SLAC-CN--246

DE84 011755

SINGLE PASS COLLIDER MEMO | CN-246

AUTHOR: K. L. Werner | DATE: 9/12/83 | REPLACES CN-

TITLE: GROUND MOTION - FREQUENCY OF OCCURANCE VERSUS AMPLITUDE OF DISTURBING TRANSIENT EVENTS

I INTRODUCTION

Successful collider operation requires that ground motion not exceed certain tolerances.[1] In this note it is pointed out that on occasion these tolerances are exceeded. The frequency of such events and their amplitudes, measured as a function of time of day, have been measured. An examination of the data leads one to conclude that most events are of cultural (i.e., man-made) origin.

II METHOD

In order to analyze the on-site disturbances during an average 24 hour period, two instruments were used to detect the ground vibrations.

1) A velocity sensitive horizontal long-period seismometer that detects the North-West component. This instrument was so mounted in order to minimize the vibrations from the two air compressors in building 023.
2) A vertical velocity transducer (L-4) to detect vertical disturbances.

The instruments where located at grade level near the vacuum assembly building 031.

DISCLAIMER

A simple schematic diagram of the experimental set-up is shown on figure A. Either instrument "1" or "2" could be selected as the input signal, that was passed through an intergrator to a "true reading" rms voltmeter thus yeilding an output proportional to displacement. The set-up was calibrated using a signal generator as the input signal and an oscilloscope.

III DATA

Figures: B,C,D,E,F,G,H,I,J --- depict the results for horizontal motion.

Figures: K,L,M,N,O,P,Q,R,S --- vertical motion.

IV DISCUSION

A) HORIZONTAL

It can be noted that higher peak to peak displacement amplitudes occur more often during the time span of 6 am to 6 pm on weekdays than between 6 pm and 6 am. One is therefore lead to conclude that these disturbances are correlated with working hours. Further evidence attesting to this conclusion is the fact that the weekend data are simular to night data.
In all figures a noticiable disturbance at 0.45 microns is seen. This is due to the two air compresores in building 023 that appear to beat against each other. Disturbances below 0.4 microns are therefore unfortunatly masked by constant running machinery. Figure J summarizes the diurnal nature of these events.

B) VERTICAL

The time of day nature of the occurrence of vertical disturbances is very simular to that of the horizontal (See Figure S.) In general, however, both in amplitude and in frequency of occurrence, vertical disturbances are considerably greater. This is probably due to the way cultural occurrences couple to the ground.

V CONCLUSION

On the bases of these above ground measurments, one might conclude that vibration level tolerances, are exceeded at a rate of approximetly once per minute.

VI SOME EXTRAORDINARY EVENTS

During this study, three earthquakes were recorded. They all occured in the same general location - Coalinga, CA. These disturbances do not fall into the "cultural" classification but are nevertheless of interest.

Figure T shows a quake registering 5.1 on the Richter scale, located ~ 230 km South of the S.L.A.C. site. A horizontal displacement of 2.6 microns was observed. On figure U we have two other quakes of magnitude 5.9 and 4.7 displayed on a different apparatus. Although the first event drives the needle off scale, the difference in the arrival time between the P and S waves is clearly evident and consistant with the known distance from the source.

