February 7, 1985

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Docket No. 50-293

LICENSEE: Boston Edison Company

FACILITY: Pilgrim Nuclear Power Station

SUBJECT: MEETINGS ON JUNE 6-7, 1984 AND JULY 18, 1984 WITH BOSTON EDISON COMPANY REGARDING MASONRY WALLS AT PILGRIM STATION

Staff members of the Structural and Geotechnical Engineering Branch and its consultants visited the Pilgrim Station on June 6 to examine the status of masonry walls repair, observe typical construction methods, observe boundary conditions, and observe attachments and surrounding safety-related systems. On the following day we met with Boston Edison Company (BECo) representatives to review calculations and the status of the masonry wall program and to discuss the reevaluation criteria. The use of statistical analysis in determining appropriate boundary loads was a major subject of discussion.

Attachment 1 provides a list of the action items which resulted from the June 7 meeting. Attachment 2 lists the attendees at that meeting and also those who attended a meeting held at NRC in Bethesda on July 18, 1984 to resolve the items in Attachment 1.

Attachments 3 through 9a are the responses to the items in Attachment 1 which were provided by BECo at the July 18 meeting.

Attachment 10 summarizes the conclusions and action items which resulted from discussion of the responses. Items 1 and 6 of Attachment 10 reflect agreements by the staff and BECo. Items 2, 3 and 5 require further action by the licensee. Subsequent staff review of the information noted in items 4 and 7 has resulted in a request to the licensee for further information. Resolution of all of these items is expected shortly.

Original signed by/

Paul H. Leech, Project Manager
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Attachments:
As stated

cc w/attachments:
See next page

DL:ORB#2	DL:ORB#2
PLeech:ajs	DVassallo
02/07/85	02/7/85

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ATTACHMENT 1

ACTION ITEMS RESULTING FROM NRC/BOSTON EDISON
MEETING ON JUNE 6-7, 1984 REGARDING
MASONRY WALLS AT PILGRIM STATION

1. BECo discussed the present status of Blockwall Resolution - a written summary to be provided by BECo (walls/B-O added in 1984).

2. Discussed test data. BECo will provide a matrix of test results:

   a) total # of walls in Plant (SR only) - subtotaled by building

   b) # of walls sampled - subtotaled by building

   c) types of sampling (i.e., top, side and bottom)

   d) correlation, if any, between length of sample vs. total length of wall

   e) how was bottom boundary handled

3. BECo will provide a copy of the summary report of statistical analysis of test data (boundary line loads)

4. On the walls qualified by use of statistically determined (i.e., 95% level of confidence) boundary line load allowables, provide additional information by wall:

   a) physical dimensions of wall

   b) ratio of actual/allowable line loads (statistical)

   c) quality of top boundary construction

   d) ratio of actual line load/bond stress allowable and how area of action is calculated - (face of block))
   (allowable bond stress per S.R.P. 3.8.4 Appendix A

   e) hardship of access

   f) recommended disposition on any high % actual/allowable

   g) qualitative explanation of why the statistical approach is conservative

5. Walls for alternate qualification 209.13 and 209.14

   - Present rationale for failure mechanism (not plausible).

   - Present a design for a protective enclosure on the single safety-related device in zone of influence giving technical basis (i.e., penetration resistance).

6. Blockouts

   a) list SR Blockouts and willingness to modify

   b) any qualified w/o mod detailed explanation as to why stand as is

      - strength mechanism (mortar and/or shear friction)
      - hardship of access

   c) interim operability of blockouts scheduled for RFO-7 (1986) - all others mod in 1985

7. Remaining walls requiring modification

   a) for walls to be mod on-line give total and forecast schedule

   b) for walls to be mod in an outage (after present refueling outage concludes) give

      1) Interim operability system aspects available structural margins

      2) Reason for outage requirement

8. Provide sample design calculations of walls 64.4, 63.4 and 188.10 with detailed explanation to demonstrate design methodology and analysis procedures.

