



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

OCT 21 1983

MEMORANDUM FOR: George Knighton, Chief
Licensing Branch No. 3
Division of Licensing

FROM: George Lear, Chief
Structural and Geotechnical Engineering Branch
Division of Engineering

SUBJECT: EVALUATION OF PG&E'S RESPONSE TO THE ANONYMOUS
ALLEGATIONS AT DIABLO CANYON, UNIT 1

Reference: Letter from J. O. Schuyler of PG&E to George Knighton
dated July 1, 1983

As requested, R. Lipinski of Structural Engineering Section A, Structural and Geotechnical Engineering Branch evaluated responses of the Pacific Gas and Electric Company, (PG&E) to the allegation no. 6, contained in the enclosure to the reference.

We find that the PG&E's response is acceptable pending review of the two items, confirmatory in nature, namely:

- a) Test programs of the material (masonry block, grout and reinforcing bars) to demonstrate validity of the actual stresses used in design.
- b) Demonstration by the PG&E that the tornado parameters (wind and the associated atmospheric pressure drop) represents the upper bound of the loads which can be expected to act on the masonry walls located in the turbine building.

During the telephone conference involving the staff and the PG&E representatives on October 18, 1983, both of these items were discussed and it is expected that the licensee will provide the pertinent information by October 25, 1983.

George Lear
George Lear, Chief
Structural and Geotechnical
Engineering Branch
Division of Engineering

Enclosure: As stated

cc: See page 2

Contact: R. Lipinski, x28428

8310310503XA

G. Knighton

-2-

cc: J. Knight
D. Jeng
B. Buckley
A. Vietti
✓ N. Chokshi
R. Lipinski

Evaluation of PG&E Response
to Anonymous Allegation No. 6
Diablo Canyon Nuclear Plant, Unit 1

1. Allegation

"Tornado Design Criteria: Masonry walls in the turbine building are not analyzed for the suction loads which might result from a tornado. Thus the tornado design criteria is (sic) incomplete."

2. Project Position

In his response, the licensee stated that the switchgear and cable spreading rooms in the turbine building are capable of withstanding a 200 mph tornado wind and the associated differential pressure of 0.86 psi.

Furthermore, all masonry walls in proximity to safety related equipment are being re-evaluated for the loads resulting from a Hosgri earthquake using the appropriate response spectra. The design suction pressure of 0.86 psi is equivalent to 1.5g seismic load for an 8-in thick masonry wall. The walls in question are being reviewed for a seismic acceleration of no less than 1.5g. In view of the above, the licensee concluded, since the seismic loads are equal or greater than the postulated tornado loads the masonry walls located in the turbine building are adequately protected.

3. Extent of Review by the Staff

During OL review of Diablo Canyon plant the applicant evaluated the tornado resisting capabilities, in terms of safewind velocities, of the Category I

structures. The safewind velocity included wind pressure and the associated atmospheric pressure drop effects and was based on the element of the structure with the minimum capability.

The switchgear and cable spreading rooms are located in the turbine buildings and the separation between the individual rooms consists of eight-inch concrete block walls, with all cells full of grout, number four reinforcing bars vertically, on 16-inch centers and two number four reinforcing bars horizontally on 32-inch centers.

At the request of the staff the licensee performed additional analysis to determine capability of the walls to resist tornado loads. This analysis consisted of evaluation of the walls for a postulated 200 mph wind pressure plus one-half of the associated atmospheric pressure drop. Because of the location of the equipment within the turbine building it has been concluded that the probability of a tornado generated missiles striking the vulnerable areas is small enough to be negligible and missiles were not included in the analysis. In the analysis the licensee compared the required capacities of the walls with those which are available, using both criteria: those of IF Bulletin 80-11 and those of the SRP Section 3.8.4, Appendix A. The analysis included comparison of shear stresses as well as those produced by the bending moment, which is governed by rebar tension stress. The allowable stresses of the material

used in the evaluation were those obtained by the tests of the actual material installed instead of using code specified minimum material properties.

In all cases examined the available capacity of the walls exceed the required capacity by a safe margin.

