TEXAS UTILITIES SERVICES INC.
2001 BRYAN TOWER · DALLAS, TEXAS 75201

Log # TXX-3202
File 170c.5

50-445

October 1, 1980

Mr. John Lehr
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION
NOAA EARTHQUAKE DATA

Dear Mr. Lehr:

Enclosed are 5 copies of the record of seismic activity we received from the National Oceanic and Atmospheric Administration, Denver, Colorado. This is the information referenced in our response to question 79 in Amendment 1 to the Comanche Peak Environmental Report, Operating License Stage.

If you have any questions about this information, please call me at 214/653-4869.

Sincerely,

Richard Werner

Richard Werner

RAW:skf
Enclosure
cc: C. K. Feist
Eric McHuron
Margery Bynoe (ANL)

BOOL
S
1/1
ADD: L E
J. Lehr 1 1

A

RADIAL SEARCH, 420 KM AROUND GLEN ROSE, TX, 32.234 N, 97.785 W, (FOR WERNER)

	SOURCE	YEAR	MO	DA	HR	MN	SEC	LAT		LONG		DEPTH (KM)	MAGNITUDES BODY	SURF	OTHER	LOCAL	INT MAX	PHENOM	RN	CE	Q/S	MAR	DG	DIST (KM)
**1 INDICATES A POSSIBLE DUPLICATE																								
	USN	1882	10	22	22	15		33.	N	095.	W						VII		499		I	118	55	395.
**1	USN	1891	01	08	08	00		31.7	N	095.	W						VII		500		G	118	15	252.
**2	EQH	1891	01	08	08	00	00.07	31.700	N	095.200	W						VII		500	D		118	15	252.
	USN	1910	05	09				30.2	N	095.	W						III		500		H	118	06	288.
	USN	1910	05	11				30.	N	095.	W						III		500		I	118	06	306.
	USN	1914	12	30	01			30.5	N	095.9	W						IV		500		G	118	05	288.
**1	USN	1916	03	10	15	30		35.5	N	098.	W						V		499		G	118	58	357.
**2	EQH	1916	03	10	15	30	00.07	35.500	N	098.000	W						V		499	F		118	58	357.
	USN	1918	09	11	05	30	00	35.5	N	098.	W								499		H	118	58	357.
	EGS	1926	12	06	15	21	24	30.0	N	097.0	W								500			118	07	266.
**1	USN	1928	12	28	00	30		35.5	N	098.0	W						VI		499		G	118	58	357.
**2	JSE	1928	12	28	00	30	00.07	35.500	N	098.000	W						VI		499	D		118	58	357.
	USN	1932	04	09	10	15		31.7	N	096.5	W						V		500		G	118	16	138.
	USN	1933	08	19	19	30		35.5	N	097.9	W						V		499		G	118	57	357.
	USN	1934	04	11	17	40		33.9	N	095.5	W						V		500		H	118	35	271.
	USN	1936	03	14	17	20		34.0	N	095.1	W						V		499		G	118	45	314.
	USN	1941	10	18	07	43		35.4	N	099.0	W								499		G	118	59	363.
	USN	1950	03	20	13	23		33.3	N	097.8	W						IV		500		G	118	37	112.
**1	USN	1952	04	09	16	29	15	35.4	N	097.8	W		5.5 MB				VII		499		B	118	57	345.
**2	JSE	1952	04	09	16	29	15.0	35.400	N	097.800	W				5.50		VII		499	D		118	57	345.
**3	S-R	1952	04	09	16	29	29.0	35.500	N	097.750	W				5.50PAS		VII		499	D		118	57	345.
	USN	1952	09	11	20	30		35.5	N	097.9	W						IV		499		G	118	57	357.
	USN	1952	04	16	02	05		35.5	N	097.9	W						V		499		G	118	57	357.
	USN	1952	07	17	00	30		35.5	N	097.9	W								499		G	118	57	357.
	USN	1952	07	17	02	00		35.5	N	097.9	W								499		G	118	57	357.
	USN	1952	08	14	21	47		35.5	N	097.9	W						IV		499		G	118	57	357.
	USN	1952	10	08	04	15		35.2	N	096.5	W						IV		499		G	118	56	344.
	USN	1953	03	16	12	50		35.4	N	097.9	W								499		G	118	57	346.
	USN	1953	03	17	13	12		35.6	N	098.0	W						VI		499		G	118	58	368.
	USN	1953	03	17	14	25		35.6	N	098.0	W								499		G	118	58	368.
	USN	1953	05	06	17	40		34.8	N	096.7	W						IV		499		G	118	46	296.
	USN	1954	04	11				35.1	N	096.4	W						IV		499		G	118	56	337.
	USN	1954	04	12	23	05		35.1	N	096.4	W						IV		499		G	118	56	337.
	USN	1954	04	13	15	48		35.1	N	096.4	W						IV		499		G	118	56	337.
	USN	1956	02	16	23	30		35.7	N	097.5	W						VI		499		G	118	57	380.
	USN	1956	04	02	16	03	18	34.2	N	095.6	W						V		499		H	118	45	294.
	USN	1957	03	19	16	35		32.0	N	095.0	W								500		H	118	25	264.
	USN	1957	03	19	16	37	38.4	32.0	N	095.0	W						V		500		H	118	25	264.
	USN	1957	03	19	17	45		32.0	N	095.0	W								500		H	118	25	264.
	USN	1957	03	19	17	41	17	32.0	N	095.0	W								500		H	118	25	264.
	USN	1957	05	15	12	45		34.8	N	096.7	W						V		499		G	118	46	296.
**1	USN	1958	05	17	10	27	07	34.5	N	098.5	W						VI		499		G	118	48	254.
**2	JSE	1958	05	17	10	27	07.0	34.500	N	098.500	W						VI		499	D		118	48	254.
	USN	1961	01	11	01	40		34.7	N	095.5	W						V		499		I	118	45	359.
	USN	1961	04	27	03			34.9	N	094.6	W								501		I	118	44	413.
	USN	1961	04	27	05			34.9	N	094.6	W								501		I	118	44	413.
	USN	1961	04	27	07	30		34.2	N	095.6	W						V		499		I	118	45	294.
**1	USN	1964	02	02	05	22	44.1	35.0	N	093.6	W	033							499		C	118	59	345.
**2	CGS	1964	02	02	08	22	44.1	35.100	N	093.700	W	033							499		004	118	59	345.
**1	CGS	1969	04	24	01	25	55.0	31.500	N	093.800	W	033	3.70MD				V		504	F		118	13	386.

