Omaha Public Power District
1623 Harney Omaha, Nebraska 68102
402/536-4000

March 9, 1984
LIC-84-066

Mr. James R. Miller, Chief
U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Licensing
Operating Reactors Branch No. 3
Washington, D. C. 20555

References: 1) NRC letter, Miller to Jones, February 6, 1984
2) Docket No. 50-285

Dear Mr. Miller:

Masonry Wall Design
IE Bulletin 80-11

In response to your request dated February 6, 1984, for additional information concerning Masonry Wall Design (IE Bulletin 80-11) please find enclosed Omaha Public Power District's response to that request.

Sincerely,

W. C. Jones
Division Manager
Production Operations

WCJ/JJF/lp

Enclosure

cc: LeBoeuf, Lamb, Leiby & MacRae
1333 New Hampshire Avenue, N.W.
Washington, D.C. 20036

Mr. E. G. Tourigny, Project Manager
Mr. L. A. Yandell, Senior Resident
Inspector

IE11
1/1
APER. CARD DIST.

RESPONSE TO
REQUEST FOR ADDITIONAL INFORMATION
MASONRY WALL DESIGN, IE BULLETIN 80-11
FORT CALHOUN STATION

QUESTION 1: With regard to Response 2 of Reference 1, the licensee indicated that arching action was used to qualify some walls. It should be noted that the NRC position on this issue states that the use of the arching action theory to qualify the unreinforced masonry walls is not acceptable; these walls should be repaired so that they can be qualified based on the NRC acceptance criteria (2). (The NRC position is attached.)

In addition, the licensee is requested to identify all affected walls.

ANSWER: The masonry walls were originally qualified based on the arching action theory. In response to the Request for Additional Information by NRC dated February 6, 1984, the walls were re-evaluated based on the working stress approach. All walls were treated as unreinforced concrete masonry walls. It is found that 13 walls out of 22 walls do not qualify for the seismic loading calculated with the dynamic analysis approach, if wall capacity is established based on working stress theory. The following walls will require modifications: (See the attached drawings)

1) Battery Room:
   a) West Wall Room #2
   b) East Wall Room #2
   c) North Wall
   d) South Wall

2) Control Room:
   a) West wall between Control Room & Computer Room
   b) South wall of Computer Room

3) Auxiliary Building

a) North Wall of Corridor between Column Line 7a and 7b
b) East Wall of Corridor between Column Line Q and T
c) West Wall of Counting Room between Counting Room and Chemistry Room
d) East Wall of Counting Room
e) East Wall of Corridor between Column Line L and N
f) West Wall of Corridor between Column Line L and N
g) North Wall of Decontamination Room

The District will repair or modify these walls as necessary so that they will comply with the design criteria in accordance with the working stress theory and qualify them for seismic loading.

QUESTION 2: With respect to the seismic analysis method, the licensee used a formula of the Uniform Building Code to evaluate the lateral forces. In Response 4 (1), the licensee indicated, however, that a dynamic analysis was being performed to validate the proposed static analysis. Provide the results of the dynamic analysis along with description of its approach. Indicate whether the input motion used for this dynamic analysis is based on the acceleration of a floor response spectrum. If not, provide justification.

ANSWER: A dynamic analysis was performed to justify the acceleration value of 0.3375g which was computed based on the Uniform Building Code approach. The acceleration (g) values calculated with the dynamic analysis approach ranged from 0.59g to 1.6g depending on the dimensions of the walls. These higher acceleration values were used as the basis for the re-qualification criteria discussed under Item 1.

Natural frequencies of the walls were calculated assuming a one-way or two-way behavior, assuming simple support boundary conditions. A poisson's ratio of 0.15 was used. The effect of door openings in the masonry walls was accounted for. An amplified floor response spectra was selected to obtain the seismic accelerations. The floor response spectras

were selected at the bottom of the wall or at the next higher elevation whichever yielded the maximum response within the frequency range determined. The seismic accelerations were increased by a factor equal to 1.05 to account for the participation of higher modes for out-of-plane flexural calculations. The damping values of 2 percent for Operational Basis Earthquake (OBE) and 4 percent for Safe Shutdown Earthquake (SSE) were used for the unreinforced masonry walls.

