BOSTON EDISON COMPANY
GENERAL OFFICES 800 BOYLSTON STREET
BOSTON, MASSACHUSETTS 02199

A. V. MORISI
MANAGER
NUCLEAR OPERATIONS SUPPORT DEPARTMENT

October 20, 1980

BECo. Ltr. #80-259

Mr. Thomas A. Ippolito, Chief
Operating Reactors Branch #2
Division of Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

License No. DPR-35
Docket No. 50-293

CO_2 System Discharge Test
Pilgrim Nuclear Power Station Unit #1

References (a) BECo Letter #80-38 dated 2/29/80
G. C. Andognini (BECo) to T. A.
Ippolito (NRC)

(b) NRC Letter TAC #11077 dated 10-7-80,
T. A. Ippolito (NRC) to A. Victor
Morisi (BECo)

(c) Telecon conversation between J. D.
Keyes, T. A. Venkataraman (BECo) and
M. Willaims, T. Elexion (NRC) on 10-2-80

(d) Telecon conversation between J. D. Keyes,
T. A. Venkataraman (BECo) and M. Williams,
Scott Hudson, T. Elexion (NRC) on 10-14-80

A001
s
1/1

Dear Sir:

In Reference (a) Boston Edison Company presented the generic technical concerns it had regarding the performance of a full scale CO_2 Discharge Test in the cable spreading room and requested NRC resolution of these concerns prior to committing to conduct the test. Reference (b) was the first correspondence BECo received which discussed the CO_2 Discharge Test. However, Enclosure 1 to Reference (b) addressed a Boston Edison request for postponement of the CO_2 test performance until the 1981 Refueling Outage, while Enclosure 2 to Reference (b) listed the status of the CO_2 Test as completed (Item 3.2.8).

This apparent discrepancy concerning Boston Edison's position on the CO_2 test was resolved during conference calls between members of your staff and ours (References (c) & (d)). It was agreed that BECo's position was as presented in Reference (a) and quoted above. It was also agreed during these discussions that in an effort to

8010270316

P

THIS DOCUMENT CONTAINS
POOR QUALITY PAGES

expedite final resolution of this issue, we would provide you with a copy of our previous submittal which specified the CO_2 system design adequacy. A copy of this letter along with the calculations which support the system adequacy are included as attachments to this letter.

We trust this information is responsive to your needs, however, should you require any additional information please do not hesitate to contact us.

Very truly yours,

A. Victor Morisi
EJ

Attachments

A - BECo Letter 78-135 (Q-15)
B - CO_2 System Calculations

Attachment A

Q15 Evaluate the consequences of a <u>design basis fire</u> in the cable spreading room. Provide an analysis which shows the effectiveness and reliability of the present CO_2 system. State the CO_2 density (as a fraction of time) at the height of the upper most cable trays considering air leakage through doorways and ducts. Show that fire brigade operations could not adversely affect extinguishment of fire by the CO_2 system.

It is the staff's position that an automatically initiated CO_2 system is acceptable for the cable spreading room as primary fire suppression provided a fixed water system in used as a backup. (A BTP APCSB 9.5-1 Section F3b (3)).

Describe your proposed design modification to meet the above position or justify noncompliance.

<u>BECo RESPONSE</u>

The carbon dioxide suppression system in the cable spreading room is designed to discharge at a rate of 80 pounds per minute through each of the 15 nozzles in the room for a total discharge of 1200 pounds per minute. It takes approximately 2 minute and 20 seconds to totally flood the CSR, requiring 2800 LB of CO_2 to provide a 50% design concentration.

At a discharge rate of 1200 pounds per minute, the highest cable tray in the room will be covered with the design concentration of CO_2 in slightly over 2 minutes. The original design calculations allow for a loss of at least 270 pounds of CO_2 due to leakage.

Recent tests of the installed rate of rise heat detectors in the CSR showed that the CO_2 system responded in 20 seconds from the time the heat was applied. The response time of these detectors to an actual fire in the CSR will vary with the severity of the fire. In addition to the rate of rise detectors, the CSR is also equipped with ionization detectors for early warning. Administrative procedures call for immediate visual inspection of the CSR and if the CO_2 system has not activated automatically it is to be manually tripped.

