



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

FEB 11 1980

MEMORANDUM FOR: Robert E. Jackson, Chief
Geosciences Branch, DSS

THRU: *RB McMullen for*
Leon Reiter, Leader
Geology and Seismology Section
Geosciences Branch, DSS

FROM: Robert L. Rothman, Geophysicist
Geology and Seismology Section
Geosciences Branch, DSS

SUBJECT: SEISMOLOGICAL INPUT PARAMETERS FOR USE IN ARMY
CORPS OF ENGINEERS (COE) GEOTECHNICAL REVIEW
OF MIDLAND 1 AND 2

The studies to evaluate the soil liquefaction and stability of the Midland site, under dynamic loading, should be conducted using values of acceleration in the range of 0.12g to 0.19g at the ground surface.

This range is encompassed by magnitude 5.0 to 5.5 earthquakes at a distance of 10 to 20 kilometers from the site. The enclosure is a list of strong motion records which are considered appropriate for use as time history input for this study.

Robert L. Rothman

Robert L. Rothman, Geophysicist
Geology and Seismology Section
Geosciences Branch, DSS

Enclosure:
As stated

cc: w/enclosure
L. Reiter
T. Cardone
R. McMullen
R. Rothman
P. Sobel
J. Greeves
J. Kane

Midland Range
 Mag 5
 0.12

Mag 5.5
 0.19

? Rock records to be used for Midland project to evaluate soil amplification. Max acceleration at top of rock?

Time History

+EARTHQUAKE		Recording Site				Reference Information			
LOCATION	DATE	MAG	Max. Horiz. Accel.	Distance KM		Soil Depth	Soil	SW-AA	
✓ San Francisco, CA NO	3/22/57	5.3	0.046g	15	Alexander Building, SF	Cal Tech A014	140'	Still Soil	115' clayey silty sand over bedrock
✓ San Francisco, CA (OK)	3/22/57	5.3	0.085g	17	State Building, San Francisco	Cal Tech A016	200'	still Soil	200' of sand over bedrock
✓ San Francisco, CA NO	3/22/57	5.3	0.047g	17	Southern Pacific Building, SF	Cal Tech A013		Deep soil site	
Northern, CA ?	9/4/62	5.0	0.048g	19	Eureka Federal Building	Cal Tech V330		Deep Soil Site	?
✓ Northern, CA (OK)	3/9/49	5.3	0.197g	29	Hollister Public Library	Cal Tech U301		Deep Soil	
✓ Central CA No	1/19/60	5.0	0.057g	8.5	Hollister Public Library	Cal Tech U307		Deep Soil	
Lytile Creek CA NO	9/12/70	5.4	0.197g	13	Wrightwood, CA	Cal Tech U334		Rock site	
✓ Southern CA NO	3/18/57	4.7	0.167g	5.4	Pt. Hueneme Naval Res. Lab	Cal Tech V329		? Soil	
Southern CA	9/12/70	5.4	0.071g	22	Cedar Springs Dam, Calif	Cal Tech W336		Intermd. rock	
Friuli, Italy	5/11/76	5.3		12	Majano	Basilli et al 1977			
Friuli, Italy	5/15/76	5.0		14	Forgaria-Cornino	Basilli et al 1977			

Factors to be considered

1. Select 4 or 5 records @ same distance from a COMPARABLE or LARGER magnitude earthquake
2. Do not alter time scales. Scale accelerations to give SSE
3. Select records with a wide range of frequencies. These records generally give higher shear stresses with depth.
4. Attempt to select records from sites with similar profiles (e.g. depth to bedrock, soil types) & similar shear wave velocity profiles

References

Basili, M., S. Polinari, and G. Tinelli, 1977, "Strong Motion Records of Friuli Earthquake", Proceedings of Specialist Meeting on the 1976 Friuli Earthquake and the Antiseismic Design of Nuclear Installations," Vol. II, Rome, Italy, 11-13 Oct. 1977.

California Institute of Technology, Strong Motion Earthquake Accelerograms, Earthquake Engineering Research Laboratory, Pasadena, California.

