January 3, 1980

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

FROM: Leon Reiter, Leader
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Geosciences Branch, DSS

SUBJECT: COMMENTS ON SEISMOLOGICAL REVIEW OF SAN ONOFRE UNIT 1

As a result of our meeting with SEP personnel last week I have undertaken an evaluation of the San Onofre Unit 1 (SONGS 1) ground motion modelling study. The purpose of this evaluation is to provide SEP with a sense of where we are in the review process and our best estimates at this time as to where we are heading. Following are some of the highlights of this evaluation along with a plot of response spectra referenced in the discussion.

A. During this evaluation I have looked at
1. Consultant's reports
2. Preliminary and limited response to these and other concerns by SCE (i.e. from their consultants TERA-DELTA)
3. Draft final report of an S^3 study on slip functions
4. Existing data from the 1979 Imperial Valley earthquake

B. I have also spoken with
1. Phyllis Sobel - NRC seismological reviewers for SONGS 2 & 3.
2. Jerry Frazier (TERA-DELTA)
3. Steve Day (S^3)

C. Summary statements
1. SONGS 1 spectrum represents a good mean estimate of ground motion from a Richter Magnitude (M_L) 6.0 to 6.4 strike-slip earthquake 3 mi offshore.
2. Most of the consultants suggest multiplication of the spectra by a factor of two to account for uncertainty in the model or larger magnitude (M_L = 6.5 or greater)
3. This factor of two places the spectra between the 0.5g Housner spectrum and the SONGS 2 & 3 OBE. It could be somewhat higher than the SONGS 2 & 3 OBE if we use a peak acceleration of 0.3g and a peak velocity of 60 cm/sec as suggested by one consultant and amplification factors in NUREG/CR-0098.

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D. Factors not yet resolved which could affect the results

1. Magnitude - the SONGS 2 & 3 review could likely increase the surface-wave magnitude (M_S) to above 6.5. However it may be shown that in this range M_S is equivalent to a lower M_L. One study by Nuttli and Herrman would equate M_S = 7.0 to M_L = 6.75.

2. SONGS 2 & 3 empirical studies yields spectra which are above the SONGS 1 spectra. This could be due to a difference in assumed magnitude and/or extrapolation techniques. The SONGS 2 & 3 84th percentile empirical spectra is roughly equivalent to the 0.67 Housner spectra.

3. The recent Imperial Valley earthquake data shows a band of peak accelerations that would appear to range from 0.18g to 0.65g at 8 km. The median value at this distance is about 0.35g. This data from an M_L = 6.4 earthquake fits the peaks predicted by the SONGS 1 study (0.30-0.38g). When spectra are computed they should be compared to the SONGS 1 spectra. Peak accelerations recorded on soil from the M_L = 6.4 San Fernando earthquake also seems to support SONGS 1 peak accelerations.

4. The controversial slip function is still controversial. S^3 studies tend to show weaknesses. TERA-CELTA claims that it has used (for another client) this slip function to successfully model the Pacoima accelerograms from the San Fernando earthquake and 3 sets of accelerograms from the 1933 Long Beach earthquake. If they really can model the high stress drop reverse-fault San Fernando earthquake then they will have made an important step in relieving some of the concerns about the slip function.

E. Expected future input

1. My detailed review of the SONGS 1 report
2. Completion of the SONGS 2 & 3 review
3. Final S^3 report
4. Comparison of spectra from the 1979 Imperial Valley earthquake with the SONGS 1 spectra
5. Full SCE response to concerns and Pacoima and Long Beach modelling results
6. Comparison with other predictive techniques

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Recommendations

1. Final spectrum will depend upon level of conservatism required.
2. At this time I would find 3.3g Hausner acceptable.
3. Presently we don't have sufficient information to back this [illegible].
4. Final spectrum may be higher due to other considerations such as the ISCS position on SCRIS 2 & 3
5. Any choice of design evaluation at this time should be sufficiently flexible to allow for changes in the spectrum selected upon when the review is completed.

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