88/339 22.

SOURCE	YEAR	MO	DA	HR	MN	SEC	LAT	LONG	DEPTH (KM)	MAGNITUDES BODY	SURF	OTHER	LOCAL	INT MAX	PHENOM	RMS	CE	Q/S	MAR	DG	DIST (KM)
**N INDICATES A POSSIBLE DUPLICATE																					
**2	USN	1964	04	24	01	28	55.3	31.5 N	093.8 W	033		4.7 MB			V		504		C	118	13	386.
**1	USN	1964	04	24	07	51	55.1	31.5 N	093.8 W	033		4.7 MB			V		504		C	118	13	384.
**2	DGS	1964	04	24	07	51	55.0	31.500N	093.800W	033		4.70MB			V		504	F		118	13	384.
**1	USN	1964	04	28	20	33	45.5	31.5 N	093.8 W	033		4.4 MB			V		504		C	118	13	386.
**2	DGS	1964	04	28	20	33	45.6	31.500N	093.800W	033		4.40MB			V		504	F		118	13	386.
**1	USN	1964	04	28	21	19	34.5	31.2 N	093.9 W	033		4.4 MB			V		504		C	118	13	387.
**2	DGS	1964	04	28	21	19	34.6	31.200N	093.900W	033		4.40MB			V		504	D	009	118	13	387.
**1	USN	1964	05	03	02	27	24.2	31.2 N	094.0 W	030		4.2 MB			IV		503		C	118	14	378.
**2	DGS	1964	05	03	02	27	24.2	31.300N	094.000W	030		4.20MB					503		008	118	14	378.
	USN	1964	05	03	02	30		31.3 N	094.0 W						III		503		G	118	14	374.
	USN	1964	08	16	11	36		31.4 N	093.8 W						V		504		G	118	13	389.
**1	JSE	1969	05	02	11	33	19.8	35.200N	096.300W	033N		4.60MB			V		499	D	008	118	56	351.
**2	USN	1969	05	02	11	33	19.8	35.2 N	096.3 W	033		4.60MB			V		499		A	118	56	351.
**1	USN	1974	12	16	02	30	21.4	35.3 N	097.5 W	010							499		A	118	57	335.
**2	GS	1974	12	16	02	30	21.4M	35.330N	097.480W	010			2.60		III		499	F	8	118	57	335.
	GS	1975	09	13	01	25	02.8	34.139N	097.369W	005G			3.40LG	TUL	IV		499	F	9	118	47	209.
	GS	1975	10	12	02	59	11.2*	34.816N	097.406W	020G			3.20LG	TUL			499		8	118	47	283.
	GS	1975	11	29	14	29	40.9*	34.521N	097.347W	005G		3.60TUL	3.50LG	SLM	V		499	F	14	118	47	251.
	GS	1977	05	07	23	01	20.4*	35.058N	100.749W	005G			4.00ML	GS			498		7	119	30	290.
	GS	1977	11	28	01	40	50.3*	35.054N	100.837W	005G			3.50ML	GS			498		12	119	20	295.
	GS	1978	06	16	11	46	54.2	33.033N	103.766W	010G	4.4 MB	4.60SLM	5.30ML	GS	V		498	F	49	119	20	291.
	GS	1979	05	07	7	39	35.6Y	35.187N	99.812W	5		3.00TUL			IV		499	F	18	118	59	372.
	GS	1979	07	05	1	05	01.0G	32.343N	103.895W	4		2.70TUL					498	N	12	119	20	300.
	GS	1979	08	13		49	19.8	35.219N	99.518W	5G		3.40TUL			IV		499	F	19	118	59	363.

