Central Virginia	1.184	0.64	6.84	7.00
4.	Zone4	0.319	0.84	6.84	7.00
5.	Zone5	0.596	0.84	6.84	7.00
6.	Piedmont and Coastal Plain	1.537	0.84	6.84	7.00
6a.	Pied&CP NE	0.604	0.84	6.84	7.00
6b.	Pied&CP SW	1.312	0.84	6.84	7.00
7.	South Carolina Piedmont	2.220	0.84	6.84	7.00
8.	Middleton Place	1.690	0.77	6.84	7.00
9.	Florida and continental margin	1.371	0.84	6.84	7.00
10.	Alabama	1.800	0.84	6.84	7.00
11.	Eastern Tennessee	2.720	0.90	6.84	7.00
12.	Southern Appalachian	2.420	0.84	6.84	7.00
12a.	Southern Appalachian North	2.185	0.84	6.84	7.00
13.	Giles County, VA	1.070	0.84	6.84	7.00
14.	Central Appalachians	1.630	0.84	6.84	7.00
15.	Western Tennessee	2.431	1.00	6.84	7.00
16.	Central Tennessee	2.273	1.00	6.84	7.00
17.	Ohio-Kentucky	2.726	1.00	6.84	7.00
18.	West VA-Pennsylvania	2.491	1.00	6.84	7.00
19.	USGS (1996) gridded seismicity rates and b value	nr[3]	0.95	6.84	7.00

1 a and b values in terms of m_{blg} magnitude, reported in Chapman and Talwani (2002).
2 Mmax range for characteristic events was designed to "represent the range of magnitude estimates of the 1886 Charleston shock proposed by Johnston (1996)" (Chapman and Talwani, 2002, p. 12). Square brackets indicate weights assigned to characteristic magnitudes. For non-characteristic background events, a truncated form of the exponential probability density function was used (Chapman and Talwani, 2002, p. 6-7).
3 nr = not reported

Table 2.5.2-10 Local Charleston-Area Tectonic Features

Name of Feature	Evidence	Key References
Adams Run fault	**subsurface stratigraphy**	**Weems and Lewis (2002)**
Ashley River fault	microseismicity	Talwani (1982, 2000) Weems and Lewis (2002)
Appalachian detachment (decollement)	gravity & magnetic data seismic reflection & refraction	Cook *et al.* (1979, 1981) Behrendt *et al.* (1981, 1983) Seeber and Armbruster (1981)
Blake Spur fracture zone	oceanic transform postulated to extend westward to Charleston area	Fletcher *et al.* (1978) Sykes (1978) Seeber and Armbruster (1981)
Bowman seismic zone	microseismicity	Smith and Talwani (1985)
Charleston fault	subsurface stratigraphy	Colquhoun *et al.* (1983) Lennon (1986) Talwani (2000) Weems and Lewis (2002)
Cooke fault	seismic reflection	Behrendt *et al.* (1981, 1983) Hamilton *et al.* (1983) Wentworth and Mergner-Keefer (1983) Behrendt and Yuan (1987)
Drayton fault	seismic reflection	Hamilton *et al.* (1983) Behrendt *et al.* (1983) Behrendt and Yuan (1987)
East Coast fault system/ Zone of river anomalies (ZRA)	**geomorphology** **seismic reflection** **microseismicity**	**Marple and Talwani (1993)** **Marple and Talwani (2000, 2004)**
Gants fault	seismic reflection	Hamilton *et al.* (1983) Behrendt and Yuan (1987)
Garner-Edisto fault	subsurface stratigraphy	Colquhoun *et al.* (1983)
Helena Banks fault zone	seismic reflection	Behrendt *et al.* (1981, 1983) Behrendt and Yuan (1987)
Middleton Place-Summerville seismic zone	microseismicity	Tarr et al. (1981) Madabhushi and Talwani (1993)
Sawmill Branch fault	**microseimicity**	**Talwani and Katuna (2004)**
Summerville fault	**microseimicity**	**Weems *et al.* (1997)**
Woodstock fault	geomorphology microseismicity	Talwani (1982, 1999, 2000) Marple and Talwani (1990, 2000)

Notes: Those tectonic features identified following publication of the EPRI teams' reports (post-1986) are highlighted by **bold-face** type.

Table 2.5.2-11 Geographic Coordinates (Latitude and Longitude) of Corner Points of Updated Charleston Seismic Source (UCSS) Geometries

Source Geometry	Longitude (decimal degrees)	Latitude (decimal degrees)
A	-80.707	32.811
A	-79.840	33.354
A	-79.527	32.997
A	-80.392	32.455
B	-81.216	32.485
B	-78.965	33.891
B	-78.3432	33.168
B	-80.587	31.775
B'	-78.965	33.891
B'	-78.654	33.531
B'	-80.900	32.131
B'	-81.216	32.485
C	-80.397	32.687
C	-79.776	34.425
C	-79.483	34.351
C	-80.109	32.614

Table 2.5.2-12 Comparison of Post-EPRI NP-6395-D 1989 Magnitude Estimates for the 1886 Charleston Earthquake

Study	Magnitude Estimation Method	Reported Magnitude Estimate	Assigned Weights	Mean Magnitude (M)
Johnston *et al.* (1994)	worldwide survey of passive-margin, extended-crust earthquakes	**M**7.56 ± 0.35 [a]	--	7.56
Martin and Clough (1994)	geotechnical assessment of 1886 liquefaction data	**M**7 - 7.5	--	7.25
Johnston (1996)	isoseismal area regression, accounting for eastern North America anelastic attenuation	**M**7.3 ± 0.26	--	7.3
Chapman and Talwani (2002) (South Carolina Department of Transportation)	consideration of available magnitude estimates	**M**7.1 **M**7.3 **M**7.5	0.2 0.6 0.2	7.3
Frankel *et al.* (2002) (USGS National seismic hazard mapping project)	consideration of available magnitude estimates	**M**6.8 **M**7.1 **M**7.3 **M**7.5	0.20 0.20 0.45 0.15	7.2
Bakun and Hopper (2004)	isoseismal area regression, including empirical site corrections	M_I 6.4 - 7.2 [b]	--	6.9 [c]

Notes:

[a] Estimate from Johnston *et al.* (1994) Chapter 3.

[b] 95% confidence interval estimate; M_I (intensity magnitude) is considered equivalent to **M** (Bakun and Hopper, 2004).

[c] Bakun and Hopper's (2004) *preferred* estimate.

Table 2.5.2-13 Comparison of Talwani and Schaeffer (2001) and UCSS Age Constraints on Charleston-Area Paleoliquefaction Events

Liquefaction Event	Event Age (YBP) [b]	Talwani and Schaeffer (2001) [a] *scenario 1*		*scenario 2*		(this study)
		Source	M	Source	M	Event Age (YBP) [b, c, d]
1886 A.D.	64	Charleston	7.3	Charleston	7.3	64
A	546 ± 17	Charleston	7+	Charleston	7+	600 ± 70
B	1,021 ± 30	Charleston	7+	Charleston	7+	1,025 ± 25
C	1,648 ± 74	*Northern*	6+	--	--	--
C'	1,683 ± 70	--		Charleston	7+	1,695 ± 175
D	1,966 ± 212	*Southern*	6+	--	--	--
E	3,548 ± 66	Charleston	7+	Charleston	7+	3,585 ± 115
F	5,038 ± 166	*Northern*	6+	Charleston	7+	--
F'	--	--	--	--	--	5,075 ± 215
G	5,800 ± 500	Charleston	7+	Charleston	7+	--

Notes:

[a] Modified after Talwani and Schaeffer's (2001) Table 2.

[b] Years before present, relative to 1950 A.D.

[c] Event ages based upon our recalibration of radiocarbon (to 2-sigma using OxCal 3.8 (Bronk Ramsey, 1995; 2001) data presented in Talwani and Schaeffer's (2001) Table 2.

[d] See Table B-1 for recalibrated 2-sigma sample ages and Table B-2 for 2-sigma age constraints on paleoliquefaction events.

Table 2.5.2-14 Seismic Sources Used for Each 1986 EPRI Team

Earth Science Team	Sources used
Bechtel	F, G, H, ,N3,BZ4, BZ5
Dames & Moore	20, 41, 52, 53, 54
Law Engineering	17, 22, 35, 108, C09, C10, C11, M33, M36, M37, M38, M39, M40, M41, M42
Rondout Associates	24, 26
Woodward-Clyde Cons.	29, 29A, 29B, 30, 32
Weston Geophysical Corp.	25, 26, 104, C19, C20, C21, C23, C24, C26, C27, C33, C35

Table 2.5.2-15 Comparison of Seismic Hazard at VEGP ESP

Mean Hazard Comparison

PGA cm/s^2	EPRI-SOG hazard	REI 2005 hazard	% diff
50	8.15E-04	8.23E-04	0.97%
100	2.23E-04	2.26E-04	1.48%
250	2.84E-05	2.91E-05	2.29%
500	4.04E-06	4.21E-06	4.11%
700	1.36E-06	1.42E-06	4.71%
1000	3.82E-07	4.02E-07	5.10%

Median Hazard Comparison

PGA cm/s^2	EPRI-SOG hazard	REI 2005 hazard	% diff
50	5.65E-04	5.75E-04	1.84%
100	1.43E-04	1.45E-04	1.05%
250	1.99E-05	2.16E-05	8.69%
500	2.53E-06	2.63E-06	3.95%
700	7.86E-07	8.13E-07	3.41%
1000	2.05E-07	2.19E-07	6.73%

85% Hazard Comparison

PGA cm/s^2	EPRI-SOG hazard	REI 2005 hazard	% diff
50	1.49E-03	1.32E-03	-11.54%
100	4.16E-04	3.67E-04	-11.71%
250	4.96E-05	4.79E-05	-3.51%
500	7.01E-06	7.16E-06	2.15%
700	2.44E-06	2.46E-06	0.61%
1000	6.98E-07	7.08E-07	1.42%