4. Remaining Open Items

The staff requested that the licensee provides additional information with regard to two items:

- a) Demonstrate, by means of test records, or otherwise, that the material properties used in the analysis are appropriate, and
- b) Demonstrate that the loads resulting from the tornado, which have been approved by the staff as appropriate for the site represent a upper boundary of the loads which would be experienced by the subject walls.

During a telephone conference, on October 18, 1983, the staff discussed these items with the licensee and the additional information is expected to be submitted for review by the staff by October 25, 1983. We regard these items as confirmatory information.

5. Conclusion

The licensee demonstrated, using methods acceptable to the staff, that the walls are capable to resist the loads expected to be experienced by the subject walls. The analysis performed by the applicant contains one relaxation relative to the normal, or currently accepted design procedures. This is the use of actual material strengths rather than code specified minimum material strengths. In our review we found the use of actual material strengths acceptable since in spite of this relaxation some margin remains. In Ref. 1 for example, the licensee stated that the average compressive strength used for the grout filling the cells of the block walls is the tested strength of 3285 psi rather than minimum specified compressive strength of 2000 psi. The steel used in the reinforcing is Grade 40. The yield and the ultimate strength of the rebar steel was determined by tests at the Pittsburgh Testing Laboratory. The test reports compiled by J. A. Blume, for 80 percent of the turbine building rebars indicate that the average tested yield strength is 51,390 psi, which is about what has been used in the analysis (51,400 psi).

The method of the analysis has been found to be acceptable to the staff. In summary, the staff finds that pending satisfactory review of the two items listed in (4) above, the walls provide reasonable assurance that they will withstand the expected loads, and therefore we find that the allegation is unfounded.

References

1. Report on Safety-Related Masonry Walls Diablo Canyon Power Plant, Unit 1, August 17, 1983, Pacific Gas and Electric Company.
2. Letter from J. O. Schuyler of PG&E to G. Knighton, NRC, dated July 1, 1983.
3. Letter from J. O. Schuyler of PG&E to D. Eisenhut, NRC dated October 11, 1983.
4. Letter from J. O. Schuyler of PG&E to D. Eisenhut, NRC, dated October 14, 1983.

SECTION IV

MATERIAL RECEIVING AND INSPECTION REPORT

1. Supplier FAULSTICH BROS / AIR VOL Block
2. Shipping list number N/A (SEE COMMENTS)
3. Purchase order number N/A (SUB CONTRACT)
4. Date material on site 26 SEP 78
5. Material description and quantities Hollow MASONRY Block
FOR FIRE PROOF Block WALLS. REFERENCE sub-contract # 003-2277

	Accept	Reject	N/A	Date	Signed
6. Documentation					
a. Shipping list	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	OCT 2 1978	<i>[Signature]</i>
b. Purchase order	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	OCT 2 1978	<i>[Signature]</i>
c. Material certification	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OCT 2 1978	<i>[Signature]</i>
d. OS & D Report	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	OCT 2 1978	<i>[Signature]</i>
7. Identification					
a. Heat/lot number	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	OCT 2 1978	<i>[Signature]</i>
b. Stamping	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	OCT 2 1978	<i>[Signature]</i>
c. Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	OCT 2 1978	<i>[Signature]</i>
8. Visual Inspection					
a. Shipping damage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OCT 2 1978	<i>[Signature]</i>
b. Workmanship	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OCT 2 1978	<i>[Signature]</i>
c. Configuration	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OCT 2 1978	<i>[Signature]</i>
9. Storage	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OCT 2 1978	<i>[Signature]</i>
10. Remarks	<u>Subcontractor TO Furnish All materials & Equipment PER sub CONTRACT.</u>				

GFAEO - QUALITY ASSURANCE
 Document reviewed and accepted.
[Signature]
 Documentation Clerk Date OCT 2 1978



CURKI

H. T. WEDDLE, PRESIDENT
~~XXXXXXXXXXXXXXXXXXXX~~

(a/c 805) 543-9290 * 2900 South Broad Street * San Luis Obispo * California 93401

June 29, 1978

Guy F. Atkinson Co.
P. O. Box 99
Avila Beach, Calif. 93424

Gentlemen,

Please find enclosed letter of certification on Air Vol Block, Inc., with current laboratory tests on the blocks attached.