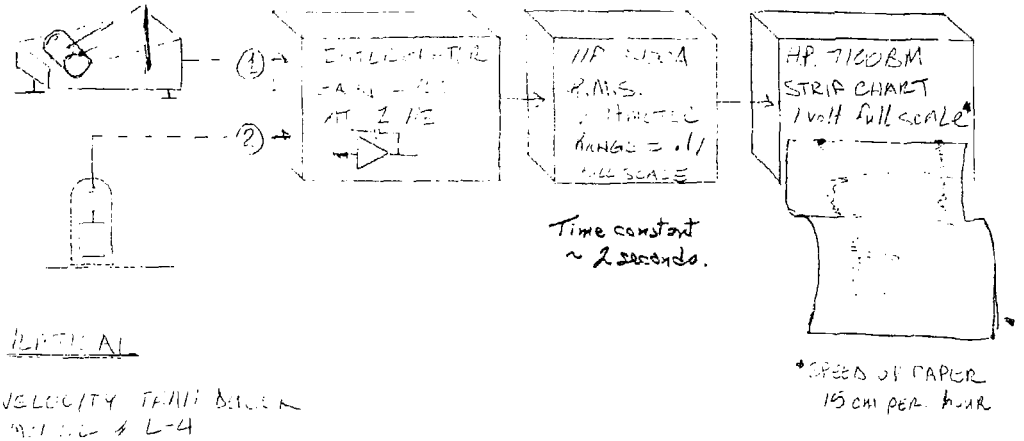
REFERENCES

1. Recommendations For On-Site Vibration Standards, G. Fischer, CN-236, 6/16/83.

2. Earthquakes: A Primer, B. A. Bell, W. H. Freeman and Co., San Francisco. © 1978.

EXPERIMENTAL SET UP

HORIZONTAL
LONG-PENDULUM [illegible]
MODEL # SL-620

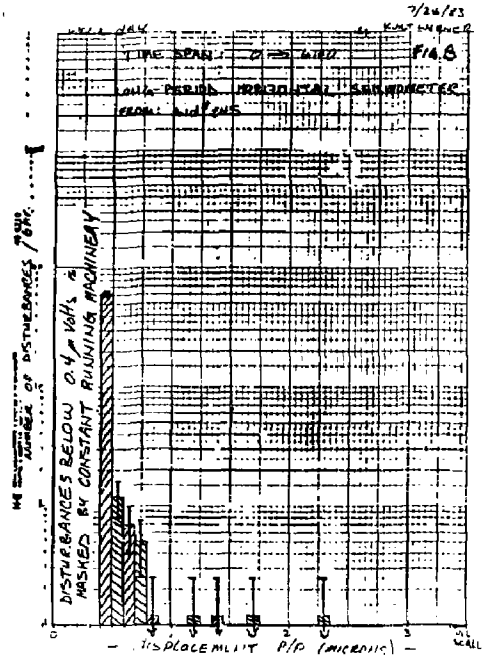


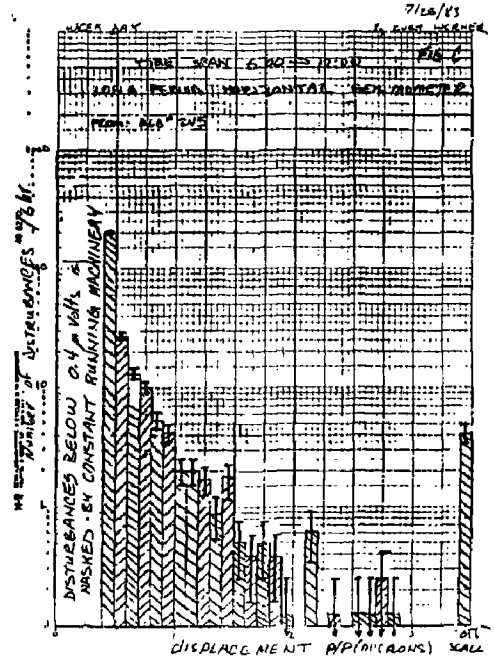
VERTICAL

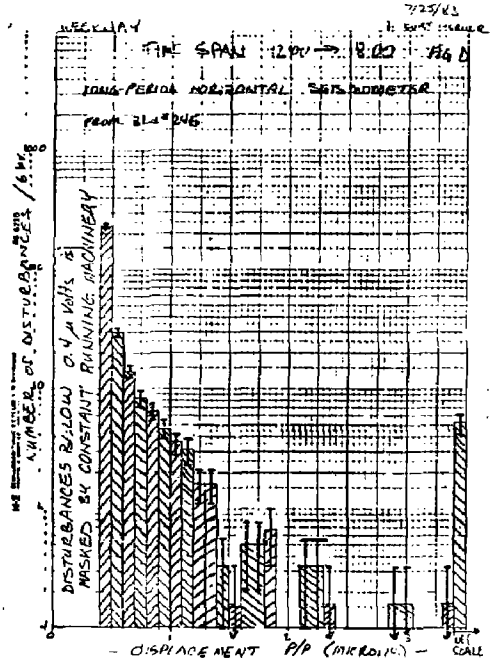
VELOCITY TRAVERSING DEVICE
MODEL # L-4

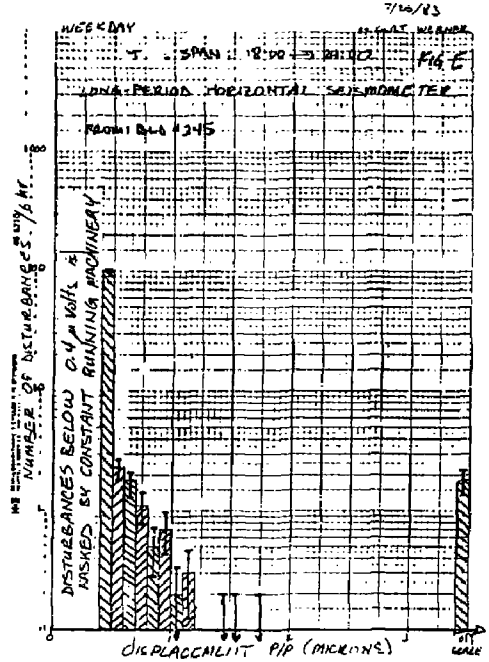
Note: either (1) or (2) as used

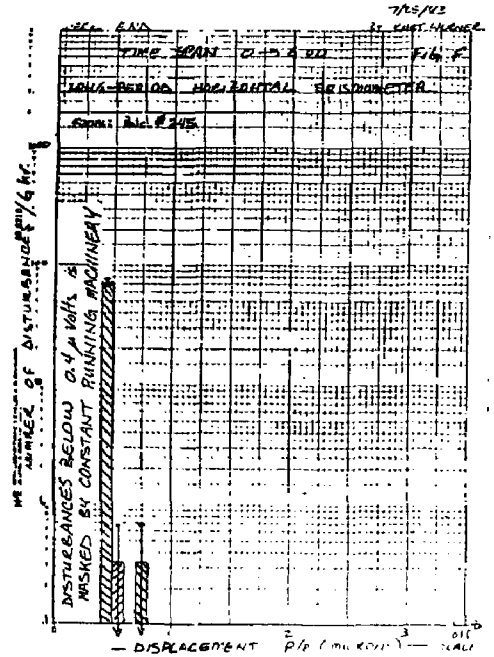
Fig. A

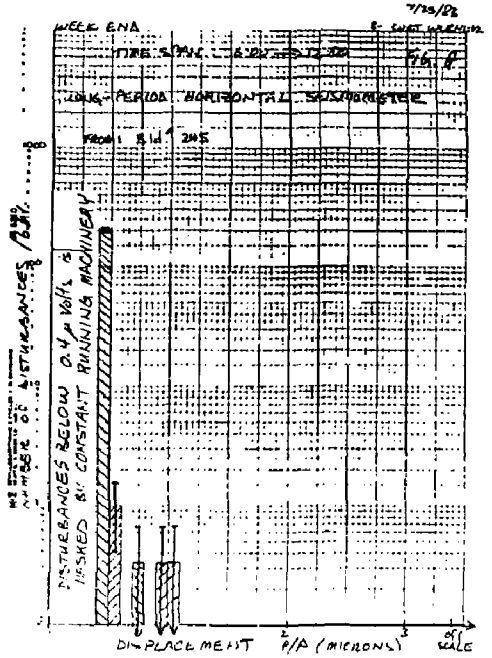

7/26/83
TIME SPAN: 0 ⇒ 6:00
FIG 8
LONG PERIOD HORIZONTAL SEISMOMETER