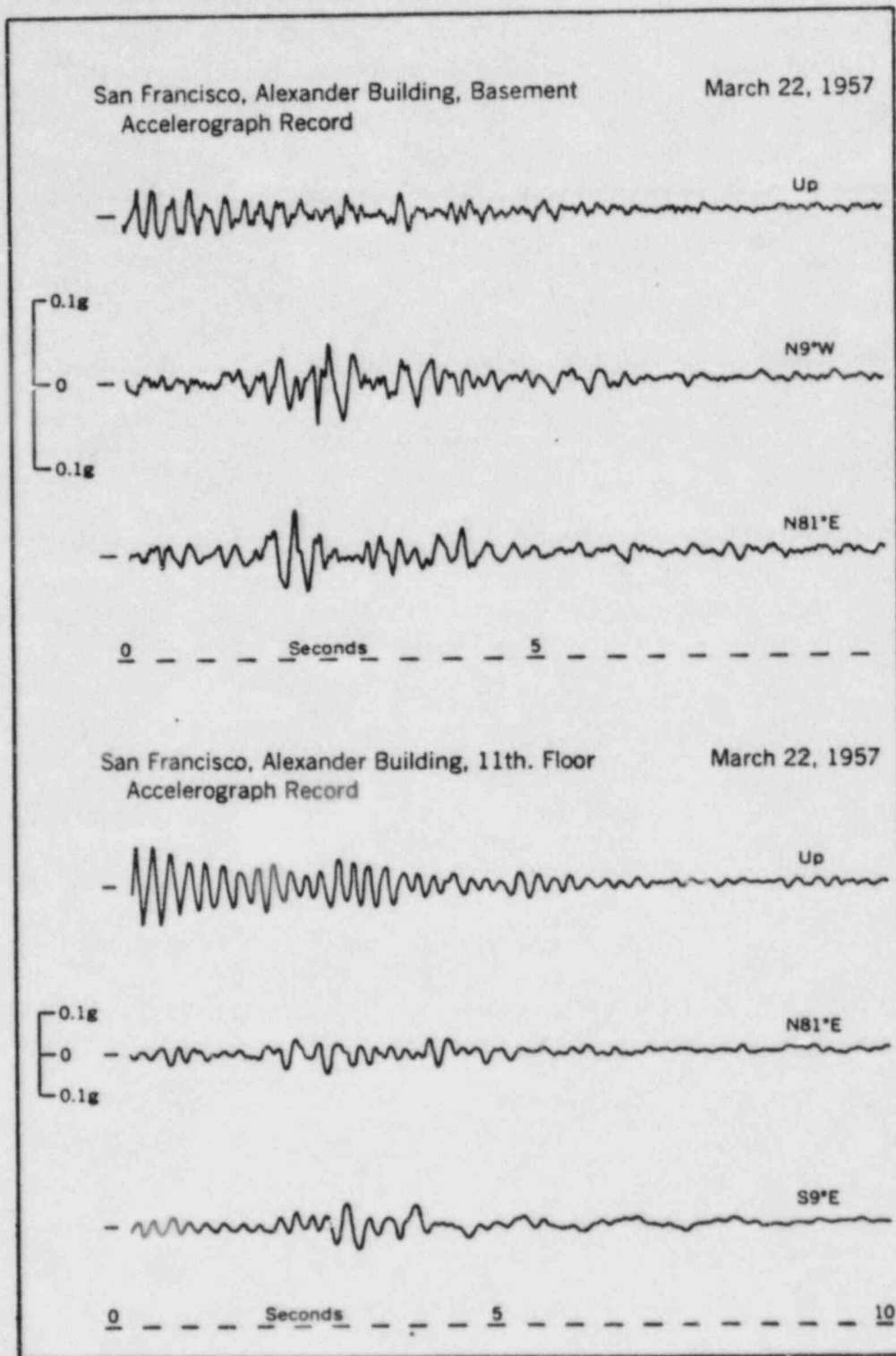


FIGURE 17.—Tracings of accelerograph records obtained at San Francisco, Alexander Building, basement and 11th floor, on March 22.

