GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, P.O. BOX 460, PLEASANTON, CALIFORNIA 94566

NUCLEAR ENERGY
ENGINEERING
DIVISION

August 13, 1980

Mr. Darrell G. Eisenhut, Director
Division of Project Management
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: Soil Shear Modulus and Bearing Capacity Values For The Soil Beneath The General Electric Test Reactor (GETR) - License TR-1 - Docket 50-70

Dear Mr. Eisenhut:

The General Electric Company's response to questions raised regarding soil shear modulus and bearing capacity values at our meeting of July 30, 1980 with the NRC Staff is attached. The responses support our position that the values selected are appropriate and are consistent with those used in the structural evaluations.

Very truly yours,

R. W. Darmitzel, Manager
Irradiation Processing Operation

/11

attachments

OFFICIAL SEAL
VIRGINIA C. CASQUEJO
NOTARY PUBLIC - CALIFORNIA
ALAMEDA COUNTY
My comm. expires MAR 8, 1981

8008140451 P

AFFIRMATION

The General Electric Company hereby submits the information pertaining to soil shear modulus and bearing capacity of the soil beneath the GETR.

To the best of my knowledge and belief, the information contained herein is accurate.

OFFICIAL SEAL
VIRGINIA C. CASQUEIRO
NOTARY PUBLIC - CALIFORNIA
ALAMEDA COUNTY
My comm. expires MAR 8, 1981

R. W. Darmitzel, Manager
Irradiation Processing Operation

Submitted and sworn before me this 13th day of August, 1980,

Virginia C Casqueiro, Notary Public in and for the County of Alameda, State of California.

EDAC

ENGINEERING DECISION ANALYSIS COMPANY, INC.
480 CALIFORNIA AVE., SUITE 301 PALO ALTO, CALIF. 94306
PHONE 415/326-0383

August 8, 1980

Mr. Dwight Gilliland
Manager of Reactor Irradiation
General Electric Company (GETR) (VNC 104)
Vallecitos Nuclear Center
Vallecitos Road
Pleasanton, California 94566

Subject: Engineering Support Services - GETR
Soil Properties
EDAC Project 117-258

Reference: ESA Letter (Meehan) to EDAC (Kost) dated 8 August 1980

Dear Dwight:

We have reviewed the referenced memo regarding shear modulus and bearing capacity of the soil materials beneath the GETR Reactor Building foundation. Our comments are as follows:

Soil Shear Modulus

The structural analyses for the load case of vibratory ground motions were performed for a soil shear modulus of G = 1,000 ksf, which is nearly equal to the upper value of G = 1,100 ksf in the referenced memo.

Analyses show that use of G = 1,100 ksf would increase the shears and moments in the Reactor Building concrete core structure by only 4 percent. There is an adequate safety margin to accommodate this insignificant increase.

Analyses also show that use of a lower value of G = 500 ksf mentioned in the referenced memo would decrease shears and moments by about 30 percent. This would greatly increase the already adequate margin of safety.

Bearing Capacity

The structural analyses for the combined load case of vibratory motions and surface rupture offset were performed for the case where the ultimate bearing capacity of the soil beneath the Reactor Building is 20 ksf. Use of this value, which is at the upper end of the range given in the referenced memo, results in more severe load cases for the structure than if lower values were to be used.

Conclusions

The shear modulus and bearing capacity given in the referenced memo are consistent with those used in the structural evaluations. Thus, the conclusions regarding the seismic adequacy of the GETR Reactor Building do not change.

Very truly yours,

for Roland L Sharpe

Garrison Kost
Vice President
for
ENGINEERING DECISION ANALYSIS COMPANY, INC.

EGK:ej

Earth Sciences Associates

701 Welch Road, Palo Alto, California 94304

(415) 321-3071

DOUGLAS H. HAMILTON
RICHARD L. MEEHAN
EUGENE A. NELSON
RICHARD C. HARDING
KARL VONDER LINDEN
LEONARDO ALVAREZ
MICHAEL T. DUKES
PATRICK O. SHIRES
ROBERT H. WRIGHT
VICTOR F. VIETS
PHILIP A. FRAME
W. ROGER HAIL
JULIO E. VALERA
BARBARA L. TURNER
DWIGHT HUNT
JAMES B. SCOTT
C. RICHARD WILLINGHAM
SALLY W. BLODEAU
TIM J. MANZAGOL
DOUGLAS M. YADON

GEOLOGY
GEOPHYSICS
SEISMOLOGY
ENGINEERING
GEOHYDROLOGY

August 8, 1980
1883

Mr. Gary Kost
EDAC
480 California Ave., Suite 301
Palo Alto, California 94306

Re: Subgrade Soil Values, GETR

Dear Gary:

Following various discussions we have had on this matter, I am forwarding comments regarding soil modulus and bearing values which we have previously recommended for use in your seismic analyses of GETR.

Subgrade Shear Modulus and Shear Wave Velocity - It is important to note that the values of these parameters are appropriate for the very strong earthquake shaking which is being assumed in analysis. Hence, our recommended value of 1.1×10^6 psf for the upper soil unit may appear low in comparison to values used for moderate earthquakes or field geophysical tests.

The value $G = 1.1 \times 10^6$ psf checks with a value of $K_2 = 18$ from Figure 5 of "Soil Moduli and Damping Factors for Dynamic Response Analysis" Report EERC 70-10, College of Engineering, University of California, a standard method for determining modulus.

The indicated shear wave velocity of 500 fps was derived from the $G = 1.1 \times 10^6$ psf shear modulus.

The justification for use of a minimum 0.1 percent strain is as follows;

- free field soil strains of 0.2 percent would be expected during earthquakes with surface particle velocities of 1 ft/sec.

- additional strains would be superimposed on the subgrade by soil-structure interaction. These strains would be roughly equal to the dynamic angular rotation of the reactor foundation. For a strain of 0.1 percent, rotation observed at the edge of the foundation would be less than 0.5 inch.

In a strong earthquake, it is likely that subgrade strains will be greater than 0.1 percent, with corresponding moduli values on the order of 0.5×10^6 psf. This value correlates well with the laboratory modulus determined by Shannon and

Wilson, of E = 500 tsf, from which I derive G = 0.4×10^6 psf. Hence, the recommended 1.1×10^6 psf should be an upper limit, i.e. conservatively on the high side.

Bearing Capacity - Our estimate of the probable realistic range of bearing capacity for rapid loading conditions is 15 to 20 ksf. This is intended as a realistic range, i.e., it does not incorporate any reduction factors as it would if it were being used as an allowable bearing value. The bearing value is to be used to determine the area of soil that would support the reactor under the worst combination of faulting and ground shaking; therefore it should be a realistic value, if the rest of the analysis is to be correspondingly realistic. In fact, there are some "conservatisms" in this recommended range. Local bearing failure should occur below this range, and eccentric loading components should also cause subgrade deformation at less than 15-20 ksf.

Very truly yours,

Richard L. Meehan

Richard L. Meehan

RLM/am