

TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

September 14, 1981

Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, DC 20555



Dear Ms. Adensam:

In the Matter of the Application of
Tennessee Valley Authority

) Docket Nos. 50-390
) 50-391

Enclosed is TVA's evaluation of the draft of an NRC staff interim position on masonry walls which was provided informally to TVA on July 8, 1981. This evaluation, which includes TVA's interpretation of applicability to Watts Bar Nuclear Plant, is being provided as specified in the TVA/NRC telephone conference call on August 13, 1981.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills, Manager
Nuclear Regulation and Safety

Sworn to and subscribed before me
this 14th day of Sept 1981

Bryant M. Lowery
Notary Public

My Commission Expires 4/4/82

Enclosure

Boo1
5/1/1

8109170172 810914
PDR ADOCK 05000390
A PDR

ENCLOSURE
WATTS BAR NUCLEAR PLANT UNITS 1 AND 2
RESPONSE TO INTERIM NRC POSITION ON MASONRY WALLS

- References:
1. Letter from NRC to All Construction Permit and Operating License Applicants dated April 21, 1980
 2. Letter from L. M. Mills to NRC dated February 12, 1981
 3. Letter from L. M. Mills to E. Adensam dated August 20, 1981

TVA provided responses to NRC's request for information (Reference 1) concerning our usage of concrete masonry walls in the category I structures at Watts Bar Nuclear Plant (WBN) in References 2 and 3. Reference 2 addressed the reinforced concrete masonry walls, and Reference 3 addressed the unreinforced concrete masonry walls.

The following comments are referenced to the specific sections of the subject NRC interim criteria. They address the differences between this criteria and TVA's masonry wall criteria as provided in References 2 and 3. The comments also provide the rationale and justification for usage of the TVA criteria.

Section 1 - General Requirements

This section states, "In new construction, no unreinforced masonry wall will be permitted."

TVA's interpretation of this portion of the criteria is that since the unreinforced masonry walls (walls not containing internal reinforcing steel) have not yet been constructed at WBN, they fall under the definition of "new" construction and thus would not be permitted. TVA believes that the usage of unreinforced masonry walls in the category I structures at WBN is appropriate for the following reasons.

1. The unreinforced block walls are designed as nonstructural members. They serve no load-carrying function with regard to the building structure. That is, they do not function as vertical load-bearing walls nor do they function as shear walls within the structure.
2. The function of the unreinforced masonry walls is to perform as radiation shield "plugs" for access openings to equipment or to function as partition walls in partitioning off portions of the buildings. The walls may also function, in some cases, as environmental barriers to prevent the effects (steam, moisture, and temperature) of a pipe rupture from "communicating" to other building areas. In this case the walls will be properly restrained to withstand the design basis events that cause the environmental condition.
3. No attachments to the unreinforced walls are permitted. Thus, the walls do not function as a structural support for any components within the building.

4. The unreinforced walls are being evaluated for the loadings as defined in the criteria in Reference 3. The walls are being evaluated for the site seismic event and those walls that would fail under seismic loading, pressure loading due to pipe break or any other applicable loading, and whose failure could damage safety-related equipment in their vicinity will have structural restraints designed and installed to prevent damage to safety-related features. Those walls whose failures will not damage safety-related equipment will not be required to fail. It should also be noted that as a continuation of TVA's evaluation of block walls at WBN, we will address walls which must stand from an environmental barrier standpoint in our final report on the NRC information request. In this case certain walls will be restrained to prohibit the effects of a pipe rupture from communicating to other building areas.

Based upon the nonstructural function of the unreinforced walls and TVA's restraint of the walls whose failure could damage safety-related equipment, it is felt that the usage of unreinforced walls at WBN represents a sound engineering and economical approach that does not pose a threat to the safe operation of the plant.

