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December 20, 1982

Director, Office of Nuclear Reactor Regulation
Attention: D. M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket No. 50-206
Fuel Storage Building
SEP Topic III-6
San Onofre Nuclear Generating Station
Unit 1

In accordance with our letter dated November 30, 1982, enclosed are ten copies of responses to NRC questions regarding the seismic reevaluation of the Fuel Storage Building. Also included are one copy of the detailed model of the structure and one copy of the digitized time histories used in the evaluation.

If you have any questions on this information please let us know.

Very truly yours,

K P Baskin

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RESPONSE TO NRC STAFF QUESTION

ON

FUEL STORAGE BUILDING NONLINEAR ANALYSIS

NOVEMBER 1982

SAN ONOFRE NUCLEAR GENERATING STATION

UNIT 1

QUESTION 1

In considering soil-structure interaction, how were the soil springs and damping ratios distributed at the switchgear room wall footing?

RESPONSE

The soil springs for the switchgear room wall were calculated based on the footing length tributary to each node. The locations of the nodes and the values of the soil springs are shown in Table 4.1 of Reference 1. The values for the soil springs were calculated by Woodward-Clyde Consultants in accordance with Reference 2.

The details of procedures are given in Reference 5.

QUESTION 2

How was the foundation slab at Elevation 14'-0" modelled in the three-dimensional seismic analysis model?

RESPONSE

This slab was cast on grade and has no structural connection to the masonry walls or the fuel pool. Therefore, the slab was not included in the three-dimensional seismic analysis model.

QUESTION 3

What is the definition of the "effective length" of wall in the derivation of the out-of-plane masonry wall properties?

RESPONSE

The effective length is half the distance to the next beam or crosswall to either side of the beam in question. The effective length is therefore merely the tributary length, as shown in Figure 3.1.

QUESTION 4

Horizontal and vertical analyses were separately performed, and the response time histories were then combined. Justify the validity of this approach because both analyses were non-linear time history analyses.

RESPONSE

The lateral and vertical load resisting components of this building are separate. The steel framing and columns resist the vertical load while the masonry walls resist the lateral loads. The vertical load resisting system remains elastic. Since there is little interaction between these two systems, separate analyses are justified. However, in the most current analyses (Reference 1) all three spatial components were applied simultaneously to the same model. Therefore this question is no longer applicable.

QUESTION 5

Was the linear, elastic model developed for the frequency extraction only, and not for any response analysis?

RESPONSE

The linear global model was used only for initial parametric studies and for modal extraction. The linear global model was not used for any component evaluation.

QUESTION 6

Your conclusions stated that "The 'as-built' structure was subjected to earthquake motions of the specified DBE level of 0.67g Housner for San Onofre Unit 1 and complied with the structural integrity acceptance criteria under this load." It is our understanding that only the El Centro records were used in a structural integrity evaluation of the building while Fig. D.2 indicate that the El Centro records do not envelop the 0.67g Housner spectra. Provide your justification of the accuracy of aforementioned conclusion statement. Our particular concers are with the wall FB-7 and roof connections to walls FB-6 and FB-7.

RESPONSE

Since Reference 3 was transmitted to the NRC, wall FB-7 and the roof con-nections to walls FB-6 and FB-7 have all been upgraded. In addition, the analysis presented in Reference 1 has been performed. In the more current analysis all three components of the three real time histories were frequency scaled so that they envelope the appropriate response spectrum. The appropriate response spectra are defined in Reference 4. Considering the recent analysis and the modifications to the structure itself since the writing of this question, the structure has been shown to be adequate.

QUESTION 7

Provide information on the reevaluation of the foundation, which is not currently included in Ref. 7.

RESPONSE

The current analysis, referred to in the question, is the analyses presented in Reference 3. Since the time this question was posed the analysis presented in Reference 1 has been performed. The results for this analysis reported in Reference 1 also address the foundation analysis. These results are presented in Section 7.1 of Reference 1 and in summary predict that the Fuel Pool basemat (between 4'-9" and 5'-9" thick) would not even crack under DBE loading.

QUESTION 8

Provide digitized records of all components of all time histories used in the analysis.

RESPONSE

Digitized records of all nine components of the three earthquakes used in the analysis are attached to this enclosure. The 8192 entries for each component are in g's and are digitized at a period of .005 seconds.

QUESTION 9

Provide references used as a basis for the in-plane strain criteria for masonry walls.

RESPONSE

The in-plane strain criteria are based on Reference 6, a copy of which is enclosed.

QUESTION 10

Provide details of the structural model for the Fuel Storage Building and the associated soil structure interaction parameters used in the model.

