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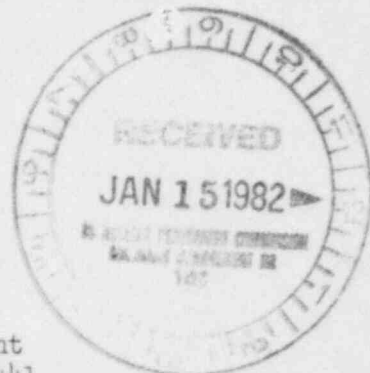
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Dalwyn R. Davidson
VICE PRESIDENT
SYSTEM ENGINEERING AND CONSTRUCTION

January 11, 1982

Mr. Robert L. Tedesco
Assistant Director for Licensing
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555



Perry Nuclear Power Plant
Docket Nos. 50-440; 50-441
Response to Request for
Additional Information -
Geology-Seismology

Dear Mr. Tedesco:

This letter and its attachment is submitted to provide draft responses to the additional questions raised by Dr. Ibrahim on the geology-seismology of the Perry Nuclear Power Plant. Enclosed is a new response for question 230.3 which supercedes the old response. Supplemental information is provided for question 230.6 in addition to the response previously provided.

It is our intention to incorporate these responses in a subsequent amendment to our Final Safety Analysis Report.

Very Truly Yours,

DR Dalwyn R. Davidson
Vice President
System Engineering and Construction

DRD: mlb

Attachment

cc: G. Charoff, Esq.
M. D. Houston
NRC Resident Inspector

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Question 230.3

Update the seismicity map within 200 miles of the site since the issuance of the FSAR and modify FSAR Figure 2.5-59 and Table 2.5-7.

Answer

Section 2.5.2 of the FSAR was prepared according to Regulatory Guide 1.70, Revision 3 (1978) in which recommended thresholds are "magnitudes greater than 3.0 and intensities greater than IV(MM)." The thresholds of Revision 3 differ from those of Revision 2 only with respect to intensity; Revision 2 required "intensities greater than III(MM)." Because the Perry FSAR contains a special Appendix (2D-D) which addresses all historical events within a 50-mile radius without any intensity threshold, it provides supplemental information on those small local earthquakes that would be covered by the more conservative threshold of Revision 2, and could be of interest for the site.

To update the seismicity information of Section 2.5.2 prepared in the fall, 1979, seismological catalogs that cover the 200-mile radius region around the site were searched. These include the Central Mississippi Valley Earthquake Bulletins (St. Louis University Network), the United States Earthquakes 1977 and 1978, the Monthly listings (NEIS), and finally the Northeastern United States Seismic Network

Bulletins, up to the last one published, No. 21. A preprint of a microearthquake list for the Anna, Ohio region was obtained from the University of Michigan. These sources provide the necessary coverage to update Table 2.5-7 up to the end of the year 1980. Only two events within 200 miles of the site were found through this update, one on the Niagara Peninsula, the other on Western Lake Erie. An update of FSAR Figure 2.5-59 and an update of the last page of Table 2.5-7 are now presented. The Kentucky Earthquake, located 265 miles from the site, has also been included in Table 2.5-7, since it falls within the search coordinates of the table. Its isoseismal map is included as part of the answer to Question 230.8. Similarly, an updated last page of Table 2.5-13 is provided; it includes the Kentucky Earthquake.