ATTACHMENT 2

ATTENDEES AT NRC MEETINGS WITH BOSTON EDISON REGARDING
MASONRY WALLS AT PILGRIM NUCLEAR POWER STATION

1. June 6-7, 1984 Meeting at Plymouth and Braintree, Massachusetts

NAME	AFFILIATION	POSITION
Thomas J. Tracy	BECo	Civil Structural Group Leader
Patrick J. Doody	BECo	Civil Structural Engineer
David C. Jeng	NRC	Section A Leader, SGEB, DE/NRR
Vu Con	Franklin Research Center	Principal Engineer
Nilesh Chokshi	NRC	Structural Engineer, SGEB
A. Hamid	Drexel University	Associate Professor

2. July 18, 1984 Meeting at Bethesda, Maryland

NAME	AFFILIATION	POSITION
Peter M. Kahler	Boston Edison	Licensing
Thomas J. Tracy	Boston Edison	Civil/Structural
Martin Button	C.E.S.	Group Leader/Project Eng.
Patrick J. Doody	Boston Edison	Civil/Structural Eng.
Nilesh C. Chokshi	NRC/NRR/SGEB	Structural Engineer
Vu Con	FRC	Principal Engineer
Ahmed Hamid	Drexel University	Professor
R. E. Lipinski	NRC/NRR/SGEB	Structural Engineer
George Lear	NRC/NRR/SGEB	Chief, SGEB
Chris Deneff	Bechtel	Civil/Structural Engineer
Paul Baughman	Cygna Engery Service	Engineering
Ron Mayes	Computech Energy Ser.	Principal
Paul Leech	NRC	Proj. Manager-Pilgrim

ATTACHMENT 3 (Response to item 1 of Attachment 1)

1. Provide a written summary of safety related blockwalls.

The blockwall effort consisted of 220 safety related masonry walls in February of 1982 when the NRC last inspected Boston Edison's program.

• Qualified by analysis (not using statistical application of test data)	24
• Qualified by modification	43
• Modification deferred until 1983-84 refueling outage (wall 64.4) (how completed)	1
• Walls to be reconsidered using more rigorous analysis	152
Total	220

BECo has completed the reconsideration of 152 walls with the following results:

• Reclassified non-safety related	7
• Qualified by reliance on statistical application of test data	50
• Qualified by use of deterministically established structural mechanisms	51
• Scheduled for qualification by modification	44
Total	152

Scope added in 1984 (refer to BECo letter #84-005, dated April 13, 1984)

• New safety related walls identified	10
• New safety related blockouts identified	16
Sub Total	26
• Walls previously designated non-safety related which are now safety related due to recent modifications	3
• Walls previously designated safety related which are now non-safety related	- 7
Adjustment to total scope	+22

Total safety related walls/blockouts = 242

ATTACHMENT 4 (Response to item 2 of Attachment 1)

TABLE 2-1

SUMMARY OF TOTAL SAFETY RELATED WALLS AND WALLS TESTED

Building	Total SR Walls	Unique # Walls Tested *
Auxiliary	29	8
Diesel Generator	5	2
Intake	5	1
Radwaste	61	16
Reactor	125	20
Turbine	17	3
	242	50

* Many walls have multiple data points.

ATTACHMENT 5 (Response to item 2 of Attachment 1)

BOTTOM BOUNDARY SHEAR CAPACITY

Hamid, Drysdale, and Heidebrecht, "Shear Strength of Concrete Masonry Joints", Journal of the Structural Division, ASCE, July 1979.

Summary

The shear strength of bed joints may be expressed as

$\tau = \tau_o + \mu \sigma_n$ τ = joint shear strength
τ_o = shear bond strength
σ_n = normal stress

Using a regression analysis of test data, the following linear relationships were empirically derived to predict the shear strengths for concrete masonry joints (type S mortar):