QUESTION 3: Regarding the boundary conditions, the licensee indicated in Response 6 (1) that a shear transfer at the top of a simply supported wall is achieved by the wedging action of the wall with mortar bond between the masonry wall and the underside of the slabs. However, it has been discovered during a recent inspection that the mortar bonds with the underside of the slabs are separated. The licensee should modify these walls to assure shear transfer will take place (i.e., clip angles could be installed). Specify the intended action for these walls.

ANSWER: The District will install clip angles at the top of both faces of 21 of the 22 masonry walls to assure that shear transfer at the top will take place. The south wall of the control room already has clip angles installed on both faces of the wall at the top.

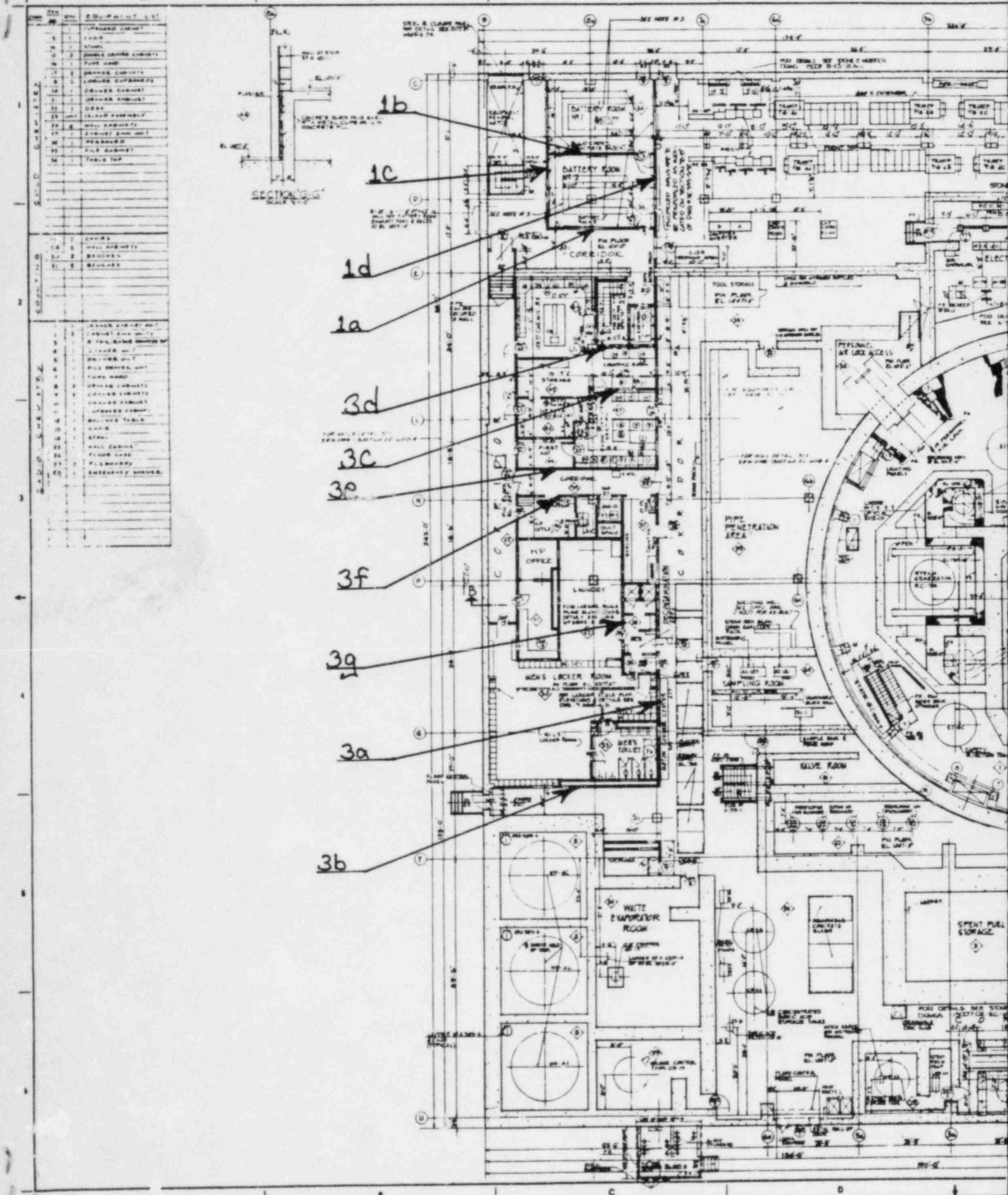
QUESTION 4: With regard to the block pullout analysis, even though the walls are not subjected to any impact or suddenly applied loads, as explained in Response B (1), the licensee should consider the case when the block could be pulled out by attachments under seismic loads. Provide a sample calculation illustrating how this case is handled.