Table 2.5.2-16 Hard Rock Mean UHS Results (in g) for VEGP ESP

Mean annual frequency of exceedance	Spectral frequency						
	PGA	25 Hz	10 Hz	5 Hz	2.5 Hz	1 Hz	0.5 Hz
10^{-4}	0.214	0.551	0.399	0.317	0.223	0.101	0.0653
$5x10^{-5}$	0.288	0.762	0.532	0.412	0.294	0.134	0.0924
10^{-5}	0.559	1.54	0.983	0.728	0.512	0.235	0.185
$5x10^{-6}$	0.747	2.06	1.28	0.914	0.635	0.294	0.241
10^{-6}	1.48	4.09	2.33	1.54	1.02	0.465	0.423

Table 2.5.2-17 Computed and Recommended Mbar and Dbar Values Used for Development of High and Low Frequency Target Spectra

High Frequency (5-10 Hz)				
	10^{-4}	**10^{-5}**	**10^{-6}**	**Recommended Values**
Mbar (Mw)	5.6	5.6	5.7	5.6
Dbar (km)	17.6	11.4	9.0	12
Low Frequency (1-2.5 Hz)				
	10^{-4}	**10^{-5}**	**10^{-6}**	**Recommended Values**
Mbar (Mw)	7.2	7.2	7.2	7.2
Dbar (km)	136.5	134.3	133.0	130

Table 2.5.2-18a Candidate High-Frequency (M5.6, R = 12km) Time Histories for Spectral Matching

Earthquake	Date	Mw	Station	Distance (km)	Vs30m (m/s)
Saguenay	11/25/88	5.9	GSC Site 16	51.9	"???"
San Francisco	03/22/57	5.28	Golden Gate Park	11.13	874.0
Coyote Lake	08/06/79	5.74	Gilroy Array #1	10.67	1428.0
Mammoth Lakes-09	06/11/80	4.85	USC McGee Creek	7.49	684.9
Coalinga-04	07/09/83	5.18	Sulphur Baths (temp)	14.47	617.4
Coalinga-05	07/22/83	5.77	Sulphur Baths (temp)	13.40	617.4
Morgan Hill	04/24/84	6.19	Gilroy - Gavilan Coll.	14.84	729.7
Morgan Hill	04/24/84	6.19	Gilroy Array #1	14.91	1428.0
N. Palm Springs	07/08/86	6.06	Silent Valley - Poppet Flat	17.03	684.9
Whittier Narrows-01	10/01/87	5.99	Mt Wilson - CIT Seis Sta	22.73	821.7
Whittier Narrows-02	10/04/87	5.27	Mt Wilson - CIT Seis Sta	18.74	821.7
Anza-02	10/31/01	4.92	Anza - Pinyon Flat	12.37	724.9
Anza-02	10/31/01	4.92	Anza - Tripp Flats Training	24.73	684.9
Anza-02	10/31/01	4.92	Idyllwild - Keenwild Fire Sta.	29.07	845.4
Gilroy	05/14/02	4.90	Gilroy - Gavilan Coll.	2.82	729.7

Table 2.5.2-18b Candidate Low-Frequency (M7.2, R = 130 km) Time Histories for Spectral Matching

Earthquake	Date	Mw	Station	Distance (km)	Vs30m (m/s)
San Fernando	02/09/1971	6.61	Isabella Dam (Aux Abut)	130.98	684.9
Loma Prieta	10/18/1989	6.93	SF-Rincon Hill	74.14	873.1
Loma Prieta	10/18/1989	6.93	So. San Francisco, Sierra Pt.	63.15	1020.6
Loma Prieta	10/18/1989	6.93	Yerba Buena Island	75.17	659.8
Northridge	01/17/1994	6.69	Rancho Cucamonga-Deer Canyon	79.99	821.7
Northridge	01/17/1994	6.69	Wrightwood-Jackson Flat	64.66	821.7
Kobe	01/16/1995	6.90	OKA	86.94	609.0
Kocaeli	08/17/1999	7.51	Bursa Sivil	65.53	659.6
Chi-Chi	09/20/1999	7.62	ILA031	83.31	649.3
Kobe	01/16/1995	6.90	MZH	70.26	609.0
Hector Mine	10/16/1999	7.13	Anza-Pinyon Flat	89.98	724.9
Hector Mine	10/16/1999	7.13	Anza-Tripp Flats Training	102.40	684.9
Hector Mine	10/16/1999	7.13	Banning-Twin Pines Road	83.43	684.9
Hector Mine	10/16/1999	7.13	Heart Bar State Park	61.21	684.9
Hector Mine	10/16/1999	7.13	Seven Oaks Dam Project Office	87.20	659.6

Table 2.5.2-19 Site Response Analyses Performed

Probability (per year) ->	10^{-4}		10^{-5}		10^{-6}				Total No. Analyses
Time Histories Analyzed ->	30 High Freq.	30 Low Freq.	30 High Freq.	30 Low Freq.	30 High Freq.	30 Low Freq.			
Randomized Soil Columns (EPRI) ->	60	60	60	60	60	60			360
Randomized Soil Columns (SRS) ->	60	60	60	60	60	60			360
									720

Table 2.5.2-20a Amplification Factors as a Function of Input Hard Rock Motion at Top of Blue Bluff Marl (depth 86 feet), as Developed from Site Response Analysis using SRS and EPRI Soil Degradation Models, for High-frequency Rock Motions

	10^{-4}			10^{-5}			10^{-6}		
Freq, Hz	Hard rock input motion	mean amp. factors EPRI	mean amp. factors SRS	Hard rock input motion	mean amp. factors EPRI	mean amp. factors SRS	Hard rock input motion	mean amp. factors EPRI	mean amp. factors SRS
100	0.294	1.18	1.20	0.703	0.979	0.920	1.60	0.766	0.620
76	0.400	0.903	0.930	0.957	0.740	0.695	2.17	0.571	0.462
60	0.499	0.769	0.799	1.19	0.606	0.573	2.71	0.456	0.369
50	0.595	0.697	0.722	1.42	0.531	0.500	3.23	0.386	0.313
40	0.631	0.775	0.819	1.51	0.553	0.523	3.43	0.379	0.306
30	0.655	0.961	1.02	1.57	0.664	0.626	3.63	0.398	0.319
25	0.647	1.14	1.21	1.55	0.812	0.768	3.71	0.446	0.354
20	0.615	1.33	1.39	1.47	0.991	0.937	3.34	0.579	0.453
16.5	0.575	1.47	1.52	1.38	1.133	1.07	3.13	0.705	0.560
13.4	0.521	1.67	1.69	1.25	1.312	1.23	2.83	0.875	0.685
12.2	0.494	1.78	1.81	1.18	1.417	1.33	2.69	0.953	0.754
10	0.438	1.81	1.82	1.05	1.600	1.50	2.38	1.15	0.928
8.1	0.377	2.19	2.18	0.902	1.747	1.65	2.05	1.34	1.09
7	0.339	2.30	2.26	0.811	1.984	1.87	1.84	1.47	1.21
6	0.298	2.05	2.03	0.713	2.096	1.93	1.62	1.68	1.38
5	0.257	2.11	2.08	0.615	2.022	1.88	1.40	1.90	1.56
4	0.212	2.56	2.54	0.507	2.300	2.16	1.15	2.09	1.70
3.3	0.175	2.88	2.81	0.419	2.687	2.51	0.952	2.42	2.00
2.5	0.131	3.16	3.05	0.314	3.089	2.83	0.713	2.78	2.33
2	0.101	2.49	2.38	0.242	2.651	2.38	0.549	2.96	2.39
1.5	0.064	3.22	3.12	0.154	3.193	2.86	0.350	3.28	2.48
1	0.035	2.34	2.30	0.0828	2.542	2.41	0.188	3.00	2.55
0.8	0.024	2.63	2.59	0.0563	2.695	2.55	0.128	2.95	2.54
0.7	0.0187	3.15	3.10	0.0447	3.141	2.97	0.101	3.31	2.86
0.61	0.0148	3.80	3.78	0.0354	3.842	3.69	0.0804	4.02	3.52
0.5	0.0109	3.40	3.43	0.0260	3.597	3.59	0.0590	4.00	3.81
0.33	0.00525	2.19	2.19	0.0126	2.269	2.25	0.0286	2.52	2.40
0.25	0.00314	1.98	1.97	0.00751	2.059	2.00	0.0171	2.24	2.07
0.15	0.00106	2.06	2.04	0.00254	2.149	2.05	0.00577	2.37	2.06
0.1	0.000370	2.27	2.23	0.000890	2.341	2.18	0.00201	2.43	2.06

Table 2.5.2-20b Amplification Factors as a Function of Input Hard Rock Motion at Top of Blue Bluff Marl (depth 86 feet), as Developed from Site Response Analysis using SRS and EPRI Soil Degradation Models, for Low-frequency Rock Motions