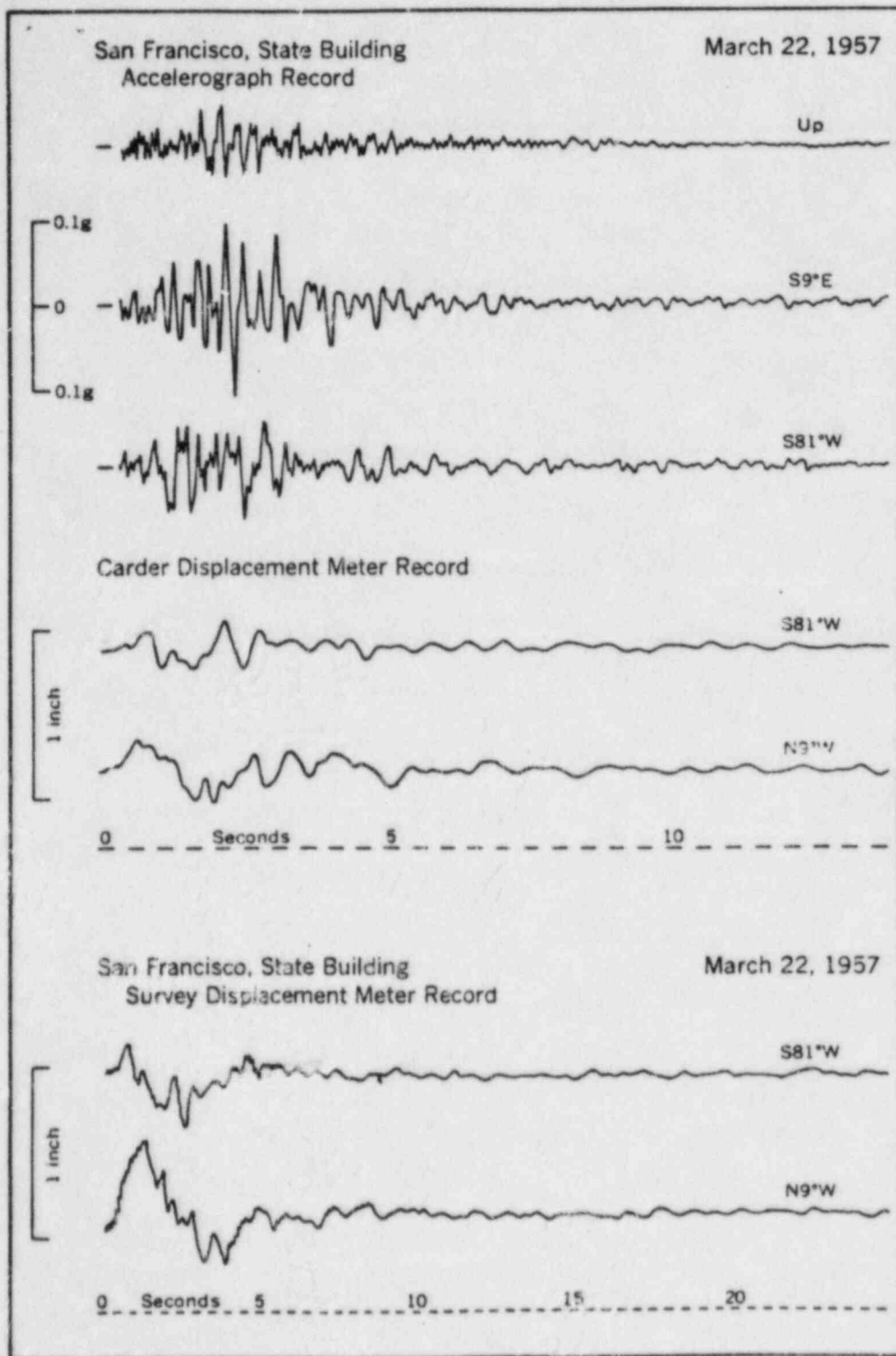


FIGURE 11.—Tracings of accelerograph and displacement meter records obtained at San Francisco, State Building, on March 22.