Sincerely yours,

H. T. WEDDLE
President

RECEIVED

JUN 30 1978

Guy F. Atkinson Company
PIN 2277

GFACO. QUALITY ASSURANCE ACCEPTED BY	
	OCT 2 1978
Q.A. INSPECTOR	DATE

AIR VOL BLOCK, INC.

June 26, 1978

RECEIVED

JUN 30 1978

Guy F. Atkinson Compar
PIN 2277

Faulstich Bros.
2900 S. Broad
San Luis Obispo, Ca. 93401

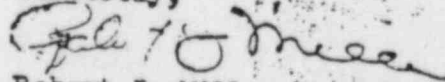
Ref: Diablo Canyon, Guy F. Atkinson Job

Gentlemen:

This is to certify that all masonry units supplied to you by Air-Vol Block, Inc. for above referenced project shall comply to the requirements of the plans and specifications. This certification includes compliance to A.S.T.M. -90, Grade A.

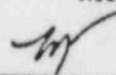
I am enclosing a copy of recent test results for your file.

Sincerely,



Robert J. Miller
Pres. Air Vol Block, Inc.

RJM;pwb

GFACO. QUALITY ASSURANCE ACCEPTED BY	
	OCT 2 1978
Q.A. INSPECTOR	DATE

Central Coast Laboratories

396 BUCKLEY ROAD • 544-3276
SAN LUIS OBISPO, CALIFORNIA 93401

A119

SOIL MECHANICS
FOUNDATION ENGINEERING

FOR: Young Brothers Construction
7600 El Camino Real
Atascadero, California 93422

DATE: December 19, 1977
LABORATORY #: CC03113

PROJECT: Security Pacific Bank - Atascadero Branch

ARCHITECT: Kerr, Hall, Hurley, Deutsch

STRUCTURAL ENGINEER: Fred Schott

CONTRACTOR: Young Brothers Construction

SAMPLE: Six 8 x 8 x 16 OE Standard and six 8 x 6 x 16 O.E. Slump concrete masonry blocks were sampled at the jobsite by Patrick Smith, of Central Coast Laboratories, on November 21 & 23, 1977.

SIZE:	8 x 6 x 16		8 x 8 x 16		*Linear Shrinkage Percent
	Length, inches	Width, inches	Length, inches	Width, inches	
	15.65	7.63	15.65	7.60	* SEE PAGE 111- MASONRY MANUAL
	7.63	5.60	7.63	7.63	
	Compression (gross area) $\text{NET AREA} = 4 \times 15.65 = 62.6 \text{ in}^2$		Moisture Content, % of Maximum		
Sample No.	Total Load to Destruction, Lbs.	Lbs. per Sq. Inch	Absorption Lbs. per Cu. Foot	Moisture Content, % of Maximum	*Linear Shrinkage Percent
8 x 6 x 16					
1	138,500	1160	**16.0	22.1	0.051
2	124,500	1040	**17.4	24.4	0.048
3	142,000	1200	**18.1	16.2	0.048
Average		1135	17.2	20.9	0.049
8 x 8 x 16					
1	144,500	2308. 1215	10.4	13.2	0.031
2	164,500	2628. 1375	10.4	19.5	0.034
3	158,000	2524. 1340	10.6	13.2	0.031
Average		2487. 1310	10.5	15.3	0.032
Specification Requirements:		1000	15.0 max	40.0 max	0.050

* Saturated to oven-dry condition.
** Rained the night prior to sampling

PAS:fw
cc:

Young Bros. Const

KHHD -2

Schott

Ken Dav. SLO Co

**GFACO. QUALITY ASSURANCE
ACCEPTED BY**

Respectfully Submitted,
G.A. INSPECTOR DATE

Central Coast Laboratories

376 BUCKLEY ROAD • 544-3776
SAN LUIS OBISPO, CALIFORNIA 93401

SOIL MECHANICS
FOUNDATION ENGINEERING

FOR: Young Brothers Construction
7600 El Camino Real
Atascadero, CA 93422

DATE: February 9, 1978

PROJECT: Security Pacific National Bank
Paso Robles Branch

LAD NO: CC03202

ARCHITECT: Priest, Richmond, Wolf & Rossi

STRUCTURAL ENGINEER: Taylor & Gaines

CONTRACTOR: Young Brothers Construction

SAMPLE: Six 8x8x16 O.E. concrete masonry blocks were sampled at Air-Vol Block Co. by B. Huggins of Central Coast Laboratories on January 16, 1978.