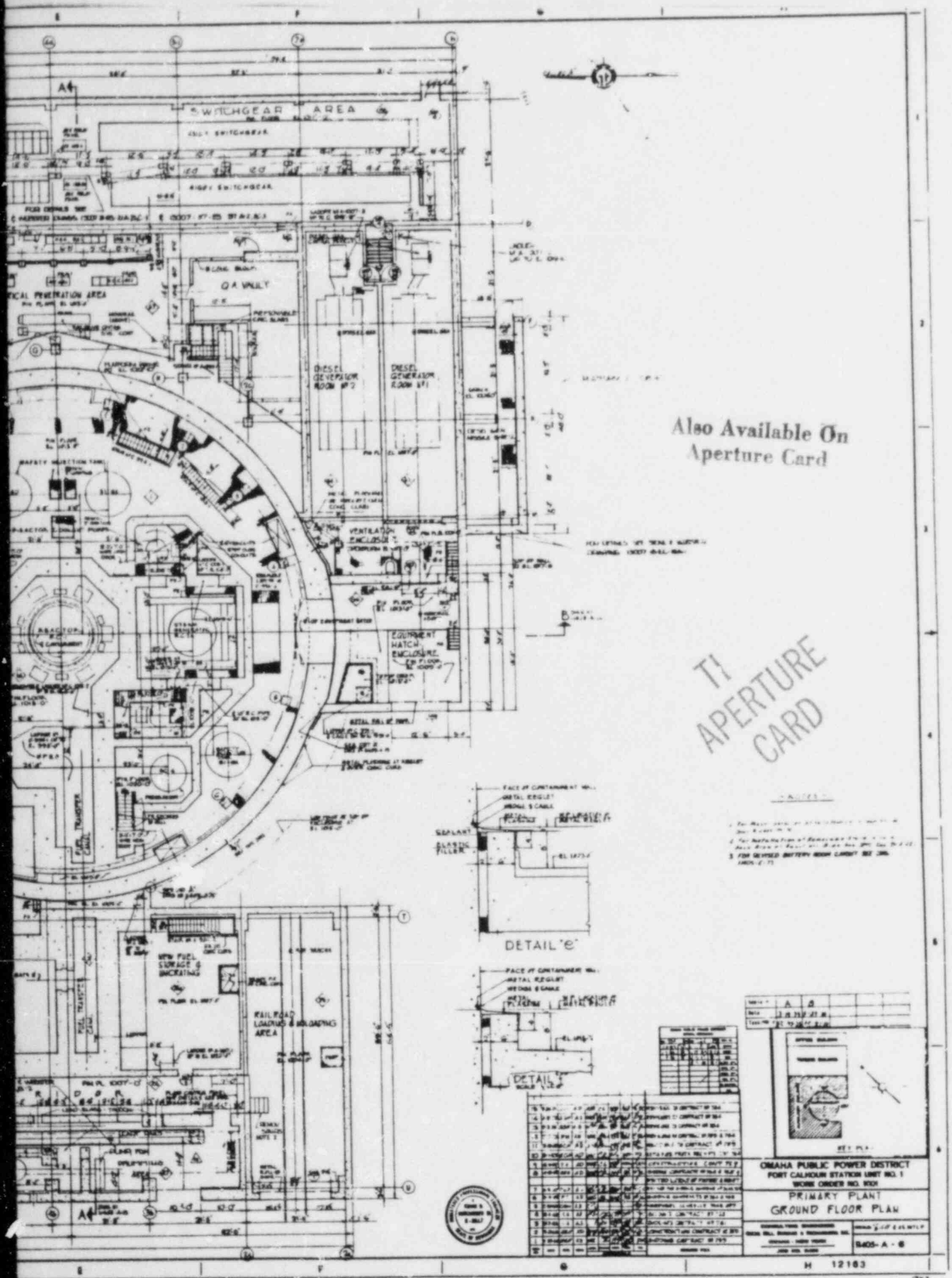
ANSWER: During the re-evaluation program it was concluded that there are no attachments on the masonry walls which could cause a block pull out under seismic loads. The only attachments on the masonry walls are some light weight non-safety related equipment. During a seismic event these attachments would fail before they would result in a block pull out.

