OCA Statement No. 1A

PENNSYLVANIA PUBLIC UTILITY COMMISSION

v.

PHILADELPHIA ELECTRIC COMPANY

Docket No. R-850152

SUPPLEMENTAL DIRECT TESTIMONY OF JAMES J. O'BRIEN

LIMERICK 1 AND COMMON CONSTRUCTION DELAY AND CONSEQUENT COST INCREASES

January, 1986

O'Brien-Kreitzberg and Associates, Inc.
2 South Centre Street
Merchantville, New Jersey 08109

Q. Have you previously filed testimony in this proceeding?

A. Yes. I filed Direct Testimony identified as OCA Statement No. 1.

Q. What is the purpose of this Supplemental Direct Testimony?

A. This testimony is presented for the limited purpose of presenting additional information on the quantification of the cost of the 27 month delay of Limerick construction.

Q. What areas of quantification will you address?

A. I will address four areas. These are:

1) Costs of delay associated with Bechtel "Indirect" costs;

2) Additional quantification of the AFUDC associated with Mark II costs.

3) Quantification of costs of delay for Limerick Unit 1 and 50% of Common Facilities.

4) Correction of a small error in the calculation of AFUDC in my Direct Testimony.

Q. What information do you have concerning Bechtel costs of delay?

A. In my Direct Testimony at pages 29-32, I discussed "Indirect" construction costs which I believe would have been avoided had construction of Limerick 1 been completed for fuel load by July, 1982, rather than October, 1984. I

identified $90 million of expenditures, including taxes, overheads and AFUDC, of PECO Indirect Costs which resulted from the 27-month delay.* I was not, however, able to develop the comparable figure for Bechtel Indirect Costs at the time I prepared my Direct Testimony. Subsequently, I obtained additional information which provides a basis for developing a Bechtel cost.

Q. Please describe the cost information to which you are referring.

A. In answer to OCA interrogatory Set 4, number 29, the Company supplied backup documentation for the Limerick construction cost reconciliation presented in PECO Exh. 2. There are two portions of that documentation which are applicable to this discussion. The first portion presents PECO's estimate of the cost impacts of schedule extensions and the second presents PECO's estimate of unanticipated escalation associated with, among other things, those schedule extensions. The portions of these interrogatories which are relevant to this discussion have been entered into the record as OCA Exhs. 62 and 64. I have also attached them to this testimony as Appendix A.

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* As noted below, the $90 million figure has been revised to $101.5 million to account for additional AFUDC.

Q. What information do these documents provide?

A. There are two line items of cost reconciliation which are specifically relevant to quantifying Bechtel Indirect Costs of the 27-month delay. These can be seen on pages I-38 and IV-3 of App. A. Page I-38 shows costs of schedule extensions for two delays. The first extension is from 3/82 to 10/82 for Limerick Unit 1. The Company estimates this to have cost $8.4 million dollars for Unit 1 and 100% of Common. The second delay is from 10/82 to 10/84 for Limerick 1. The Company estimates this to have cost $92.0 million for Limerick 1 and Common. It should be noted that these figures exclude AFUDC. Page IV-3 of App. A shows the unanticipated escalation associated with these two delays. For the delay from 3/82 to 10/82, PECO estimates $2.9 million of unanticipated escalation. For the delay from 10/82 to 10/84, PECO estimates a cost of $39.6 million.

Since I have developed a July, 1982, fuel load date for Limerick 1, I have used only 50% of the cost estimates for the 3/82 to 10/82 delay.

Q. What do the costs you have cited above represent?

A. The delay cost estimates were developed by PECO and Theodore Barry & Associates (TB&A). Mr. Osborn of TB&A stated during cross-examination that the costs of delay were related to items such as having tools and equipment on

site, maintaining that equipment, the carrying cost on the equipment, continuity of supervision, continuity of support staff, records maintenance, facilities maintenance, warehousing, and maintenance of support facilities. Tr. 1259-1261. TB&A witness Kononetz explained during cross-examination that these costs are almost entirely Bechtel related rather than PECO related. Tr. 1260, 1273-1275. In fact, of the total project cost impact of the 2 year delay of $224.3 million identified in Bechtel Forecast 5, OCA Exh. 63, which provides the basis for the Limerick 1 and 100% of Common costs discussed above, Mr. Kononetz identified only $1.8 million as associated with a PECO account. Tr. 1273.

Q. Are these the types of costs you were referring to in your Direct Testimony which you had not then been able to quantify?

A. Yes. With the information supplied during the cross-examination of the TB&A witnesses, I now believe I can quantify at least some of the Bechtel "Indirect" costs of delay.

Q. Please state what your quantification shows.

A. Schedule JJO'B-21 shows that the Bechtel Indirect Costs of the 27 month delay for Limerick 1 and 100% of Common Facilities is $137.2 million. With the associated AFUDC, the total for Bechtel Indirect costs is $171.9 million.

Q. Did you attempt to develop the Bechtel Indirect Costs another way?

A. Yes, subsequent to the date the OCA presented my Direct Testimony to PECO, I requested the Company to provide a quantification of Bechtel charges which would allow an Indirect Cost analysis to be performed. The Company response is attached as Sch. JJO'B-22. As can be seen, PECO was unable to provide any information other than total annual Bechtel charges by broad category. Thus, to date, the information in the PECO Exh. 2 cost reconciliation is the best information PECO has made available.

Q. Please explain the additional information you have on the quantification of the Mark II Redesign problem.

A. In my Direct Testimony I presented a cost for the Mark II error of $136.1 million of direct costs plus $24.6 million of AFUDC. Subsequently, in response to IR-OCA-14-2, PECO provided an estimate of the AFUDC associated with the $136.1 million. This answer indicates that the AFUDC accumulated on Mark II direct costs is $37.356 million through December 31, 1984, and $58.032 million through March, 1986. This presents a total cost of $173.456 million through December, 1984, and $194.132 million through March, 1986. IR-OCA-14-2 is appended as Sch. JJO'B-23. The Company's calculation is based upon estimated monthly direct expenditures on Mark II and the

AFUDC rate in effect for each month. Further, it is developed through March, 1986, and therefore includes AFUDC through the date of projected commercial operation. My original estimate ended as of December, 1984.

Q. Have you developed a cost estimate of delay for Limerick 1 and 50% of common facilities?

A. Yes. In my Direct Testimony, my calculations show the cost impact of the 27-month delay for Limerick 1 and 100% of Common Facilities. Subsequently, I have prepared a cost analysis using 50% of Common Facilities.

Q. What does that analysis show?

A. As can be seen in Sch. JJO'B-24, the direct cost of the 27-month delay for Limerick 1 and 50% of Common Facilities is $183.5 million. The associated AFUDC totals $302.3 million. This sums to a total cost of $485.8 million.

The PECO Indirect Costs for Limerick 1 and 50% of Common Facilities including AFUDC is $83.0 million. See Sch. JJO'B-25. The Bechtel Indirect Costs for Limerick 1 and 50% of Common Facilities including AFUDC is $140.6 million. See Sch. JJO'B-26.

I would note at this point that the total cost of PECO Indirects for Limerick 1 and 100% of Common Facilities I presented in my Direct Testimony only included AFUDC through December 31, 1984. Including AFUDC through

Allocation of Annual Expenditures
And Derivation of AFUDC Accruals
Associated with Bechtel Indirects
Incurred Between August 1982 and October 1984, Inclusive

BASED ON LIMERICK 1 AND 100% OF COMMON

STEP 1: ALLOCATION OF ANNUAL DIRECTS

Year	Actual Nominal Directs	Months in Year		Nominal Directs Over Period Actual Annual	Actual Share	Bechtel Indirects $137.2 Annual
1971	31.2					
1972	33.9					
1973	56.0					
1974	71.3					
1975	80.7					
1976	104.7					
1977	113.6					
1978	89.7					
1979	104.9					
1980	161.2					
1981	219.7					
1982	322.3	01-Aug	31-Dec	133.9	15.4%	21.1
1983	399.1	ALL		399.1	45.8%	62.9
1984	407.6	01-Jan to	31-Oct	338.6	38.8%	53.3
1985	149.7					
1986	12.7	15-Feb-86 CO				
	2358.3			871.5	100.0%	$137.2

STEP 2: DERIVATION OF AFUDC ACCRUALS

YEAR	BECHTEL INDIRECTS Annual	Semi	Cum	AFUDC RATES Semi	Effective	AFUDC ACCRUALS Semi	Annua	Cum	TOTAL
1982	21.1	0.0	21.1	9.10%	0.00%	0.0	0.4	0.4	0.0
		21.1		9.30%	3.87%	0.4			21.5
1983	62.9	31.4	83.9	9.30%	4.65%	1.8	5.1	5.5	54.7
		31.4		9.30%	4.65%	3.4			89.5
1984	53.3	31.9	137.2	9.40%	4.70%	5.1	11.7	17.2	126.5
		21.3		9.40%	4.70%	6.6			154.5
1985				9.50%	4.75%	7.5	15.4	32.6	162.0
				9.50%	4.75%	7.9			169.9
1986				9.60%	1.21%	2.1	2.1	34.7	171.9
TOTAL MIXED-CURRENT GROSS:									$171.9

Q.IR-OCA-22-1. Please provide a breakdown, or the Company's best estimate, of Bechtel annual charges for Limerick 1 and Common on a basis similar to the breakdown given for PECo in DR-OCA-6-2(b). This breakdown, or estimate, should show separately annual expenditures for Home Office and Field overheads and project support indirects. This should include, however. classified by PECo or Bechtel, project management costs such as cost control, schedule control, procurement, warehousing, site security, and plan and document control.