	10^{-4}			10^{-5}			10^{-6}		
Freq, Hz	Hard rock input motion	mean amp. factors EPRI	mean amp. factors SRS	Hard rock input motion	mean amp. factors EPRI	mean amp. factors SRS	Hard rock input motion	mean amp. factors EPRI	mean amp. factors SRS
100	0.224	1.31	1.25	0.517	1.111	0.896	1.03	0.931	0.591
76	0.305	0.987	0.942	0.704	0.828	0.667	1.40	0.692	0.439
60	0.380	0.802	0.765	0.878	0.660	0.532	1.74	0.550	0.349
50	0.453	0.695	0.662	1.047	0.557	0.449	2.08	0.462	0.293
40	0.483	0.677	0.644	1.115	0.532	0.428	2.22	0.437	0.277
30	0.506	0.764	0.73	1.168	0.529	0.417	2.32	0.417	0.264
25	0.505	0.90	0.86	1.167	0.570	0.440	2.32	0.422	0.266
20	0.493	1.07	1.02	1.139	0.653	0.492	2.26	0.445	0.276
16.5	0.476	1.21	1.16	1.101	0.762	0.57	2.19	0.481	0.293
13.4	0.453	1.41	1.34	1.046	0.877	0.66	2.08	0.536	0.316
12.2	0.440	1.49	1.42	1.017	0.943	0.71	2.02	0.571	0.335
10	0.413	1.61	1.54	0.954	1.151	0.87	1.90	0.68	0.389
8.1	0.381	1.91	1.82	0.880	1.343	1.05	1.75	0.83	0.46
7	0.359	2.09	1.96	0.830	1.534	1.23	1.65	0.97	0.55
6	0.334	1.99	1.88	0.771	1.734	1.35	1.53	1.12	0.66
5	0.307	1.97	1.89	0.709	1.804	1.38	1.41	1.36	0.78
4	0.275	2.46	2.37	0.635	1.967	1.62	1.26	1.57	0.93
3.3	0.246	2.90	2.78	0.569	2.443	2.05	1.13	1.94	1.21
2.5	0.209	3.29	3.05	0.483	2.813	2.29	0.960	2.43	1.61
2	0.181	2.34	2.16	0.418	2.817	2.24	0.831	2.82	1.82
1.5	0.137	3.30	3.07	0.318	3.124	2.29	0.632	3.19	1.70
1	0.0917	2.27	2.21	0.214	2.697	2.42	0.423	3.70	2.32
0.8	0.0768	2.67	2.56	0.193	2.754	2.41	0.405	3.26	2.42
0.7	0.0703	3.25	3.10	0.184	3.233	2.80	0.397	3.50	2.48
0.61	0.0652	4.00	3.90	0.177	3.933	3.43	0.390	3.94	2.71
0.5	0.0590	3.66	3.72	0.167	4.107	4.01	0.382	4.75	3.46
0.33	0.0317	1.97	2.00	0.0901	2.219	2.30	0.206	2.85	2.96
0.25	0.0209	1.64	1.65	0.0592	1.726	1.75	0.136	2.05	2.06
0.15	0.0095	1.36	1.36	0.0270	1.395	1.39	0.0617	1.55	1.54
0.1	0.0047	1.30	1.29	0.0134	1.321	1.31	0.0307	1.45	1.40

Table 2.5.2-21 Spectral Accelerations (SA, in g) for Hard Rock Conditions and for Hypothetical Outcrop of Highest Competent In Situ Layer (Top of Blue Bluff Marl)

	Hard Rock spectral accel, g			Soil spectral accel, g		
Freq	10^{-4}	10^{-5}	10^{-6}	10^{-4}	10^{-5}	10^{-6}
100	0.214	0.559	1.480	0.255	0.531	1.025
76	0.293	0.777	2.059	0.268	0.558	1.063
60	0.394	1.057	2.802	0.311	0.629	1.167
50	0.464	1.257	3.334	0.333	0.656	1.180
40	0.517	1.416	3.758	0.423	0.778	1.310
30	0.545	1.511	4.011	0.545	0.984	1.452
25	0.551	1.540	4.090	0.646	1.217	1.636
20	0.522	1.419	3.685	0.723	1.390	1.925
16.5	0.493	1.309	3.330	0.758	1.474	2.139
13.4	0.456	1.176	2.914	0.784	1.523	2.299
12.2	0.438	1.115	2.727	0.800	1.553	2.349
10	0.399	0.983	2.330	0.722	1.522	2.405
8.1	0.375	0.904	2.071	0.831	1.551	2.517
7	0.359	0.852	1.909	0.801	1.658	2.574
6	0.339	0.792	1.728	0.671	1.601	2.650
5	0.317	0.728	1.540	0.612	1.306	2.665
4	0.287	0.659	1.369	0.694	1.190	2.419
3.3	0.259	0.595	1.213	0.735	1.335	2.350
2.5	0.223	0.512	1.020	0.706	1.300	2.184
2	0.193	0.445	0.886	0.440	1.153	2.036
1.5	0.152	0.352	0.698	0.484	0.952	1.705
1	0.101	0.235	0.465	0.226	0.597	1.396
0.8	0.091	0.230	0.489	0.237	0.595	1.388
0.7	0.083	0.220	0.481	0.264	0.664	1.436
0.61	0.076	0.207	0.462	0.299	0.761	1.535
0.5	0.065	0.185	0.423	0.238	0.745	1.741
0.33	0.038	0.107	0.245	0.075	0.242	0.712
0.25	0.026	0.072	0.166	0.042	0.126	0.341
0.15	0.012	0.033	0.075	0.016	0.046	0.116
0.1	0.006	0.016	0.036	0.007	0.021	0.051

Table 2.5.2-22 SSE Amplitudes (g) for the Hypothetical Outcrop of Highest Competent In Situ Layer (Top of Blue Bluff Marl)

	Soil amplitudes				raw	smoothed
Freq	10^{-4}	10^{-5}	AR	DF2	SSE	SSE
100	0.255	0.531	2.08	1.08	0.275	0.275
76	0.268	0.558	2.08	1.08	0.289	0.295
60	0.311	0.629	2.02	1.05	0.328	0.326
50	0.333	0.656	1.97	1.03	0.344	0.366
40	0.423	0.778	1.84	0.978	0.423	0.435
30	0.545	0.984	1.80	0.962	0.545	0.551
25	0.646	1.217	1.88	0.995	0.646	0.646
20	0.723	1.390	1.92	1.01	0.732	0.725
16.5	0.758	1.474	1.95	1.02	0.774	0.764
13.4	0.784	1.523	1.94	1.02	0.800	0.795
12.2	0.800	1.553	1.94	1.02	0.816	0.803
10	0.722	1.522	2.11	1.09	0.787	0.787
8.1	0.831	1.551	1.87	0.989	0.831	0.789
7	0.801	1.658	2.07	1.07	0.860	0.773
6	0.671	1.601	2.39	1.20	0.807	0.758
5	0.612	1.306	2.13	1.10	0.673	0.748
4	0.694	1.190	1.71	0.924	0.694	0.724
3.3	0.735	1.335	1.82	0.967	0.735	0.710
2.5	0.706	1.300	1.84	0.977	0.706	0.706
2	0.440	1.153	2.62	1.30	0.571	0.580
1.5	0.484	0.952	1.96	1.03	0.499	0.480
1	0.226	0.597	2.65	1.31	0.295	0.295
0.8	0.237	0.595	2.51	1.25	0.297	0.297
0.7	0.264	0.664	2.51	1.25	0.332	0.332
0.61	0.299	0.761	2.55	1.27	0.379	0.379
0.5	0.238	0.745	3.13	1.50	0.356	0.356
0.33	0.0750	0.242	3.23	1.53	0.115	0.115
0.25	0.0420	0.126	3.00	1.44	0.0606	0.0606
0.15	0.0158	0.0458	2.90	1.41	0.0222	0.0222
0.1	0.00718	0.0207	2.88	1.40	0.0100	0.0100

