TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401

400 Chestnut Street Tower II

June 3, 1983

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

In the Matter of the	)	Docket Nos. 50-259
Tennessee Valley Authority	)	50-260
		50-296

By my letter to you dated April 22, 1983 we submitted a response to NRC request for additional information regarding IE Bulletin 80-11 masonry wall investigations for Browns Ferry Nuclear Plant. In that letter we committed to submit the results of a wall displacement analysis by June 30, 1983. Enclosed is that response.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills, Manager
Nuclear Licensing

Subscribed and sworn to before
me this 3rd day of June 1983.

Paulette H. White
Notary Public
My Commission Expires 9-5-84

Enclosure
cc (Enclosure):
U.S. Nuclear Regulatory Commission
Region II
ATTN: James P. O'Reilly, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

Mr. R. J. Clark
Browns Ferry Project Manager
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20814

IE 11
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ENCLOSURE
IE BULLETIN 80-11, MASONRY WALL DESIGN
WALL DISPLACEMENT ANALYSIS
BROWNS FERRY NUCLEAR PLANT

Item 8

According to Reference 5, page 4, the differential floor displacement was found to be less than 0.01 ft for all floor elevations below the operating floor. Provide the criteria by which this displacement was judged to be insignificant, and justify.

Response

The effects of differential floor displacement on masonry walls were evaluated by performing a finite element analysis of the wall judged to be the most severely affected by building displacement using the computer program SUPERB developed by Structural Dynamics Research Corporation.

Masonry wall 71B was selected for the analysis because it has a significantly greater ratio of width to height than any other masonry wall and it is located at an elevation in the reactor building having a horizontal displacement due to earthquake per unit height as great as any other level where masonry walls are located. Wall 71B is an unreinforced-mortared wall 25-feet high and extends 22 feet 7 inches in the north-south direction. There is a 7-foot- 6-inch-high opening at the base of the wall beginning 1 foot 4 inches from the northern edge and extending 6 feet 4 inches to the south. The wall is adjoined on its north and south ends by the concrete building structure and is restrained at the top by steel angles attached to the bottom of the floor above on the east and west sides of the wall. (Please refer to Appendix A enclosed in the letter from L. M. Mills to James P. O'Reilly dated October 1, 1981, for the location and description of all masonry walls that are near safety-related systems.)

Since Design Criteria BFN-50-D709 allows the same stresses for the operating basis earthquake and the design basis earthquake in unreinforced masonry walls, the wall was analyzed for the effects of building displacement due to the controlling design basis earthquake. The differential displacements for which wall 71B was analyzed were determined by doubling the building displacements for an operating basis earthquake obtained from the seismic report prepared by John A. Blume and Associates and do not exceed 0.0026 foot. The stresses due to displacement in the east-west direction were found to be low and, when combined with other stresses caused by the design basis earthquake, did not cause allowable stresses to be exceeded.

Two conditions of end restraint were investigated when examining the effects of north-south building displacement. First, the top of the wall was assumed to be bonded to the floor above while small gaps exist between both sides and the adjacent building structure. Secondly, the concrete building structure was assumed to be in direct contact with the wall and thus was loading the block wall in the direction of the building displacement while no bond was assumed to exist between the top of the wall and the floor above. For this

condition a uniform horizontal load resulting in the design displacement was applied along one side of the wall. The bottom of the wall was assumed to be bonded to the floor below for both conditions.

The shear stress in the mortar was found to be less than the allowable of 40 lb/in^2 when the wall was subject to the north-south displacement. The normal stresses in the mortar were generally found to be within allowable limits for this loading condition. However, in limited areas the tensile stresses in the mortar exceed the 10 lb/in^2 allowable. The regions of tensile stress exceeding 10 lb/in^2 are limited to the vicinity of the opening and in the lower southern corner of the wall and have a total area never exceeding 8 percent of the area of the wall. Even though the allowable tensile stress is exceeded in these regions and cracking can occur, the wall is in no danger of collapsing because of the nature of the loading. Since the masonry walls are not needed by the building structure to resist seismic forces, the maximum building displacements will not be effected by their performance. Since the masonry walls will be distorted only a set amount, they will not collapse due to this distortion regardless of the development of cracks. It should also be noted that wall 71B, as well as all other masonry walls which have support conditions that could cause in-plane distortion of the walls due to differential building displacement and whose failure could effect safety-related features, are to be restrained by steel members with spacings not exceeding 4 feet because of loading conditions defined in design criteria BFN-50-D709 R2.

In summary, TVA's investigation has determined that the masonry walls will maintain their stability (will remain standing) when subjected to the maximum differential building displacement and other loads caused by the design basis earthquake.