RESPONSE

A copy of the ANSR II Program echo print of the model is enclosed. Also enclosed are computer plots showing the nodes and those portions of the ANSR II Program User's Manual relevant to the model.

REFERENCES

1. Computech Engineering Services, Inc., "Seismic Reevaluation of Reinforced Concrete Masonry Walls", Volume 5: Fuel Storage Building Soil Backfill Condition Evaluation", San Onofre Nuclear Generating Station Unit 1, Report No. 534-02, September 1982; (transmitted in letter from K.P. Baskin to D.M. Crutchfield, dated September 30, 1982, Subject: SEP Topic III-6, Fuel Storage Building).

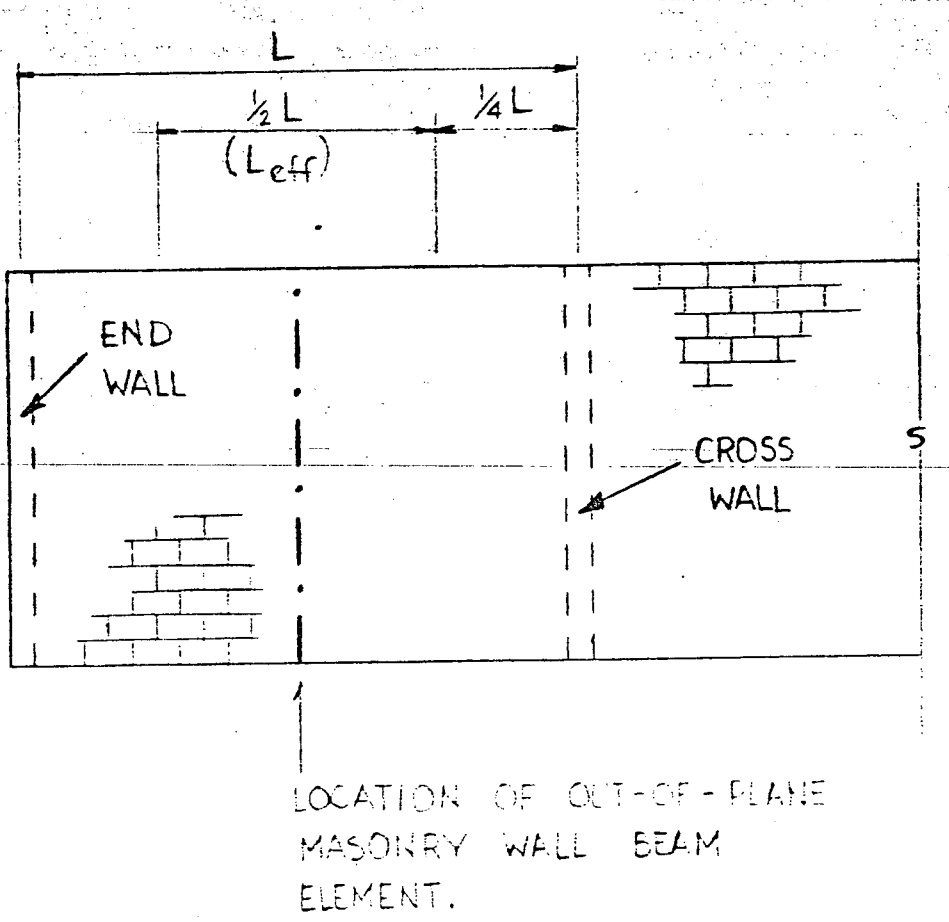
2. Woodward-Clyde Consultants, Balance of Plant (BOP) SONGS Unit 1 Soil-Structure Interaction Methodology Report, Revision 1, Orange, California, July 1978.

3. Computech Engineering Services, Inc., "Seismic Reevaluation of Reinforced Concrete Masonry Walls", Volume 4: Fuel Storage Building", San Onofre Nuclear Generating Station Unit 1, Report No. 534-02, April 1982; (transmitted in letter from K.P. Baskin to D.M. Crutchfield, dated April 30, 1982, Subject: SEP Topic III-6, Seismic Design Considerations).

4. Letter from W. Paulson to R. Dietch, Subject: SEP Topics 11-4.A and 11-4.C. Free Field Ground Motions to be used in the Seismic Reevaluation of San Onofre Nuclear Generating Station, Unit 1 (SONGS-1) dated September 16, 1982.

5. Enclosure to letter from K. P. Baskin to D. M. Crutchfield Subject: Response to Open Items, SEP Topic III-6, dated September, 15, 1982.

6. Chen, Shy-Wen J. et al., Cyclic Loading Tests of Masonry Single Piers, Volume 2 - Height to Width Ratio of 1, Earthquake Engineering Research Center, University of California, Berkely, California, December 1978.



WALL ELEVATION

FIGURE 3.1