FROM: 214 & 245
DISTURBANCES BELOW 0.4 μ VOLTS AS MASKED BY CONSTANT RUNNING MACHINERY
NUMBER OF DISTURBANCES /6 HR.
DISPLACEMENT P/P (MICRONS)
FULL SCALE

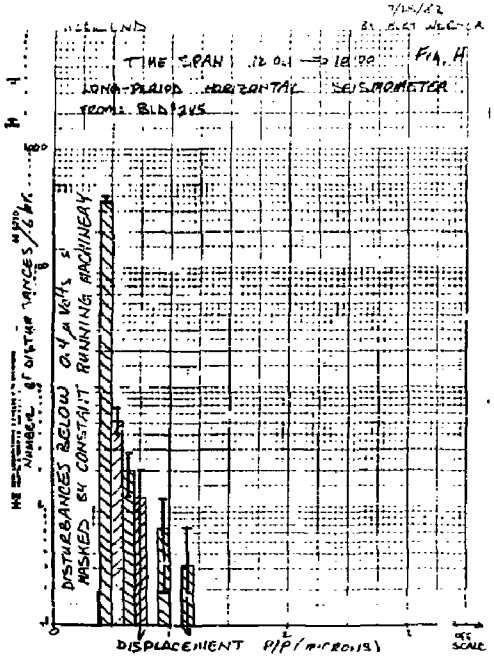

7/26/83
TIME SPAN 6:00 ⇒ 12:00
FIG 7
LONG PERIOD HORIZONTAL SEISMOMETER
FROM: 214 & 245
DISTURBANCES BELOW 0.4 μ VOLTS AS MASKED BY CONSTANT RUNNING MACHINERY
NUMBER OF DISTURBANCES /6 HR.
DISPLACEMENT P/P (MICRONS)
FULL SCALE

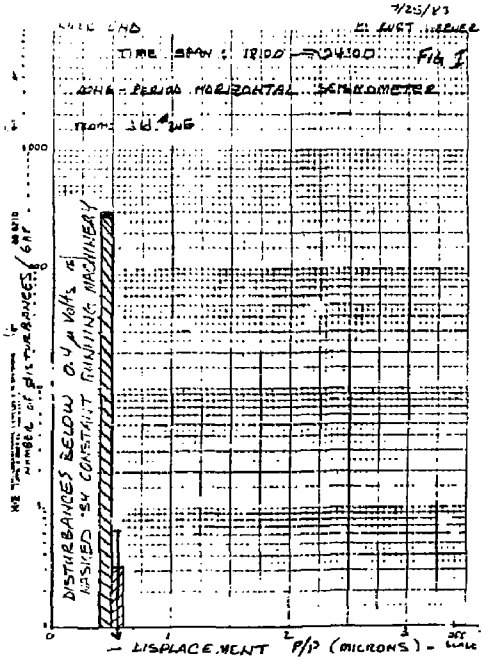

7/25/83
TIME SPAN 12:00 ⇒ 18:00
FIG 9
LONG PERIOD HORIZONTAL SEISMOMETER
FROM 214 & 245
DISTURBANCES BELOW 0.4 μ VOLTS AS MASKED BY CONSTANT RUNNING MACHINERY
NUMBER OF DISTURBANCES /6 HR.
DISPLACEMENT P/P (MICRONS)
FULL SCALE