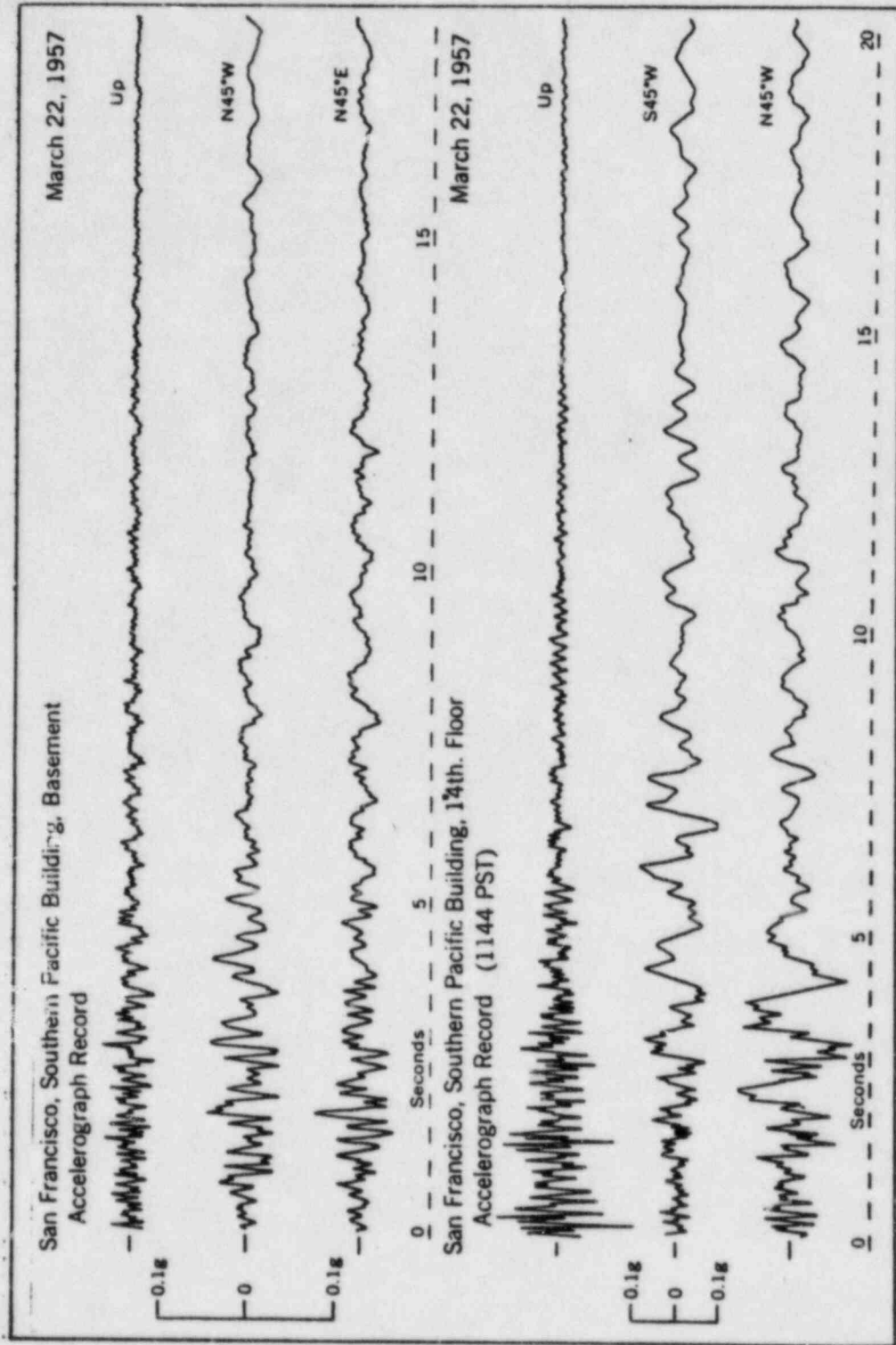


FIGURE 30.—Tracings of accelerograph records obtained at San Francisco, Southern Pacific Building, basement and 14th floor, on March 22.