The Kentucky Earthquake is a moderate event that occurred on July 27, 1980 near Sharpsburg, Kentucky. The National Earthquake Information Service (Monthly Listing) computed a preliminary origin time of 18:52:21.8 (GMT), epicentral coordinates at 38.17°N and 83.91°W, and a magnitude 5.1_{m_b}. The maximum reported intensity was VII (MM), mostly based on broken chimneys of older construction, cracked and fallen plaster, overturned and rotated tombstones, and few instances of moderate structural damage to concrete block and brick buildings. Although the epicenter was located near Sharpsburg, some of the worst damage was observed in Maysville, Kentucky, about 30 miles north of the epicenter, where alluvial sediments along the Ohio River contributed to the ground motion

amplification. In the immediate epicentral region, an intensity VI (MM) was predominantly observed, as shown on the isoseismal map. A right-lateral strike slip motion along a fault plane oriented N42°E and dipping 50°, has been inferred, and a focal depth estimate of 15 km calculated for this event (Mauk et al., 1981, in press B.S.A.A.). Using Gupta and Nuttli's attenuation model and an epicentral intensity VII (MM), the calculated intensity at the Perry site is III (MM); this is in agreement with the felt reports observed on the isoseismal map. The area of perceptibility has been estimated to be approximately 675,000 km² (260,000 mi²). This event is probably associated with splay faults of the Kentucky River Fault System. Because the Safe Shutdown Earthquake at Perry accomodates an Intensity VII (MM) and its equivalent magnitude, this event does not create any problem.

To assure completeness, Dr. Edward Walter, of John Carroll University Seismological Observatory, in Cleveland, was contacted about any local event that might have been missed by the U.S.G.S., St. Louis U. and N.U.S.S.N. networks, but could have been detected by the local station (CLE). The answer was that no local events have occurred since the last one reported in Appendix 2D-D. Professor Walter commented that the Cleveland area is a quiet region, with only infrequent small events.

In conclusion, the updated seismicity within 200 miles of the site does not reveal any new data suggesting that the original assessment of the SSE should be changed.

Rev.

SUPPLEMENT TO QUESTION 230.6:

Three additional sensitivity tests have been run for the purpose of confirming the consistency of the results and illustrating the fact that the Parkfield earthquake is an anomalous event. Tables 1 and 2 (revised) present all relevant data. Figure 20 shows the response spectra obtained whenever two components from the Temblor Station (Parkfield earthquake) are included. The 84th percentile peak acceleration increases from 98.9 cm/sec^2 to 153.3 cm/sec^2 , and the spectral level is considerably raised over the entire period range. Figure 21 and 22 show the response spectra obtained when two events of $M_L=6.0$ and three events of $M_L=6.0, 6.0$ and 6.1 are added to the basic subset. As shown on Table 2 (revised), the peak acceleration at the 84th percentile is very similar, i.e. 133.0 and 131.6 cm/sec^2 . The spectra are almost identical. The interesting point to be noticed is that these spectra are lower than those obtained with the inclusion of the Temblor components to the basic subset, although they include the contributions of events of $M_L=6$ level. These sensitivity tests suggest that the Parkfield data obtained at Temblor might indeed correspond to a much higher magnitude level ($M_L=6.4$ and 6.7) as calculated by Kanamori and Jennings. On that basis, these records would not be acceptable to model the design earthquake $m_b=5.3$.