NUMBER OF HITS 74
NUMBER OF SUSPECTED DUPLICATES 13

PREPARED BY THE NATIONAL GEOPHYSICAL AND SOLAR-TERRESTRIAL DATA CENTER

ENVIRONMENTAL DATA SERVICE----------NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

SOURCES OF DATA

SOURCES OF LISTINGS IN THE EARTHQUAKE DATA FILE ARE SUMARIZED BELOW. THE SOURCE IS INDICATED FOR EACH ENTRY BY A 2- OR 3-CHARACTER CODE OR ABBREVIATION; THESE ARE IDENTIFIED IN THE LIST IN APPENDIX FOUR(4). THE ORIGINAL SOURCE SHOULD BE ACKNOWLEDGED IN STUDIES USING LARGE BLOCKS OF DATA FROM THE FILE.

PRELIMINARY DETERMINATION OF EPICENTERS

THE PRINCIPAL DATA SOURCE, WHICH INCLUDES SOME 80,000 EARTHQUAKES, IS THE PRELIMINARY DETERMINATION OF EPICENTERS (PDE) PROGRAM. THIS IS A SYSTEMATIC, CONTINUING ACTIVITY INITIATED IN 1937 BY THE U.S. COAST AND GEODETIC SURVEY AND CONDUCTED SINCE 1973 BY THE U.S. GEOLOGICAL SURVEY. THE EPICENTERS ARE COMPUTED FROM ARRIVAL-TIME INFORMATION PROVIDED BY AT LEAST SEVERAL OF THE 400 OR SO COOPERATING SEISMOGRAPH STATIONS OF THE GLOBAL NETWORK. THESE STATIONS ARE OPERATED BY USGS, NOAA, OTHER GOVERNMENT AGENCIES, COLLEGES AND UNIVERSITIES, AND MANY FOREIGN INSTITUTIONS; MANY OF THEM ARE PART OF THE WORLD-WIDE NETWORK OF STANDARD SEISMOGRAPHS (WWNSS).

THE SOURCE IS NOT IDENTIFIED BY PDE IN THE FILE, BUT BY THE NAME OF THE ORGANIZATION OPERATING THE PDE PROGRAM: COAST AND GEODETIC SURVEY (C&GS), PRIOR TO 1970; NATIONAL OCEAN SURVEY (NOS), 1970 TO 1971; ENVIRONMENTAL RESEARCH LABORTORIES (ERL), 1971 TO 1973; AND GEOLOGICAL SURVEY (GS), 1973 ONWARD. PRIOR TO 1960, EPICENTERS WERE LOCATED WITH AN ACCURACY OF ABOUT 0.5 DEGREES IN LATITUDE AND LONGITUDE AND + OR -25 KM IN DEPTH. SHALLOW-FOCUS EPICENTERS WERE ASSUMED TO BE 25 KM OR 33 KM DEEP, DEPENDING ON THE TRAVEL-TIME TABLES USED IN THE COMPUTATION.