A.IR-OCA-22-1. The detailed breakdown for Bechtel charges requested in this interrogatory is not available, as PECo does not summarize charges in the categories requested. However, Attachment IR-OCA-22-1 contains the Bechtel annual charges divided into the following categories: manual, non-manual, Engineering, other home office, subcontracts, material and startup.

The Bechtel annual charges divided into the above mentioned categories is not readily available for the years prior to 1976, therefore, we are providing the total Bechtel annual charges for that period. The Bechtel annual charges for the Limerick Unit 1 and Common part of the project are not available separately for the period 1976 through 1982. However, we are providing the charges for this period for the entire Limerick project. The Bechtel annual charges shown for the period 1983 through October 1985 are for the Limerick 1 and common part of the Limerick project.

Responsible Witness: J.J. Clarey, Superintendent-Limerick Section

BECHTEL CHARGES ($1,000)

	Manual	Non-Manual	Engr.	OHO	Subcontract	Mat'l	S.U.	Total
THRU 1972								16829
1973								54214
1974								60195
1975								79017
1976	41483	10064	18684	*	12237	27656		110124
1977	38431	10213	25148	*	14179	30528		118499
1978	34207	10590	23516	*	15457	38004		121774
1979	38050	10997	18968	*	24042	31866		123923
1980	50402	15344	22993	*	32460	37521		164720
1981	78177	22552	28539	12275	40177	40840		222560
1982	107121	39505	48154	16770	39912	47070		298532
1983	110594	59334	46399	15157	60027	32404	8723	322638
1984	87655	60372	29701	9233	61910	33188	17905	292864
thru 10/85	6119	12325	9374	4876	8058	11637	3072	56461

* - included with engineering
OHO - Other Home Office
S.U. - Startup
thru 1982 - total Station
1983 thru 10/85 - Limerick 1 and Common

Q. IR-OCA-14-2. Please provide the AFUDC accumulated on the $136.1 million of costs identified as related to Mark II changes. Please show the calculation of the figure by year.

A. IR-OCA-14-2. Cost accounting practices for the Limerick project do not allow for itemization of AFUDC associated with the Mark II expenditures. However, an estimate of AFUDC per year associated with the total $136.1 Million Mark II expenditure (see response to IR-OCA-14-1) is tabulated below. Attachment IR-OCA-14-2 is a computer printout illustrating the calculation of the AFUDC per year.

Year	AFUDC ($ x 10^3)
1975	5
1976	44
1977	140
1978	335
1979	698
1980	1,391
1981	3,085
1982	5,994
1983	10,889
1984	14,775
1985	16,870
1986	3,807

Responsible Witnesses: V.S.Boyer, Sr.Vice President-Nuclear Power

D.R.Helwig, Supervising Engineer - Nuclear Services Branch

LIMERICK ESTIMATED MARK 2 EXPENDITURES ($1000)

CALCULATION OF AFUDC

SERVICE DATE 2/15/86

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1975	COST + OVHD	10	10	10	10	10	10	33	33	34	33	33	34
	AFUDC	0	0	0	0	0	0	0	0	1	1	1	1
1976	COST + OVHD	70	70	70	70	70	70	86	87	87	86	87	87
	AFUDC	1	2	2	2	3	3	4	4	5	5	6	6
1977	COST + OVHD	141	142	142	141	142	142	141	142	142	141	142	142
	AFUDC	7	8	9	9	10	11	12	13	14	15	16	17
1978	COST + OVHD	283	283	284	283	283	284	350	350	350	350	350	350
	AFUDC	18	19	21	22	24	26	29	31	33	35	37	40
1979	COST + OVHD	366	367	367	366	367	367	816	817	817	816	817	817
	AFUDC	43	46	48	50	52	55	60	62	66	69	72	75
1980	COST + OVHD	750	750	750	750	750	750	1066	1067	1067	1066	1067	1067
	AFUDC	81	85	90	94	99	104	122	129	136	143	150	158
1981	COST + OVHD	1850	1850	1850	1850	1850	1850	1866	1867	1867	1866	1867	1867
	AFUDC	173	183	196	208	221	234	277	291	305	319	333	347
1982	COST + OVHD	2216	2217	2217	2216	2217	2217	3933	3933	3934	3933	3933	3934
	AFUDC	379	394	411	428	445	462	508	532	563	593	624	654
1983	COST + OVHD	4450	4450	4450	4450	4450	4450	3133	3133	3134	3133	3133	3134
	AFUDC	712	744	779	813	848	882	954	983	1007	1032	1056	1080
1984	COST + OVHD	708	708	709	708	708	709	708	708	709	708	708	709
	AFUDC	1164	1179	1185	1190	1196	1201	1263	1268	1274	1279	1285	1290

TOTAL COST BY YEAR	THRU 12/74	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	TOTAL
DIRECT COST	0	260	940	1700	3800	5300	10900	22300	36900	45500	8500	136100
OVERHEAD	0	0	0	0	0	0	0	0	0	0	0	0
DIRECT COST + OVERHEAD	0	260	940	1700	3800	5300	10900	22300	36900	45500	8500	136100
AFUDC	0	5	44	140	335	698	1391	3085	5994	10869	14778	37356
COST + OVHD + AFUDC	0	265	984	1840	4135	5998	12291	25385	42894	56369	23275	173456
AFUDC RATE (JAN-JUN)		0.0650	0.0670	0.0700	0.0710	0.0740	0.0750	0.0830	0.0910	0.0930	0.0940	
AFUDC RATE (JUL-DEC)		0.0675	0.0690	0.0710	0.0730	0.0750	0.0820	0.0900	0.0930	0.0930	0.0940	

TOTAL COST FOR THE PROJECT - 136100

TOTAL AFUDC FOR THE PROJECT - 37356

12/05/85

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LIMERICK ESTIMATED MARK 2 EXPENDITURES (01000) PART 2

CALCULATION OF AFUDC

SERVICE DATE 2/15/86

1985	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
COST + OVHD	0	0	0	0	0	0	0	0	0	0	0	0
AFUDC	1373	1373	1373	1373	1373	1373	1438	1438	1438	1438	1438	1438

1986	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
COST + OVHD	0	0	0	0	0	0	0	0	0	0	0	0
AFUDC	1523	1523	761	0	0	0	0	0	0	0	0	0

TOTAL COST BY YEAR	THRU 12/84	1985	1986	TOTAL
DIRECT COST	136100	0	0	136100
OVERHEAD	0	0	0	0
DIRECT COST + OVERHEAD	136100	0	0	136100
AFUDC	37356	16870	3807	58032
COST + OVHD + AFUDC	173456	16870	3807	194132
AFUDC RATE (JAN-JUN)		0.0950	0.0960	
AFUDC RATE (JUL-DEC)		0.0950	0.0960	

TOTAL COST FOR THE PROJECT - 136100

TOTAL AFUDC FOR THE PROJECT - 58032

12/05/85

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Derivation of Revised Nominal Direct Construction Expenditures
Based On OKA Determination of Prudent Fuel Load
Of 31 July 1982

BASED ON LIMERICK 1 AND 50% OF COMMON

Actual fuel load: 26-Oct-84
Prudent fuel load: 31-Jul-82 = 818 days before actual

Year	Actual Nominal Directs	North-Atlantic Handy-Whitman Index	Deflator to 1971	Actual Real Directs
1971	26.5	88	1.000	26.5
1972	28.6	95	0.926	26.4
1973	50.1	100	0.880	44.1
1974	61.3	114	0.772	47.3
1975	70.2	127	0.693	48.6
1976	82.3	136	0.647	53.7
1977	99.0	146	0.603	59.7
1978	78.0	155	0.568	44.3
1979	97.5	170	0.518	50.4
1980	147.9	184	0.478	70.7
1981	182.3	200	0.440	80.2
1982	262.1	217	0.406	106.3
1983	332.1	227	0.388	128.8
1984	329.9	235	0.374	123.5
1985	116.0	242	0.364	42.2
1986	8.0	253	0.348	2.8
	1981.8			961.6

Pattern of Actual Real Directs
Over "Stretchout" Period

(91 Months Preceding
Actual Fuel Load)

Months in Year	Real Directs Over Period	Share of Annual Period	Actual Between 31-Jul-82 and 26-Oct-84	Reallocated to 91 Months Preceding Actual Fuel Load
29-Mar to 31-Dec	45.3	7.2%		19.8
ALL	44.3	7.1%		19.4
ALL	50.4	8.0%		22.1
ALL	70.7	11.3%		31.0
ALL	80.2	12.8%		35.1
ALL	106.3	16.9%	44.6	46.5
ALL	128.8	20.5%	128.8	56.4
01-Jan to 26-Oct	101.2	16.1%	101.2	44.3
15-Feb-86 CO				
		100.0%	274.6	274.6