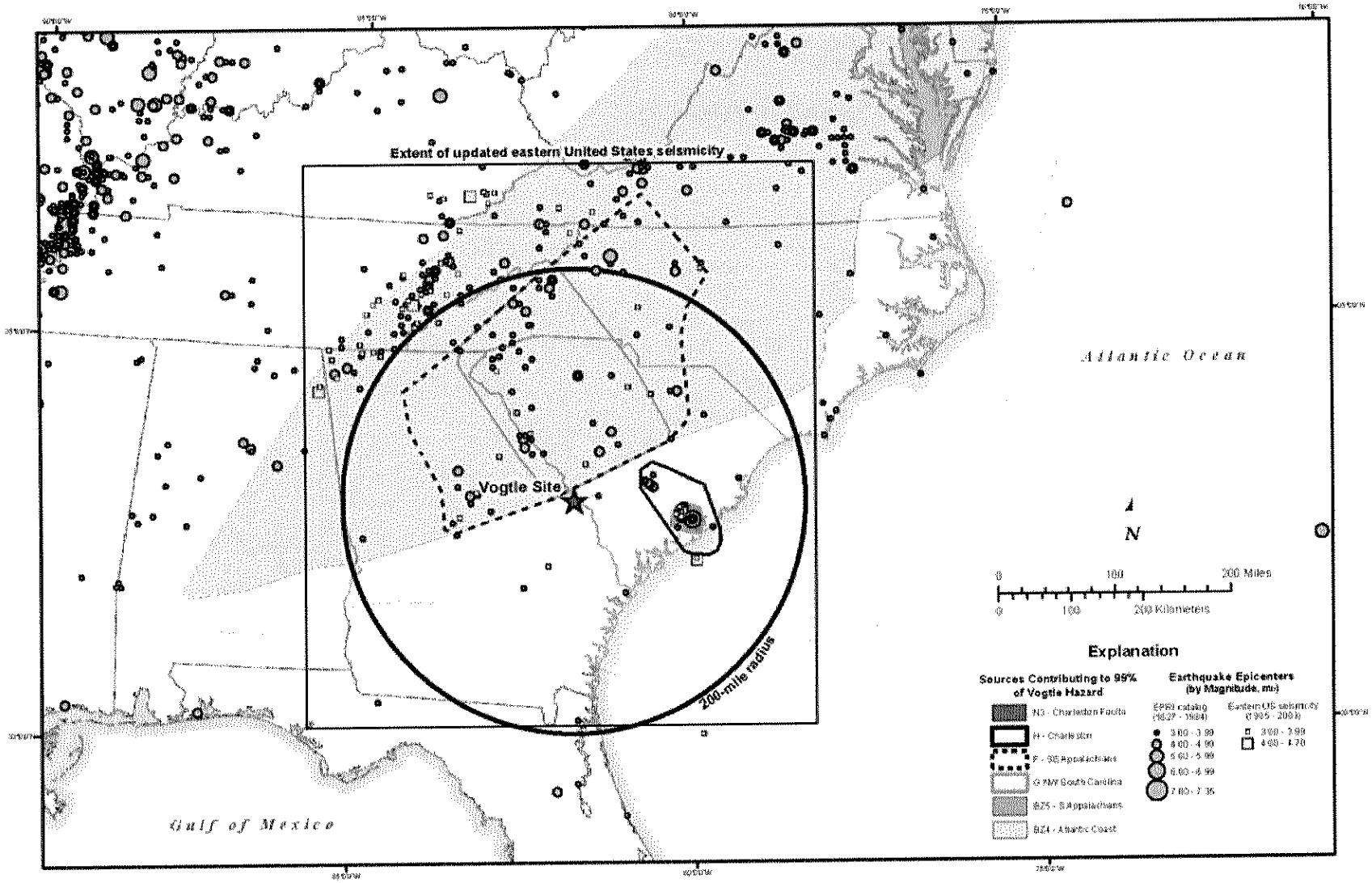

Figure 2.5.2-1 Bechtel EPRI Zones

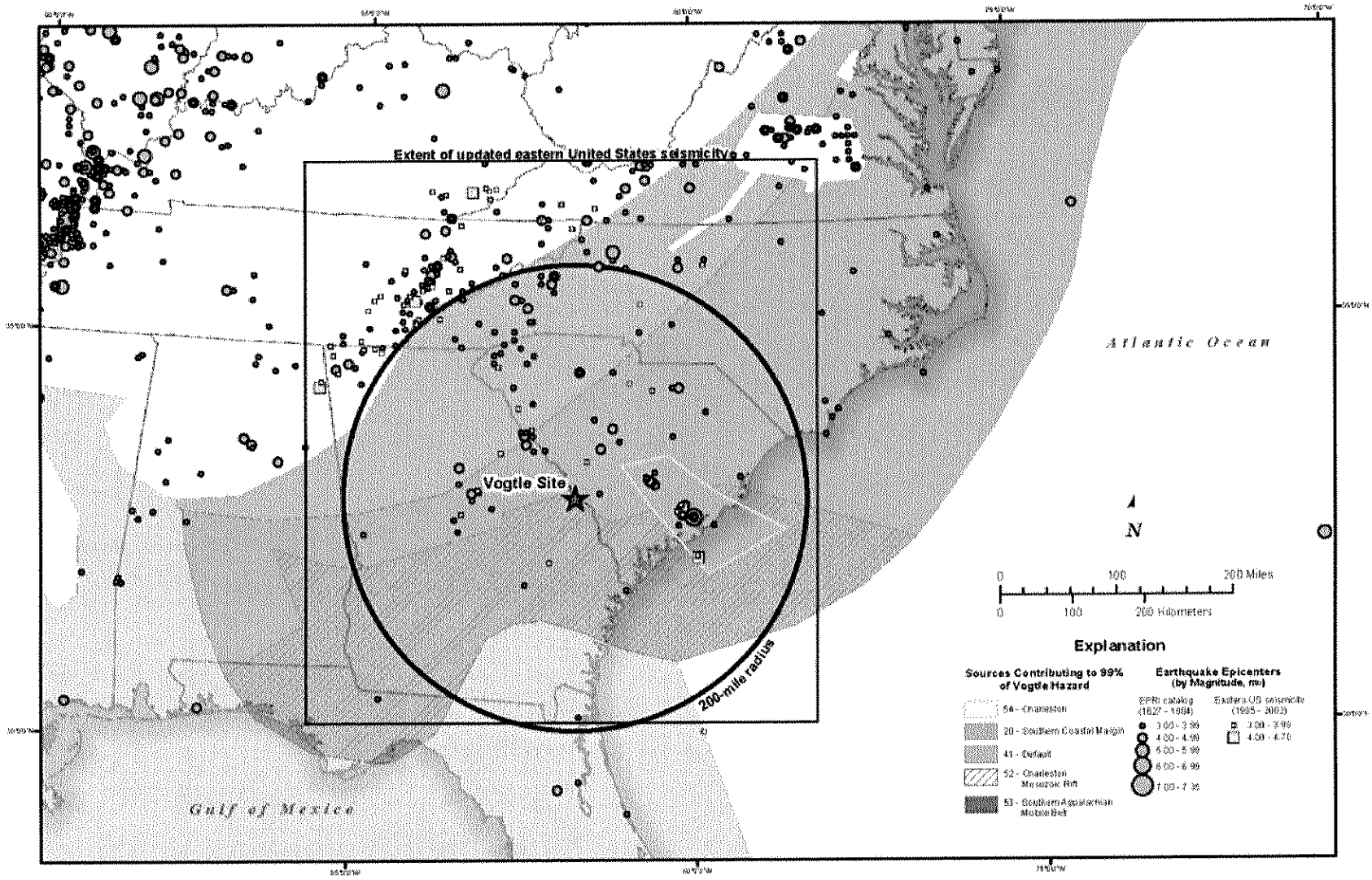

Figure 2.5.2-2 Dames and Moore EPRI Zones

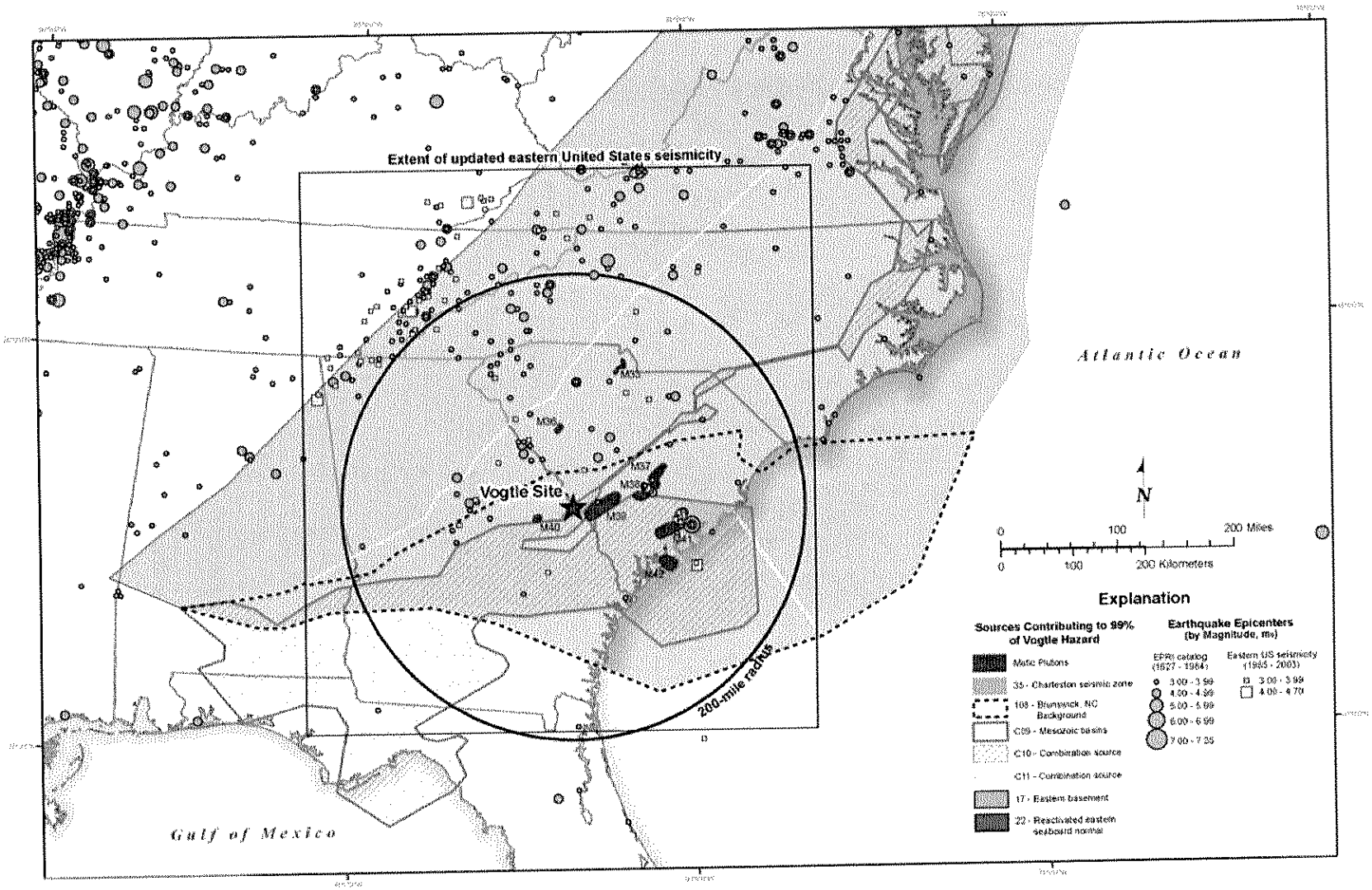

Figure 2.5.2-3 Law EPRI Zones