The reliability of CO_2 systems has been found to be 96.1% effective as determined by U. S. Navy evaluation reported in an article "Reliability of Fire Protection Systems" by M. J. Miller (Chemical Engineering Progress, April 1974).

Administrative procedures require that the fire brigade enter the CSR with breathing apparatus to determine that there are no human occupants present and also to observe if the fire has been extinguished. If the fire has not been extinguished or rekindles, the low-pressure CO_2 storage tank has the capacity for a second shot which is activated by the fire brigade. In addition to fire brigade operations, the Plymouth Fire Department is also notified. The Fire Department has a normal response time of 6 minutes or less Their professional experience will assist in extinguishing the fire.

A fixed water system is available outside the cable spreading room as a back up to the total flooding carbon dioxide system. No design modification is required for this area.

DIVISION OF CHEMETRON CORPORATION

Low Pressure Carbon Dioxide Flow Calculations

Attachment B

SYSTEM FOR Boston Edison Co. (plant name)
Pilgram Station (location)

HAZARD Cable Spread Room (combustible material)

DRAWING NO. FL-15683

CALC. SHEET 1 OF

BY A.J.L. DATE

PROPOSAL NO.

JOB NO. FL-15693

INSURANCE REF. NO.

HAZARD EFFECTIVE DISCHARGE PERIOD, DESIGN FLOW RATE AND STORAGE REQUIREMENT

	Effective Discharge Period (in seconds)	Design Flow Rate (lbs. per min. liquid)	Lbs. CO_2 Storage Sub Totals	Lbs. CO_2 Storage Storage Totals
TOTAL FLOODING (TF) – Requirement is 2800 lbs. CO_2				
Vapor discharge period and vapor discharge	17		112	
Effective discharge period, design flow rate and storage	135	at 1200	= 2700	
Total Discharge Period, Design Flow Rate and Storage	152	1200		2812
LOCAL APPLICATION (LA)				
Minimum effective discharge period – 30 seconds				
Plus high temperature condition				
Plus other				
Effective discharge period, design flow rate and storage		at	=	
Vapor discharge period and vapor discharge				
Total Discharge Period, Design Flow Rate and Storage				
COMBINED LOCAL APPLICATION & TOTAL FLOODING (From LA and TF figures above)				
Local application design flow rate				
Total flooding design flow rate				
Total Hazard Design Flow Rate				
EXTENDED DISCHARGE				
Initial Discharge Period and Design Flow Rate		at	=	
Extended Discharge Period and Design Flow Rate		at	=	
FINAL DISCHARGE PERIOD, DESIGN FLOW RATE AND STORAGE	152	1200		2812

LOW PRESSURE STORAGE: 4 ton for REL shot protection.

REMARKS: 30% concentration will be attained in approx. 1½ min.

POOR ORIGINAL

POOR ORIGINAL

DIVISION OF CHEMETRON CORPORATION

SYSTEM FOR ______ (plant name) ______ (location)