Derivation of Revised Nominal Direct Construction Expenditures
Based On OKA Determination of Prudent Fuel Load
Of 31 July 1982

BASED ON LIMERICK 1 AND 50% OF COMMON

(CONTINUED)

Year	Pattern of Reallocated Real Directs when Shifted to 91 Months Preceding Prudent Fuel Load		Remaining Real Directs to Reallocate Before/After Prudent Fuel Load	Revised Directs After Reallocation		
	Months in Year	Annual		Real	Nominal	
1971	ALL	24.5		26.5	26.5	
1972	ALL	20.0		26.4	28.6	
1973	ALL	24.2		44.1	50.1	
1974	ALL	32.0		47.3	61.3	
1975	ALL	37.9		73.1	105.5	
1976	ALL	48.9		79.8	123.3	
1977	ALL	53.5		83.9	139.2	
1978	01-Jan to 31-Jul	33.6	51.7	76.2	134.3	
1979				98.3	170.6	
1980				119.6	250.1	
1981				133.7	303.8	
1982				127.7	314.9	
1983				34.9	90.0	20-Nov-83 CO
1984			22.3			
1985			42.2			
1986			2.8			
		274.6	129.0	961.6	1798.3	

DIFFERENCE IN TOTAL NOMINAL DIRECT: $183.5

Derivation of AFUDC Accruals on Nominal Direct Construction Expenditures
For Limerick 1 and Common Facilities
As Revised By OKA According to 31 July 1982 Fuel Load

BASED ON LIMERICK 1 AND 50% OF COMMON

(In Millions of Nominal Dollars)

	ANNUAL DIRECTS						AFUDC							Totals	
	OKA			PECO			AFUDC Rates		ACCRUALS					OKA	PECO
										OKA		PECO			
Year	Annual	Semi	Cum	Annual	Semi	Cum	Nominal	Effectiv	Semi	Annual	Cum	Annual	Cum		
1971				26.5	26.5		8.00%	8.00%	1.1	1.1	1.1	1.3	1.3	27.6	27.8
1972				28.6	28.6	55.05	8.00%	8.00%	3.5	3.5	4.6	3.4	4.7	59.6	59.7
1973				50.1	25.1	105.15	8.00%	4.00%	2.9	6.8	11.4	5.9	10.6	87.6	115.7
					25.1		7.50%	3.75%	3.8					116.5	
1974				61.3	30.6	166.45	7.50%	3.75%	5.0	11.4	22.8	9.7	20.2	152.2	186.7
					30.6		7.50%	3.75%	6.4					189.3	
1975	105.5	52.8	272.0	70.2		236.6	8.00%	4.00%	8.7	20.3	40.5	16.2	36.5	248.1	273.1
		52.8					8.25%	4.13%	11.6					312.4	
1976	123.3	61.6	395.2	92.3		328.9	8.20%	4.10%	14.4	32.4	72.3	22.3	58.7	388.4	387.6
		61.6					8.40%	4.20%	18.0					468.0	
1977	139.2	69.6	534.5	99.0		427.9	8.60%	4.30%	22.1	48.5	121.3	39.7	98.4	559.7	516.3
		69.6					8.70%	4.35%	26.4					655.8	
1978	134.3	67.1	668.8	79.0		505.9	7.10%	3.55%	24.9	54.0	175.3	40.1	138.5	747.9	634.5
		67.1					7.30%	3.65%	29.1					844.1	
1979	170.6	85.3	939.4	97.5		603.4	7.40%	3.70%	33.4	71.9	247.2	51.8	190.3	962.8	783.7
		85.3					7.50%	3.75%	38.4					1086.5	
1980	250.1	125.1	1089.5	147.9		751.3	7.50%	3.75%	43.9	99.1	346.2	69.4	249.7	1255.5	1001.0
		125.1					9.20%	4.10%	55.2					1435.7	
1981	303.8	151.9	1393.3	182.3		933.6	8.30%	4.15%	64.1	143.6	489.8	92.2	341.9	1651.7	1275.5
		151.9					9.00%	4.50%	79.5					1883.2	
1982	314.9	157.4	1708.2	262.1		1195.8	9.10%	4.55%	91.3	196.6	686.4	129.3	471.6	2132.0	1667.4
		157.4					9.30%	4.65%	105.2					2394.7	
1983	90.0	45.0	1798.3	332.1		1528.0	9.30%	4.65%	115.1	210.0	896.5	171.2	642.8	2554.8	2170.7
		45.0					9.30%	3.62%	95.0					2694.7	
1984				329.9		1857.8	9.40%					223.5	866.2	=======	2724.0
							9.40%								
1985				116.0		1973.8	9.50%					270.3	1136.5		3110.2
1986				8.0		1981.8						62.3	1198.8		3180.5
DIFFERENCE IN TOTAL MCS:				$485.8								Per DR-Staff-LIM-14			3784.2

Allocation of Annual Expenditures
And Derivation of AFUDC Accruals
Associated with PECO Indirects
Incurred Between August 1982 and October 1984, Inclusive

BASED ON LIMERICK 1 AND 50% OF COMMON

STEP 1: ALLOCATION OF ANNUAL DIRECTS

PECO Indirects for Limerick 1/100% Common: $81.0

Year	Nominal Directs Limerick 1	Nominal Directs Common	Months in Year	Nominal Directs Over Period: ANNUAL EXPENDITURES Limerick 1	Common	Limerick 1 + 50% Common	Share	PECO Indirects $66.2 Annual
1971	$21.8	$9.4						
1972	23.2	10.7						
1973	43.8	12.2						
1974	50.3	21.0						
1975	57.1	23.6						
1976	75.6	29.1						
1977	78.8	34.8						
1978	58.9	30.8						
1979	81.1	23.8						
1980	124.6	36.6						
1981	133.1	86.6						
1982	196.5	125.8	01-Aug 31-Dec	81.6	52.2	133.9	15.4%	10.2
1983	264.2	134.9	ALL	264.2	134.9	399.1	45.8%	30.3
1984	250.3	157.3	01-Jan to 31-Oct	207.9	130.7	338.6	38.8%	25.7
1985	82.0	67.4						
1986	3.3	9.4	15-Feb CO					
	1544.6	813.4		553.7	317.8	871.5	100.0%	$66.2
			Share of Limerick 1 + Common:	63.5%	36.5%			

STEP 2: DERIVATION OF AFUDC ACCRUALS

YEAR	PECO INDIRECTS Annual	Semi	Cum	AFUDC RATES Semi	Effective	AFUDC ACCRUALS Semi	Annua	Cum	TOTAL
1982	10.2	0.0	10.2	9.10%	0.00%	0.0	0.2	0.2	0.0
		10.2		9.30%	3.87%	0.2			10.4
1983	30.3	15.2	40.5	9.30%	4.65%	0.9	2.5	2.7	26.4
		15.2		9.30%	4.65%	1.6			43.2
1984	25.7	15.4	66.2	9.40%	4.70%	2.4	5.6	8.3	61.1
		10.3		9.40%	4.70%	3.2			74.5
1985				9.50%	4.75%	3.6	7.4	15.7	78.2
				9.50%	4.75%	3.8			82.0
1986				9.60%	1.21%	1.0	1.0	16.7	83.0
	TOTAL MIXED-CURRENT GROSS:								$83.0

Allocation of Annual Expenditures
And Derivation of AFUDC Accruals
Associated with Bechtel Indirects
Incurred Between August 1982 and October 1984, Inclusive

BASED ON LIMERICK 1 AND 50% OF COMMON

STEP 1: ALLOCATION OF ANNUAL DIRECTS

PECO Indirects for Limerick 1/100% Common: $137.2

Year	Nominal Directs Limerick 1	Nominal Directs Common	Months in Year	Nominal Directs Over Period				
				ANNUAL EXPENDITURES				
				Limerick 1	Common	Limerick 1 + 50% Common	Share	Bechtel Indirects $112.2 Annual
1971	$21.8	$9.4						
1972	23.2	10.7						
1973	43.8	12.2						
1974	50.3	21.0						
1975	57.1	23.6						
1976	75.6	29.1						
1977	78.8	34.8						
1978	58.9	30.8						
1979	81.1	23.8						
1980	124.6	36.6						
1981	133.1	86.6						
1982	196.5	125.8	01-Aug 31-Dec	81.6	52.2	133.9	15.4%	17.2
1983	264.2	134.9	ALL	264.2	134.9	399.1	45.8%	51.4
1984	250.3	157.3	01-Jan to 31-Oct	207.9	130.7	338.6	38.8%	43.6
1985	82.0	67.4						
1986	3.3	9.4	15-Feb CO					
	1544.6	813.4		553.7	317.8	871.5	100.0%	$112.2
	Share of Limerick 1 + Common:			63.5%	36.5%			