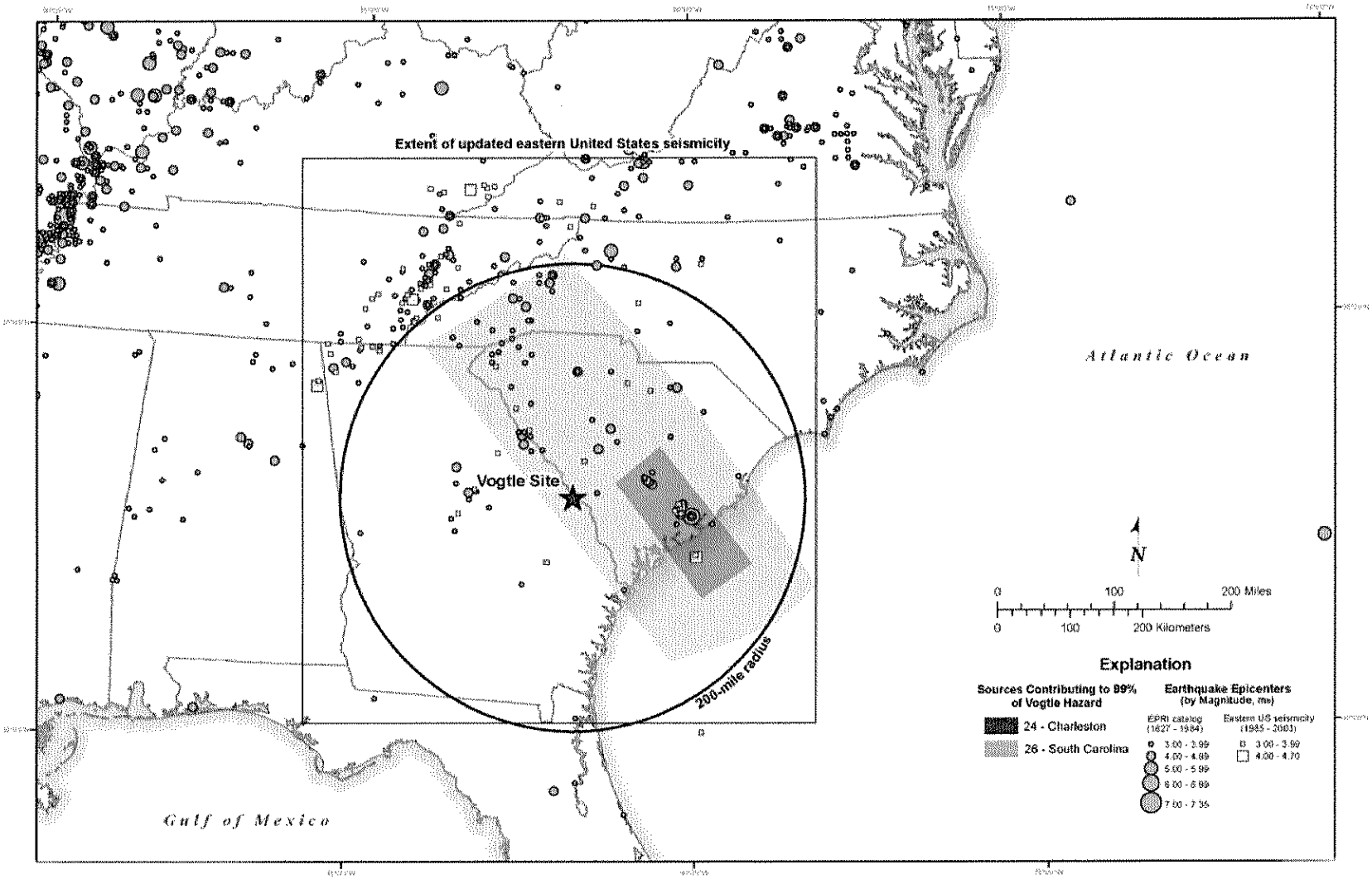

Figure 2.5.2-4 Rondout EPRI Zones

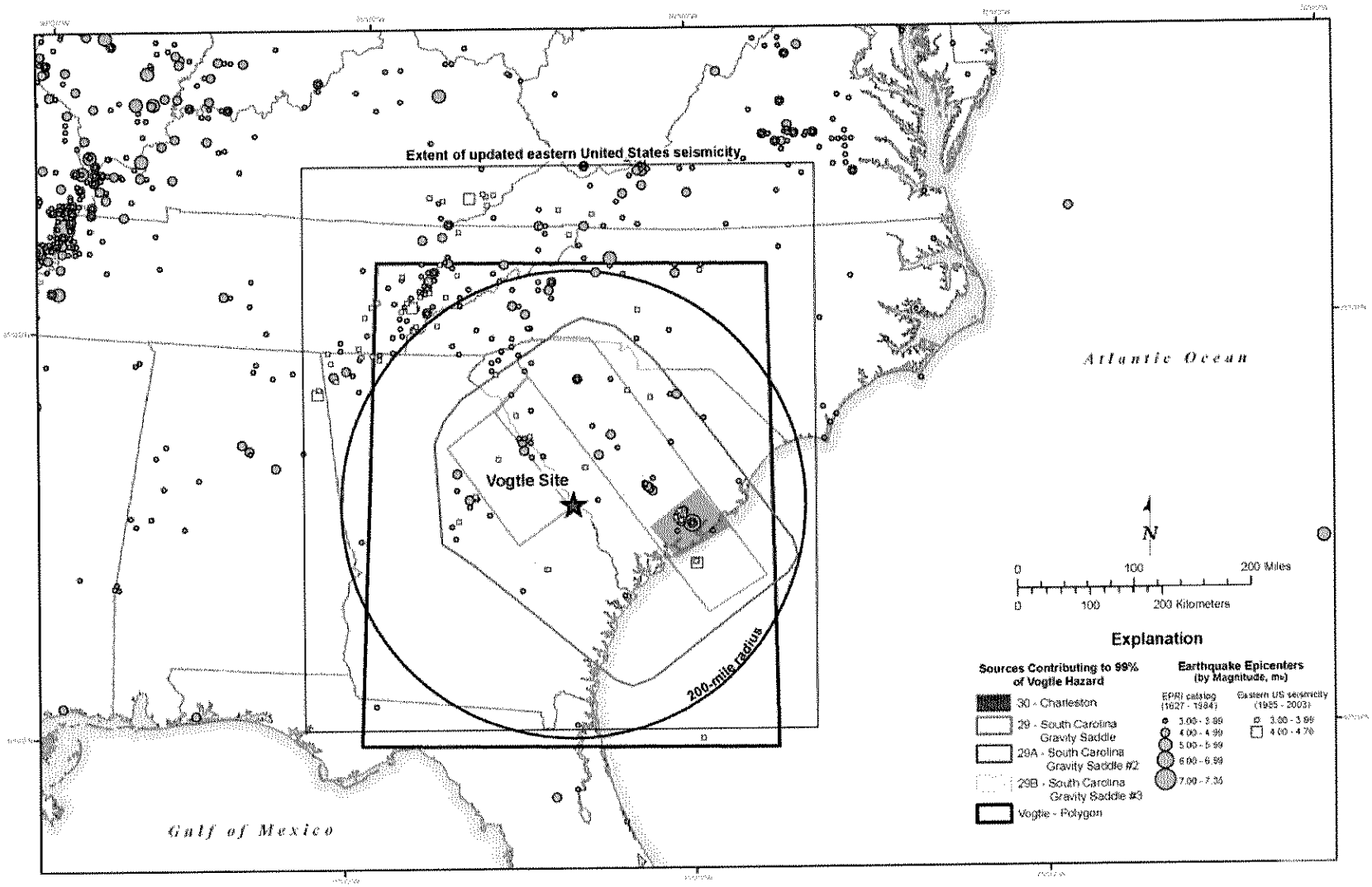

Figure 2.5.2-5 Woodward-Clyde EPRI Zones

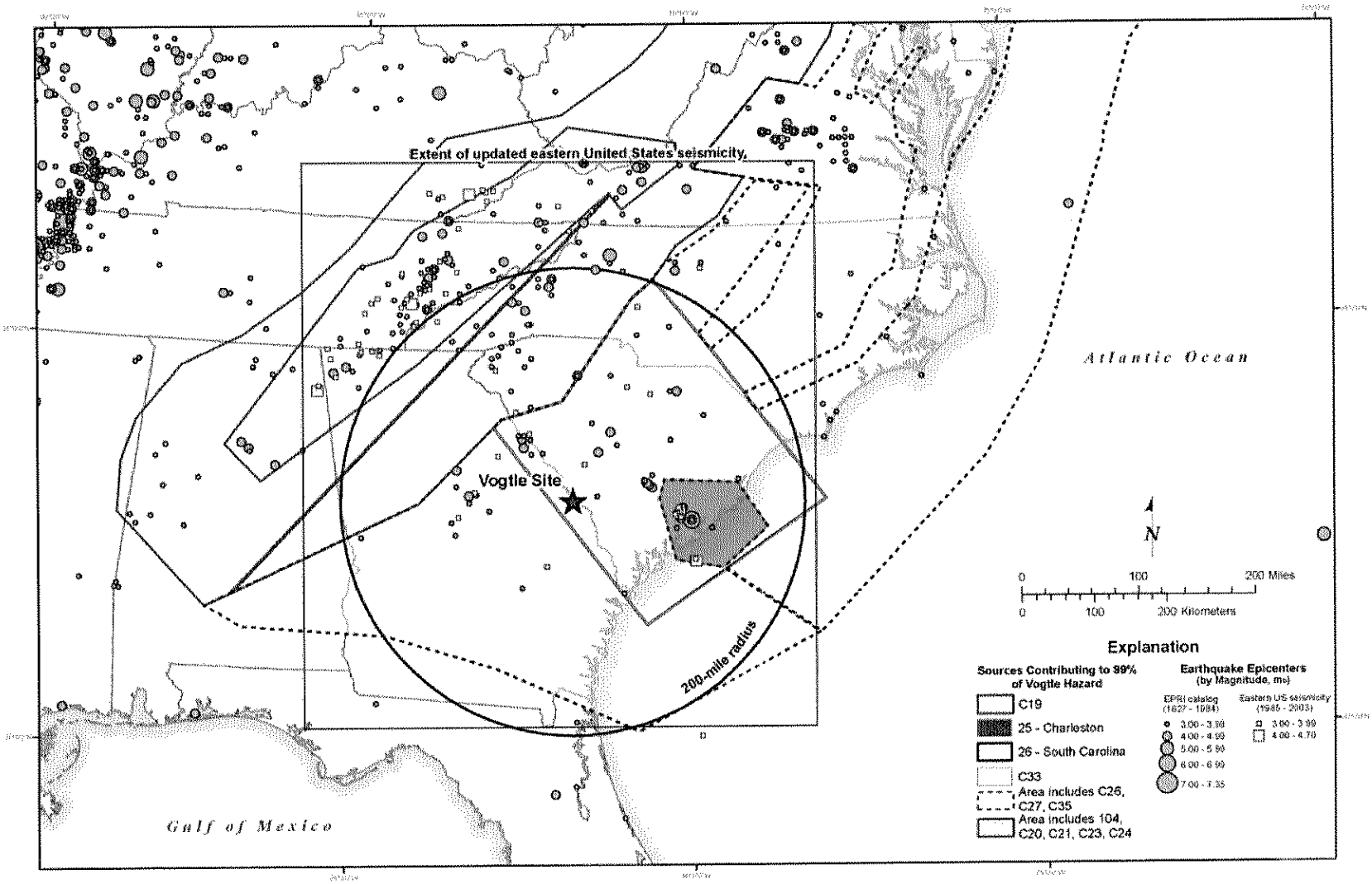

Figure 2.5.2-6 Weston EPRI Zones