SINCE 1960, EARTHQUAKE ARRIVAL TIMES REPORTED BY COOPERATING STATIONS ARE PROCESSED ROUTINELY BY COMPUTER, WITH EXTERNAL CONTROL BY A SEISMOLOGIST. READINGS FROM A MINIMUM OF FIVE SEISMOGRAPH STATIONS ARE REQUIRED FOR AN ACCEPTABLE SOLUTION OR EPICENTER. THESE LOCATIONS ARE PUBLISHED IN INITIAL AND MONTHLY PDE PUBLICATIONS AS SOON AS SUFFICIENT DATA HAVE ACCUMULATED TO INSURE A REASONABLE DEGREE OF ACCURACY. MOST DETERMINATIONS ARE CONSIDERED ACCURATE TO A FEW TENTHS OF A DEGREE IN POSITION AND TO 25 KM IN DEPTH. (A COMPLETE DESCRIPTION OF THE PDE COMPUTER PROGRAM IS PROVIDED BY ENGDAHL AND GUNST). BODY-WAVE MAGNITUDES (MB) HAVE BEEN ROUTINELY COMPUTED SINCE APRIL 1963. SURFACE-WAVE MAGNITUDES (MS) HAVE BEEN COMPUTED AS PART OF THE PDE PROGRAM SINCE MAY 1968 WHENEVER SUFFICIENT DATA ARE AVAILABLE. IN GENERAL, THESE MAGNITUDES REPRESENT AN AVERGE OF INDIVIDUAL STATION VALUES. SIGNIFICANT DEVIATIONS FORM A COMPUTED AVERAGE ARE DELETED AND A NEW MEAN VALUE IS THEN DETERMINED. THE RESULTANT VALUES ARE PROBABLY ACCURATE TO WITHIN ABOUT 0.3 UNIT OF MAGNITUDE.

SEISMICITY OF THE EARTH AND ASSOCIATED PHENOMENA

GUTENBERG AND RICHTER DESCRIBE THE DATA TABULATED IN THEIR CLASSIC REFERENCE, SEISMICITY OF THE EARTH AND ASSOCIATED PHENOMENA. APPROXIMATELY 300 EPICENTERS FOR LARGE EARTHQUAKES, COVERING THE PERIOD 1899 THROUGH 1952, WERE ADDED TO THE EARTHQUAKE DATA FILE FROM THIS SOURCE.

SEISMICITY OF THE SOUTHERN CALIFORNIA REGION

APPROXIMATELY 16,400 EPICENTERS FROM THE REPORT BY HILEMAN, ET AL HAVE BEEN INCORPORATED IN THE EARTHQUAKE DATA FILE. THE DATA COVER THE PERIOD JANUARY 1, 1932, TO DECEMBER 31, 1972. THE REPORT IS ESSENTIALLY A LOCAL BULLETIN SUMMARY FOR THAT PERIOD DURING WHICH PERSONNEL OF THE CALIFORNIA INSTITUTE OF TECHNOLOGYS SEISMOLOGICAL LABORATORY AT PASADENA (PAS) LOCATED EARTHQUAKES IN THE SOUTHERN CALIFORNIA REGION. PRIOR TO 1961 EPICENTRAL LOCATIONS WERE ROUTINELY DETERMINED BY GRAPHICAL METHODS, USUALLY ASSUMING A FOCAL DEPTH OF 15 KM. AFTER 1961 ALL LOCATIONS HAVE BEEN DETERMINED BY COMPUTER TECHNIQUES USING LEAST-SQUARES METHODS. MANY OF THE LARGER PRE-1961 EARTHQUAKES HAVE BEEN RELOCATED USING THE LATEST COMPUTER PROGRAMS.

PAS EPICENTERS WITHIN THEIR LOCAL NETWORK GENERALLY ARE PREFERRED OVER THOSE PUBLISHED IN THE PDE AND UNITED STATES EARTHQUAKES REPORTS. THEY OVERLAP WITH 2,400 EPICENTERS FROM OTHER SOURCES AND ARE DESIGNATED AS PREFERRED.

CATALOGUE OF EARTHQUAKES IN NORTHERN CALIFORNIA AND ADJOINING AREAS

APPROXIMATELY 10,400 EARTHQUAKES FROM THE REPORT BY BOLT AND MILLER HAVE BEEN INCORPORATED IN THE EARTHQUAKE DATA FILE. THE DATA COVER THE PERIOD JANUARY 1, 1910, TO DECEMBER 31, 1972. THE REPORT IS ESSENTIALLY A LOCAL BULLETIN SUMMARY FOR THAT PERIOD DURING WHICH PERSONNEL OF THE UNIVERSITY OF CALIFORNIA SEISMOGRAPHIC STATIONS AT BERKELEY (UCB) LOCATED EARTHQUAKES IN NORTHERN CALIFORNIA AND ADJOINING AREAS. IT INCORPORATES MODIFICATIONS AND ADDITIONAL OBSERVATIONS THAT HAVE BEEN MADE SINCE THE TIME OF PUBLICATION OF THE ORIGINAL BULLETINS.