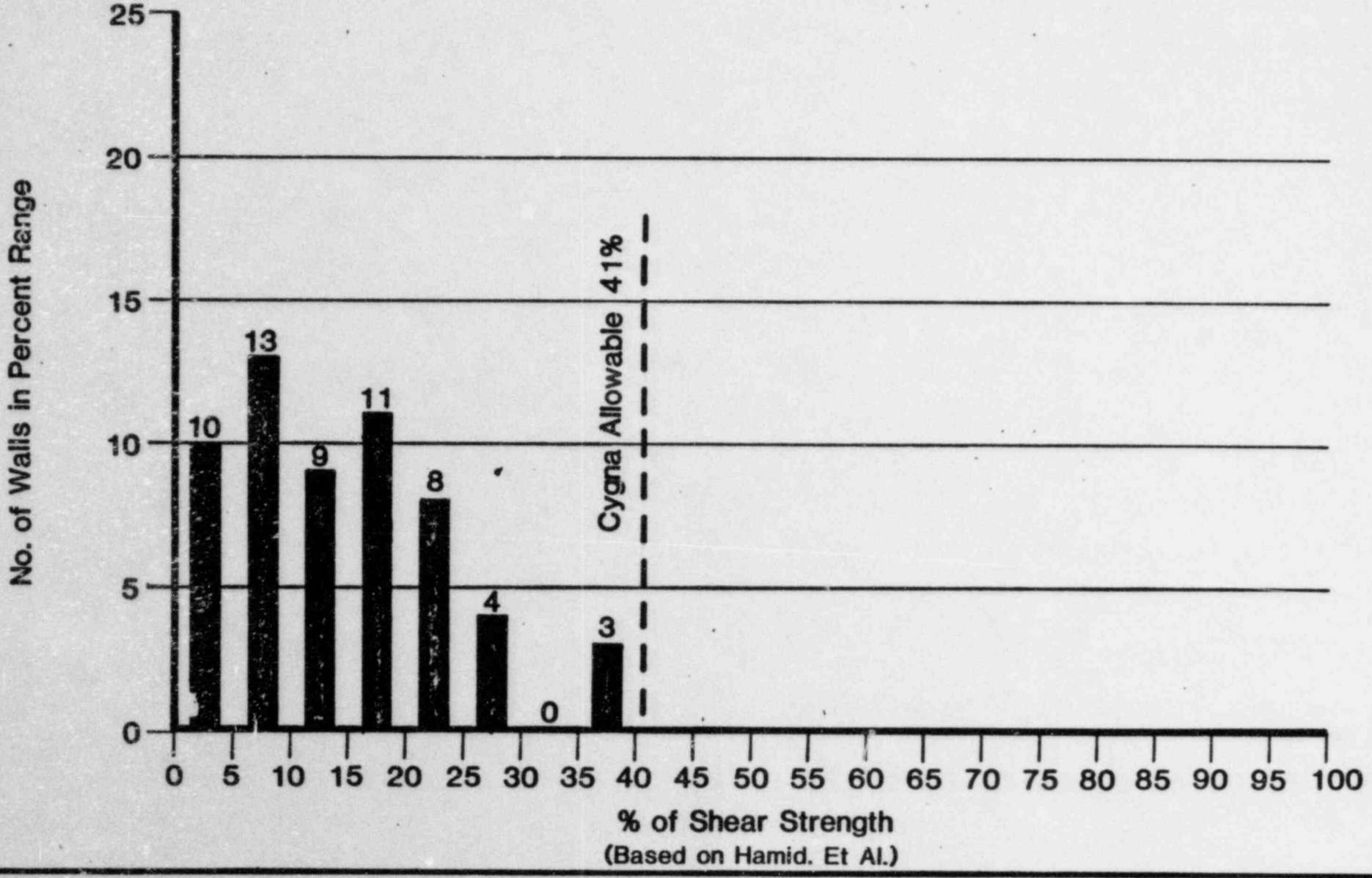
Ungrouted: $\tau = 76 + 1.07 \sigma_n$

Weak grout: $\tau = 114 + 1.0 \sigma_n$

Strong grout: $\tau = 156 + 1.54 \sigma_n$

Application to Pilgrim Walls

Pilgrim walls are composed of materials similar to those tested by Hamid, et al. At the bed joint, because the grouted cores stop on the floor surface, the joint should be assumed ungrouted, but the net section should include the grouted area. Because the in-plane compressive stress for these walls (which are not load bearing in most cases) is small, the strengthening effect of the normal force may be neglected. The attached charts show the distribution of bottom shear boundary loads at Pilgrim as a percentage of the shear strength for ungrouted masonry as proposed in the paper.


No. of Walls in Percent Range
25
20
15
10
5
0
10
13
9
11
8
4
0
3
Cygna Allowable 41%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
% of Shear Strength
(Based on Hamid. Et Al.)

Shield Walls