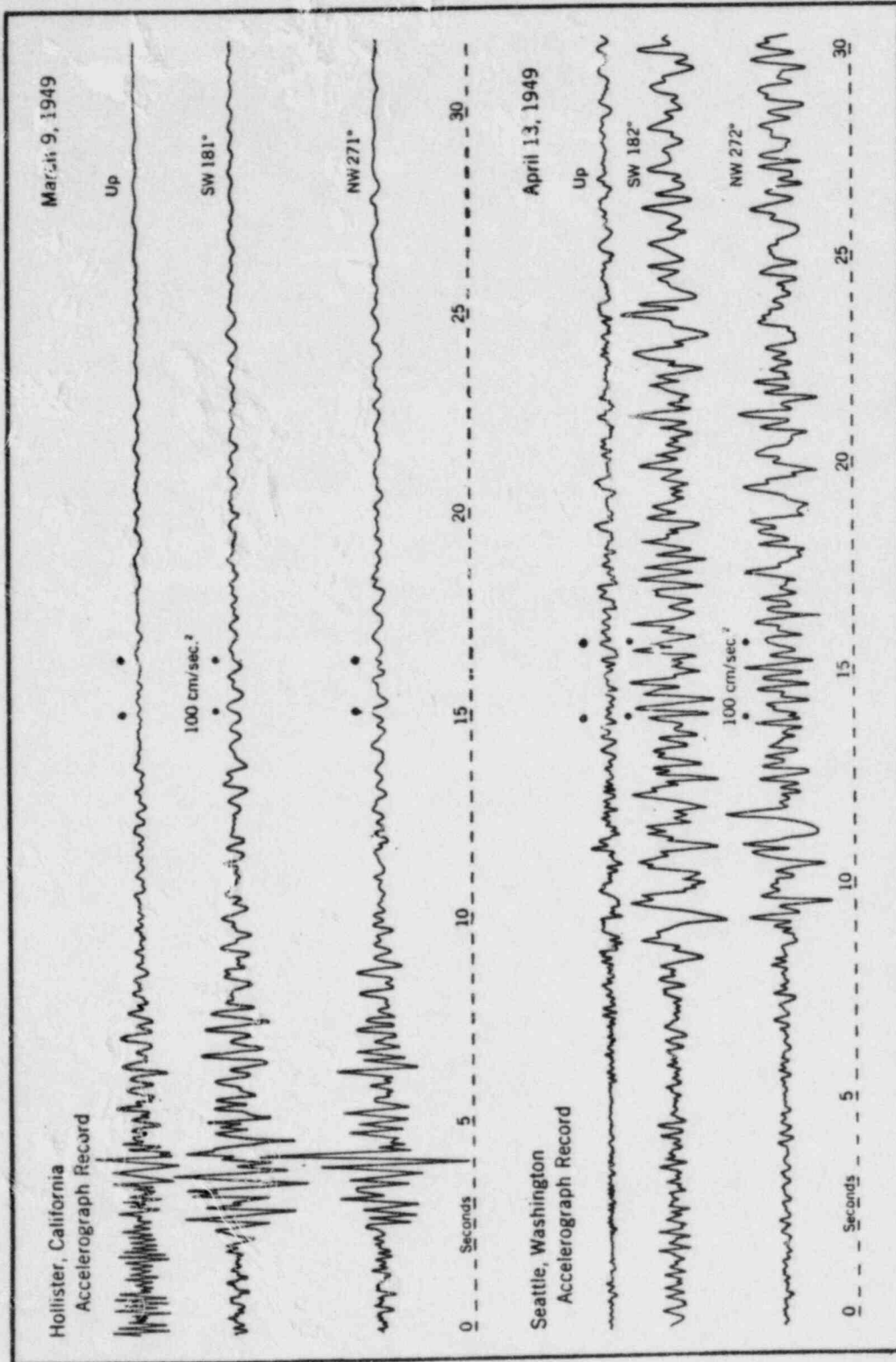


FIGURE 10.—Tracings of accelerograph records obtained at Hollister on March 9 and Seattle on April 13.