7/26/83
TIME SPAN 18:00 ⇒ 24:00
FIG 6
LONG PERIOD HORIZONTAL SEISMOMETER
FROM: 214 & 245
DISTURBANCES BELOW 0.4 μ VOLTS AS MASKED BY CONSTANT RUNNING MACHINERY
NUMBER OF DISTURBANCES /6 HR.
DISPLACEMENT P/P (MICRONS)
FULL SCALE

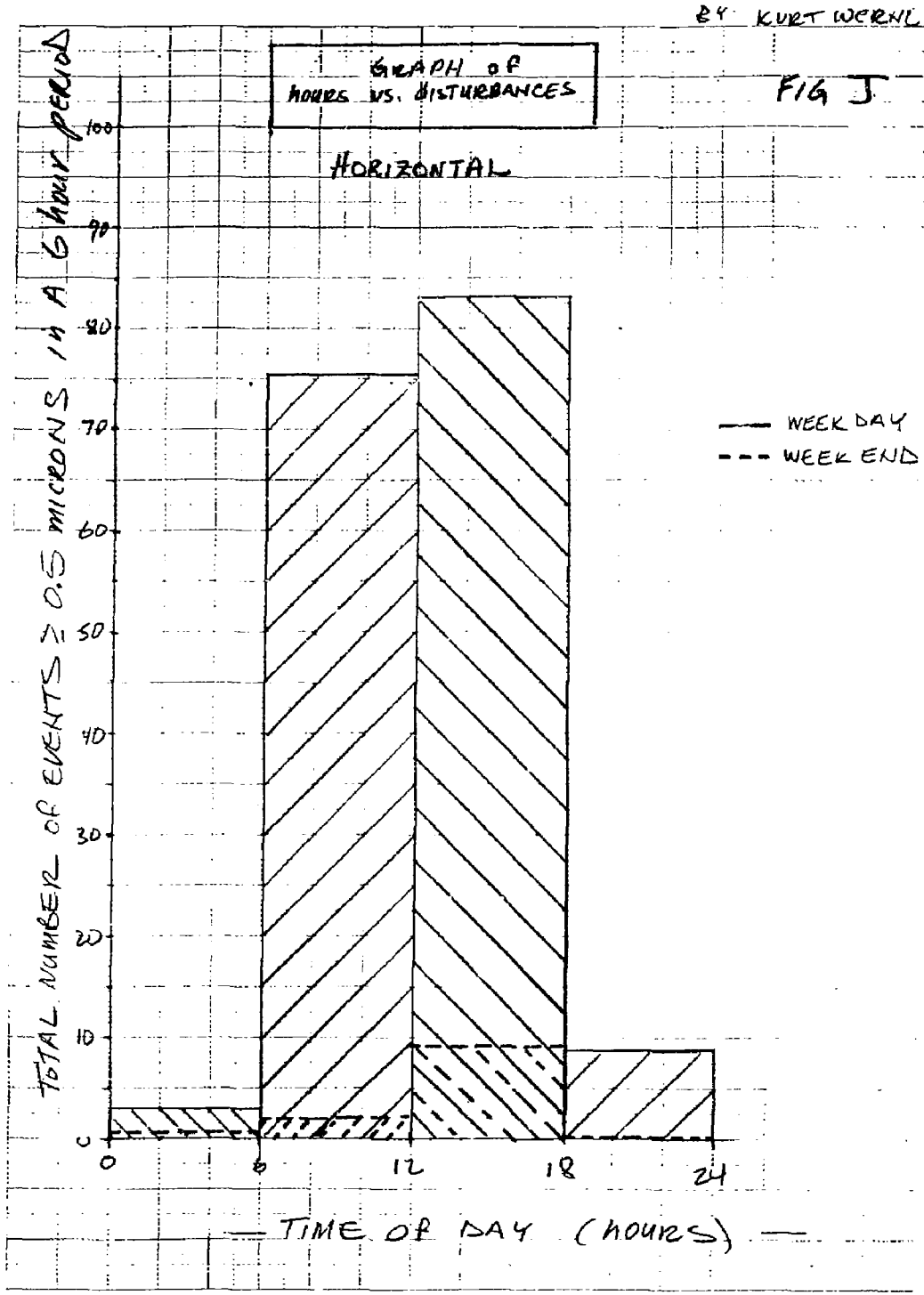

WEEK END
TIME SPAN 0.1 → 6.00
FIG. F
LONG-PERIOD HORIZONTAL SEISMOMETER
FROM: BLD # 245
DISTURBANCES BELOW 0.4 μ VOLTS IS MASKED BY CONSTANT RUNNING MACHINERY
NUMBER OF DISTURBANCES PER 1/4 HR.
DISPLACEMENT P/P (MICRONS)
SCALE