TABLE I (Revised.)
ACCELEROGRAMS USED FOR PERRY SITE SPECIFIC RESPONSE SPECTRA

Date	Time(UT)	m_b	M_L	Depth (km)	I_0	Location	Ref. No.	Epic. Dist. (km)	Hypo. Dist. (km)	Peak Acc. (gals)	Comp.	Station
NOV 28 1935	14:41:54	-	5.0 ^o	5	VI	Helena, Montana	U297	5.8	7.7	76.8 83.0	N E	Helena Fed. Bldg
SEP 12 1970	14:30:52	5.2	5.4	9.0	VII	Lytle Creek	W335	20.8	22.7	69.8 54.9	S85°E S05°E	Cedar Springs Allen Ranch
JAN 12 1975	01:37:17	4.7	5.2	2.0	VI	Cape Mendocino	PC175	16.0	16.1	92.1 72.4	S60°E N30°E	Petrolia, Cape Mendocino
AUG 01 1975	20:20:00	5.8	5.7*	15	IX	Oroville, CA	OS875	12.0	19.2	90.6 82.5	N37°E N53°W	Oroville Seismic Station
AUG 06 1979	17:05:23	5.4	5.9	Surface Rupture	VIII	Coyote Lake	CYGL1	9.1*	9.1	111.1 83.7	320° 230°	Gilroy Array No. 1
SEP 11 1976	16:31:00	5.0	5.5	9	VIII- IX	Friuli, Italy	I132	15.5	17.9	66.6 35.5	EW NS	San Rocco
SEP 11 1976	16:35:00	5.3	5.9	6	IX	Friuli, Italy	I139	14.0	15.2	84.9 84.2	NS EW	San Rocco
SEP 15 1976	03:15:19	5.7	6.1	9.0	VIII- IX	Friuli, Italy	I153	9.0	12.7	118.6 59.8	EW NS	San Rocco
OCT 31 1935	18:37:56	5.4	6.0	8	VII	Montana	B025	5.6	10.4	143.5 142.5	N00°E N90°E	Carroll College
JUN 28 1966	04:26:12	5.8	5.6	Surface	VII	Parkfield	B037	16.1**	16.1	264.3 340.8	N65°W E25°W	Temblor
SEP 15 1976	09:21:18	5.4	6.0	11.7	IX	Friuli, Italy	I169	20.0	23.2	124.8 230.4	NS EW	San Rocco

*Magnitude quoted is "5.7 BRK" - U. S. Earthquakes.

^o"Richter magnitude" - Chang 1978.

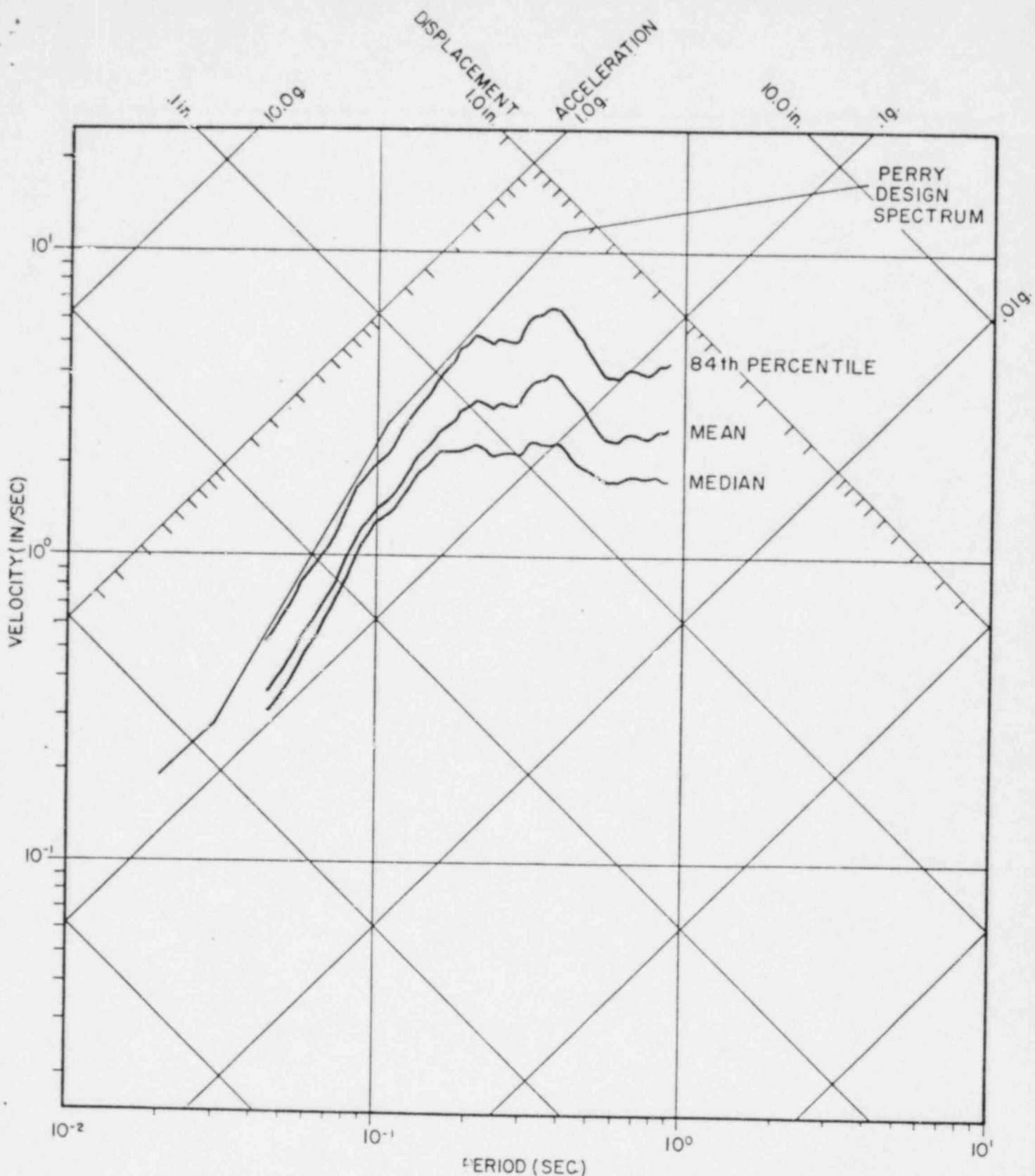
* Joyner, Boore and Porcella (1981) - Closest approach of surface projection of rupture.