STEP 2: DERIVATION OF AFUDC ACCRUALS

YEAR	PECO INDIRECTS Annual	Semi	Cum	AFUDC RATES Semi	Effective	AFUDC ACCRUALS Semi	Annua	Cum	TOTAL
1982	17.2	0.0	17.2	9.10%	0.00%	0.0	0.3	0.3	0.0
		17.2		9.30%	3.87%	0.3			17.6
1983	51.4	25.7	68.6	9.30%	4.65%	1.4	4.2	4.5	44.7
		25.7		9.30%	4.65%	2.7			73.2
1984	43.6	26.1	112.2	9.40%	4.70%	4.2	9.6	14.1	103.5
		17.4		9.40%	4.70%	5.4			126.3
1985				9.50%	4.75%	6.1	12.6	26.7	132.5
				9.50%	4.75%	6.4			138.9
1986				9.60%	1.21%	1.7	1.7	28.4	140.6
	TOTAL MIXED-CURRENT GROSS:								$140.6

Derivation of AFUDC Accruals on Nominal Direct Construction Expenditures
For Limerick 1 and Common Facilities
As Revised By OKA According to 31 July 1982 Fuel Load

BASED ON LIMERICK 1 AND 100% OF COMMON
REVISED DECEMBER 13, 1985

(In Millions of Nominal Dollars)

	ANNUAL DIRECTS						AFUDC							Totals	
	OKA			PECO			AFUDC Rates		ACCRUALS					OKA	PECO
										OKA		PECO			
Year	Annual	Semi	Cum	Annual	Semi	Cum	Nominal	Effectiv	Semi	Annual	Cum	Annual	Cum		
1971				31.2	31.2		8.00%	8.00%	1.3	1.3	1.3	1.5	1.5	32.5	32.7
1972				33.9	33.9	65.1	8.00%	8.00%	4.1	4.1	5.4	3.9	5.4	70.5	70.5
1973				56.0	28.0	121.1	8.00%	4.00%	3.4	7.9	13.3	6.8	12.2	102.0	133.3
					28.0		7.50%	3.75%	4.4					134.4	
1974				71.3	35.6	192.4	7.50%	3.75%	5.8	13.2	26.5	11.3	23.5	175.9	215.9
					35.6		7.50%	3.75%	7.4					218.9	
1975	122.5	61.3	314.9	80.7		273.1	8.00%	4.00%	10.1	23.5	47.0	19.0	42.5	287.2	315.6
		61.3					8.25%	4.13%	13.4					361.9	
1976	140.8	70.4	455.7	104.7		377.8	8.20%	4.10%	16.6	37.4	84.3	26.3	68.8	448.9	446.6
		70.4					8.40%	4.20%	20.8					540.1	
1977	158.4	79.2	614.1	113.6		491.4	8.60%	4.30%	25.5	55.9	140.2	35.3	104.1	644.7	595.5
		79.2					8.70%	4.35%	30.4					754.3	
1978	154.7	77.4	768.8	89.7		581.1	7.10%	3.55%	28.7	62.1	202.3	47.4	151.5	860.4	732.6
		77.4					7.30%	3.65%	33.4					971.2	
1979	196.3	98.2	965.2	104.9		686.0	7.40%	3.70%	38.5	82.7	285.0	61.8	213.7	1107.8	898.7
		98.2					7.50%	3.75%	44.2					1250.2	
1980	290.0	145.0	1255.1	161.2		847.2	7.50%	3.75%	50.5	114.1	399.1	81.6	294.3	1445.7	1141.5
		145.0					8.20%	4.10%	63.5					1654.2	
1981	371.1	185.5	1626.2	219.7		1066.9	8.30%	4.15%	74.0	166.4	565.5	109.7	404.0	1913.8	1470.9
		185.5					9.00%	4.50%	92.4					2191.7	
1982	392.7	196.4	2018.9	322.3		1389.2	9.10%	4.55%	106.6	230.1	795.6	153.4	557.4	2494.7	1946.6
		196.4					9.30%	4.65%	123.4					2814.5	
1983	118.4	59.2	2137.3	399.1		1788.3	9.30%	4.65%	135.4	247.4	1042.9	203.6	761.0	3009.1	2549.3
		59.2					9.30%	3.52%	112.0					3180.2	
1984				407.6		2195.9	9.40%					266.3	1027.9	=======	3223.8
							9.40%								
1985				149.7		2345.6	9.50%					323.7	1351.6		3697.2
1986				12.7		2358.3						74.7	1426.3		3784.6
DIFFERENCE IN TOTAL MCG:				$604.4								Per DR-Staff-LIM-14			3784.2

Allocation of Annual Expenditures
And Derivation of AFUDC Accruals
Associated with PECO Indirects
Incurred Between August 1982 and October 1984, Inclusive

BASED ON LIMERICK 1 AND 100% OF COMMON

STEP 1: ALLOCATION OF ANNUAL DIRECTS

Year	Actual Nominal Directs	Months in Year		Nominal Directs Over Period		
				Actual		PECO Indirects $81.0
				Annual	Share	Annual
1971	31.2					
1972	33.9					
1973	56.0					
1974	71.3					
1975	80.7					
1976	104.7					
1977	113.6					
1978	89.7					
1979	104.9					
1980	161.2					
1981	219.7					
1982	322.3	01-Aug	31-Dec	133.9	15.4%	12.4
1983	399.1	ALL		399.1	45.8%	37.1
1984	407.6	01-Jan to	31-Oct	338.6	38.8%	31.5
1985	149.7					
1986	12.7	15-Feb-86 CO				
	2358.3			871.5	100.0%	$81.0

STEP 2: DERIVATION OF AFUDC ACCRUALS

YEAR	PECO INDIRECTS Annual	Semi	Cum	AFUDC RATES Semi	Effective	AFUDC ACCRUALS Semi	Annua	Cum	TOTAL
1982	12.4	0.0	12.4	9.10%	0.00%	0.0	0.2	0.2	0.0
		12.4		9.30%	3.87%	0.2			12.7
1983	37.1	18.5	49.5	9.30%	4.65%	1.0	3.0	3.3	32.3
		18.5		9.30%	4.65%	2.0			52.8
1984	31.5	18.8	81.0	9.40%	4.70%	3.0	6.9	10.2	74.7
		12.6		9.40%	4.70%	3.9			91.2
1985				9.50%	4.75%	4.4	9.1	19.2	95.6
				9.50%	4.75%	4.7			100.2
1986				9.60%	1.21%	1.2	1.2	20.5	101.5
TOTAL MIXED-CURRENT GROSS:									$101.5

APPENDIX A

Q. OCA-4-29.

Please provide all workpapers, studies, analyses or other support for each of the cost reconciliation figures on Exhibit 2, Schedule 1.

A. OCA-4-29.

The attached compendium provides supporting documentation for the cost reconciliation figures cited in PECo Exhibit 2, Schedule 1. Included in this detail are the individual reconciliation items apportioned to specific cost causation factors; the total costs ascribed to each item; the Unit 1 and Common percentage of the total cost for each item; the Unit 1 and Common cost for each item, rounded to the nearest $ 0.1 million; and the referenced Forecast basis for each of the cost items. The methodology used in compiling, unitizing and apportioning costs to specific cost causation factors is detailed in Section VI of PECo Statement No. 8.

Responsible Witnesses:
B. P. Kononetz, TB&A
David R. Helwig, Supervising Engineer, Nuclear Services Branch, PECo

COST RECONCILIATION BACKUP

TO

PECO EXHIBIT NO. 2

TABLE OF CONTENTS

NOTE: ITEMS WITHIN THIS REPORT ANNOTATED WITH AN (*) IN THE COLUMN LABELED "UNIT 1 & COMMON COST" INDICATE THAT THOSE ITEMS WERE DETERMINED TO NOT WARRANT AN ALLOCATION OF DISTRIBUTABLE COSTS FROM SECTION V.

SECTION ONE: REGULATORY AND OTHER EXTERNALLY-IMPOSED CONDITIONS

RECONCILIATION ITEM	TOTAL COST ($MM)	UNITIZATION %	UNIT 1 & COMMON COST ($MM)	FORECAST BASIS
NON-NRC REQUIREMENTS (cont'd)				
Redesign of Schuylkill pumphouse and discharge per PaDER requirements.	0.4 (0.3) 0.1	100% 100% 100%	0.4 (0.3) 0.1	1(P.III-3) 1(P.III-3) 1(P.III-3)
Indirects and distributables prorated to Non-NRC requirements.	---	---	11.3	All
COST IMPACT OF SCHEDULE EXTENSIONS DUE TO LICENSING DELAYS AND OTHER FACTORS				
Costs of schedule extension from 54 months to 60 months.	2.0	65%	1.3*	Pre. Est.
Costs associated with a revised construction schedule reflecting a January 1973 construction start.	13.0	65%	8.5*	Pre. Est.
Construction Permit delay from 1-73 to 6-74.	18.6 21.0 (4.5) 0.2 0.6 5.8 (0.8) 21.7	65% 100% 100% 100% 65% 65% 65% 65%	12.1* 21.0* (4.5)* 0.2* 0.4* 3.8* (0.5)* 14.1*	1(P.III-1) 1(P.III-2) 2(P.III-5) 1(P.III-2) 2(P.III-1) 2(P.III-1) 3(P.I-6) 2(P.III-1)
Fuel load delay for Unit 1 from 4-79 to 8-80; from 9-80 to 1-82 for Unit 2.	29.6	65%	19.2*	1(P.III-1)
Costs associated with a fuel load delays (10/81-10/83).	31.9	55.3%	17.6*	2(P.III-1)
Cost associated with fuel load delay to 3/82; 5/84.	22.6	57%	12.9*	4(P.14)
Delay in fuel load date to 10/82 and 10/84.	11.6	72.2%	8.4*	4(P.14)
Schedule delay from 10/82 to 10/84 for Unit 1 and 10/84 to 10/86 for Unit 2.	141.6	65%	92.0*	5(P.17)

