52-001

GE Nuclear Energy

ABWR

Date 6/26/92

Fax No. —

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This page plus 9 page(s)

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Subject Containment ultimate strength evaluation

Message Enclosed are Au-Shen Lu's response to the remaining 11 questions on the subject.

Response to questions 8 & 9 were provided in my FAX dated 6/1/92

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w/out Encl
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NRC PDR
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June 26, 1992

cc: H. E. Townsend
J. D. Duncan
C. B. Buchholz

To: J. N. Fox

From: A. S. Liu A. S. Liu

Subject: ABWR Containment Ultimate Strength

Reference: Memo to J.N. Fox from A.S. Liu, ABWR Drywell Head Buckling Capability, dated June 1, 1992.

Enclosed are the responses to the remaining 11 NRC questions on the containment ultimate strength evaluation. Please fax them to Gotum Bagchi of NRC for review. This, together wit the reference, completes our response to all 13 questions on Appendix 19F.

1. The discussion in Section 19F.2.1 (Ref. 1) states; "(1) the containment and building walls were connected at the upper pool and the diaphragm floor elevation, and both were anchored to a common base slab, and (2) the other floor slabs and the diaphragm floor slab were simulated by ring slabs to account for their stiffening effect on the cylindrical wall.". This modelling appears to be a departure from the physical characteristics of the ABWR containment. Provide information on how such a model was justified to be representative of the actual containment behavior under pressure, temperature and horizontal force as depicted in Fig. 19F-2.4.

Response

The connections between the containment and building walls mentioned in item (1) above are the two major interaction paths along the pool girder direction existing in the actual design. The building interaction effects through other slabs mentioned in item (2) were taken into account in sizing the ring slabs so as to maintain the same rigidities as the prototype. The simulation effects on the response to internal pressure loading were evaluated for two floor slabs in the 1/10 scale top slab model. The calculated hoop stresses in the ring slabs were found in good agreement with those in the prototype as shown in attached Fig. 1-1, indicating that the constraining effects of floor slabs were properly included in the tests. With regard to thermal response, the temperature loading applied closely maintained the average wall temperatures in the containment cylinder and top slab of the prototype in the normal operation condition during winter in which the temperature differences between inside and outside of the containment are larger. The purpose of the horizontal force test was to investigate the ultimate shear strength of the cylindrical shell so that the margin of safety in the seismic design of the prototype can be assessed. Prior to the final destructive test, the applied horizontal forces in several loading cycles were kept the same as the the design shear capacity of the prototype. In the final destructive test, a shear failure occurred when the applied force reached to the level about 3.6 times higher than the design load.