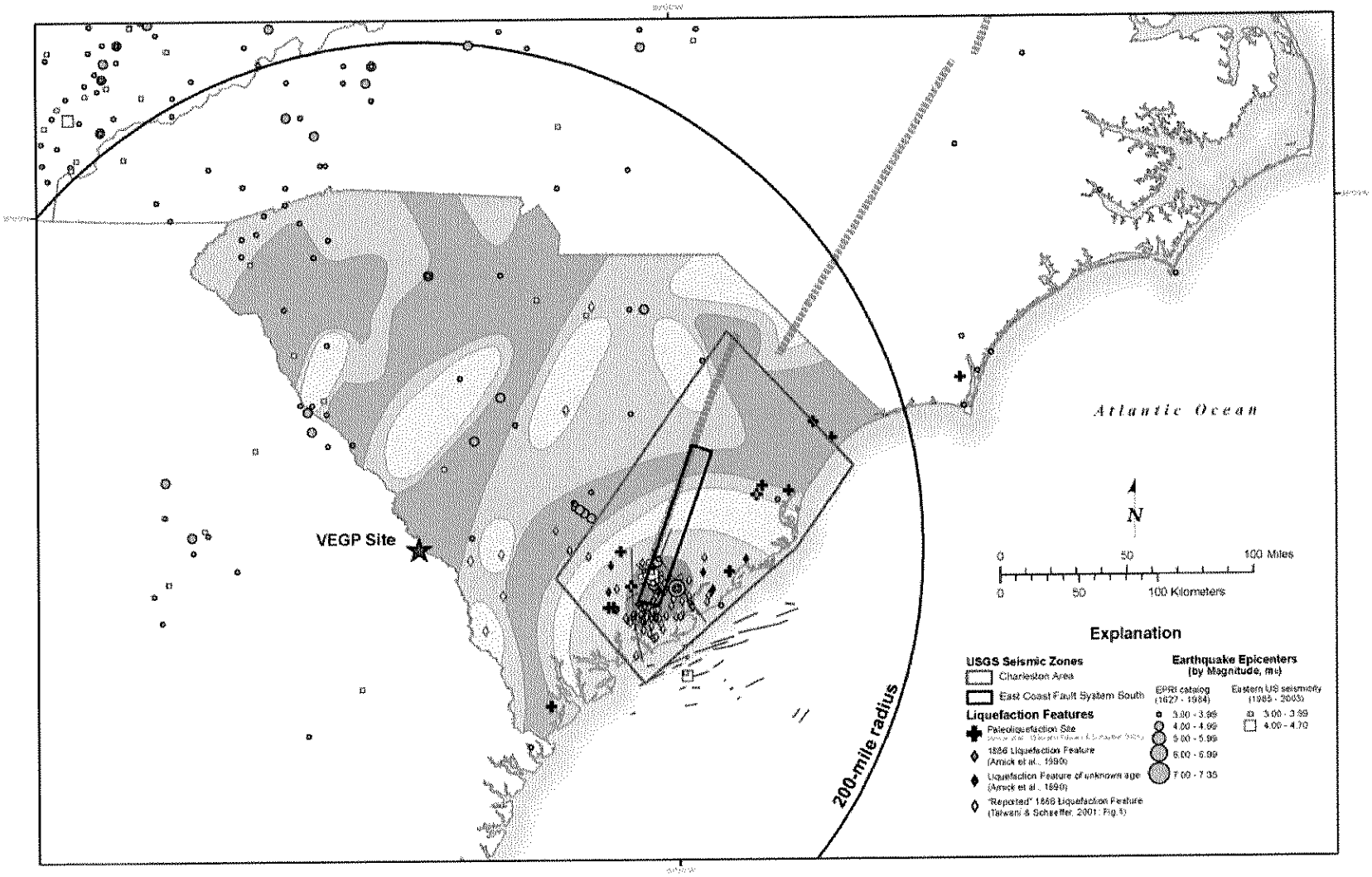

Figure 2.5.2-7 USGS Model

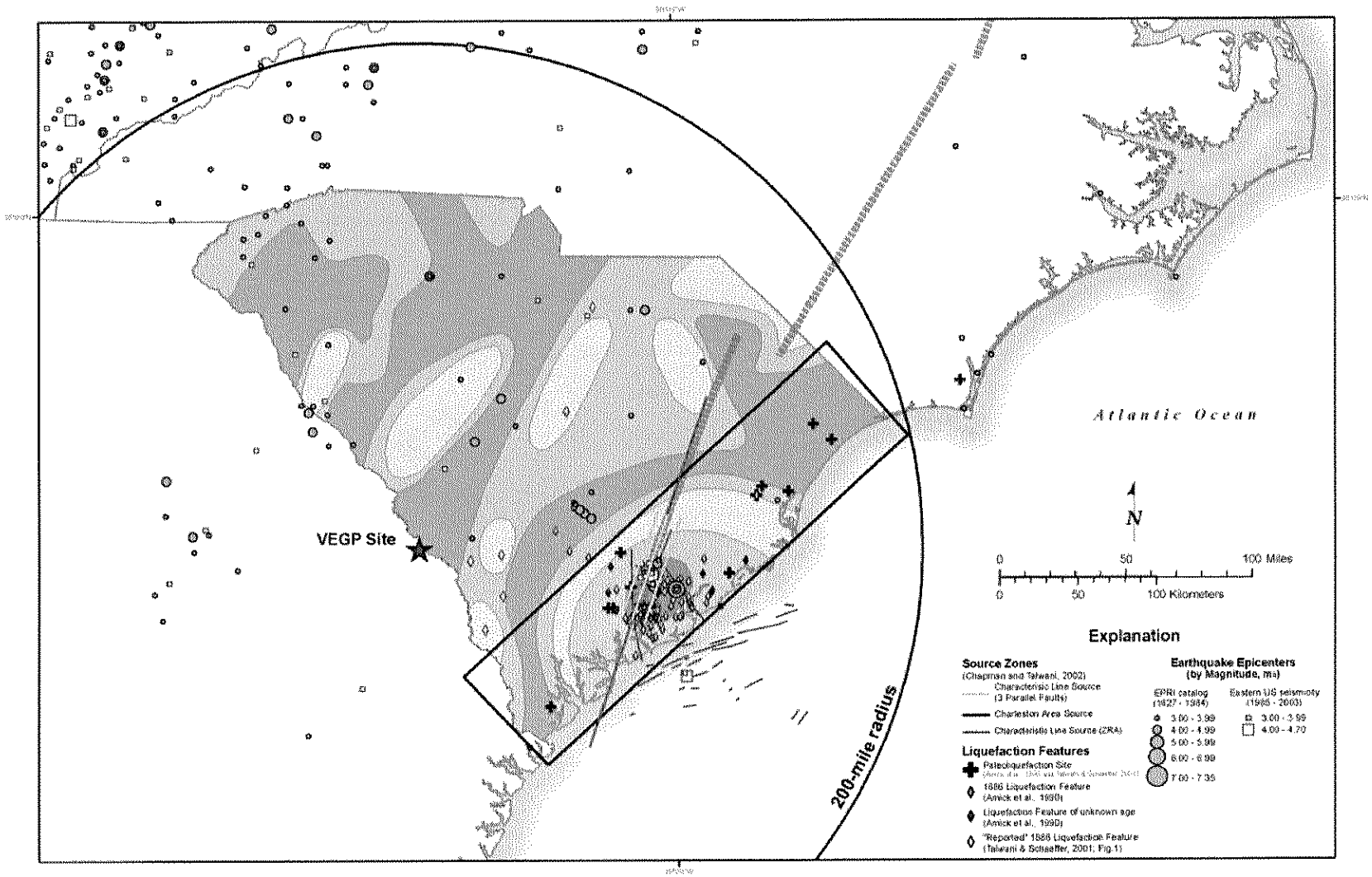

Figure 2.5.2-8 SCDOT Model

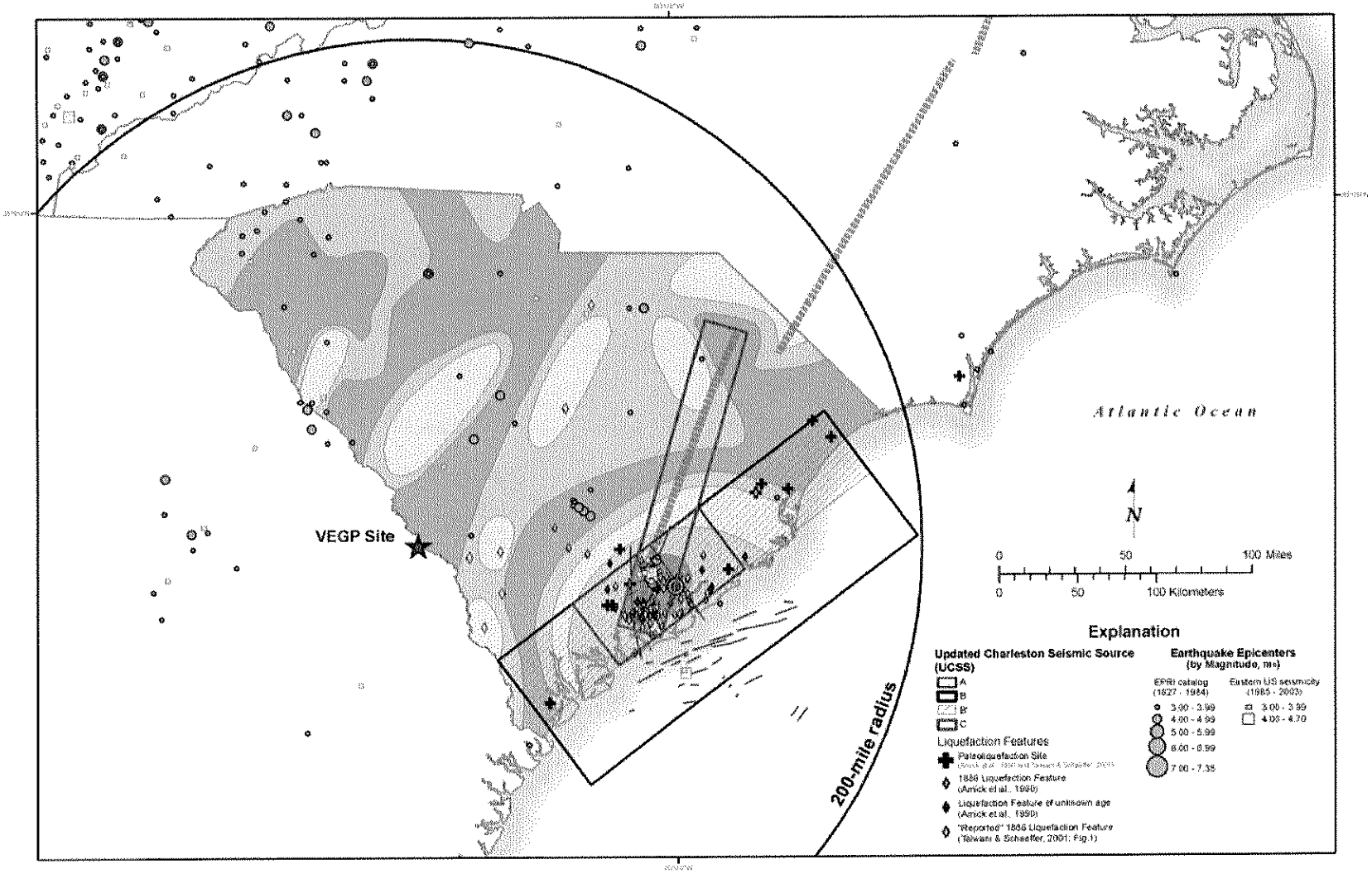

Figure 2.5.2-9 UCSS Map