HAZARD ______

DRAWING NO. ______

BY A. J. L. DATE -30-

PROPOSAL NO. ______

JOB NO. FL-15_

INSURANCE REF. NO. ______

HAZARD COMPONENTS (dimensions)	Nozzle Ident.	TOTAL FLOODING (TF): Volume (cu. ft.)	CO_2 Factor (lb./cu. ft.)	CO_2 Req'd (pounds)	LOCAL APPLICATION (LA), Rate By Volume: Theoretical Volume (cu. ft.)	CO_2 Factor (lb./cu. ft. per min.)	Rate By Area: Dist. From Surf. (in ft.) Liquid	Coated	Design Area (sq. ft.)	NOZZLE DATA: Design Flow Rate (lb./min.)	Terminal PSIA	Req'd Code No.	Act. Code No.	Nozzle Type
40'-0" x 34'-0" x 14'-0" H		19040												
58'-0" x 18'-0" x 14'-0" H		14616												
		33656	.083	2793										
		Call		2800#										
	N1									80	281	6.6	6.5	6" mp
	N2									80	278	6.7	6.5	
	N3									80	275	6.9	7.0	
	N4									80	270	7.1	7.0	
	N5									80	265	7.3	7.5	
	N6									80	260	7.5	7.5	
	N7									80	259	7.6	7.5	
	N8									80	286	6.3	6.5	
	N9									80	286	6.3	6.5	
	N10									80	284	6.4	6.5	
	N11									80	280	6.7	6.5	
	N12									80	274	6.9	7.0	
	N13									80	269	7.1	7.0	
	N14									80	264	7.3	[illegible]	
	N15									80	263	7.4	[illegible]	
										1200				

DIVISION OF CHEMETRON CORPORATION

BY A.J.L DATE 6-30-

SYSTEM FOR ______ (plant name) ______ (location) PROPOSAL NO. ______

HAZARD ______ JOB NO. FL-15663

DRAWING NO. ______ INSURANCE REF. NO. ______

PIPE SECTION	TANK TO A	A TO A	A TO N4	N4 TO N[illegible]
PIPE SIZE / SCHED	3" / 80 [illegible]	2½" / 40 S	1½ / 40 S	1½" / [illegible]
actual length	10	111	6	12
tee	2 tee SIDE: 20	1 tee SIDE: 13	1 tee SIDE: 9	1 tee SIDE: 9
ell	1 6"x3" REDUCER: 8	3 ell 90°: 20	1 ell 90°: 4	
union or cplg				
valve	1 valve T.S.O: 2			
(other)	1 CARDOX 3": 23			
SECTION LENGTH	113	144	19	21
FLOW RATE	1200	1200	560	480
START PSIA	300	297	299	296
START LENGTH	—	56	95	160
TOTAL EQUIV. LENGTH	115	200	114	181
TERMINAL PSIA	297	299	296	[illegible]

PIPE SECTION	N10 TO N11	N11 TO N12	N12 - N13	N[illegible] - [illegible]
PIPE SIZE / SCHED	1¼" / 40 S	1" / 40 S	1" / 40 S	¾ / [illegible]
actual length	10	10	10	5
tee	1 tee SIDE: 8	1 tee SIDE: 6	1 tee SIDE: 6	1 tee SIDE: 5
ell				
union or cplg				
valve				
SECTION LENGTH	18	16	16	10
FLOW RATE	400	[illegible]	[illegible]	[illegible]
START PSIA	284	280	274	269
START LENGTH	114	67	115	[illegible]
TOTAL EQUIV. LENGTH	132	83	131	[illegible]
TERMINAL PSIA	280	274	269	[illegible]

PIPE SECTION	N12 TO N15	A TO N8	N8 TO N[illegible]	[illegible] TO [illegible]
PIPE SIZE / SCHED	¾" / 40 S	1½ / 40 S	1½ / [illegible]	1½" / [illegible]
actual length	5	6	23	12
tee	1 tee SIDE: 5	1 tee SIDE: 9	1 tee SIDE: 9	1 tee SIDE: 9
ell			1 ell 90°: 4	
union or cplg				
valve				
(other)				1 TEE THRU: 3
SECTION LENGTH	10	15	36	24
FLOW RATE	80	640	560	480
START PSIA	264	289	286	281
START LENGTH	370	71	116	210
TOTAL EQUIV. LENGTH	380	86	152	234
TERMINAL PSIA	263	286	281	278

PIPE SECTION	N2 TO N3	N3 TO N4	N4 TO N5	N5 TO N[illegible]
PIPE SIZE / SCHED	1¼" / 40 S	1" / 40 S	1" / 40 S	¾" / 40 S
actual length	10	10	10	5
tee	1 tee SIDE: 8	1 tee SIDE: 6	1 tee SIDE: 6	1 tee SIDE: 5
ell				
union or cplg				
valve				
SECTION LENGTH	18	16	16	10
FLOW RATE	400	320	240	160
START PSIA	278	275	270	265
START LENGTH	152	61	130	92
TOTAL EQUIV. LENGTH	170	77	146	102
TERMINAL PSIA	275	270	265	26[illegible]

DIVISION OF CHEMETRON CORPORATION

BY A.J.L DATE 6-...