SIZE: Length, Inches 15.6
Width, " 7.6
Depth, " 7.6

Sample No.	Compression (Gross Area) Total Load to Destruction, Lbs.	Lbs. per Sq. Inch	Absorption Lbs. per Cu. Foot	Moisture Content, Percent of Maximum	*Linear Shrinkage Percent
1	133,500	1,125	9.8	20.0	.043
2	167,500	1,411	10.5	16.7	.033
3	182,500	1,537	12.0	13.0	.039
Average of three:	2574.	1,358	10.7	16.6	.038
Specification Requirements:		1,000 min.	15.0 max.	40.0 max.	.060 max.

*Saturated to oven-dry condition.

CENTRAL COAST LABORATORIES

Patrick Alan Smith
Patrick Alan Smith
Quality Control Director

Copies to:
PRWR
Taylor & Gaines
Pac. S.W. Realty
Young Bros.

PAS:ls

GFACO. QUALITY ASSURANCE
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AS
G.A. INSPECTOR
OCT 2 1978
DATE

2487
2574
3592
8654
Average 26.8%

PACIFIC GAS AND ELECTRIC COMPANY

345 MARKET STREET - SAN FRANCISCO, CALIFORNIA 94102 - TELEX 7214000 - TWX 511 571 6567

P. O. Box 117
Avila Beach, California 93424

May 22, 1978

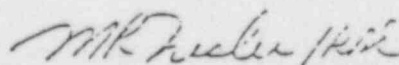
Mr. R. W. Wunderlich
Project Manager
Guy F. Atkinson Company
P. O. Box 99
Avila Beach, California 93424

Diablo Canyon Project
Specification 5422
Concrete Block Walls

Dear Mr. Wunderlich:

In regard to the concrete block to be installed, the work shall be performed in accordance with Specification 8828 and shall meet Q. A. requirements of Specification 8828.

Sincerely,



M. R. TRESLER
Project Superintendent

COPIES MADE FOR
file 64 Reading file Demottei - SSF B. Irvine B. Bruguier M. Walsh ✓ G. 22-78

FILE: CORRES
WASARY
QCP-14

RECEIVED

MAY 23 1978

Guy F. Atkinson Company
PIN 2277

MAX DESIGN
MASONRY

PACIFIC GAS AND ELECTRIC COMPANY

PG&E + 245 MARKET STREET • SAN FRANCISCO, CALIFORNIA 94106 • (415) 781-4211 • TWX 910-372-1107
P. O. Box 117
Avila Beach, California 93424

May 8, 1978

RECEIVED

MAY 9 1978

Guy F. Atkinson Company
PIN 2277

Mr. R. W. Wunderlich
Project Superintendent
Guy F. Atkinson Company
P. O. Box 99
Avila Beach, California 93424

Diablo Canyon Project
Specification 5422
Your Letter A.4-30
Concrete Mix Design

Dear Mr. Wunderlich:

The 3/8" mix, furnished by San Luis Ready Mix, is acceptable for filler in your concrete block work. The design mix is for 2,000 P.S.I. in 28 days. The design mix for one yard of concrete (saturated and dry surface) is as follows:

Cement	564 lbs.
Sand	1,907 lbs.
3/8" Agg.	827 lbs.
Water	49 Gal.
Slump	5" ± 1" at batch plant
Grout Aid #2	6 lbs.*

*Grout Aid #2 is to be added on site to the delivered mix - 6 lbs./yd. or per manufacturer's recommendation.

