BALTIMORE GAS AND ELECTRIC

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VICE PRESIDENT
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February 3, 1992

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Containment Pressure Instrument Tubing Modification (TAC Nos. M79911 and M79912)

REFERENCE: (a) Letter from Mr. D. G. McDonald, Jr. (NRC) to Mr. G. C. Creel (BG&E), dated December 30,1991, same subject

Gentlemen:

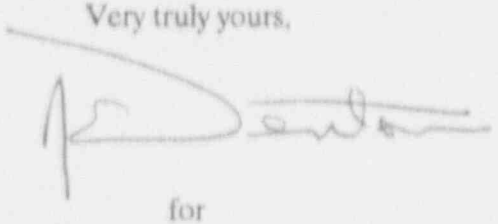
At the request of NRC Region I, the Office of Nuclear Reactor Regulation (NRR) has reviewed our modifications to the supports for certain instrument lines routed across building expansion joints. As described in the referenced letter, NRR found the methodology we used (employing alternate damping values) to analyze these modifications unacceptable in that it did not conform to the methodology described in the Updated Final Safety Analysis Report (UFSAR). We have reviewed the options provided by the Staff for resolving this issue and have chosen to reanalyze and modify the tubing so that it will be flexible enough to accommodate the relative displacements predicted by the applicable floor response spectra of the UFSAR. Depending on the nature of the proposed modifications, we may not be able to perform them while the plant is operating because of the potential impact on the operability of the containment pressure sensing instrumentation. Therefore, until the analyses are complete and we know how extensive the modifications will be, we have scheduled the tubing modifications to be performed during the next outages of sufficient duration following August 1, 1992. This will allow sufficient time to complete engineering and planning activities for these modifications. If the analysis and engineering indicate that the modifications can be performed during power operation, they will be completed by August 1, 1992.

We believe this schedule to be acceptable considering the fact that a Safe Shutdown Earthquake has a rather low probability of occurrence during this time frame. Additionally, the conservatism that is incorporated into the overall plant seismic design criteria provides adequate margin for assuring plant operability.

We also we believe an engineering approach using alternate damping values is technically sound, and that it may be useful for future design activities at Calvert Cliffs. To this end, we would like to pursue the inclusion of NRC-approved alternate damping values into the UFSAR. Therefore, our responses to the technical issues raised in the referenced NRC letter are provided in Attachment (1). We will submit this methodology for NRC review, if required, pursuant to 10 CFR 50.59 prior to its use in justifying any plant modification.

Should you have any further questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,



for
Vice President - Nuclear Energy

GCC/PSF/psf/dlm

Attachment: (1) Response to Seismic Technical Issues

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ATTACHMENT (1)

RESPONSE TO SEISMIC TECHNICAL ISSUES

Issue 1 - Use of Increased Soil Damping

NRC Concern

Baltimore Gas and Electric Company (BG&E) adopted a set of soil damping values accepted by the Systematic Evaluation Program (SEP) for its revised seismic analysis of the instrument tubing, even though Calvert Cliffs is not an SEP plant. The basis for this selection was:

1. *Some conservatisms due to large soil damping in soil-structure interactions, and*

2. *A previous NRC approval on the use of the SEP criterion for the masonry wall analysis of Calvert Cliffs.*

BG&E Response

The selection of the soil damping values different from those used in the original seismic analysis was limited to the determination of realistic absolute seismic deflections between one part of the auxiliary building and the containment building only for seismic anchor movement of the instrument tubing. The method approved previously for the SEP program was selected because of (1) its ease of use, (2) its conservatism, and (3) its approval by the NRC on other non-SEP plants. The previous approval by the NRC of the Calvert Cliffs' masonry wall analysis was not a primary factor in its selection for this application.

Although the formulations for strain dependent soil impedance were available when the original seismic analysis on Calvert Cliffs was performed, the practice was to consider only the effects of stiffness and not the associated radiation damping term. The original analysis conservatively limited soil damping to the material damping of the soil. Later, from vibration testing as well as from more sophisticated methodology developed for Soil-Structure Interaction (SSI), it became apparent that the energy absorption from natural modes that were predominantly due to radiation soil damping were substantially greater than that provided by material damping alone. This increased damping can be accounted for in analyses by increasing the effective viscous damping for the affected modes.

The formulation to analytically address SSI is rather complex. However it was determined by the NRC that for plants typical of Calvert Cliffs, a reasonable and conservative estimate of SSI damping could be determined by applying certain limitations to the simplified expressions developed in the time frame of the original Calvert Cliffs analysis. This was the basis upon which the SEP approach to SSI was used. It was used in this application only to provide a realistic estimate of expected relative seismic displacement between the auxiliary building and the containment building as part of the instrument tubing evaluation. Seismic inertia loads associated with the tubing and its supports were based on results from the original seismic analysis.

Issue 2 - Use of a "Peak Amplification Factor" Curve

NRC Concern

Baltimore Gas and Electric Company used a "Peak Amplification Factor" chart to find the corresponding reduction in response of the original analysis with the use of the so-called "lower bound" of the estimated 12% damping. The chart was developed by Westinghouse Electric Corporation based on an experimental testing of a switchgear subjected to sine beat vibration. The use of this amplification

factor reduction curve is not necessarily applicable to the seismic response evaluation of the massive three-dimensional structures of Calvert Cliffs.

BG&E Response

The amplification chart, which is available in the literature, was developed using classical analytical methods and not by switchgear test. As such, it is applicable to any dynamic system regardless of size or construction. The chart provides a relationship between expected peak amplification and damping values for various sine beat functions as well as pure sinusoidal and random spectra functions. The chart was not used to establish an absolute amplification. It was used only to provide a ratio of amplification between two damping values. With all other parameters held constant, the ratio of amplification between two damping values is expected to be independent of structural configuration. Because the excitation due to actual seismic input may vary somewhat from the idealized excitation functions included in the chart, the total field of excitations were enveloped. Further, the expected value of SSI damping was conservatively limited to 12% even though higher values were computed.

The directional (3D) coupling effect is not expected to significantly alter the effective damping or the overall displacement between the two adjacent structures of interest.

Issue 3 - Use of SEP Soil-Structure Interaction on a "Layer Site"

NRC Concern

Baltimore Gas and Electric Company's approach assumes the complete validity of elastic half-space theory with the simulation of motion to calculate soil damping. The NRC staff believes that the soil damping based on the BG&E criterion does not represent the realistic soil damping of Calvert Cliffs Nuclear Power Plant founded on layered soil.

BG&E Response

The containment building at Calvert Cliffs is founded at about Elev. -116 inches with the auxiliary building about 20 feet lower. Thus, the subsurface zone of primary interest for the seismic analysis extends from Elev. 0 down to about Elev. -200 feet. Data from the Final Safety Analysis Report (FSAR), confirmed by a 1980 geotechnical report for the North parking area, show this zone to consist of dense, greenish-gray sand silts and silty fine sands of the Chesapeake Group (Miocene Geologic Age). The soil has occasional thin interbeds of shells and cemented sand. The SPT "N values" within the zone are consistent. Uphole seismic measurements of shear wave velocity within the Miocene stratum gave a constant velocity of 1600 feet/second. The FSAR notes that the Chesapeake group has been divided into three separate geologic formations. It notes that "for purposes of this study, these formations are essentially identical."

All the evidence points to a very consistent subsurface profile within the zone of influence for the seismic analysis below the main plant structures. The soil and its properties show no significant variation within the zone; and thus, it does not appear appropriate to model the zone as a layer system.