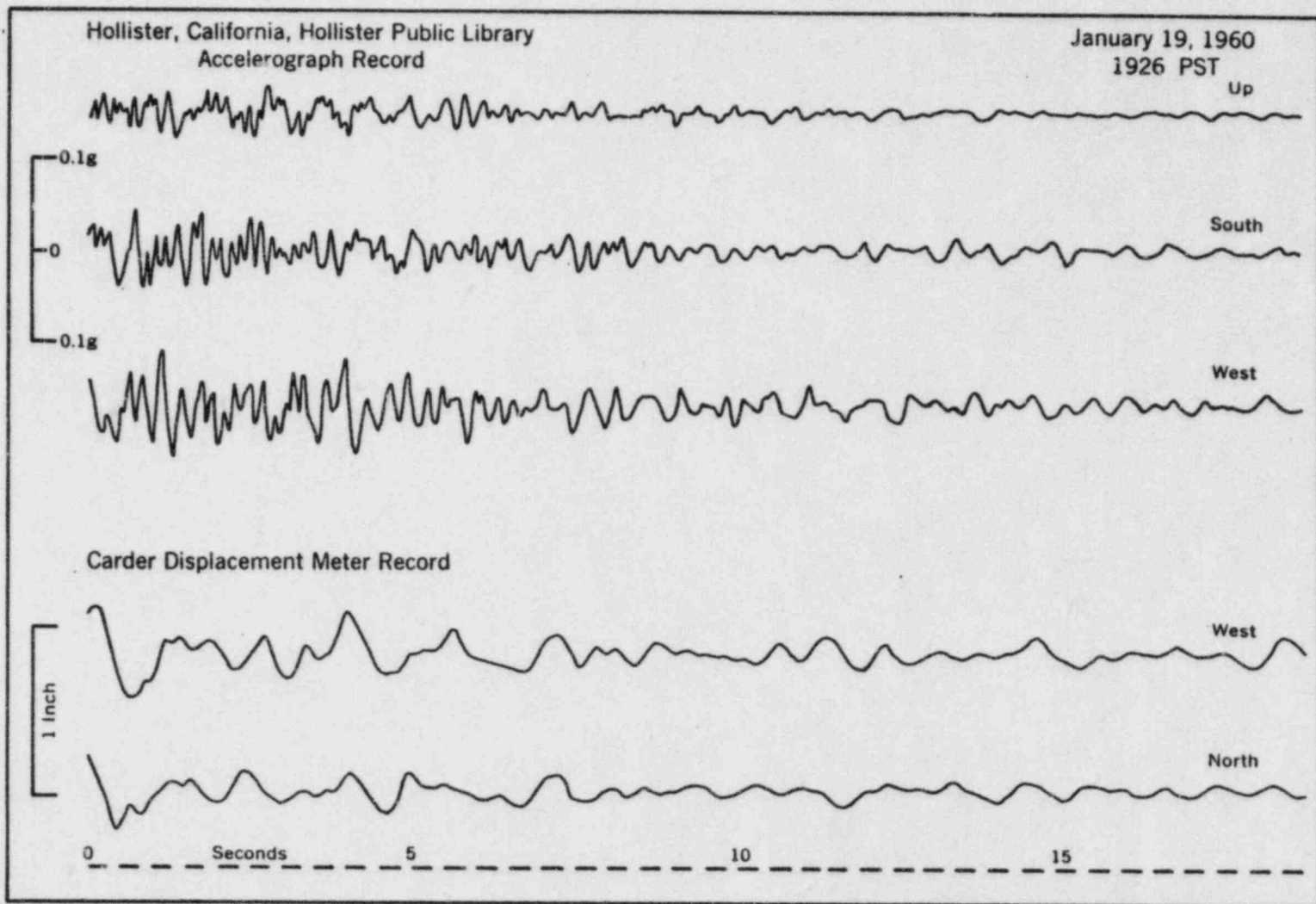


FIGURE 7.—Tracings of accelerograph and Carder Displacement Meter records obtained at Hollister on January 19.