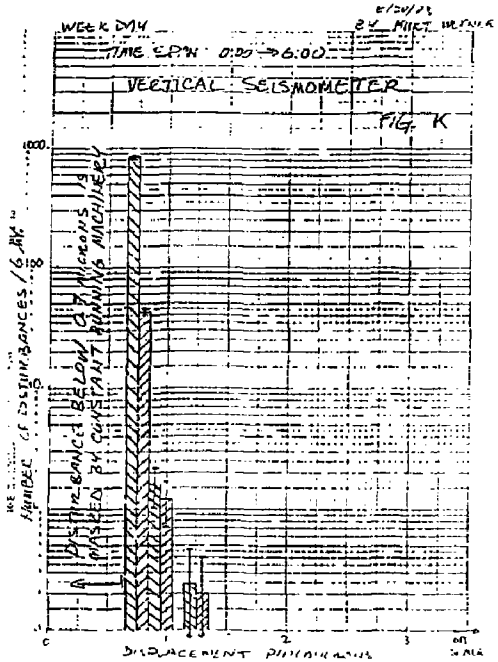

WEEK END
TIME SPAN 6.00 → 12.00
FIG. G
LONG-PERIOD HORIZONTAL SEISMOMETER
FROM: BLD # 245
DISTURBANCES BELOW 0.4 μ VOLTS IS MASKED BY CONSTANT RUNNING MACHINERY
NUMBER OF DISTURBANCES PER 1/4 HR.
DISPLACEMENT P/P (MICRONS)
SCALE

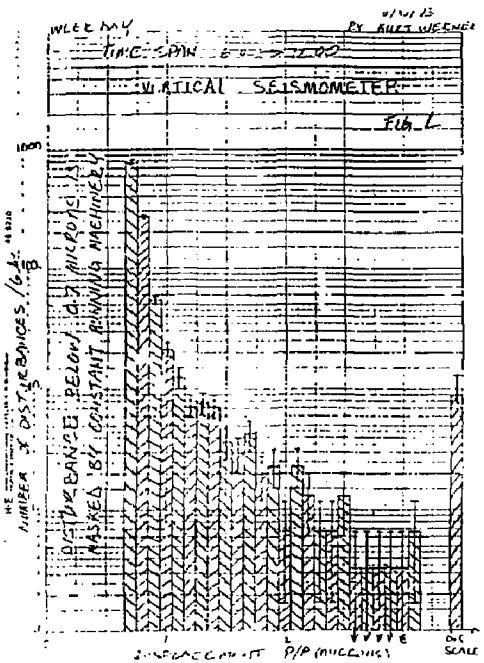

WEEK END
TIME SPAN 12.00 → 18.00
FIG. H
LONG-PERIOD HORIZONTAL SEISMOMETER
FROM: BLD # 245
DISTURBANCES BELOW 0.4 μ VOLTS IS MASKED BY CONSTANT RUNNING MACHINERY
NUMBER OF DISTURBANCES PER 1/4 HR.
DISPLACEMENT P/P (MICRONS)
SCALE

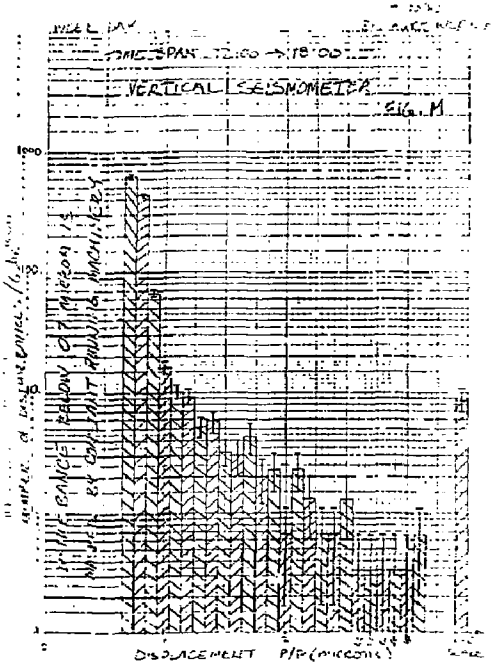

WEEK END
TIME SPAN 18.00 → 24.00
FIG. I
LONG-PERIOD HORIZONTAL SEISMOMETER
FROM: BLD # 245
DISTURBANCES BELOW 0.4 μ VOLTS IS MASKED BY CONSTANT RUNNING MACHINERY
NUMBER OF DISTURBANCES PER 1/4 HR.
DISPLACEMENT P/P (MICRONS)
SCALE