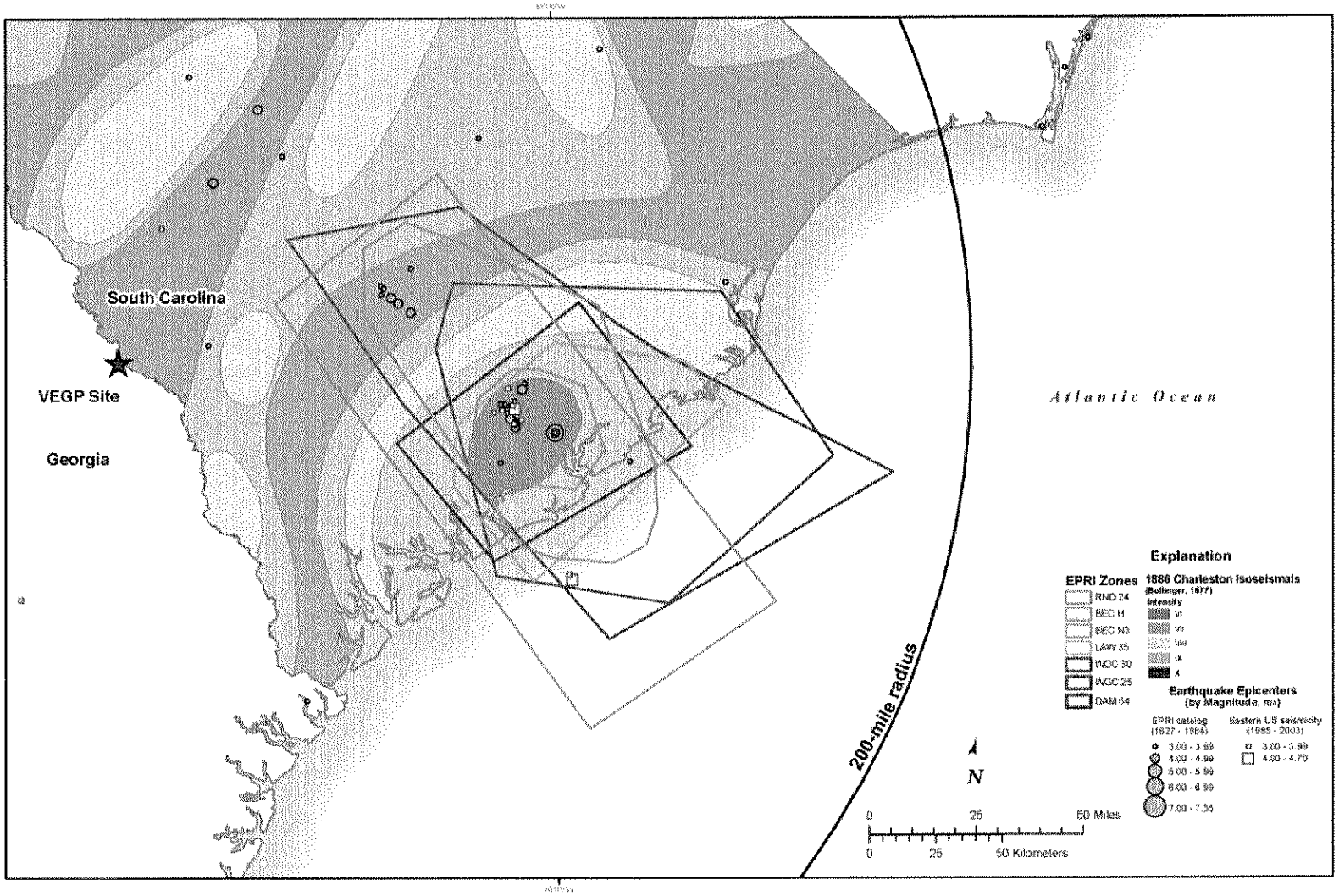

Figure 2.5.2-10 EPRI All Charleston Map

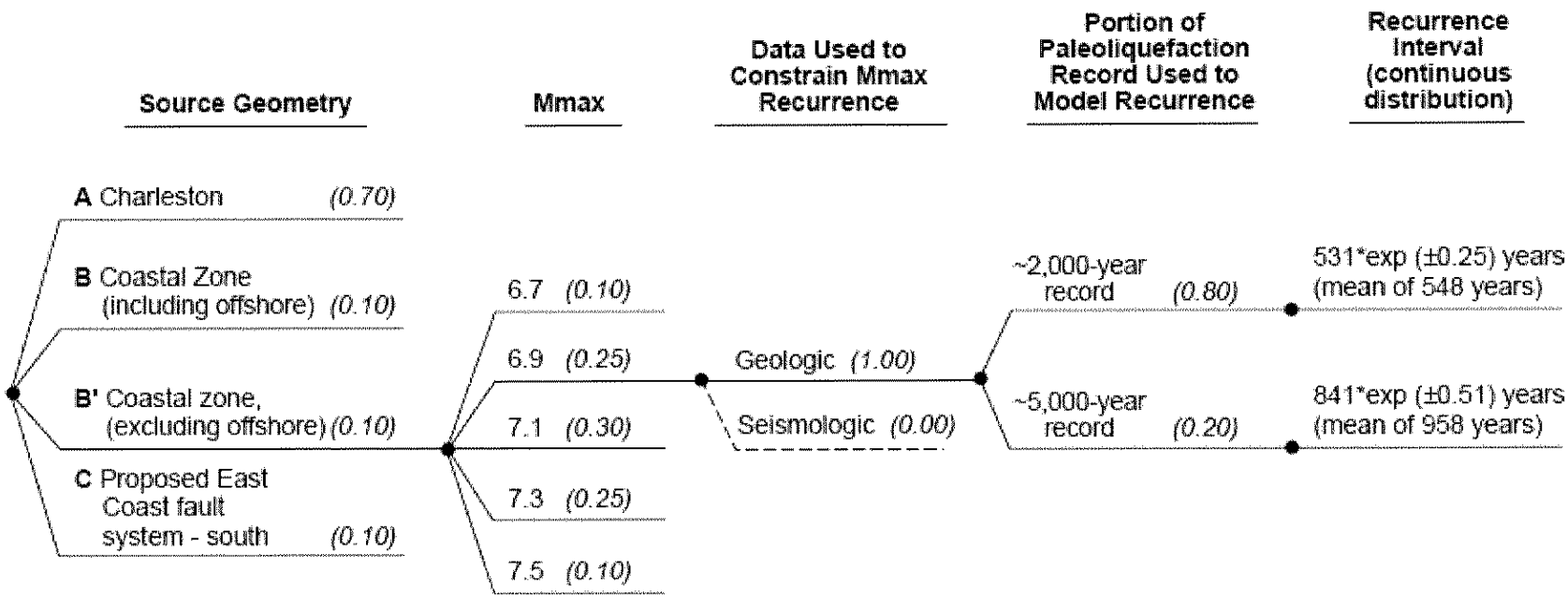

Figure 2.5.2-11 Updated Charleston Seismic Source (USGS) Logic Tree with Weights for each Branch Shown in Italics