Port Hueneme Naval Research Bldg 3/18/57

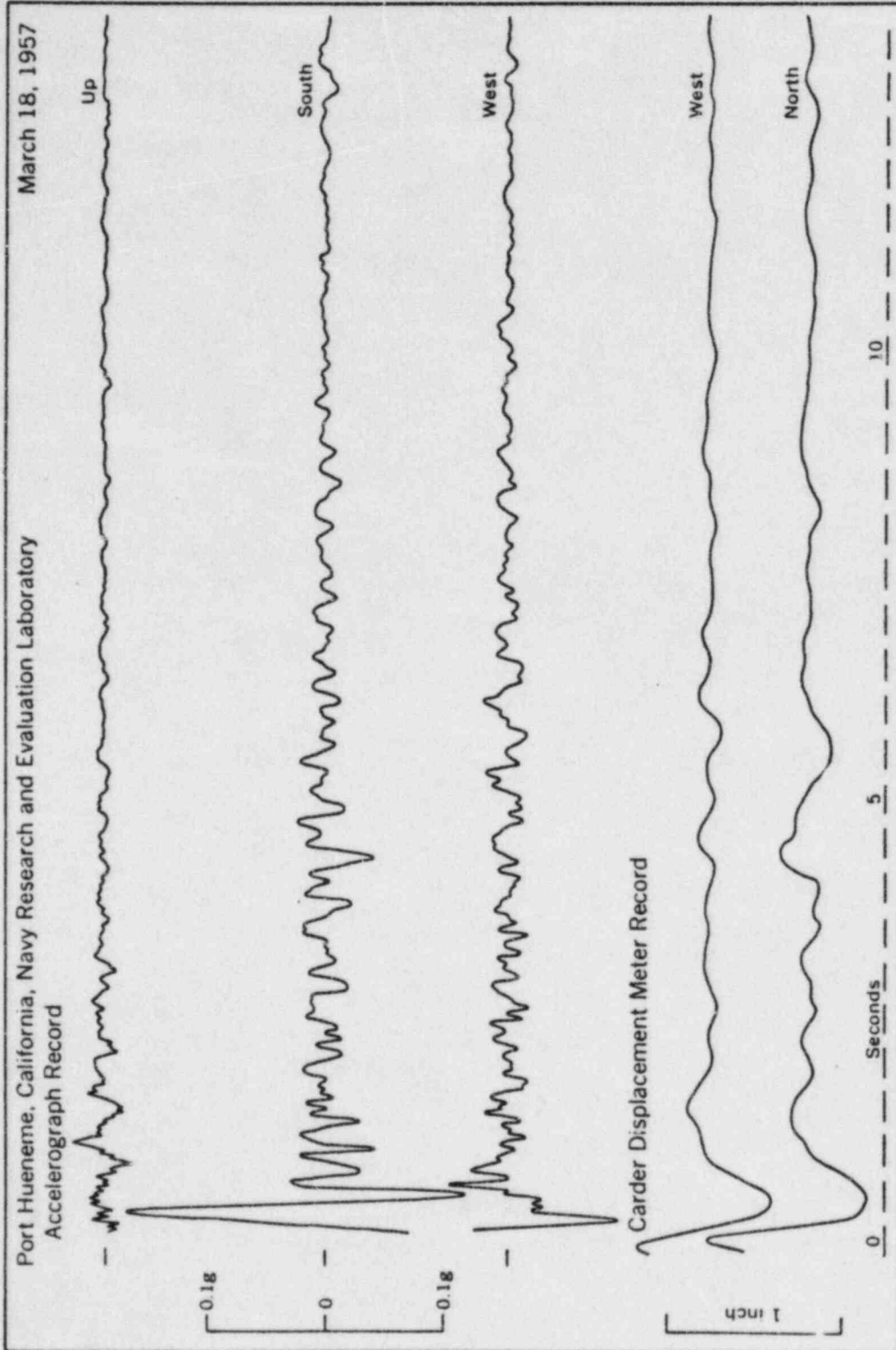


FIGURE 15.—Tracings of accelerograph and displacement meter records obtained at Port Hueneme on March 18.