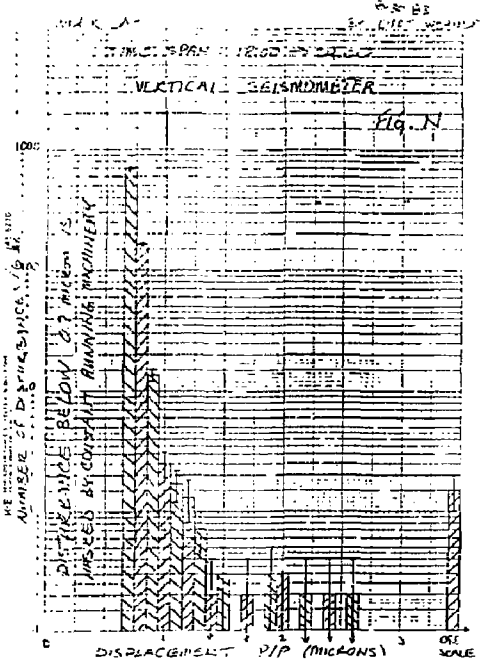
BY KURT WERNLE

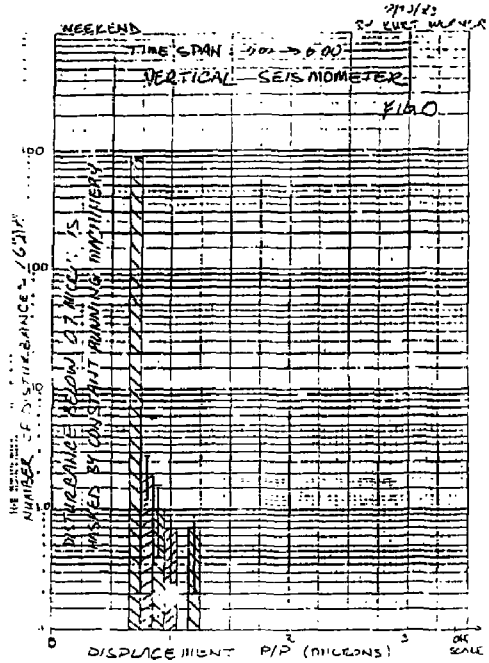


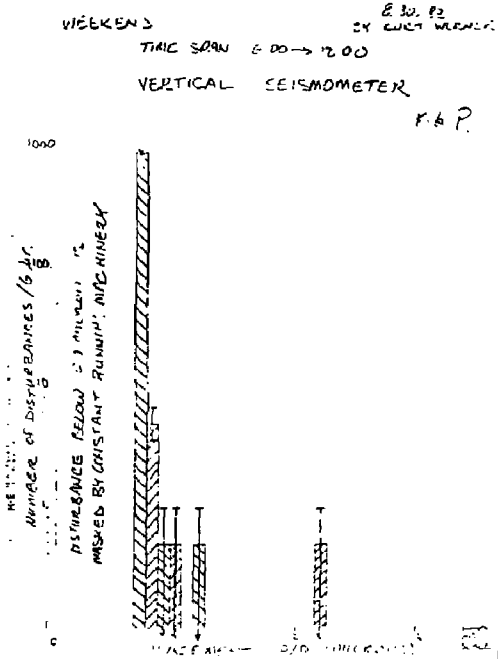

WEEK DAY
TIME SPAN 0:00 → 6:00
VERTICAL SEISMOMETER
FIG. K
DISTURBANCES BELOW 0.7 MICRONS MASKED BY CONSTANT RUNNING MACHINERY
DISPLACEMENT P/P (MICRONS)

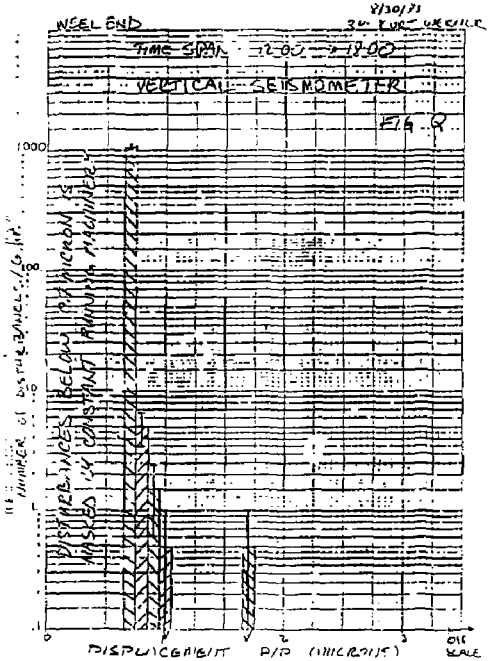

WEEK DAY
TIME SPAN 6:00 → 12:00
VERTICAL SEISMOMETER
Fig. L
DISTURBANCES BELOW 0.7 MICRONS MASKED BY CONSTANT RUNNING MACHINERY
DISPLACEMENT P/P (MICRONS)

