

Enclosure 1

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
STRUCTURAL AND GEOSCIENCES BRANCH
EVALUATION OF MASONRY WALL DESIGN, IE BULLETIN 80-11
PALISADES NUCLEAR PLANT

1.0 INTRODUCTION

Consumers Power Company's (CPCo.) letter of March 30, 1989, provided the information requested by the staff on IE Bulletin 80-11, Masonry Wall Design. As a result of our reviews of the information, the staff had identified in a prior communication to the licensee dated April 15, 1988, three unreinforced hollow masonry walls as requiring additional evaluation and/or testing, and had listed seven questions requiring additional information from the licensee. CPCo's reply of July 31, 1989, along with the information obtained during the staff site visit of July 11, 1989, provided the required information to resolve the staff concerns.

2.0 EVALUATION

During our earlier review of the masonry block walls at the Palisades site the staff raised concerns on the proposed qualification approach for three hollow masonry walls under the action of out-of-plane loads. The licensee's proposed evaluation approach included the use of the Arching Action Theory. This theory relies on the fact that higher resistance can be developed by creating large in-plane clamping forces thereby forming a three hinged arch mechanism after the mid-span and end supports cracking has occurred. A major requirement for the actual development of this physical principle (arching mechanism) are the existence of the rotational restraint at the wall boundaries and the prevention of the gross sliding of the walls at the support sections.

Tests performed to qualify hollow unreinforced masonry walls for the Oconee Nuclear Station have proven the applicability of this theory under proper wall boundary conditions. Computech Engineering Services, Inc. (CES) had been involved in the development of the original tests and in the evaluation of the test results. CES has served as CPCo consultant in evaluating these three hollow unreinforced walls.

The applicability of the test results to the Palisade's hollow unreinforced masonry walls has been demonstrated based on comparison of the dimensional and material properties, boundary conditions, and loading functions. The evaluation indicated that the test walls were all larger than and with similar materials as the three masonry block walls at the Palisades site. Also, the boundary conditions for the Palisades masonry walls are stiffer than those of the tested walls. One of the three walls is a multi-wythe wall and has rigid side supports. The tested walls are all single-wythe walls. Finally, the loading functions for the tested walls included quasi-static and dynamic (earthquake) loads. Two of the subject walls at the Palisade site are governed by earthquake loads while the other wall is governed by the tornado missile loads.

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The results of CES evaluation can be summarized as follows:

WALL	HEIGHT	WIDTH	MOMENT CAPACITY	COMPUTED MOMENT	SAFETY FACTOR
C-107-14	12'-0"	14'-0"	119.5 K-ft.	35.5 k-ft.	3.37
C-107.5	8'-6"	12'-8"	205.8 K-ft.	48.5 k-ft.	4.24
C-321-1	12'-5"	8'-0"	308 K	288 k	1.07

The results have been found acceptable by the staff during the site visit after review of CES evaluation material.

Two masonry walls C-107-12 and C-108-12 had been identified as needing re-evaluation to ascertain that the design allowable stress limit of 30ksi for the reinforcing bars was met. CPCo enlisted the support of Bechtel Power Corporation, to perform the required re-evaluation. The results of this reevaluation were presented at July 11, 1989, meeting and were found acceptable by the staff.

The design assumptions of masonry wall C-104-5 were questioned during the initial evaluation, based on unclear documentation of the configuration of the boundary conditions. The support provided to the wall by a steel column was not clear in the original licensee submittal due to the lack of proper sketches and/or photographs. The staff was able to verify the integrity of the steel column support and the assumed boundary condition during the site visit of July 11, 1989, and finds the assumed boundary conditions acceptable.

The last issue requiring resolution applied to masonry wall C-303-9. This wall is a 6'x 6' x 2' thick solid masonry block wall serving as a blackout in a Category I wall that separates the auxiliary and service buildings. This masonry wall is covered by a massive heavy gauged steel junction box containing security circuitry. The licensee has evaluated the capacity of the steel junction box to resist the postulated missile impact utilizing the evaluation criteria of Bechtel Power Corporation BC-Top 9. This report is a topical report approved by the staff. The evaluation indicates that the junction box is capable of dissipating the postulated missile impact energy. The staff finds the results of this evaluation acceptable.

3.0 CONCLUSION

The licensee has addressed and resolved the original staff concerns on the applicability and adequacy of the Arching Action Theory for walls C-107-14, C-107-5 and C-321-1, the qualification of walls C-107-12 and C-108-12 for adherence to the allowable stress limit of 30 ksi, the verification of the support boundary conditions for wall C-104-5, and the evaluation of the energy absorption capacity of the steel junction box covering wall C-303-9. Based on the above evaluation and findings, we consider the remaining issues related to the evaluation of Palisades masonry walls resolved.