J. Kane 16/84



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NOV 29 1979

MEMORANDUM FOR: L. G. Hulman, Chief
Hydrology-Meteorology Branch, DSE

THRU: W. S. Bivins, Leader *WSB*
Hydrologic Engineering Section, HMB, DSE

FROM: R. O. Gonzales, Hydraulic Engineer
Hydrologic Engineering Section, HMB, DSE

SUBJECT: TRIP TO THE MIDLAND 1 AND 2 SITE

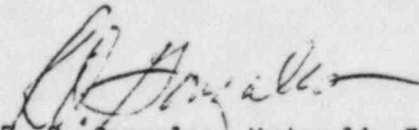
On November 14, 1979, the undersigned, along with Darl Hood, LPM, and representatives of the Corps of Engineers met with the applicant, Consumers Power Company (CPCo) and its engineering consultant, Bechtel, to discuss the work and analyses that have been done since structure settlement problems were encountered in August 1978. This site visit was the initial site tour by the U. S. Army Corps of Engineers, NRC consultant on the soil settlement issue. Enclosure 1 presents a list of attendees at this meeting. In August 1978, CPCo reported to the NRC resident inspector, R. Cook, that there was larger than expected settlement of the diesel generator building foundation. Since then, a soils investigation program has revealed that the plant fill under the diesel generator building consists of soft to very stiff clay with pockets of very loose to dense sand. CPCo's investigation has shown that this fill was not adequately compacted. After considering several options to correct the problems, a decision was made by CPCo to preload the diesel generator building with 20 feet of granular material to reduce pore pressure and consolidate the soft areas of clay fill. This fix however, will not significantly improve the quality of loose sands so there is a potential for liquefaction. A permanent dewatering system to remedy this potential liquefaction problem has been proposed by the applicant. Initially, this system consisted of 200 to 300 submersible deepwells that would extend to the original clay till. At this meeting, we were informed that some preliminary pumping tests have shown a very low recharge rate. Consequently, the number of deepwells initially proposed may not be needed. Additionally, the applicant is considering a grout curtain or slurry wall between the power block area and the cooling pond as a measure for reducing the ground water level. The final design will be based on tests that are being undertaken at the present time. Currently, two pumping tests are being conducted; the first in a well that has been drilled in the granular backfill between the circulating water conduits, and the second in a well that has been located to test some deeper sands. The location of the well between the circulating water conduits was selected because the granular backfill may provide the most permeable pathway for groundwater to flow from the cooling pond to

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beneath the power block. This well should define the highest rate of recharge. The second well which penetrates the deeper sand layers will be used to determine if water seeping from the cooling pond is recharging the groundwater through this deeper granular pathway.

Groundwater recharge rates will be determined from the temporary dewatering system now being installed to dewater the electrical penetration areas and the valve pits. These tests are scheduled to begin in about a month. An injection system will be used in this temporary dewatering to allow any fines, being removed, to be monitored to provide some basis for selection of well filters. In addition, the temporary dewatering will provide additional data about the permeability of the soil.

The tests now being conducted will be used in designing the permanent dewatering system and to demonstrate that the system conforms with section 2.4.13 of the Standard Review Plan including Branch Technical Positions HMB/GSB 1.



R. O. Gonzales, Hydraulic Engineer
Hydrologic Engineering Section
Hydrology-Meteorology Branch
Division of Site Safety and
Environmental Analysis

Enclosure:
As Stated

cc: w/enclosure
D. Muller
W. Kreger
D. Hood
~~W. Bivins~~
J. Kane
L. Heller
R. Jackson
R. Gallagher, Region III
R. J. Cook - NRC Resident
Inspector - Midland
Local PDR
NRC PDR
ACRS (18)

ENCLOSURE 1

Attendees at November 14, 1979 Meeting
Midland Plant, Midland, Michigan

Tom C. Cooke, Consumers Power Company	Project Superintendent
Robert G. Wollney, Consumers Power Company	Quality Assurance Group Supervisor
Al Boos, Bechtel	Project Field Engineer
Chuck McConnell, Bechtel	Engineer
Jim O. Wanzeck, Bechtel	Geotechnical Engineer
Joe Kubinski, Detroit District Corps of Engineers	Geotechnical Engineer
Ron Erickson, Detroit District Corps of Engineers	Geologist
Ron Cook, Nuclear Regulator Commission	Resident Inspector
Gene Gallagher, Nuclear Regulatory Commission	Region II Inspector
Raymond Gonzales, Nuclear Regulatory Commission	NRR/DSE/HMB
Darl Hood, Nuclear Regulatory Commission	NRR/DPM/LWR#4