Consumers Power
POWERING MICHIGAN'S PROGRESS
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July 31, 1989

Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT - UPDATED RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION ON IE BULLETIN 80-11, "MASONRY WALLS" (TAC No 42915)

By letter dated April 15, 1988, the NRC requested additional information regarding Consumers Power Company's response to IE Bulletin 80-11, "Masonry Walls". Our letter dated July 20, 1988 identified work had begun on responding to the request, however, much of the remaining effort hinged on obtaining the original calculational packages from the architect/engineer. These packages were not obtained until January 1989 and consequently, a partial response was provided on March 30, 1989. This response indicated that two walls (C-107-12 and C-108-12) required further calculational evaluation and that three walls (C-107-05, C-107-14 and C-321-01) required justification of arching action for qualification. This submittal committed to complete the evaluations and justifications and submit the results for NRC review by October 1, 1989.

During teleconferences between representatives of Consumers Power Company and NRC staff on May 10, 1989 and on May 15, 1989, additional information regarding our March 30, 1989 submittal was requested. Acceleration of our completion schedule was also requested to support a July 1989 meeting between Consumers Power Company and the NRC staff. Subsequently, a meeting was held at the Palisades Plant on July 11, 1989. At this meeting the previously requested information was provided. A summary of the information discussed is included within the attached update to Consumers Power Company's March 30, 1989 letter. Additional information is annotated by markings in the right margin.



Ralph R Frisch
Senior Licensing Analyst

CC Administrator, Region III, USNRC
NRC Resident Inspector - Palisades

Attachment

IEB 80-11-LI01-NL04-LI01



IE11
1/1

ATTACHMENT

Consumers Power Company
Palisades Plant
Docket 50-255

# UPDATE TO THE MARCH 30, 1989 RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION ON IE BULLETIN 80-11, "MASONRY WALLS"

July 31, 1989

9 Pages

QUESTION 1

With reference to the reinforcement in masonry walls, the ACI 531-79 Code (Ref 1) specifies that the minimum area of reinforcement in a wall in either direction, vertical or horizontal, shall be 0.0007 (0.07%) times the gross cross-sectional area of the wall and that the minimum total area of steel, vertical and horizontal, shall not be less than 0.002 (0.2%) times the gross cross-sectional area. In view of this, clarify whether the reinforced walls at this plant meet the above criteria.

RESPONSE

Thirteen walls relied on reinforcement in their qualification analysis. Of the thirteen walls, three walls comply with the definition of, "reinforced masonry", arbitrarily defined in Section 11.3.2.2 of ACI 531-79. The remaining ten walls are identified below:

| Wall No. | | |
|---|---|---|
| | C-104-06 | C-107-17 |
| | C-104-11 | C-108-02 |
| | C-104-12 | C-108-05 |
| | C-107-12 | C-108-12 |
| | C-107-16 | C-109-07 |

All walls met the requirement of 0.07% reinforcement in the vertical direction. Four walls C-104-06, C-104-11, C-107-16 and C-109-07 relied only on the vertical reinforcement in an analysis using a vertical element to qualify them. Four of the remaining six walls C-104-12, C-107-17, C-108-02, and C-108-05 do not meet the requirements of 0.07% horizontal reinforcement or the requirement of 0.2% combined area of horizontal and vertical reinforcement. Although these walls do not meet these requirements, their respective analyses utilizing actual steel reinforcement values show they have sufficient strength to resist the imposed loads and meet the allowable joint reinforcement stress of 30 ksi identified in Section 10.2.1.2 of ACI 531-79. The remaining two walls C-107-12 and C-108-12 required further evaluation which is provided in the revised response to Question 2.

QUESTION 2

If the joint reinforcement is used to resist tension in a vertically reinforced wall, it should follow the working stress design method which limits its allowable to 30 ksi. Please clarify whether this criterion has been satisfied. If this criterion is not satisfied, identify all affected walls along with the calculated stress value for each wall.

RESPONSE

Six walls relied on joint reinforcement in combination with vertical reinforcement to resist the imposed out-of-plane loads. The six walls are:

| | |
|---|---|
| C-104-12 | C-108-02 |
| C-107-12 | C-108-05 |
| C-107-17 | C-108-12 |

The working stress design method was utilized in the analysis of these walls. The allowable joint reinforcement stress of 30 ksi identified in Section 10.2.1.2 of ACI 531-79 was used for normal loadings. For extreme loads such as SSE, the allowable working stress of 30 ksi was factored by 1.67 which is within the guidelines of Standard Review Plan 3.8.4 Appendix A. Walls C-104-12, C-107-17, C-108-02, and C-108-05 satisfy the allowable joint reinforcement as defined above. The joint reinforcement in walls C-107-12 and C-108-12 was shown to meet the allowable 30 ksi joint reinforcement stress when the allowable working stress was factored by 1.67 and the loads of existing attachments and additional thickness of concrete were distributed. The joint reinforcement stress analysis for walls C-107-12 and C-108-12 completed by Bechtel Power Corporation on July 7, 1989 was presented to NRC representatives on July 11, 1989 during a meeting at Palisades.