SYSTEM FOR ______ (plant name) ______ (location) PROPOSAL NO ______

HAZARD ______ JOB NO. FL-156E3

DRAWING NO. ______ INSURANCE REF. NO. ______

PIPE SECTION N6 TO N7		PIPE SECTION		PIPE SECTION		PIPE SECTION	
PIPE SIZE 3/4 SCHED. 40S		PIPE SIZE SCHED.		PIPE SIZE SCHED.		PIPE SIZE SCHED.	
actual length	5	actual length		actual length		actual length	
1 tee SIDE	5	tee		tee		tee	
ell		ell		ell		ell	
union or cplg		union or cplg		union or cplg		union or cplg	
valve		valve		valve		valve	
SECTION LENGTH	10	SECTION LENGTH		SECTION LENGTH		SECTION LENGTH	
FLOW RATE	80	FLOW RATE		FLOW RATE		FLOW RATE	
START PSIA	260	START PSIA		START PSIA		START PSIA	
START LENGTH	415	START LENGTH		START LENGTH		START LENGTH	
TOTAL EQUIV. LENGTH	425	TOTAL EQUIV. LENGTH		TOTAL EQUIV. LENGTH		TOTAL EQUIV. LENGTH	
TERMINAL PSIA	259	TERMINAL PSIA		TERMINAL PSIA		TERMINAL PSIA	

PIPE SECTION		PIPE SECTION		PIPE SECTION		PIPE SECTION	
PIPE SIZE SCHED.		PIPE SIZE SCHED.		PIPE SIZE SCHED.		PIPE SIZE SCHED.	
actual length		actual length		actual length		actual length	
tee		tee		tee		tee	
ell		ell		ell		ell	
union or cplg		union or cplg		union or cplg		union or cplg	
valve		valve		valve		valve	
SECTION LENGTH		SECTION LENGTH		SECTION LENGTH		SECTION LENGTH	
FLOW RATE		FLOW RATE		FLOW RATE		FLOW RATE	
START PSIA		START PSIA		START PSIA		START PSIA	
START LENGTH		START LENGTH		START LENGTH		START LENGTH	
TOTAL EQUIV. LENGTH		TOTAL EQUIV. LENGTH		TOTAL EQUIV. LENGTH		TOTAL EQUIV. LENGTH	
TERMINAL PSIA		TERMINAL PSIA		TERMINAL PSIA		TERMINAL PSIA	

PIPE SECTION		PIPE SECTION		PIPE SECTION		PIPE SECTION	
PIPE SIZE SCHED.		PIPE SIZE SCHED.		PIPE SIZE SCHED.		PIPE SIZE SCHED.	
actual length		actual length		actual length		actual length	
tee		tee		tee		tee	
ell		ell		ell		ell	
union or cplg		union or cplg		union or cplg		union or cplg	
valve		valve		valve		valve	
SECTION LENGTH		SECTION LENGTH		SECTION LENGTH		SECTION LENGTH	
FLOW RATE		FLOW RATE		FLOW RATE		FLOW RATE	
START PSIA		START PSIA		START PSIA		START PSIA	
START LENGTH		START LENGTH		START LENGTH		START LENGTH	
TOTAL EQUIV. LENGTH		TOTAL EQUIV. LENGTH		TOTAL EQUIV. LENGTH		TOTAL EQUIV. LENGTH	
TERMINAL PSIA		TERMINAL PSIA		TERMINAL PSIA		TERMINAL PSIA	