BRK EPICENTERS ARE PREFERRED IN THE AREA OF THEIR NETWORK OVER APPROXIMATELY 2,900 EPICENTERS ORIGINALLY PUBLISHED IN THE PDE AND UNITED STATES EARTHQUAKES REPORTS. DIFFERENCES FROM EARLIER DATA OF UP TO ABOUT 0.2 DEGREES OF LATITUDE AND LONGITUDE SHOULD BE CONSIDERED WITHIN NORMAL LIMITS OF ERROR.

EARTHQUAKE HISTORY OF THE UNITED STATES

THIS SUMMARY OF SIGNIFICANT EARTHQUAKES, REVISED BY COFFMAN AND VON HAKE(1973), HAS PROVIDED MOST OF THE PRE-1928 U.S. DATA NOW INCLUDED IN THE EARTHQUAKE DATA FILE. THE GEOGRAPHIC LOCATIONS LISTED ARE GIVEN TO THE NEAREST TENTH OF A DEGREE AND USUALLY REPRESENT THE TOWN WHERE THE HIGHEST INTENSITY OCCURRED. PRIOR TO 1897, THESE LOCATIONS SHOULD NOT BE CONSIDERED TO BE EPICENTERS, AS INSTRUMENTAL DATA ARE NOT AVAILABLE FOR THAT PERIOD. ONLY THOSE EARTHQUAKES FOR THE PERIOD 1638-1928 (ABOUT 900) HAVE BEEN INCORPORATED IN THE DATA FILE, BECAUSE POST-1927 DATA HAVE BEEN INCLUDED FROM OTHER, MORE DETAILED SOURCES.

UNITED STATES EARTHQUAKES

MUCH OF THE FELT DATA INCORPORATED IN THE EARTHQUAKE DATA FILE (INCLUDING INTENSITY, ASSOCIATED PHENOMENA, AND CULTURAL EFFECTS) AND SOME INSTRUMENTAL DATA HAVE BEEN EXTRACTED FROM THE UNITED STATES EARTHQUAKES REPORTS, PUBLISHED ANNUALLY BY THE COAST AND GEODETIC SURVEY AND SUCCESSOR ORGANIZATIONS FROM 1928 THROUGH 1972 AND JOINTLY BY NOAA/USGS THEREAFTER.