SECTION ONE: REGULATORY AND OTHER EXTERNALLY-IMPOSED CONDITIONS

RECONCILIATION ITEM	TOTAL COST ($MM)	UNITIZATION %	UNIT 1 & COMMON COST ($MM)	FORECAST BASIS
COST IMPACT OF SCHEDULE EXTENSIONS DUE TO LICENSING DELAYS AND OTHER FACTORS (cont'd)				
Home office engineering associated with schedule delay.	4.5	65%	2.9*	4(P.16)
Unit 1 schedule delay from 7/84 and 9/84 fuel load.	3.4	100%	3.4*	7(PT-1[illegible])
Commercial operation delay from April to August 1985 due to delay in issuance of full power license.	28.5	100%	28.5*	Trend 7-7-[illegible]
Commercial operation delay from August 1985 to December 1985 due to delay in issuance of full power license.	95.9	100%	95.9*	Trend 7-10-[illegible]
Additional funds needed due to schedule delays in the HVAC balancing operation.	0.1	100%	0.1*	Trend 7-7-3[illegible]
Commercial operation delay from December 1985 to February 1986 due to delay in issuance of full power license.	27.8	100%	27.8*	Trend 7-13-1[illegible]
Modification of ITT HVAC damper actuators due to seal shelf to seal shelf life being exceeded.	0.4	100%	0.4	7(P.6[illegible]
Condenser tube cleaning and plugging to mitigate deterioration during project delay.	3.3 (0.1)	100% 100%	3.3* (0.1)*	7(P.13[illegible] Trend 7-6-[illegible]
Cost of maintaining meteorological towers and monitoring equipment during extended schedule.	1.4	100%	1.4*	PECo(32[illegible]
NSSS contract cost increases due to delay.	3.6 2.1 0.1	100% 100% 100%	3.6* 2.1* 0.1*	PECo(30 PECo(30 PECo(30

RECONCILIATION ITEM	TOTAL COST ($MM)	UNITIZATION %	UNIT 1 & COMMON COST ($MM)	FORECAST BASIS
COST IMPACT OF SCHEDULE EXTENSIONS DUE TO LICENSING DELAYS AND OTHER FACTORS (cont'd)				
Increased cost of environmental monitoring.	5.7	100%	5.7*	PECo(8334)
	0.5	100%	0.5*	PECo(8139)
	2.8	100%	2.8*	PECo(8333)
Indirects and distributables prorated to cost impact of schedule extensions.	---	---	0.2	All

SECTION IV

UNANTICIPATED ESCALATION

SECTION FOUR: UNANTICIPATED ESCALATION

RECONCILIATION ITEM	TOTAL COST ($MM)	UNITIZATION %	UNIT 1 & COMMON COST ($MM)	FORECAST BASIS
IV. UNANTICIPATED ESCALATION				
Escalation associated with the upgrading of the Schuylkill River Facilities.	3.0 (0.2)	100% 100%	3.0* (0.2)*	Pre. Est. 4(P.16)
Escalation associated with the refueling floor missile protection.	3.0	100%	3.0*	Pre. Est.
Escalation associated with a seismic criteria change of .12g to .15g.	3.0	60.0%	1.8*	Pre. Est.
Escalation associated with civil commodity and material increases.	11.0	57.3%	6.3*	Pre. Est.
Escalation associated with large and small process pipe quantities.	3.0	53.3%	1.6*	Pre. Est.
Escalation associated with re-evaluation of field manual labor.	5.0	62.0%	3.1*	Pre. Est.
Escalation associated with re-evaluation of non-manual requirements for Quality Control.	1.0	65.0%	0.7*	Pre. Est.
Other unanticipated escalation.	0.1 1.0	100% 65.0%	0.1* Trend 7-8-[illegible] 0.7*	Pre. Est.
Escalation associated with engineering and other home office support.	4.0	52.5%	2.1*	Pre. Est.
Escalation associated with a revised construction schedule reflecting a January 1973 construction start.	43.0	60.5%	26.0*	Pre. Est.
Escalation associated with a schedule extention from 54 months to 60 months.	20.0	60.0%	12.0*	Pre. Est.

SECTION FOUR: UNANTICIPATED ESCALATION

RECONCILIATION ITEM	TOTAL COST ($MM)	UNITIZATION %	UNIT 1 & COMMON COST ($MM)	FORECAST BASIS
UNANTICIPATED ESCALATION (cont'd)				
Reduced delay charges on fan cabinets.	(0.1)	65%	(0.1)*	4(P.16)
Escalation rate adjustment from 6 to 7 percent for 1978 and beyond, to agree with SFPD guidelines.	16.9	52.7%	8.9*	1(P.III-1)
Escalation rate re-evaluation to reflect actual 1974 escalation and to incorporate new guidelines.	111.0	58.8%	65.3*	1(P.III-1)
Increased escalation for reinforcing steel and drywell framing system.	1.0 0.2	65% 50%	0.7* 0.1*	1(P.III-2) 1(P.III-2)
Re-evaluate escalation for reactor shield.	0.2	50%	0.1*	2(P. III-3)
Additional escalation for miscellaneous mechanical subcontracts.	1.9	65%	1.2*	2(P.III-4)
Re-evaluation of to-go escalation for pipe.	(1.4)	65%	(0.9)*	2(P.III-4)
Re-evaluation of to-go escalation for large fabricated pipe.	(5.6)	69.4%	(3.9)*	3(P.III-5)
Deletion of unallocated escalation from Forecast 2.	(23.9)	32.6%	(7.8)*	3(P.III-5)
3 year multi-trade agreement labor escalation from 7% to 3 1/2%.	(23.0)	40%	(9.2)*	4(P.14)
Revise projected escalation rates (7% to 8%).	12.8	55.5%	7.1*	4(P.14)
NSSS contract escalation.	0.8 1.6 14.0	100% 100% 100%	0.8* 1.6* 14.0*	PECo(301) PECo(301) PECo(301)

SECTION FOUR: UNANTICIPATED ESCALATION

RECONCILIATION ITEM	TOTAL COST ($MM)	UNITIZATION %	UNIT 1 & COMMON COST ($MM)	FORECAST BASIS
UNANTICIPATED ESCALATION (cont'd)				
Increase in home office wage rates over forecasted due to actual escalation exceeding forecast.	9.8	66.3%	6.5*	4(P.16)
Reactor shield access doors increase in commitment amount due to change in escalation rate.	0.2	50%	0.1*	5(P.22)
Change in escalation rate since Forecast 5.	15.7	37.0%	5.8*	5(P.152)
Escalation associated with schedule delays.	69.7	58.8%	41.0*	1(P.III-1)
	61.7	58.8%	36.3*	1(P.III-1)
	69.1	49.1%	33.9*	2(P.III-1)
	14.0	37.9%	5.3*	4(P.14)
	5.3	54.7%	2.9*	4(P.14)
	80.9	49.0%	39.6*	5(P.27)
Re-evaluation of labor rates.	1.7	100%	1.7*	Trend 7-5-5F
	7.8	65%	5.1*	5(P.28)
	2.8	65%	1.8*	1(P.III-4)
	14.0	65%	9.1*	1(P.III-2)
	(22.0)	65%	(14.3)*	1(P.III-2)
	(17.6)	65%	(11.4)*	2(III-4)
	(3.0)	65%	(2.0)*	3(P.I-7)
	34.6	65%	22.5*	5(P.28)
	0.2	100%	0.2*	7(P.III)
	(1.2)	100%	(1.2)*	Trend 7-III-1F
Price relief to Ingersoll-Rand Co. for chilled water circulation pumps.	0.1	65%	0.1*	3(P.I-5)
Additional price relief to Byron Jackson for emergency service water pumps and RHR service water pumps.	0.4	50%	0.2*	3(P.I-5)
Price relief granted to other vendors.	1.1	65%	0.7*	2(P.III-1)
Price relief to Crane-Deming for vertical radwaste pumps.	0.1	100%	0.1*	3(P.I-5)

Q. On pages 2-4 of Mr. O'Brien's supplemental direct testimony (OCA Statement No. 1A), he discusses the calculation of an amount of $137.2 million without AFUDC ($171.9 million with AFUDC) that he describes as Bechtel indirect costs resulting from the 27-month delay for Limerick 1 and 100% of common facilities. With respect to this calculation:

a. Are any of these costs duplicative of other costs elsewhere estimated by Mr. O'Brien in this proceeding?

