VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

April 7, 1989

W. R. CARTWRIGHT
VICE PRESIDENT
NUCLEAR

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Serial No. 88-551A
NL/RPC:vlh R2
Docket Nos. 50-280
50-281
50-338
50-339
License Nos. DPR-32
DPR-37
NPF-4
NPF-7

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
NORTH ANNA POWER STATION UNITS 1 AND 2
NRC BULLETIN NO. 80-11: MASONRY WALL DESIGN

In our letter (Serial No. 88-551) dated October 31, 1988, Virginia Electric and Power Company committed to provide a response to an open item associated with NRC Bulletin 80-11 on masonry block walls. In a telephone conversation with your staff on March 9, 1989, we stated that our calculations were conservatively performed assuming, for analysis purposes, that the masonry block walls were free standing cantilevers. We indicated that we were presently reviewing Bulletin 80-11 documentation and that the walls we had reviewed up to that time were supported at a minimum of two boundaries. It was agreed that we would identify any free standing, safety-related walls at Surry and North Anna Power Stations and provide details with dimensions of the exact walls in question.

As concluded in the attachment, it has been determined through a review of the 112 and 55 safety-related masonry block walls at Surry and North Anna, respectively, that there are no free standing cantilever block walls. This determination and the summary of analysis procedure provided in the attachment should sufficiently address the issue of concern (fixity at the mortar bed joint). We believe this response will adequately close out the

IE11
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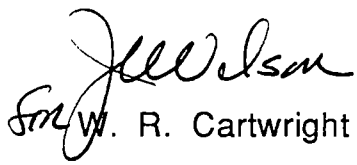
open item. Should you require additional information, we can meet with members of your staff as scheduled on April 19, 1989.

Please contact us regarding the outcome of this resolution.

Very truly yours,



For W. R. Cartwright

Attachment

cc: United States Nuclear Regulatory Commission
Region II
101 Marietta Street, N. W.
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Atlanta, Georgia 30323

Mr. W. E. Holland
NRC Senior Resident Inspector
Surry Power Station

Mr. J. L. Caldwell
NRC Senior Resident Inspector
North Anna Power Station

ATTACHMENT

SUMMARY OF ANALYSIS PROCEDURE FOR MASONRY BLOCK WALLS
IE BULLETIN 80-11

The boundary conditions used in the analysis of a particular wall were dependent on the specific wall geometry, the relative stiffness of the adjoining structural elements (slab or wall), and the determination of how the wall would interact with these elements so that the load would be transferred in a manner consistent with the wall geometry specific to the wall being analyzed. In some instances, it was determined that the boundary conditions where fixity might be assumed were not consistent with the specific wall geometry and supporting elements, and in these cases the joints described above were considered as pinned.

The appropriate boundary conditions for each case were calculated to be representative of the physical condition for both the calculation of dynamic response and the dynamic analysis.

Reevaluation of masonry walls utilized conservative assumptions, simplified analysis techniques, conventional boundary conditions, and conservative acceptance criteria. Analysis employed conservative damping values and amplified response spectra. Conventional boundary conditions used were simple, fixed or pinned.

It was assumed that the tensile stresses normal to the bed joints will provide for moment resistance up to the level of stress at which rupture will occur. This moment resistance at the base of a cantilevered wall is consistent with the definition of a fixed boundary condition for the purpose of calculating stresses or internal forces in the wall, which is a statically determinate structure.

The allowable stresses used for tension normal to the bed joint have an adequate safety factor in the analysis performed for IEB 80-11. Clamping devices were not used as a means of preventing rotation at fixed boundaries because there was no assurance that such a device would behave as designed to transmit loads without damaging the masonry walls. In lieu of clamping devices and where moment fixity was included as a boundary condition, the stresses associated with the resulting boundary moment were transmitted to supporting structures within acceptable stress limits.

In the Phase 1 or initial phase of the block wall analysis, the walls were analyzed using the most conservative criteria (i.e. cantilever wall) and simplified analytical techniques to screen those walls where more complex analysis was not warranted. Where additional analysis was warranted more exact analysis techniques which are still conservative, were applied to incorporate refined boundary conditions, more precise loading definitions, and computer aided analysis.

The following design approach was established in the block wall reevaluation procedure. The initial or Phase 1 analysis:

1) Review the boundary conditions, seismic input, and natural frequency calculations, revise these as required.

2) Perform the inertial calculations based on the resonant range accelerations.

3) Perform the displacement, and the external load calculations.

4) Combine the stresses and compare these against the allowable values. Note if the calculated stresses exceed code allowable values, specify the percentage of overstress, if any.

5) Perform the local analysis of the wall. Note, if any local stresses exceed the code allowables value and specify the percentage of overstress, if any.

6) If the calculated stresses in both Steps 4 or 5 do not exceed allowable values, the wall is acceptable.

7) If the calculated stress exceed the allowable values, then this wall shall be reanalyzed based on arch action criteria.

Walls previously analyzed under Phase 1 and identified as requiring further analysis due to the inertial stresses exceeding the Phase 1 allowables were reviewed as follows using the inelastic concept of arch action:

1) Review the initially chosen boundary conditions. Boundaries chosen as free edges due to openings may be reevaluated as pinned provided that the local stress concentrations are properly addressed.

2) The walls may be analyzed using a dynamic modal analysis based on an orthogonal grid of beams with lumped masses at the joints.

The review of the safety-related masonry block walls at Surry and North Anna Power Stations indicates that there are no free standing cantilever block walls. The block walls were, however, analyzed in certain cases as free standing cantilever walls since this method of analysis provides the most conservative results. Free standing cantilever block walls are statically determinate structures and can be analyzed by hand calculation using simplified strength of material methods.