Sincerely,

M. R. TRESLER
Project Superintendent

COPIES MADE FOR
File 6.4
Reading File
Demattai - SSF
ticker file
R Wunderlich
B Irvine
m walsh
B Brugnier
5-9-78

PACIFIC GAS AND ELECTRIC COMPANY

PG&E +

245 MARKET STREET • SAN FRANCISCO, CALIFORNIA 94106 • (415) 781-4211 • TWX 910-372-5100

P. O. Box 117
Avila Beach, California 93424

May 5, 1978

RECEIVED

MAY 8 1978

Guy F. Atkinson Comm
PIN 227

Mr. R. W. Wunderlich
Project Manager
Guy F. Atkinson Company
P. O. Box 99
Avila Beach, California 93424

Diablo Canyon Project
Specification 5422
Your Letter A.5-6 *NAU 2*
Masonry-Block walls

Dear Mr. Wunderlich:

The letters of certification from your subcontractor Faulstich Bros. on Air Vol. Concrete Block, Kaiser Cement, Coast Rock and the special hydrated lime are acceptable.

A letter of certification (and/or test results) however, must be furnished on the concrete block units provided by Basalt Rock Company.

Sincerely,

M. R. TRESLER
Project Superintendent

COPIES MADE FOR
File 6.4
Reading File
Demattei-SSF
W. Harris
R. Wunderlich
M. Walsh
B. Irvine
BRUGUIE/C. [unclear]
5-8-78

FILE: WASOMR

GUY F. ATKINSON COMPANY

CONTRACTORS AND ENGINEERS

DIABLO CANYON POWERPLANT

POST OFFICE BOX 99

AVILA BEACH, CALIFORNIA

93424

FILE: WLS

April 21, 1978

Mr. M.R. Tresler
Pacific Gas and Electric Company
Post Office Box 117
Avila Beach, CA 93424

Attention: Jim Cochran

Diablo Canyon Project - Specification 5422
Ready Mix Concrete for Concrete Block Work

A4-30

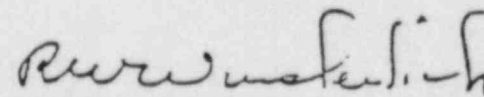
Gentlemen:

With your approval we will use ready-mix concrete for filler in our concrete block work.

The concrete to be furnished by San Luis Ready Mix. The mix will be 3/8" and designed for 2000 psi at 28 days.

Very truly yours,

GUY F. ATKINSON COMPANY



R.W. Wunderlich
Project Manager

RWW/dh

Attachment

GROUT MIX DESIGN FOR
CONCRETE BLOCK CORE FILL

Design for one yard of concrete (saturated and dry surface):
2000 psi at 28 days.

cement	564 lb.
sand	1907 lb.
3/8" agg.	827 lb.
water	49 gal.
slump	5" \pm 1"

Central Coast Laboratories

396 BUCKLEY ROAD • 544-3376
SAN LUIS OBISPO, CALIFORNIA 93401



Laboratory No. CC0155

Marked AIR VOL BLOCK, INC.

Sample 8 x 8 x 16" Open End Gray Concrete Blocks

Received January 19, 1972

Submitted by Air Vol Block, Inc.

SHRINKAGE TESTS:

	<u>Sample 1</u>	<u>Sample 2</u>	<u>Sample 3</u>
Saturated	10.0064	10.0070	10.0067
Oven Dry	10.0010	10.0021	10.0018
Shrinkage	.0054	.0049	.0049
% Shrinkage	.054	.049	.049

AVERAGE SHRINKAGE = 0.051% SPECIFICATION = 0.06% Maximum

COMPRESSION TESTS:

	<u>GROSS AREA</u>	<u>TOTAL LOAD</u>	<u>GROSS PSI</u>
7 5/8 x 15 9/16"	118.7	222,500	1,874.47
7 5/8 x 15 9/16"	118.7	221,000	1,861.64
7 5/8 x 15 9/16"	118.7	229,000	1,929.23

AVERAGE = 1,888.51

Respectfully submitted,

Robert E. Williams
Robert E. Williams, Civil Engineer

REW:1

NOTE

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