** Boore et al (1978) - Closest approach of rupture.

TABLE 2 (Revised)

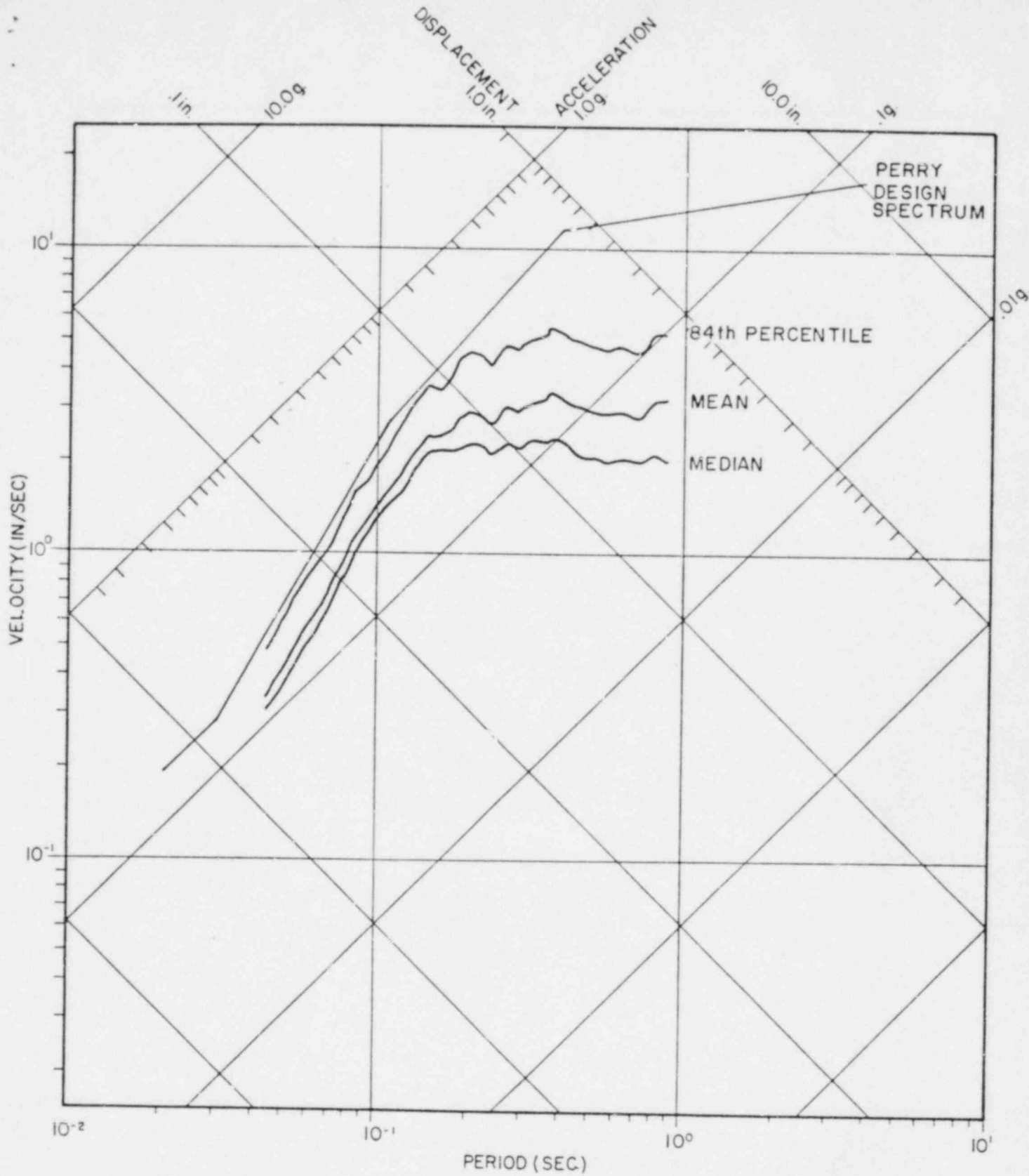
STATISTICS FOR PERRY SITE SPECIFIC SPECTRA