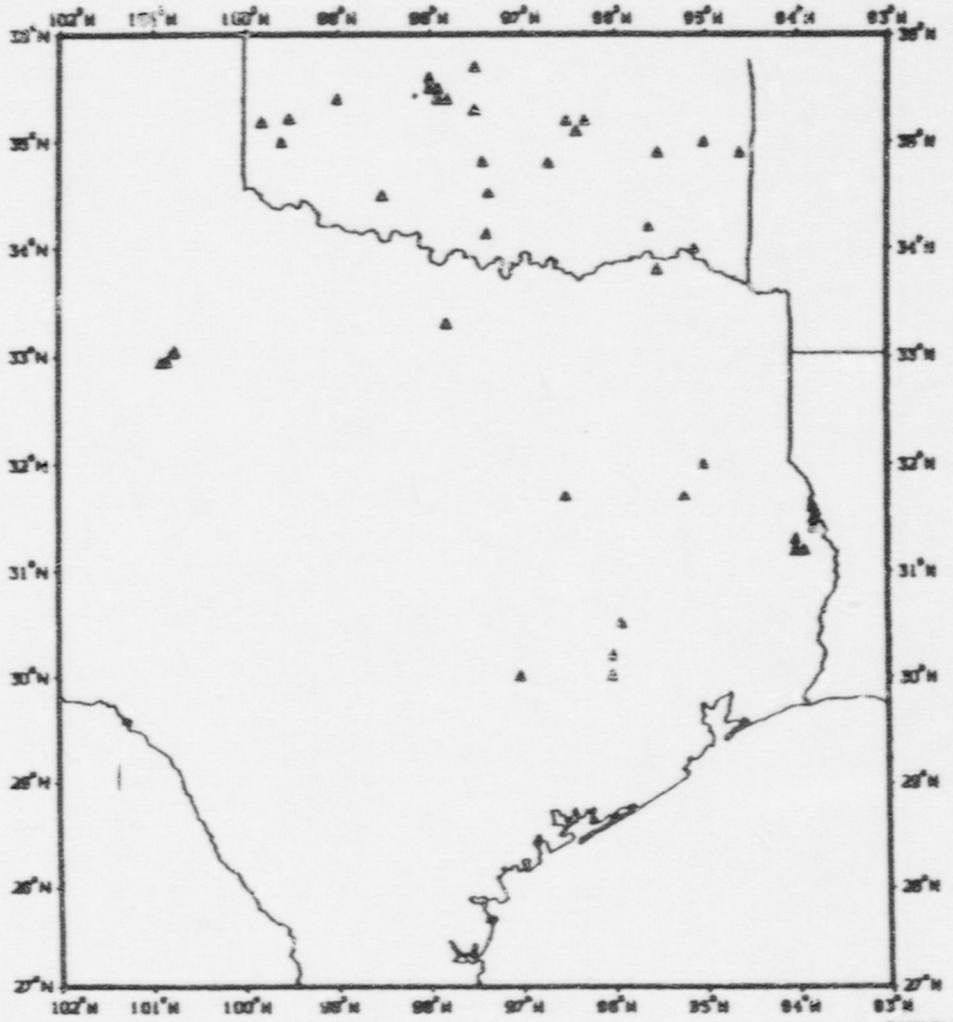
CATALOG OF EARTHQUAKES ALONG THE SAN ANDREAS FAULT SYSTEM IN CENTRAL CALIFORNIA

A MICROEARTHQUAKE NETWORK BETWEEN HOLLISTER AND SAN FRANCISCO HAS BEEN OPERATED SINCE 1969 BY THE U.S. GEOLOGICAL SURVEY, MENLO PARK, CALIF. APPROXIMATELY 14,500 EPICENTERS HAVE BEEN DETERMINED FOR THE PERIOD 1969-1973. THESE DATA WILL BE INCLUDED IN THE EARTHQUAKE DATA FILE IN THE NEAR FUTURE. A DESCRIPTION OF THE ORIGINAL NETWORK IS PUBLISHED IN EATON, ET AL. A SERIES OF ANNUAL AND QUARTERLY CATALOGS HAVE BEEN PUBLISHED AS OPEN-FILE REPORTS BY THE U.S. GEOLOGICAL SURVEY.

OTHER SOURCES

ADDITIONAL SOURCES UTILIZED IN DEVELOPING THE EARTHQUAKE DATA FILE INCLUDE MONTHLY PUBLICATIONS OF THE BUREAU CENTRAL INTERNATIONAL DE SEISMOLOGIE, STRASBURG, FRANCE, FOR THE PERIOD 1950-1961 AND THE INTERNATIONAL SEISMOLOGICAL SUMMARY, KEW, ENGLAND, FOR 1950-1959. DATA FROM THESE SOURCES FOR OTHER TIME PERIODS WILL BE ADDED TO THE FILE IN THE FUTURE.

A MORE COMPLETE DESCRIPTION OF THE EARTHQUAKE DATA FILE IS CONTAINED IN KEY TO GEOPHYSICAL RECORDS DOCUMENTATION NO. 5, EARTHQUAKE DATA FILE SUMMARY, BY MEYERS AND VON HAKE (NOAA,EDS,NGSDC,BOULDER,CO 80303)



NGSDC/EDIS/NOAA BOULDER, COLORADO

60 EARTHQUAKES PLOTTED

80/09/22. 16.20.32.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
ENVIRONMENTAL DATA AND INFORMATION SERVICE
National Geophysical and Solar-Terrestrial Data Center
Boulder, Colorado 80303

THE EARTHQUAKE DATA FILE NOW CONTAINS *PRELIMINARY DETERMINATION OF EPICENTERS* DATA THROUGH DECEMBER 1979. TOTAL FILE CONTAINS 162,391 EVENTS (UNITED STATES SINCE 1638; WORLDWIDE SINCE 1897).

EARTHQUAKE DATA FILE - ADDITIONAL SOURCE CODES

USN "Catalog of Historical U. S. Earthquakes" Appendix A, Guidelines for Developing Design Earthquake Response Spectra (Technical Report M-114, Construction Engineering Research Laboratory, P. O. Box 4005, Champaign, IL 61820, 1975) - Many of these data are extracted from the annual reports, "United States Earthquakes" (See SOURCES OF DATA). The location listed for these events is usually the position of the place where the highest intensity was reported.