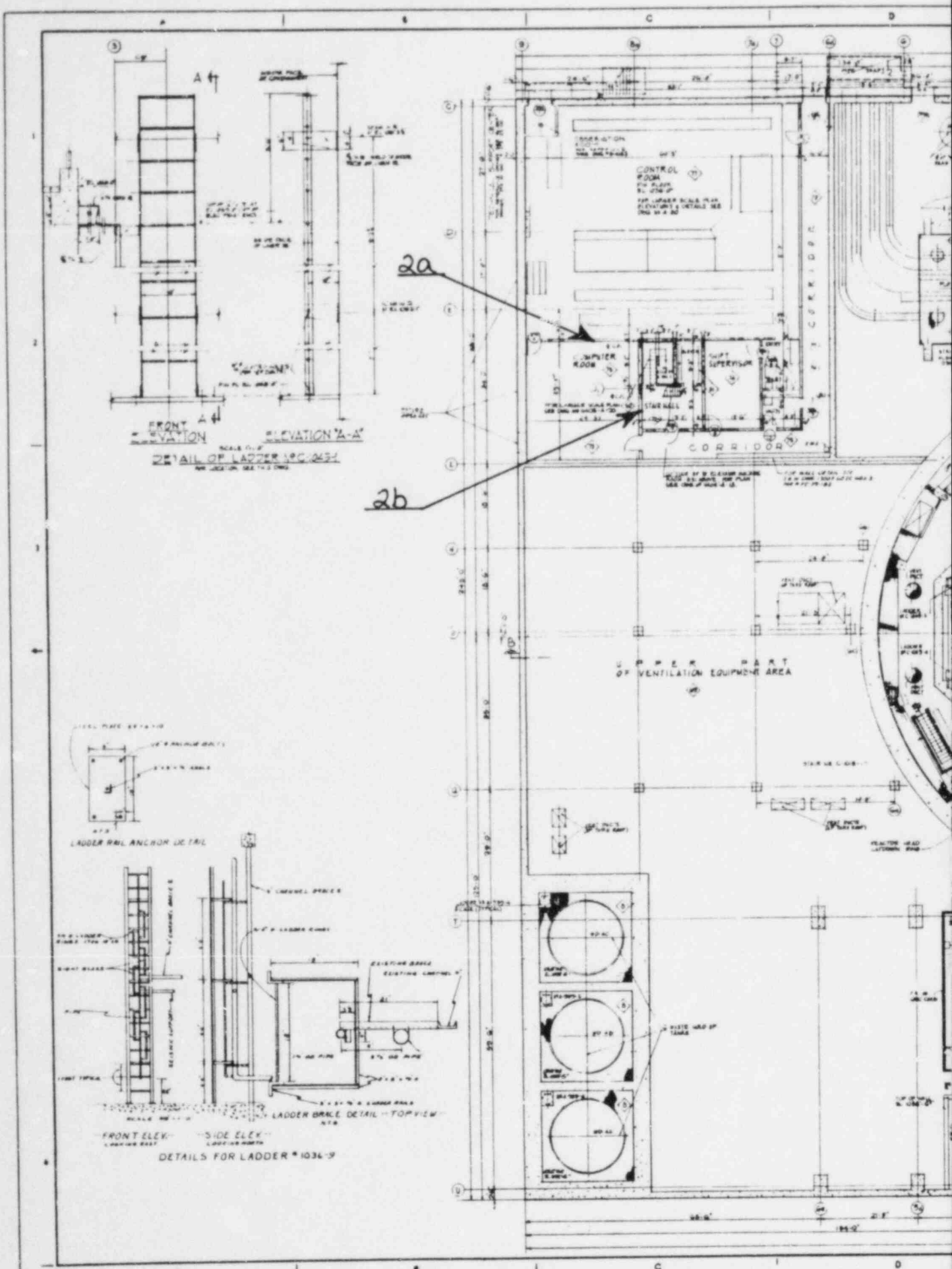
However, the District will perform the block pull out calculations for each attachment to these masonry walls to justify this conclusion and provide the commission with sample calculations by the end of the 1984 refueling outage, May 15, 1984.