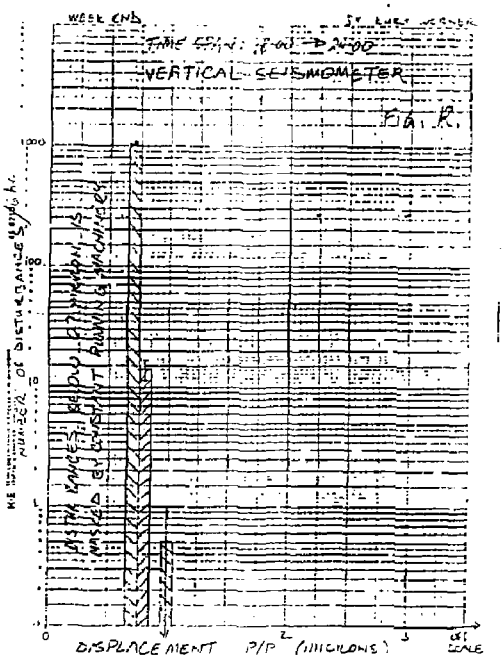

TIME SPAN 12:00 → 18:00
VERTICAL SEISMOMETER
Fig. M
DISTURBANCES BELOW 0.7 MICRONS MASKED BY CONSTANT RUNNING MACHINERY
DISPLACEMENT P/P (MICRONS)


TIME SPAN 18:00 → 24:00
VERTICAL SEISMOMETER
Fig. N
DISTURBANCES BELOW 0.7 MICRONS MASKED BY CONSTANT RUNNING MACHINERY
DISPLACEMENT P/P (MICRONS)


WEEKEND
TIME SPAN 6:00 → 6:00
VERTICAL SEISMOMETER
FIG O.
DISPLACEMENT P/P (MICRONS)


WEEKEND
TIME SPAN 6:00 → 12:00
VERTICAL SEISMOMETER
FIG P


WEEKEND
TIME SPAN 12:00 → 18:00
VERTICAL SEISMOMETER
FIG Q
DISPLACEMENT P/P (MICRONS)


WEEK END
TIME SPAN 18:00 → 24:00
VERTICAL SEISMOMETER
FIG R.
DISPLACEMENT P/P (MICRONS)