EARTHQUAKE DATA FILE

Abbreviations used -

Source:

ADK Adak, AK, USA
AEC U.S. Atomic Energy Commission
ALG Algiers, Algeria
ALI Alicante, Spain
ALM Almeria, Spain
ALQ Albuquerque, NM, USA
APA Apatity, RSFSR, USSR
API Apia, Samoa Is.
ATH Athens Observatory, Greece
BCI Bureau Central International de Séismologie, Strasbourg, France
BLA Blacksburg, VA, USA
BNS Bensberg, Federal Republic of Germany
BOG Bogota, Colombia
BRA Bratislava, Czechoslovakia
BRK Berkeley (Haviland), CA, USA
BSS *Bulletin of the Seismological Society of America*
BUC Bucharest, Romania
BUL Bulawayo, Rhodesia
CAN Canberra, Australian Capital Territory, Australia
CAR Caracas, Venezuela
CFR Charles F. Richter (see Richter, 1958, in References)
CGS Coast and Geodetic Survey
CHC Chapel Hill, NC, USA
CLL Collmberg, German Democratic Republic
DJA Djakarta, Java, Indonesia
EQH *Earthquake History of the United States* (see References)
ERL Environmental Research Laboratories
G-R Gutenberg-Richter (see Gutenberg and Richter, 1954, in References)
GOL Golden (Bergen Park), CO, USA
GS U.S. Geological Survey, Denver, CO, USA
HEL Helsinki, Finland
HRB Hurbanovo, Czechoslovakia
HVO Hawaiian Volcano Obsy., Hawaii National Park, HI, USA
ISK Istanbul-Kandilli, Turkey
ISS International Seismological Summary, Kew, England, UK
IST Istanbul, Turkey
JER Jerusalem, Israel
JMA Japan Meteorological Agency, Tokyo, Japan
JOH Johannesburg, South Africa
KAR Karachi, Pakistan
KEW Kew, England, UK
KIR Kiruna, Sweden
LEM Lembang, Java, Indonesia
LIS Lisbon, Portugal
LJU Ljubljana, Yugoslavia
LWI Lwiro, Zaire
MAL Malaga, Spain
MAN Manila, Philippines
MAT Matsushiro, Honshu, Japan
MER Merida, Mexico
MOS Moscow, RSFSR, USSR
MOX Moxa, German Democratic Republic
NES Northeastern Seismological Association, Weston, MA, USA
NOS National Ocean Survey
NOU Noumea, New Caledonia
NRR North Reno, NV, USA
OAX Oaxaca, Mexico
OBM Ulan Bator, Mongolia
OTT Ottawa, Ontario, Canada
OXF Oxford, MS, USA
PAL Palisades, NY, USA
PAS Pasadena, CA, USA
PDE *Preliminary Determination of Epicenters*
PEK Peking, China
PET Petropavlovsk, RSFSR, USSR
PMG Port Moresby, Papua
PMR Palmer, AK, USA
PRA Praha (Prague), Czechoslovakia

PRU Pruhonice, Czechoslovakia
QUE Quetta, Pakistan
RAC Raciborz, Poland
REY Reykjavik, Iceland
RIV Riverview, New South Wales, Australia
RMP Rome (Monte Porzio Catone), Italy
ROM Rome, Italy
SAN Santiago, Chile
SEA Seattle, WA, USA
SHI Shiraz, Iran
SHL Shillong, India
SLM St. Louis, MO, USA
SNM Socorro, NM, USA
SSS San Salvador, El Salvador
STR Strasbourg, France
STU Stuttgart, Federal Republic of Germany
SYK Sykes (see References)
TAC Tacubaya, Mexico
TEH Teheran, Iran
TOC Tocklai, India
TRI Trieste, Italy
TRN Trinidad, Trinidad, W.I.
TUL Tulsa, OK, USA
UCC Uccle, Belgium
UGL Uglegorsk, RSFSR, USSR
UPP Uppsala, Sweden
USE *United States Earthquakes*
VIC Victoria, British Columbia, Canada
WAR Warsaw, Poland
WEL Wellington, New Zealand
YSS Yuzhno-Sakhalinsk, RSFSR, USSR
ZUR Zurich, Switzerland

Date and origin time in Universal (Greenwich) Time.