	Average M_L	Average Epic. Distance (Km)	Median Peak Acc. (cm/sec ²)	Mean Peak Acc. (cm/sec ²)	Peak Acc. 84th Percentile (cm/sec ²)	No. of Components	No. of Stations	No. of Earthquakes
1. Basic Subset (Strict Criteria)	5.51 ± .33	13.3 ± 4.71	75.2	78.1	98.9	14	6	7
2. Basic Subset plus two M_L 5.9	5.63 ± .37	12.1 ± 4.79	81.8	86.6	114.6	18	7	9
3. Same as above plus Parkfield included	5.63 ± .35	12.5 ± 4.69	93.2	106.3	155.6	20	8	10
4. Basic Subset Parkfield included	5.53 ± .30	13.66 ± 4.49	89.5	103.4	153.3	16	7	8
5. Basic Subset Plus 2 $M_L=6.0$	5.62 ± .36	13.31 ± 5.25	88.4	96.1	133.0	18	7	9
6. Basic Subset Plus $M_L=6.0, 6.0$ and 6.1	5.67 ± .37	12.88 ± 5.14	88.0	95.4	131.6	20	7	10



MEDIAN, MEAN AND 84TH PERCENTILE
 RESPONSE SPECTRA FOR PERRY (ROCK) SITE
 (Basic Subset, Parkfield Included, 5% Damping)