A. Each of the delay cost calculations presented by Mr. O'Brien is an independently accurate estimation of the costs for each item. Thus, the PECO and Bechtel Indirect cost calculations are accurate and not duplicative. If one sums the total costs of delay, however, as developed item by item, i.e. Bechtel and PECO Indirect costs, Mark II costs, and the revised costs to complete construction by July, 1982, the component costs of escalation, and AFUDC on that escalation, for the Indirect and Mark II costs included in the revised cost to completion for a July, 1982 fuel load, will be duplicative.

the costs of delay and sum the overall delay costs to a July, 1982 fuel load date with the Indirect and Mark II costs, the proper costs figures should be as follows:

% of Common	revised costs to 6/82 fuelload	Bechtel Ind.	PECO Ind.	MarkII	Total
100%	$542.1m	171.9m	101.5m	194.1m	1,009.6m
50%	$430.0m	140.4m	83.0m	194.1m	847.7m

If the PUC makes an adjustment for the overall delay costs, including Bechtel and PECO Indirect costs, but not for the Mark II costs, the costs figures are as follows:

% of Common	revised costs to 6/82 fuelload	Bechtel Ind.	PECO Ind.	Total
100%	$568.3m	171.9m	101.5m	841.7m
50%	$456.4m	140.6m	83.0m	680.0m

If the PUC makes an adjustment for the overall costs of delay, but not for the Bechtel and PECO Indirect costs or the Mark II costs, the figures are as stated in OCA Statement 1A, as follows:

% of Common	revised costs to 6/82 fuelload	Total
100%	$604.4m	$604.4m
50%	$485.8m	$485.8m

PECO EXHIBIT NO. 10

R-850152

2-11-86

1H5 jas

Q.9 For each model and analysis identified in response to Question 5, above, identify all modifications or adjustments made to account for Limerick-specific events, activities or factors, and describe in detail the specific changes for all activities and their related durations, manhours, quantities, dollars and any other relevant measures used to describe or quantify such events and activities and their effects upon Limerick cost, schedule or other applicable parameters.

A.9 This information has been provided in OCA St. No. 1. Below is a description of the steps taken in producing the schedule analysis for Limerick Unit 1.

Duplication of Limerick Baseline Overall Construction Schedule

The Limerick Baseline Schedule was duplicated by using Bechtel Power Corporation's computer printout of the Limerick Unit 1 and 2 construction schedule dated June 4, 1974/Revision 1. The quality of the reproduced computer reports and the accompanying network drawings was poor. While the drawings were dated 5/23/74/Revision 4, they were presumed to match the PECO furnished printout. These drawings were relied upon for some logic and durations.

The Bechtel computer reports were generated using McAuto's MSCS scheduling software (this determination was made by reference from other PECO documents). There was no printout of the masterfile identifying MSCS as the software package used and no computer tapes available. The network is in an ADM format and interconnecting restraints are identified on the run in one of three ways: Dummy; Area Interface; a blank description. Activity durations are in whole weeks. The schedule start date is November 2, 1973; the Unit 1 completion date is the activity Fuel Load Unit 1 on April 9, 1979; and first safety concrete occurs for Unit 1 with the activity FR&P Basemats and Install Embeds which occurs on July 1, 1974.

Bechtel's construction schedule also included a number of activities labeled Winter Protection. These activities were not tied to construction activities and therefore appeared as critical (0 float), creating some confusion when trying to follow the actual critical path through construction. In order to make following the critical path less confusing, these winter activities were suppressed from printing in the OKA reports.

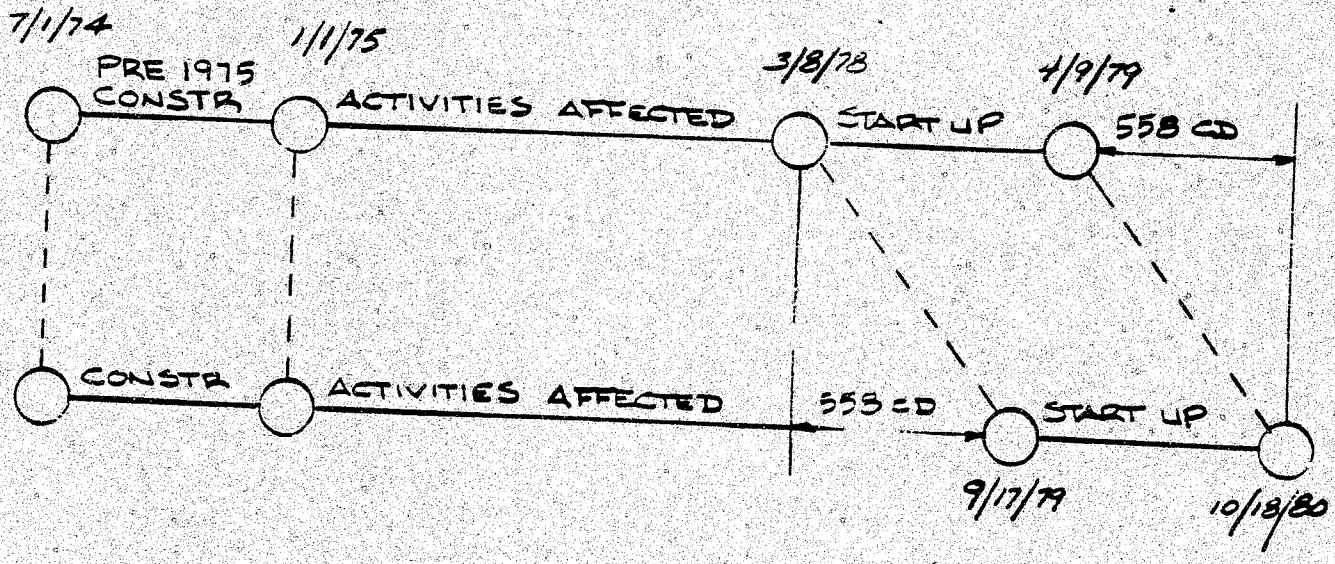
Once the Bechtel schedule was transferred to OKA's computer, a one to one check was performed on the critical path for both Unit 1 and Unit 2 to assure conformance.

Overall Construction Schedule Impacted by PUC Accepted Delay

The next step was to take the the baseline schedule and extend the fuel load date for Unit 1 to conform with the delay accepted by the PUC during the calendar years 1975 through 1977. The commission concluded that the commercial operation date for Unit 1 could prudently be extended to April 1981. Backing up the April 1981 date by six months gives a fuel load date for Unit 1 of October 1980.

The accepted delay affected the activities on the baseline schedule which fell in-between January 1, 1975 and up to, but not including the start up phase which occurs on March 8, 1978. These activities were extended to produce the October 1980 fuel load date.

This was accomplished by sorting the baseline activities by early start and early finish dates and changing the durations of the activities proportionally to produce the accepted delay. Below is a figure which tries to illustrate this graphically.



As can be seen the fuel load date for Unit 1 was pushed from April 9, 1979 to October 18, 1980, a total of 558 calendar days or approximately one and one-half years. This latest schedule will be referred to as the PUC revised baseline.

The PUC Revised Baseline Impacted by Mark II Containment Re-designed.

The final step was to take the PUC revised baseline and impact the pertinent construction activities affected by the Mark II re-design in the containment area. These construction activities were structural steel; large and small pipe hangers; large and small pipe; conduit; and tray occuring in calendar year 1975 and beyond.

Activity durations were increased by 34 percent to take into account the effect of Mark II's re-design on construction activities. With these duration increases, the fuel load date for unit 1 was extended from October 18, 1980 to December 11, 1981 a total of 419 calendar days or approximately 1 year and 2 months.

2. On page one of your testimony, you state that OKA was listed by Engineering News Record as "37th nationally." What was the basis for the ranking as 37th? What were the selection criteria employed? What were the eligibility requirements for being so listed?

2. The ranking is, in fact, outdated. According to the latest ranking performed by Engineering News Record (ENR) and reported in the May 17, 1884 issue, OKA is 25th nationally (copy attached).

While OKA responded to an unsolicited questionaire, copies of neither the questions nor answers were retained. OKA does not have any information regarding ENR's selection criteria or eligibility requirements past those stated in the referenced article.

Designers' CM billings rise 5%

Slightly fewer design firms reported billings for construction management (CM) services last year, but the total volume of CM fees continued to climb. CM business generated $1.46 billion in billings, 5% more than the previous year, and accounted for 17% of total billings, compared with 13% in 1982.

In a reversal of the trend for total design billings, CM fees for overseas work posted a sharp gain in 1983, while those for work at home fell almost 2% to $890 million. Fees for foreign CM rose 18% to $570 million and accounted for 45% of all foreign billings. By comparison, 1982's foreign CM billings totaled $482 million, about 35% of that year's foreign billings total.

Engineer-architects (E-As) were the leaders in CM billings last year, capturing $918.1 million, or 62% of the CM market. E-As relied on CM projects for about 24% of their total billings, the largest percentage of any of the design groups. Architect-engineers pocketed $275 million in CM billings, or roughly 19% of the market. Consulting engineering firms, which drew 16% of their billings from the CM market, claimed $260.1 million, an 18% market share. Architectural firms registered $10.5 million in CM billings, about 1% of the market.