Authority (follows origin time):

A Parameters of explosion supplied by U.S. Atomic Energy Commission (AEC).
B Parameters of hypocenter supplied by University of California at Berkeley.
E Some or all parameters of explosion (controlled or accidental) supplied by any group or individual other than AEC.
G Parameters of hypocenter supplied by the U.S. Geological Survey (USGS) for any area other than Island of Hawaii.
H Parameters of hypocenter supplied by the USGS Hawaiian Volcano Observatory.
J Parameters of hypocenter supplied by St. Louis University.
L Parameters of hypocenter supplied by Lamont-Doherty Geological Observatory.
M Hypocenter based on macroseismic information.
P Parameters of hypocenter supplied by California Institute of Technology.
R Parameters of hypocenter supplied by University of Nevada.
S An NEIS solution based on use of dense local networks, a local crustal model, or other methods not routinely applied by NEIS.
U Parameters of hypocenter supplied by University of Utah.
V Parameters of hypocenter supplied by Virginia Polytechnic Institute and State University.
W Parameters of hypocenter supplied by University of Washington.
X Time not reported.
Z Noninstrumental time and location.
* Second-order hypocenter determination by CGS/NOS/ERL/GS using incomplete or less reliable data.

Depth control: A, assigned; D, restrained to agree with reported depth phases; G, restrained by geophysicist; N, restrained at normal depth (33 km) when data are not sensitive to depth for a shallow focus.

Magnitudes: See source codes. Surface Wave, SH = Horizontal components used.

Int (intensity) map: BSS, *Bulletin of the Seismological Society of America;* EQN, *Earthquake Notes;* PDE, *Preliminary Determination of Epicenters;* USE, *United States Earthquakes.*

Intensity: Maximum in Modified Mercalli (MM) scale or converted to MM scale.

Phenomena:

D	Diastrophism	- F, surface faulting; U, uplift/subsidence; D, faulting and uplift/subsidence.
T	Tsunami	- T, tsunami generated; Q, possible tsunami.
S	Seiche	- S, seiche; Q, possible seiche.
V	Volcanism	- V, earthquake associated with volcanism.
N	Nontectonic	- C, coal bump or rockburst in coal mine; E, explosion, accidental, controlled, or suspected explosion; I, collapse; L, lights or other such visual phenomena seen; M, meteoritic source; R, rockburst.
O	Waves generated	- A, acoustic wave; G, gravity wave; B, both A & G; T, T-wave.

Region number (RN): Geographic region number as describe[illegible]gdahl, and Hill.

Cultural Effects (CE): C, casualties; D, damage; F, felt.

Quality/Number of Stations (Q/S): Quality indicators are usually on an A, B, C, or D basis (A-very accurate; B-good; C-fair; D-poor). When used in combination for deep shocks (e.g. BBA) these represent the accuracy of (in order) epicenter, origin time, and depth.

Marsden/Degree Square (MAR DG): Numbering system dividing the world into 10° squares (MAR) and 1° subsquares (DG). Complete Earthquake Data File available sorted by this method.

REFERENCES

Bolt, Bruce A. and Roy D. Miller, *Catalogue of Earthquakes in Northern California and Adjoining Areas 1 January 1910-31 December 1972,* Seismographic Stations, University of California, Berkeley, 1975.

Coffman, Jerry L. and Carl A. von Hake, *Earthquake History of the United States, Publication 41-1, Revised Edition (Through 1970),* National Oceanic and Atmospheric Administration, Environmental Data Service, 1973.

Engdahl, Eric R. and Robert H. Gunst, "Use of a High Speed Computer for the Preliminary Determination of Earthquake Hypocenters," *Bulletin of the Seismological Society of America,* vol. 56, no. 2, April 1966.

Flinn, Edward A., E.R. Engdahl, and Alan R. Hill, *Bulletin of the Seismological Society of America*, vol. 64, no. 3, Part II, June 1974.

Gutenberg, B. and C.F. Richter, *Seismicity of the Earth and Associated Phenomena*, Princeton University Press, 1954 (Second Edition), Hafner Publishing Company, 1965, Facsimile Edition.

Hileman, James A., Clarence R. Allen, and John M. Nordquist, *Seismicity of the Southern California Region 1 January 1932 to 31 December 1972*, Seismological Laboratory, California Institute of Technology, Pasadena, 1973.

Richter, Charles F., *Elementary Seismology*, W.H. Freeman and Company, 1958.

Sykes, Lynn R., various papers in *Bulletin of the Seismological Society of America* and *Journal of Geophysical Research*.

Wood, Harry O. and Frank Neumann, Modified Mercalli Intensity Scale of 1931, *Bulletin of the Seismological Society of America*, vol. 21, no. 4, 283, December 1931.

DIST (far right column on printouts) is the distance in kilometers between the earthquake location and the designated point for radius searches.