OCT 4 1979

MEMORANDUM FOR: V. Noonan, Chief
Engineering Branch
Division of Operating Reactors

THRU: P. T. Kuo, Group Leader
Seismic Review Group
Division of Operating Reactors

FROM: Abdel Rafiz
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SUBJECT: OPERATING BASIS EARTHQUAKE REVIEW - RE ANALYSIS OF PIPING SYSTEMS OF SURRY POWER STATION UNITS 1 AND 2

References: (1) Vepco letter to NRC on the same subject dated September 13, 1979

(2) NRC letter to Virginia Electric and Power Company dated May 25, 1979 addressing the subject matter.

I have reviewed the subject matter raised by VEPCO letter of September 13, 1979 (Ref. 1) in response to NRC letter (Ref. 2) regarding the operating basis earthquake reanalysis of the piping systems of Surry Power Station and I have the following comments:

1. Equation 1 of Ref. 1 gives an approximate relation for predicting the new level of earthquake for which the USA OBE design requirements are met. Before discussing my judgment on the adequacy of this equation, let me rewrite the referenced equation (using the same symbols) in the following fashion:

$$S_E = S_O \left(1 - \frac{(S_t - S_o)}{S_E}\right) \quad \ldots \ldots (1)$$

$$\text{let } S_t = S_o + S_x \quad \ldots \ldots (1A)$$

where S_E = as defined in Ref. 1

S_o = All other stresses (not including earthquake stresses) generated by mechanical sustained loadings (pressure and dead weights) and occasional loads such as thrust from relief and safety valve loads from pressure and flow transients.

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Substitute Eq. 1A into Eq 1, then a_n could be expressed as follows:

$$a_n = a_o \left(1 - \frac{Ss + Sm - Sa}{Sa}\right)$$

$$= a_o \left(1 - 1 + \frac{Sa - Sm}{Ss}\right)$$

$$= a_o \frac{Sa - Sm}{Sa}$$

Therefore, $\frac{an}{ao} = \frac{Sa - Sm}{Ss}$ . . . . . (1B)

The objective of the applicant is to maximize the ratio an/ao and hopefully reach a value of one or more. In order to reach that ratio, the value of (Sa - Sm) should be as high as possible, and/or the value of Ss should be as low as possible. Unfortunately, the value of (Sa - Sm) is independent of the seismic excitation and is constant regardless of the value of g associated with Surry Power Station. The only remaining value of Eq. 1B affected by the seismic activity is Ss and it is to the benefit of the applicant to keep this value as low as possible if he were to reach his objective of an/ao 1.

The problem arises for those areas or components where seismic stresses (Ss) are high compared to stresses caused by other mechanical loads. For those components an/ao could be very low and the applicant might not be able to qualify his equipments and components for the original value of the OBE.

Before closing my discussion on this point, I like to point out that if the applicant can not meet the requirements of OBE load combinations, it does not mean that the plant is unsafe. Since the safety of the nuclear power plant is not tied to OBE, but rather to SSE load combinations, the possibility of relaxing the OBE allowable stresses should be explored.

2. In Equation 3 of the referenced document (Ref. 1) the seismic stresses are increased by a factor of 1.25 to take into account the variations in soil properties. We do not see the reasons or justification why this increase should be applied to the resulting seismic stresses only and not, also, to the seismic induced anchor movements (SA). As expected, the variations of soil properties should affect both the anchor stresses as well as the stresses generated by the seismic anchor movements.

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3. On page 3 of the referenced document (Ref. 1), the applicant stated that the seismic stresses are calculated using the last iteration of SHAKE with θ max as input and then the resulting seismic inertia stresses SI are increased by 25 percent. However, it is not clear how curve 3 (Figures 1 through 6) has been generated from curve 2, since curve 3 is more than 1.25 percent of curve 2.

4. In order to come to a conclusion on the adequacy of the 25% bumping factor, the method of arriving at the bump factor must be explained in greater detail. Also, the adequacy of the soil variation must be reviewed and accepted by appropriate NRC staff.

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cc:
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