QUESTION 5: A total of 20 walls are identified as being stacked by blocks with no mortar. However, as indicated in Response 9 (1), only seven locations on five unreinforced walls were provided with structural restraints. Indicate whether restraints were also provided for other walls. If not, provide the technical basis and justification (i.e., based on available test data) as to why no restraint is required. Restraints should be installed for all of these walls.

ANSWER: All of the 20 shield walls were inspected in accordance with the requirements of IE Bulletin No. 80-11. These walls are removable walls in which the solid masonry units are stacked with no mortar. The structural restraints were originally installed on all of the 20 shield walls to contain the stacked blocks in-place. The evaluation program concluded that seven walls have safety-related equipment in the proximity of these walls. The failure of these walls during a seismic event may cause damage to the safety related equipment. Restraints on two of these seven shield walls were designed for the seismic loading. The other five walls required modifications to qualify them for the seismic loads. The additional restraints to reinforce these walls were installed at seven locations on five walls to qualify them for seismic loading. These restraints were installed as a part a modification which was completed in January 1982. The remaining thirteen walls do not have any safety related equipment in the immediate area and their failure will not cause damage to any safety related equipment. These walls do have originally installed structural restraints.


1b
1c
1d
1a
3d
3c
3e
3f
3g
3a
3b
BATTERY ROOM
CORRIDOR
PIPE PENETRATION AREA
MEN'S LOCKER ROOM
MEN'S TOILET
SAMPLING ROOM
VALVE ROOM
WASTE EVAPORATOR ROOM
SPENT FUEL STORAGE
LAUNDRY




A
A
FRONT ELEVATION
ELEVATION "A-A"
DETAIL OF LADDER No. 1036-9
2a
2b
CONTROL ROOM
SHIFT SUPERVISOR
STAIR WELL
CORRIDOR
UPPER PART OF VENTILATION EQUIPMENT AREA
LADDER RAIL ANCHOR DETAIL
LADDER BRAKE DETAIL - TOP VIEW
FRONT ELEV.
SIDE ELEV.
DETAILS FOR LADDER No. 1036-9