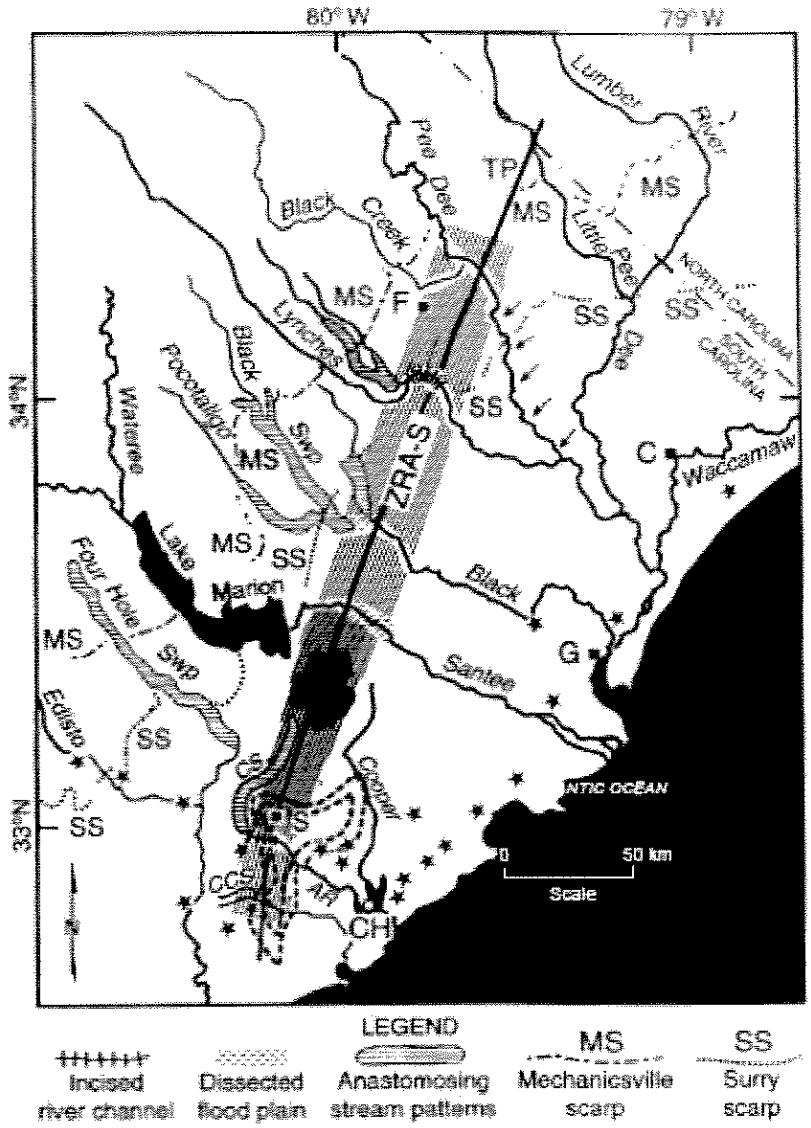

Figure 2.5.2-XX. Map of ZRA-S from Marple and Talwani (2000). Figure shows southern zone of river anomalies (ZRA-S; striped area), anastomosing stream patterns, pre 1886 sandblow sites (stars), and topographic profile (TP, bold line) approximately along the ZRA-S axis. Arrows along Pee Dee River denote reach flowing against southwest valley wall. Closed dashed contours near Summerville are highest-intensity isoseismals of the 1886 Charleston, South Carolina, earthquake (from Dutton, 1889). Abbreviations are as follows: AR - Ashley River; C - Conway; CCS - Caw Caw Swamp; CH - Charleston; CS - Cypress Swamp; F - Florence; G - Georgetown; LM - Lake Moultrie; MS - Mechanicsville littoral scarp; S - Summerville; SS - Surry littoral scarp.

Figure 2.5.2-12 Map of ZRA-S from Marple and Talwani (2000)

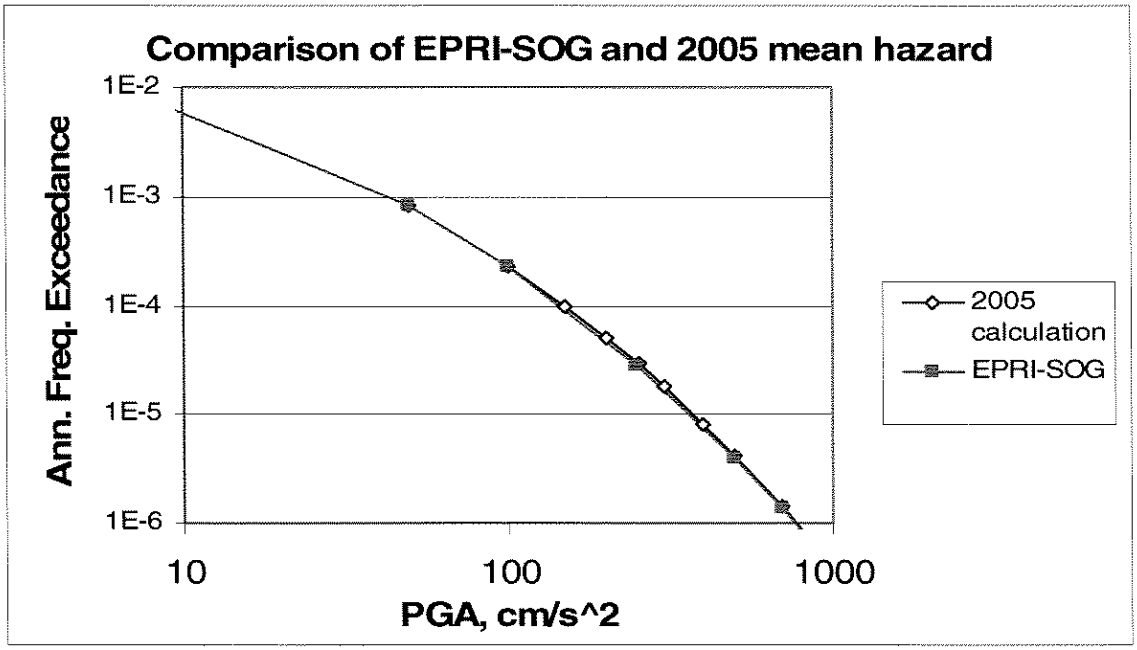

Figure 2.5.2-13 PGA Mean Seismic Hazard Curves for Current (2005) Calculation and for EPRI-SOG

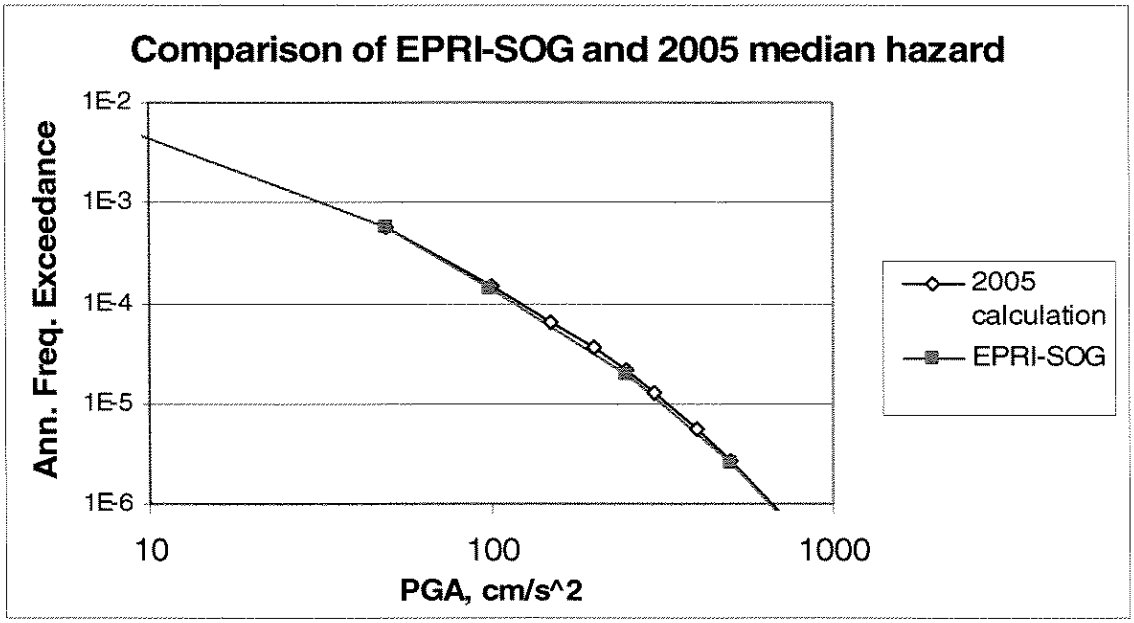

Figure 2.5.2-14 PGA Median Seismic Hazard Curves for Current (2005) Calculation and for EPRI-SOG

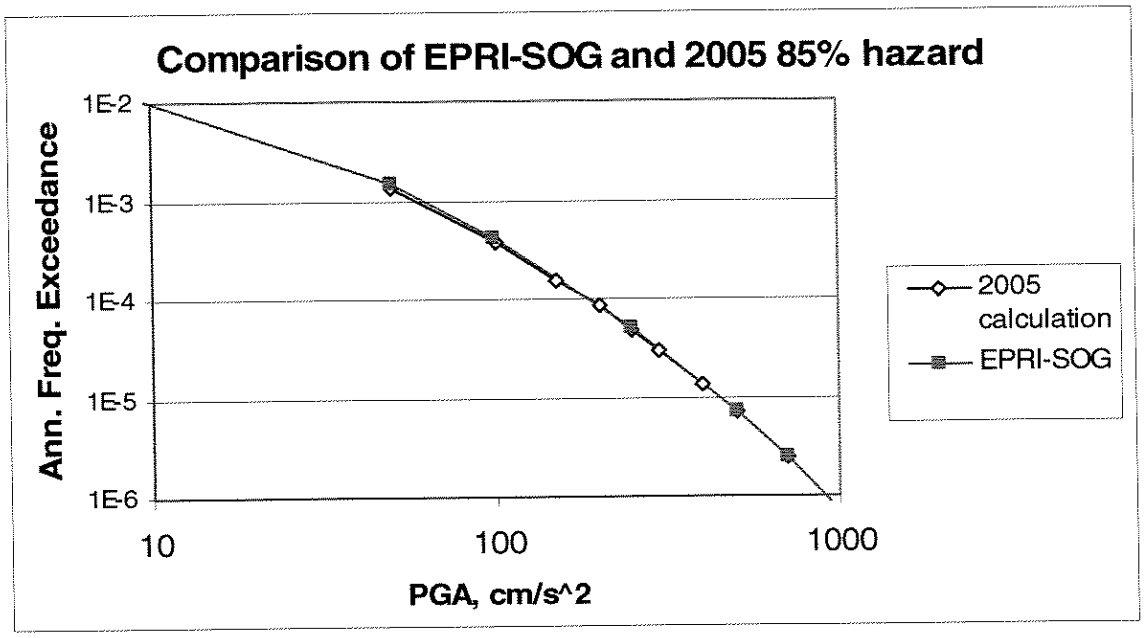

Figure 2.5.2-15 PGA 85 Percent Seismic Hazard Curves for Current (2005) Calculation and for EPRI-SOG