6/5/18
BY: KURT WERNER

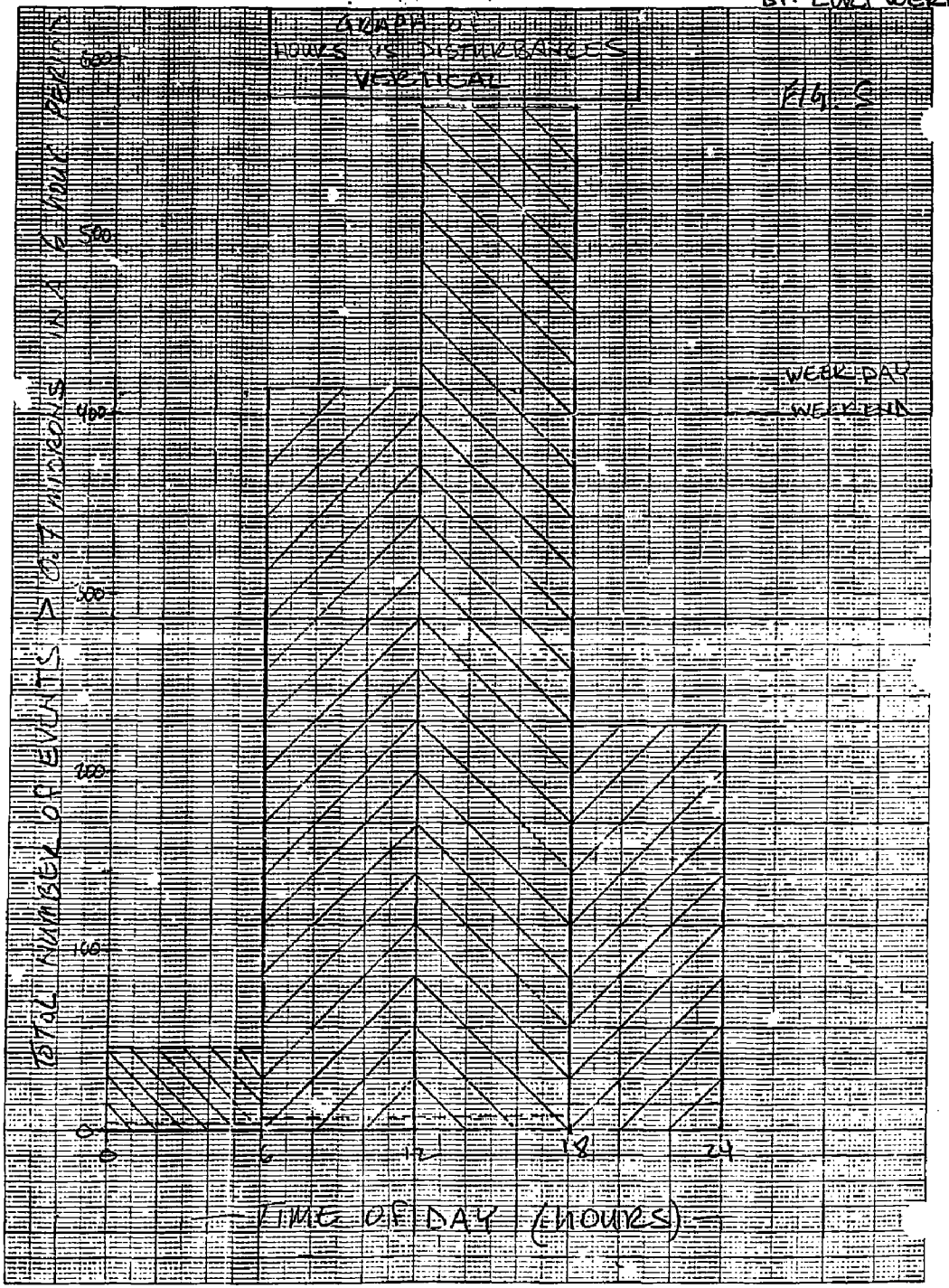
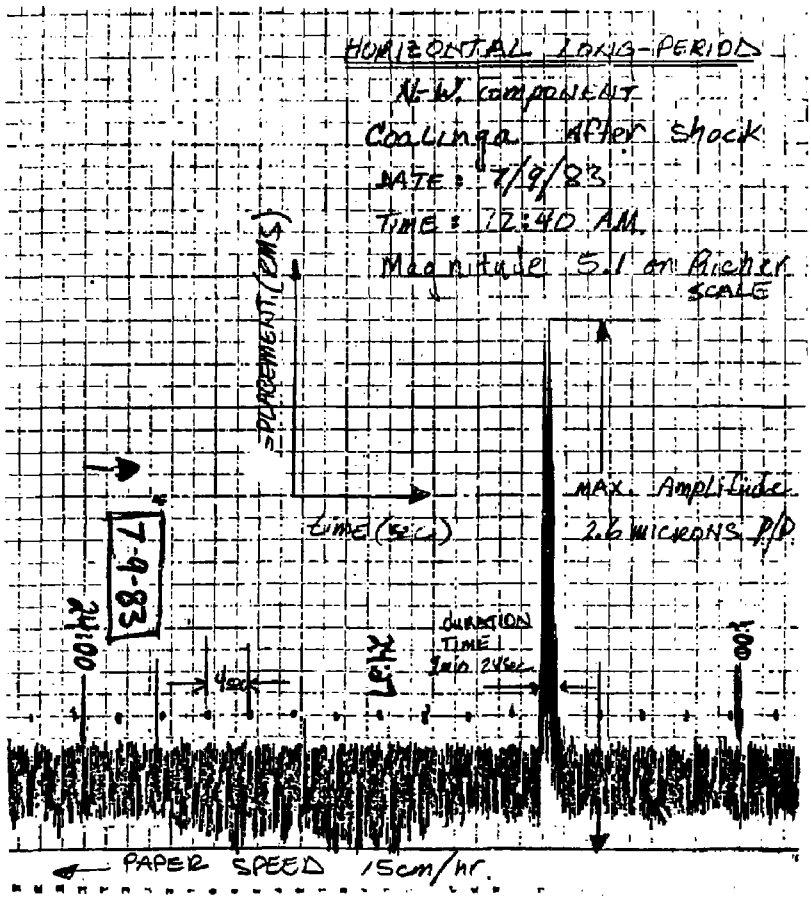
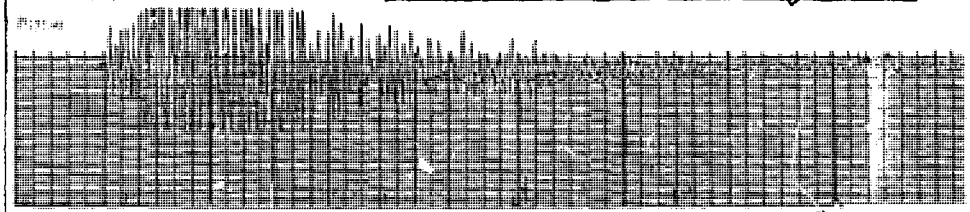


FIG. T


HORIZONTAL LONG-PERIOD
N-W. COMPONENT
Coalinga After Shock
DATE: 7/9/83
TIME: 12:40 AM.
Magnitude 5.1 on Richter SCALE
DISPLACEMENT (CMS)
TIME (SEC)
MAX. AMPLITUDE
2.6 MICRONS P/P
7-9-83
24:00
4SEC
DURATION TIME 3min 24sec
00:00
PAPER SPEED 15cm/hr.

Event A M = 5.9

COALINGA EVENTS July 21 1983



7-22-83 9:37.40

P-S=26sec

Max Amplitude –

P-S=26sec = 130KM (Max Amplitude 5.5mm on long period Horiz.

Event B, m = 4.1 = ½ sensitivity of "Standard Instrument" N-W component)

FIG. U