PIPE SECTION		PIPE SECTION		PIPE SECTION		PIPE SECTION	
PIPE SIZE SCHED.		PIPE SIZE SCHED.		PIPE SIZE SCHED.		PIPE SIZE SCHED.	
actual length		actual length		actual length		actual length	
tee		tee		tee		tee	
ell		ell		ell		ell	
union or cplg		union or cplg		union or cplg		union or cplg	
valve		valve		valve		valve	
SECTION LENGTH		SECTION LENGTH		SECTION LENGTH		SECTION LENGTH	
FLOW RATE		FLOW RATE		FLOW RATE		FLOW RATE	
START PSIA		START PSIA		START PSIA		START PSIA	
START LENGTH		START LENGTH		START LENGTH		START LENGTH	
TOTAL EQUIV. LENGTH		TOTAL EQUIV. LENGTH		TOTAL EQUIV. LENGTH		TOTAL EQUIV. LENGTH	
TERMINAL PSIA		TERMINAL PSIA		TERMINAL PSIA		TERMINAL PSIA	

CARDOX

DIVISION OF CHEMETRON CORPORATION

CALC. SHEET 5 OF 5

BY A.J.L. DATE 6-[illegible]

SYSTEM FOR ______ (plant name) ______ (location)

PROPOSAL NO. ______

HAZARD ______

JOB NO. EI-15683

DRAWING NO. ______

INSURANCE REF. NO. ______

SUMMARY OF PIPE WEIGHT AND VOLUME

SCHEDULE 80 PIPE						SCHEDULE 40 PIPE					
NOMINAL PIPE SIZE	FEET OF PIPE	WEIGHT OF PIPE lbs. per ft.	WEIGHT TOTALS	VOLUME OF PIPE cu. ft. per ft.	VOLUME TOTALS	NOMINAL PIPE SIZE	FEET OF PIPE	WEIGHT OF PIPE lbs. per ft.	WEIGHT TOTALS	VOLUME OF PIPE cu. ft. per ft.	VOLUME TOTALS
6		28.57		.181		6		18.97		.201	
5		20.78		.126		5		14.62		.139	
4		14.98		.08		4		10.79		.088	
3 1/2		12.5		.062		3 1/2		9.11		.068	
3	10	10.25	103	.046	.460	3		7.58		.051	
2 1/2		7.66		.029		2 1/2	111	5.79	643	.033	3.6[illegible]
2		5.02		.021		2		3.65		.023	
1 1/2		3.63		.012		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
1 1/4		3.0		.009		1 1/4	20	2.27	45	.010	.2[illegible]
1		2.17		.005		1	40	1.68	67	.006	.2[illegible]
3/4		1.47		.003		3/4	20	[illegible]	[illegible]	[illegible]	
1/2		1.08		.0016		1/2		.85		.0021	
TOTALS			103		.460	TOTALS			938		5.00[illegible]

		WEIGHTS	VOLUMES
1	TANK SHUT-OFF VALVE	170	
____	SECTIONALIZING VALVE	____	
____	MASTER VALVE	____	
1	~~SELECTOR OR~~ MASTER-SELECTOR VALVE	150	
	TOTAL SCHED. 80 PIPE	103	.460
	TOTAL SCHED. 40 PIPE	938	5.003
	TOTALS	W = 1361	V = 5.463

Lbs. CO_2 required to cool pipe line - Formula

$$\frac{W \times Cp \times T}{120}$$

Time in seconds to obtain liquid discharge - Formula

$$\frac{W \times Cp \times T}{.913 \times R} + \frac{1050 \times V}{R}$$

W - Weight of pipe, etc.
Cp - Specific heat of pipe (steel - .11, alum. - .22)
T - Temperature of pipe in °F
R - Design flow rate
V - Volume of pipe

$$\frac{W \times Cp \times T}{120} = \frac{1361 \times .11 \times 90°}{120} = \frac{13474}{120} = 112 \text{ lbs } CO_2$$

$$\frac{13474}{913 \times 1200} + \frac{1050 \times 5.46}{1200} = \frac{13474}{1096} + \frac{5733}{1200} = 12.2 + 4.7 = 17.4$$

Call 17