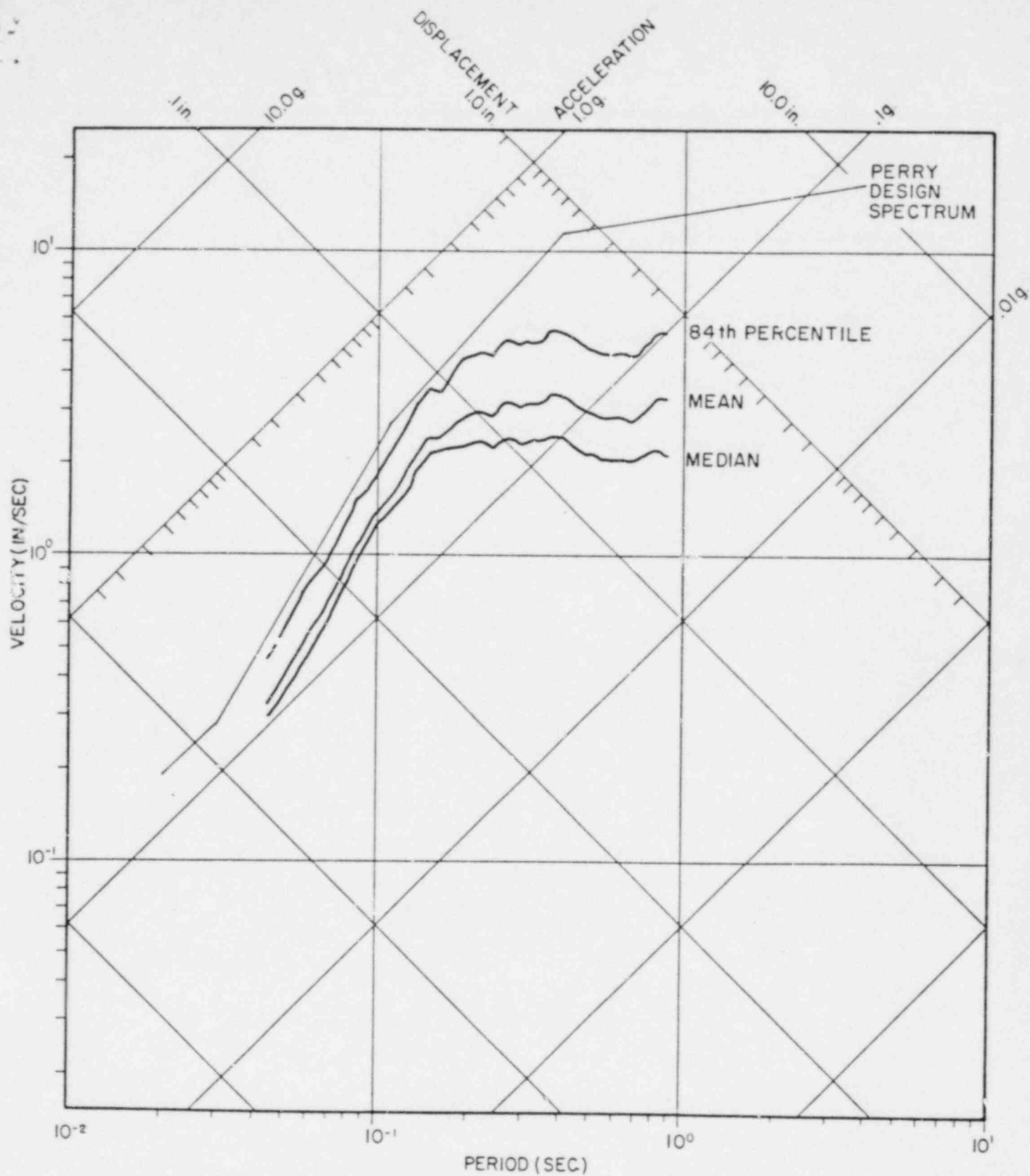
Figure 20



MEDIAN, MEAN AND 84TH PERCENTILE
RESPONSE SPECTRA FOR PERRY (ROCK) SITE

(Basic Subset, Magnitude Range Extended
to Include Two Events With
Magnitude $M_L \approx 6.0$, 5% Damping)

Figure 21



MEDIAN, MEAN AND 84TH PERCENTILE
RESPONSE SPECTRA FOR PERRY (ROCK) SITE.

(Basic Subset, Magnitude Range Extended
to Include Three Events With
Magnitude $M_L=6.0, 6.0$ and $6.1, 5\%$ Damping)

Figure 22