Section 2 - Loads and Load Combinations

For the extreme environmental, abnormal, abnormal/severe environmental and abnormal/extreme environmental load conditions, and specifically load combinations (7) and (8) of the subject NRC criteria, the pressure loads due to pipe break and seismic loads are combined.

In TVA's criteria for unreinforced walls as presented in Reference 3, the loads due to seismic and pressure as a result of pipe break are not combined. It should also be noted that a load factor of 1.0 is used on the pressure and seismic load in the TVA criteria whereas the NRC criteria proposes a load factor of up to 1.5 on pressure loads and 1.25 on the 1/2 safe shutdown earthquake.

TVA believes that since the unreinforced walls do not serve a structural function, in that their primary functions are as "shield plugs" or partition walls, it is not necessary to design the walls for the combination of seismic and pressure loads. The failure of these walls would have no effect on the structural integrity of the structure or building. Thus, the two safety considerations for the walls is that they not be allowed to fall and damage safety-related equipment in the vicinity of the walls and that certain walls stand intact as environmental barriers. TVA's design criteria for the unreinforced walls requires that they be evaluated and restrained as required to resist either pressure loadings due to pipe break or seismic loadings due to the site seismic event, but the walls are not required to withstand these loads simultaneously.

In addition to the above, there are some additional differences between TVA's loads and load combinations for the unreinforced walls and those in the subject NRC criteria. They are listed below with justification for usage of the TVA criteria.

1. TVA's criteria does not address the 1/2 safe shutdown earthquake for "service load conditions." Since the unreinforced walls are nonstructural members and must only be restrained to prevent failure and resulting damage to safety-related equipment in the immediate vicinity, or to prevent communication of environmental effects to other building areas, only the safe shutdown earthquake loading was considered since it is the loading that would produce failure of the walls.
2. TVA's criteria does not reflect loadings due to pipe reactions (R_o and R_r) since attachments to the unreinforced walls are not permitted^a and thus these loads do not exist.
3. TVA's criteria does not reflect loadings due to temperature effects (T_o and T_r) on the walls. The effects of differential temperature loadings^a on the unreinforced walls under either service load or accident conditions is felt to be of minimal effect on the unreinforced walls and thus would have negligible effects on the failure of the walls.
4. TVA's criteria does not consider the effects of a pipe restraint force due to a postulated pipe break (Y_r) since no attachments or pipe supports are allowed on the unreinforced walls and thus the load does not exist.
5. TVA's criteria does not reflect a live load consideration since no attachments or live loads are permitted on the unreinforced walls.

TVA's criteria for reinforced masonry walls, as presented in Reference 2, addresses only dead load, live load (attachments to the walls are allowed) and the 1/2 safe shutdown earthquake and safe shutdown earthquake loadings. As reflected in Reference 3, TVA is presently continuing its investigation into all loading concerns addressed in NRC Bulletin 80-11. Revisions to the reinforced masonry wall criteria will be developed and issued as required.

Section 3.0 - Allowable Stresses

Paragraph (c) states, "When tension perpendicular to bed joints is used in qualifying the unreinforced masonry walls, the allowable value will be justified by test program or other means pertinent to the plant and loading conditions. For reinforced masonry walls, all the tensile stresses will be resisted by reinforcement."

As demonstrated by TVA's criteria in Reference 2 for the reinforced masonry walls, the tensile stresses in the walls are resisted only by the reinforcement. For the unreinforced walls, TVA's criteria as presented in Reference 3 allows tensile stress in the mortar perpendicular to the bed joint equal to the allowable stresses as given in ACI 531-79. The criteria further requires, in accordance with ACI 531-79, that where construction records conforming in general to the requirements outlined in section 4.5.2 of ACI 531-79 are not available, the allowable tensile stress will be reduced by one-half.