CRS Sirrine, Inc, (CRSS) Houston, captured first place on ENR's list of the 50 largest U.S. construction managers. The CRS Group, Inc., ranked fourth on the CM list last year, has since acquired J.E. Sirrine Co., Greenville S.C., which ranked 28th on the CM list last year. Foreign and domestic CM markets accounted for nearly two-thirds of CRSS's 198 billings.

Second place on the CM list went to Gibbs & Hill, Inc., Ne York City. CM fees for that firm rose to about 56% of its tot billings last year, compared to 1982 when CM fees accounte for only 22%. Nearly all of that increase was due to a rise i the company's domestic CM billings, which more than triple between 1982 and 1983.

Third and fourth place were captured by Holmes & Narver

These design firms led the CM market

		CM—% of total billings
1	CRS Sirrine, Inc., Houston, Tex.	64
2	Gibbs & Hill, Inc., New York, N.Y.	56
3	Holmes & Narver, Inc., Orange, Calif.	67
4	Planning Research Corp., New York, N.Y.	53
5	De Leuw, Cather & Co., Wash., D.C.	58
6	CH2M Hill, Inc., Corvallis, Ore.	25
7	Daniel, Mann, Johnson, & Mendenhall, Los Angeles, Calif.	33
8	Williams Bros. Engrg. Co., Tulsa, Okla.*	97
9	Sverdrup Corp., St. Louis, Mo.	32
10	International Engrg. Co., San Francisco	27
11	Harza Engrg. Co., Chicago, Ill.	45
12	Parsons Brinckerhoff, Inc., N.Y.C.	36
13	The Louis Berger Group, East Orange, N.J.	18
14	Gilbert/Commonwealth Cos., Reading, Pa.	10
15	Swan Wooster Engrg., Inc., Portland, Ore.	76
16	Black & Veatch, Kansas City, Mo.	16
17	King-Wilkinson, Inc., Houston, Tex.	51
18	Metcalf & Eddy, Inc., Boston, Mass.	24
19	Gannett Fleming, Harrisburg, Pa.	30
20	Walk, Haydel & Assoc., Inc., New Orleans, La.	52
21	Frank Moolin & Assoc., Inc., Anchorage	72
22	Howard Needles Tammen & Bergendoff, Kansas City, Mo.	14
23	Heery Int'l., Inc., Atlanta, Ga.	43
24	The Kuljian Corp., Philadelphia, Pa.	41
25	O'Brien-Kreitzberg & Assoc., Inc., Merchantville, N.J.	95
26	Ultrasystems Engrs. & Constructors, Inc., Irvine, Calif.	59
27	Burns & McDonnell, Kansas City, Mo.	21
28	Stanley Consultants, Inc., Muscatine, Iowa	32
29	Hayden-Wegman Consult. Engrs., Boston	100
30	A. Epstein & Sons, Inc., Chicago, Ill.	12
31	Singmaster & Breyer, Inc., N.Y.C.	100
32	Tetra Tech, Inc., Pasadena, Calif.	10
33	STV Engrs., Inc., Pottstown, Pa.	15
34	Dynatech Nuclear, Inc., San Francisco	100
35	Lockwood Greene Engrs., Inc., Spartanburg, S.C.	11
36	Sykes Enterprises, Inc., Charlotte, N.C.	47
37	Lockwood, Andrews & Newnam, Inc., Houston, Tex.	26
38	Donohue & Assoc., Inc., Sheboygan, Wis.	20
39	Betz Converse Murdoch, Inc., Plymouth Meeting, Pa.	25
40	Mason & Hanger-Silas Mason Co., Inc., Lexington, Ky.	36
41	McNamee, Porter & Seeley, Ann Arbor, Mich.	75
42	URS Engrs., San Mateo, Calif.	9
43	Sargent & Lundy, Chicago, Ill.	2
44	CE Maguire, Inc., Providence, R.I.	13
45	Brown & Caldwell, Pleasant Hill, Calif.	15
46	Perry, Dean, Rogers & Partners, Inc., Boston, Mass.	100
47	James M. Montgomery, Inc., Pasadena, Calif.	8
48	Engineering-Science Cos., Arcadia, Calif.	10
49	Perkins & Will, Chicago, Ill.	14
50	Coffman Engrs., Inc., Seattle, Wash.	22

