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DEPARTMENT OF APPLIED MECHANICS AND
ENGINEERING SCIENCES, MAIL CODE B-010

LA JOLLA, CALIFORNIA 92093

September 22, 1978

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

DISTRIBUTED TO ACRS MEMBERS

Dear John:

Enclosed please find my comments to the ACRS meetings of June 14-15 and July 6-7, 1978, regarding Diablo Canyon Nuclear Power Plant.

The travel expense and compensation forms have been sent to Ms. Dundr.

Sincerely,

J. E. Luco

JEL:bs
Enc.

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Diablo Canyon
X - J.E. Luco

Comments on the ACRS Subcommittee Meeting of 6/14/78
regarding Diablo Canyon Nuclear Power Plant - J. E. Luco

The concept of an 'effective' peak ground acceleration was discussed again during the meeting. In previous reports I have expressed the opinion that not enough justification has been presented for the use of 'effective' peak acceleration lower than the value recommended by the USGS. A recent study by Bertero, Mahim and Herrera ('A Seismic Design Implications of Near-Fault San Fernando Earthquake Records,' Earthquake Engineering and Structural Dynamics, Vol. 6, pp. 31-42, 1978) provides additional information of the need to treat the use of 'effective' accelerations with utmost care.

After a detailed study of the Olive View Hospital buildings which suffered major damage during the San Fernando earthquake, Bertero et al. conclude:

"Usually large velocities may be developed at near-fault sites. Methods for constructing elastic and inelastic design response spectra should reflect the larger values recorded at such sites. In particular, methods which use standard ground spectrum shapes and effective acceleration values smaller than the expected peak values may not be reliable at near-fault sites."

In addition, in the text of the paper the authors write:

"... some procedures reduce the peak ground acceleration of standard type earthquakes (sometimes by 50 percent or more) to an 'effective' acceleration level that occurs a sufficient number of times to effect the structural response. The use of these reduced acceleration values in conjunction with ... standard ground spectrum shapes ... may lead to further underestimation of the peak ground velocity and displacement at near-fault sites. Thus, to avoid unconservative designs, derivation of smoothed linear-elastic response spectra for near-fault sites should be based on realistic estimates of peak ground acceleration, velocity and displacement. This would result in higher values of ground velocity and displacement than are usually considered at present."

In several occasions it has been argued that the peak acceleration of 1.25 g recorded at Pacoima Dam does not reflect the damage potential, but, rather the local response associated with the irregular topography of the site.

The aforementioned study of Bertero et al. sheds some light into this matter. Bertero et al. used modified Pacoima Dam records with peak accelerations of 0.4 and 0.8 g and predicted permanent drifts for a nonlinear model of the Olive View Hospital of 5 and 20 in, respectively. Since the observed permanent drifts were in excess of 30 in, it seems that the peak acceleration at the site of the Olive View Hospital was not significantly lower than that recorded at Pacoima Dam. In my opinion these results indicate that the Pacoima records are representative of the motion in the near-fault region and that the USGS recommendation of a peak acceleration of 1.15 g is not excessive for a 7.5 magnitude earthquake.

Comments on the ACRS Committee Meeting of 7/7/78
regarding Diablo Canyon Nuclear Power Plant - J.E. Luco

During the meeting Dr. Frazier consultant for the applicant indicated that he had conducted studies to establish the type of waves that would arrive at the Diablo Canyon Site from an offshore fault. He said that his studies showed that most of the excitation would be arriving in the form of almost vertically incident waves. If his calculations are correct, this indicates that the reduction of the input motion for the so-called tau-effect may not be justified. This additional information, which was not made available to the Committee in time, suggests that the use of an exaggerated reduction for tau-effect coupled with the use of a very small torsional excitation may underestimate the response of the plant.

If one considers the alternative of assuming that a significant portion of the energy arrives in the form of surface waves, again one finds that the analysis presented by the applicant underestimates the response. I have indicated in a previous report that if one assumes horizontally incident waves then the reduction for tau-effect used by the applicant is too large and the amount of torsional input considered is too low. Dr. Seed consultant for the applicant mentioned at the meeting that consideration of Rayleigh surface waves could lead to an increase in the calculated response. Again, these studies of the response of the plant to Rayleigh surface waves that lead to a higher response were not made available to the Committee.

On the basis of the statements by Drs. Frazier and Seed, it becomes apparent that the reduction of the input motion by tau-effect is not justified for Diablo Canyon.

A considerable amount of time was devoted to the discussion of the amount of damping used in the analysis. Most of the information presented by NRC to justify the 7 percent of critical damping was taken from a report from Werner and Reddy (Equivalent Viscous Damping for Seismic Analyses of Nuclear Plants, Report SAN/1011-103 prepared by Agbabian Associates for U.S.E.R.D.A., 1975). This report gives considerable emphasis to the damping values reported by Hart et al. (1973), Hart and Vesudevan (1975), and Iemura and Jennings (1974). The damping values reported in these studies

correspond to the attenuation characteristics of the complete structure-foundation-soil system and are heavily invluenced by the effects of soil-structure interaction. Since the Diable Canyon Plant is supported on hard material the effects of soil-structure interaction will be small. In these conditions the damping calues used should reflect only that portion of the energy dissipated in the structure.