QUESTION 3

Indicate any wall that has only joint reinforcement (horizontal reinforcement), no vertical reinforcement, and may have been qualified using the tensile resistance of the joint reinforcement. (See enclosure 2).

RESPONSE

No masonry walls included in Palisades IE Bulletin No. 80-11 evaluation are in this category.

QUESTION 4

With regard to the arching action technique, the use of the arching action theory to qualify unreinforced masonry walls is not proven. (See enclosure 3). Please provide additional justification for not modifying walls 107.5, 105.14, and 321.1.

RESPONSE

The reference to wall 105.14 in this question appears to be a typographical error. The correct reference should be to wall C-107-14. Consumers Power Company enlisted the services of Computech Engineering Services, Inc., Berkeley, CA to provide justification for the arching action to qualify walls C-107-05, C-107-14, and C-321-01. As detailed within Computech Engineering Services, Inc (CES) July 1989 report entitled, "Evaluation of Masonry Walls, Palisades Nuclear Plant" and as presented to NRC representatives during a meeting on July 11, 1989, arching action has been justified with a resultant safety factor greater than unity for walls C-107-05, C-107-14 and C-321-01.

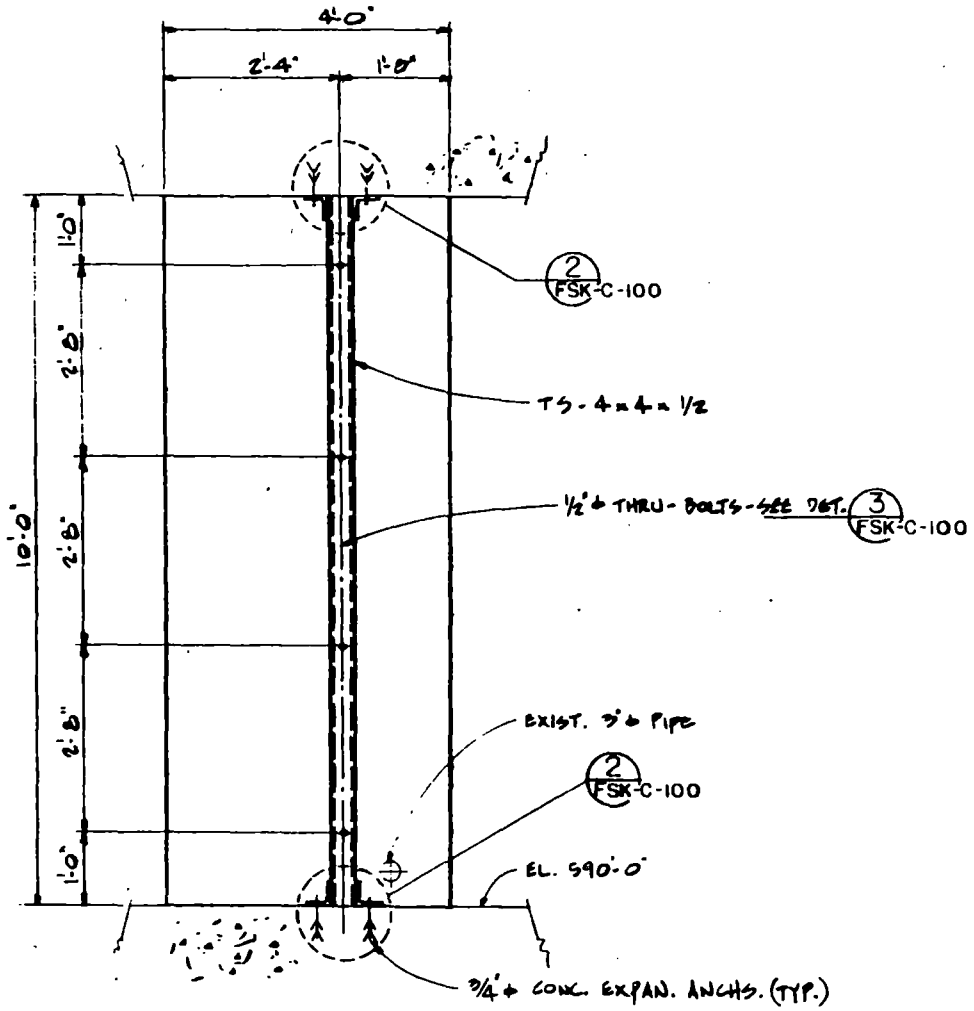
The CES evaluation was based on the arching action methodology as developed by Duke Power Company and validated by a test program performed by CES. As shown in the CES report, Palisades walls C-107-05, C-107-14 and C-321-01 differ slightly in physical characteristics than those walls included in the validation test program, however, the geometry and boundary conditions of the Palisades walls are enveloped by those included within the CES test program.