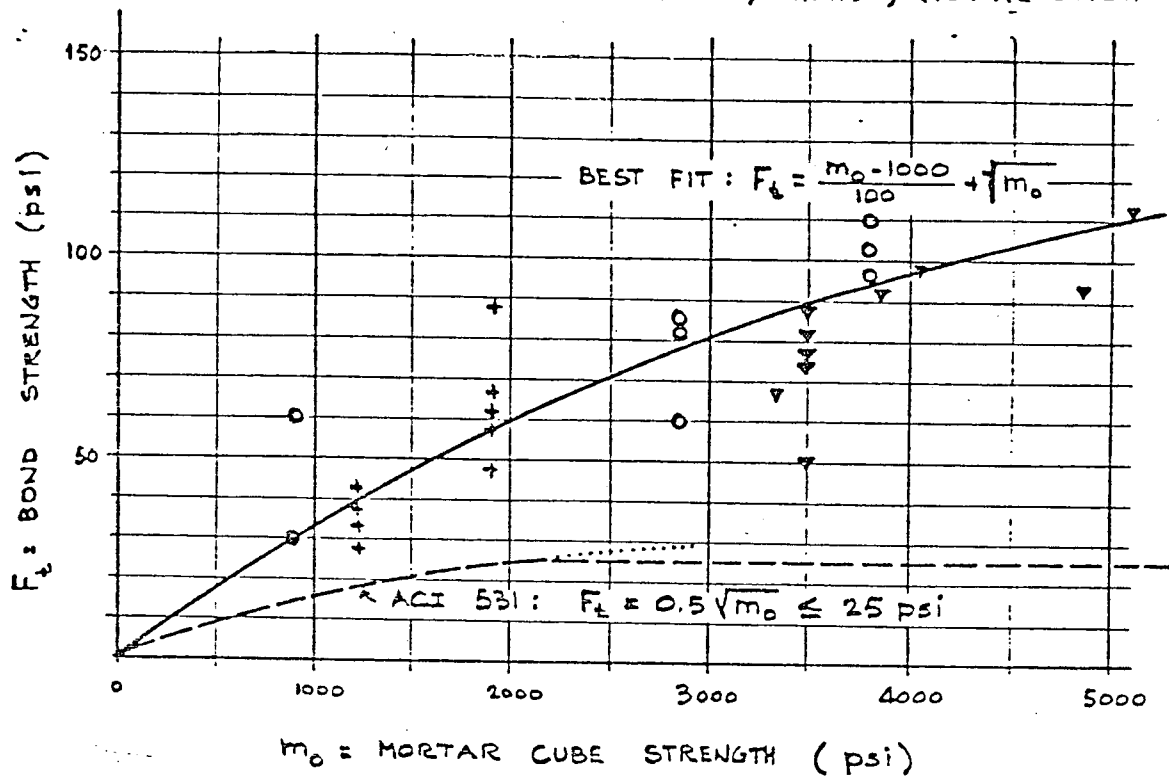
TVA believes the allowable tensile stress perpendicular to the bed joint as specified by ACI 531-79 is adequate and acceptable for design purposes. The attached graph represents the testing program data from which the ACI 531 committee based its code. In these tests unreinforced masonry walls (usually 4 feet wide by 8 feet high) were constructed in the laboratory and restrained at the top and base. A vertical strip of uniform load (an inflatable air bag) was applied to these walls. The walls were loaded to tensile failure and plot of the tensile bond strength of the mortar versus mortar cube strengths has been recorded by the National Concrete Masonry Associates and others (see attached). As the graph shows, the ACI 531-79 allowables for tensile stress are very conservative and therefore justifiable for usage. TVA, therefore, does not presently propose any additional testing to justify this allowable tensile stress.

▼ NCMA RESEARCH

○ "Tests of Structural Bond of Masonry Mortars to Concrete Block"

R.E. Copeland, E.L. Sayer; ACI JOURNAL, Nov. 1964

+ "Load Tests of Patterned Masonry Walls", R.O. Hedstrom



TENSILE BOND STRENGTH VS. MORTAR CUBE STRENGTH