QUESTION 5

In Response No. 11 of Reference 3, a sample calculation was provided for beam brace modification for wall C-104.5 in which the modified wall was analyzed as a horizontal beam strip. However, drawing FSK-C-104.5 (Q) (1) shows that the two vertical sides of the wall are free. Since the vertical sides are free, please provide justifications for the horizontal beam strip assumption.

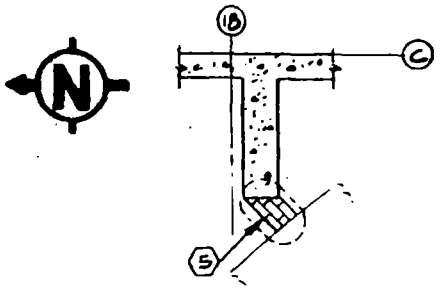
RESPONSE

The analysis models wall C-104-05 as a horizontal strip 1 ft. in width and 4 ft long supported by a single vertical member located 20 in. from the west end of the wall. As shown on the attached drawing, FSK-C-104.5(Q)(1), this geometry is acceptable as the tube steel support attached to the wall demonstrates fixed boundary conditions allowing a horizontal cantilever strip analysis. The ends of the wall are not considered to be supported in the analysis. The shear and tensile allowable stresses of the masonry are shown not to be exceeded, therefore, the wall is capable of resisting the imposed loads.




ELEVATION LOOKING SOUTHEAST

3/4" = 1'-0"




PARTIAL PLAN EL. 590'-0"

NOTES -

1. FOR GENERAL NOTES SEE DWG. FSK-C-100

| | | | | | |
|---|---|---|---|---|---|
| 1 | 1/27/93 | AS-BUILT BLOCKWALL MOD. PER GWO 5160 REVISED AS RECORD. | DRB | JGD | TCS |
| 0 | 9/92 | ISSUED FOR CONST. | DRB | JGD | TCS |
| NO. | DATE | REVISIONS | BY | CHECKED | APPROVED |

DRAWING NOTES: ENGINEER A. SPESARD | DRAWN L. BERTYN

**BECHTEL**
ANN ARBOR, MICHIGAN

PALISADES PLANT
CONSUMERS POWER COMPANY
GWO 5160

AUXILIARY BUILDING
MASONRY WALL REPAIR

| JOB No. | DRAWING No. | REV. |
|---|---|---|
| 12447-047 | FSK-C-104,5(Q) | 1 |

QUESTION 6

In Response No. 4 of Reference 3, a total of four walls (C-107.10, C-107.28, C-107.31, C-108.11) were identified to be removed. Please provide the status of these walls.

RESPONSE

Walls C-107-10, C-107-28, C-107-31, and C-108-11 have been removed.

QUESTION 7

Reference 3 indicated that plate analysis was used to qualify a number of walls. Please explain the analytical procedures used in the post-cracked state of the wall (ie, cracks along the vertical and horizontal direction).

RESPONSE

Plate analysis was used to qualify twenty-six walls. Of the twenty-six walls, seventeen walls did not exceed the allowable tensile stresses in the masonry and were qualified using uncracked section properties. The remaining nine walls used the cracked section properties of the reinforced masonry for qualification. Cracked section properties were used to reduce the section stiffness in the post-cracked state. The resulting stiffness was employed to redefine the natural frequencies of the wall. These frequencies were then in turn used to determine response spectra ordinates. The ordinates were then employed to evaluate the capacity of the resultant wall cross section. Orthotropic section properties were employed for walls cracked in only one plane. Typical calculations were reviewed with NRC personnel at the July 11, 1989 meeting.

QUESTION 8

In Response No. 9 of Reference 3, wall 303.9 was identified as unqualified under tornado missile impact. However, it was stated that no modification was needed. Please provide justification for not modifying this wall (i.e., details of the wall with surrounding structures, quantitative results supporting your conclusion).

RESPONSE

Per Consumers Power Company response to NRC dated November 8, 1982 and titled, "PALISADES PLANT - RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING IE BULLETIN 80-11, MASONRY WALLS", Wall C-303-09 is a 6' x 6' x 2' thick solid block wall, serving as a blockout in a major structural wall separating the auxiliary and service buildings. The block wall is considered an exterior wall in that the surrounding service building is not designed for tornados. There is no safety-related equipment in proximity to the block wall. The service building side of the wall is almost entirely covered by a massive junction box containing security circuitry. Although the circuitry is not safety related, continuous surveillance of the plant area would be required as the security equipment is handled during any anticipated modification. The auxiliary building side of the wall bounds the elevation 602'-0" pipeway where the radiation field is very high.

The block wall could conceivably be modified by replacing it with reinforced concrete. This modification would expose the service building to radiation fields from the pipeway during construction. An alternative modification would be to install a thick steel plate over the service building side that would provide a tornado protection already provided to a limited extent by the junction box and service building. In view of ALARA considerations, consideration of the fact that the service building and junction box do indeed provide for some tornado protection and diverse missile scatter patterns, and a missile impact energy dissipation analysis completed by Bechtel Power Corporation, no modification will be pursued. The energy dissipation analysis is available on site on request.