* Estimated by ENR

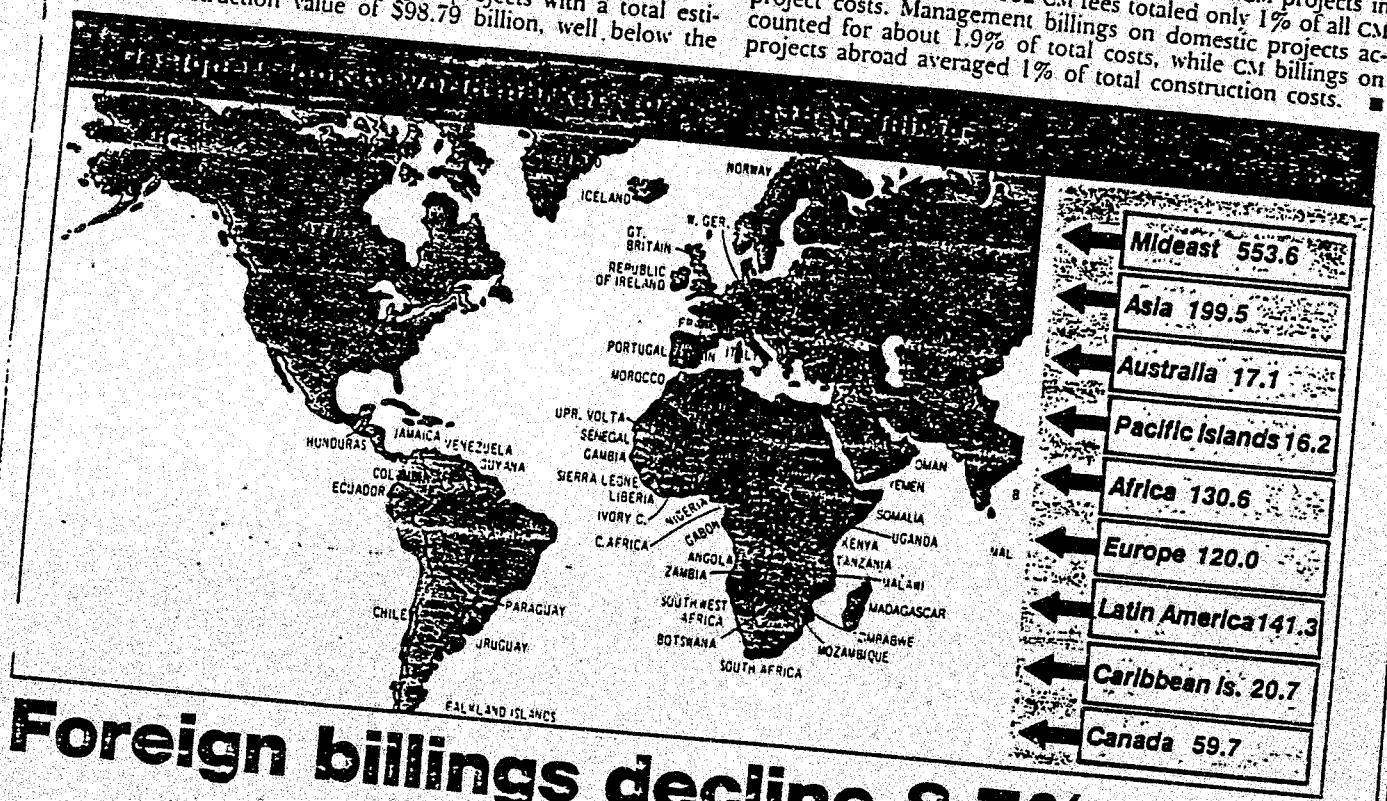
500 footnotes: Continued

Incl. Herziger & Assoc., Inc.; Technical Resources, Inc. **uu.** *Incl. Saudi Geotechnical Services, Riyadh, Saudi Arabia* **vv.** *Fromerly The Falick/Klein Partnership, Inc.* **ww.** *Formerly Hayden, Harding & Buchanan, Inc. & Leonard S. Wegman Co., Inc.* **xx.** *Incl. A + E Design Group, Inc.* **yy.** *Incl. Southwest Engrg.* **zz.** *Incl. Scott & Scott Consultants, Inc.; LEI Consultants, Inc.* **AA.** *Incl. NANA Surveying; H&B Surveyors* **BB.** *Incl. Building Conservation Technology* **CC.** *Incl. Technodyne Engr. Co.* **DD.** *Incl. Canger, Schoor & Cassera, Inc.* **EE.** *Incl. Const. Planning Assoc.; Interior Planning Assoc.; Caplinger Planners; Dessin Petit; Engrg. Planning Group, Inc.; Robert Tannen, Inc.* **FF.** *Incl. Olson & Terzian* **GG.** *Incl. H&A of New York* **HH.** *Formerly Herman Blum Consult. Engrs.; Incl. Consolidated Engrs., Inc.* **II.** *Incl. Webster Martin, Inc.* **JJ.** *Formerly Engineers, Inc.* **KK.** *Incl. Edmands Engrg., Inc.; Granger Engrg., Inc.; Geotechnical & Materials Consultants, Inc.; John Dziurman Assoc., Inc.* **LL.** *Incl. Hoyle Tanner & Assoc., Inc.* **MM.** *Incl. Sanchez & Suarez Assoc., Puerto Rico* **NN.** *Formerly Hoad Engrs., Inc.* **OO.** *Incl. EC Engrg. & Science, Inc.; W&W Facilities Group, Inc.* **PP.** *Incl. EDM, Inc.* **QQ.** *Incl. Mechanical Electrical Systems, Inc.* **RR** *Incl. Paul Planert Design Assoc.* **SS.** *Incl. Great Basin Aeria Surveys* **TT.** *Incl. Frankhouser-Jenkins Assoc.* **UU.** *Incl. MCI /Consult. Engrs.* **VV.** *Incl. Gordon Herkenhoff & Assoc.; Leeds Hill & Jewett* **WW.** *Formerly Richard Browne Assoc.* **XX.** *Inc Landev Engrs., Inc.; Baseline Corp.* **YY.** *Incl. Design Concepts Inc.; Delpro Corp.* **ZZ.** *Incl. Aerial Mapping Co.* **1a.** *Incl. Electri cal Design, Inc.; Walters & Beyer Civil Consult. Engrs.* **1b.** *Inc. W-J Assoc., Inc.; EDAW Assoc., Inc.* **1c.** *Incl. Homan & Law rence Engrg. Co.* **1d.** *Incl. E & I Systems, Inc.; Delta Design Inc.* **1e.** *Incl. Century A-E, Inc.*

Inc., Orange, Calif., and Planning Research Corp, New York City, dropping from the second and third-place slots. DeLeuw Cather & Co., Washington, D.C., jumped from ninth place last year to fifth. Additions to this year's top 10 CM firms include seventh-ranked Daniel, Mann, Johnson & Mendenhall, Los Angeles, up from No. 11 last year, and International Engineering Co., San Francisco, which moved from No. 14 to rank 10th this year.

Top 500 design firms managed projects with a total estimated construction value of $98.79 billion, well below the previous year's $136.5 billion. Foreign CM projects accounted for $53.01 billion, or about 54% of estimated construction costs for CM projects.

Management costs, taken as a percentage of total construction costs, increased slightly last year. CM billings accounted for about 1.4% of the total estimated cost of CM projects in 1983. By comparison, 1982 CM fees totaled only 1% of all CM project costs. Management billings on domestic projects accounted for about 1.9% of total costs, while CM billings on projects abroad averaged 1% of total construction costs. ■



Foreign billings decline 8.7%

The Top 500 design firms billed clients abroad for only $1.26 billion in 1983, an 8.7% decrease from the previous year, as many foreign economies remained mired in recession. The downturn in foreign billings was the first since 1969, when ENR began to track The Top 500's work outside the U.S. A total of 203 firms, or about 41% of The Top 500, reported some foreign billings in 1983, down slightly from the previous year, when 45% of all firms posted billings from work abroad.

Engineer-architects (E-As) led The Top 500 in foreign billings, capturing $619.1 million, nearly half of the foreign design market. E-A firms relied on clients outside the U.S. for 16% of their total billings, more than any other design group. By comparison, consulting engineers derived about $383.2 million, or 15.6% of their billings, from projects abroad, and architect-engineers (A-Es) collected $206.9 million, or 12.7% of their billings, from foreign sources. Architectural firms billed foreign clients for $49.6 million, roughly 7.8% of their total 1983 billings.

The Mideast remained the largest foreign market for U.S. designers, despite a winding down of new megaprojects. Following a slight decline in 1982, Mideast billings rose 2% last year, to $553.6 million, or about 44% of all foreign billings. But sharp declines in other regions offset the Mideast gain. Economic uncertainties and huge national debts in some countries apparently discouraged construction in Latin America. Billings from those countries totaled only $141.3 million in 1983, about a quarter less than the previous year. African markets declined 28% to $130.6 million, and European billings, at $120 million, were down 21% from 1982's level. The Caribbean contributed $20.7 million to the foreign billings total, a 9% increase, and Canadian billings totaled $59.7 million, down 4%.

In contrast, designers found Asia a growing source of new business. Billings, climbing steadily since the early 1980s, totaled $199.5 billion, a 2% increase over last year. The Pacific islands contributed 16.2 million, an 8% increase over last year, but billings from Australian projects totaled only $17.1 million, a 34% decline.

Although foreign design billings shrank in 1983, increased U.S. military spending for construction overseas has helped some firms abroad. Dames & Moore (D&M), Los Angeles, for example, is working on U.S. military construction sites in the Mediterranean area. Henry Klehn, chief operating officer for D&M, claims overseas markets have remained "generally strong" for his company. In addition to its military work, the firm has projects in Australia, New Zealand and the Middle East.

Sargent & Lundy (S&L), Chicago, in an effort to win new design contracts, is marketing its powerplant services overseas, says Senior Partner L. E. Ackmann. Recently S&L entered into a joint venture with Davey-McKee Pacific in

3. On pages one and two of your testimony, you state that you have testified on 15 occasions as an expert witness on project management. On which of these occasions have your recommendations been adopted by the body before which you testified? Please be specific about the content of your recommendations and the findings and conclusions of the regulatory body.

3. The referenced citation states that Mr. O'Brien has been accepted as an expert witness on project management and CPM scheduling on more than 15 occasions. This figure represents a best recollection since no log is kept of appearances, specific content of recommendations, or findings and conclusions that may have been predicated thereon. Testimony from specific cases may be reviewed upon request. Findings and conclusions of regulatory bodies are not specifically retained by OKA, but presumably are available in the public domain.

6. Provide a detailed description of the computerized networks developed by Mr. O'Brien for use by NEES and DL&P to schedule transmission, substation and other work. How many activities per average construction project were input into the computerized schedules? Are these computerized scheduling tools still in use at NEES and DL&P today?

6. OKA has not retained the documents or records or work products used or created for these assignments, and Mr. O'Brien has no detailed recollection of the requested items, nor any knowledge as to whether or not the schedules are still in use.

7. Provide a detailed description of the State Island Community College Power Plant and Capitol Power Plant projects referenced at page JJO'B-1.4 of Exhibit JJO'B-1. Provide the net generating capacity in megawatts, the total cost, the construction schedule duration and a detailed list of construction activities for each plant. Describe in detail OKA's specific responsibility, OKA's manhours expended in the effort, OKA total billings in the project, and work performed at each project. Describe any computer models used by OKA to perform these assignments.

7. The Staten Island Community College Power Plant was a small, self-contained unit which was postponed in 1975 and subsequently cancelled. Mr. O'Brien has no detailed recollection of the requested information for either project.

8. On pages 3 and 4 of OCA Statement No. 1, reference is made to "prudent construction management practices." Please describe what criteria is used to determine "prudent construction management practices." Please provide the basis for this criteria and the resulting definition of "prudent construction management."

A. In my opinion, prudent construction management involves the judicious and disciplined planning, scheduling, monitoring and controlling of a project.

9. Provide documentation of the research that "shows that no U.S. Boiling Water Reactor (BWR) facility with a construction start contemporaneous with Limerick's completed construction any time in 1981 or before" (OCA Statement No. 1, p. 6). List all the potential reasons that these plants or LGS could not have been completed by 1981, in Mr. O'Brien's opinion.

9. a) "Nuclear Power Plants Construction Status Report Data as of 06/30/82"; published by USNRC; NUREG 0030; Vol. 6, No. 2.

b) The reasons for the failure of these plants to be completed timely are addressed at the question an answer given at the bottom of p. 12 and at p. 13 of OCA Statement No. 1.

10. Provide the basis for the statement that PECO "delayed the project unnecessarily" (OCA Statement No. 1, p. 6). Provide all documents relied upon in reaching that conclusion.

10. The basis for the statement is the analysis given at OCA Statement No. 1 which indicates LGS could have been completed earlier, and the fact that two similar plants were completed earlier under the same regulatory constraints. All documentation has been previously provided.

13. Provide a listing of all of the factors which Mr. O'Brien believes could result in a prudent delay to nuclear project construction as compared to the scheduled completion date. Explain whether, to what extent, and how each of these factors was evaluated by Mr. O'Brien in reaching his conclusion that Limerick 1 and Common Plant could have been completed by July 1982. Provide all data which Mr. O'Brien employed in reaching such conclusion.

A. The factors that could result in a prudent delay must be reviewed on a case by case basis. The conclusion that Limerick 1 and Common Plant could have been completed by July, 1982, is discussed extensively in OCA Statements 1 and 2.

14. In Mr. O'Brien's opinion, are there any circumstances under which reasonable and prudent utility management would delay completion of a nuclear power plant? In answering this question, consideration should be given to both reason arising from management's discretionary action and from external forces beyond the control of management.

A. Yes. See the answer to IR-PECO-OCA-3-13.

15. On page seven of your testimony, you state "thus, it is my opinion that reasonable and prudent management should dedicate itself to completing a project such as this as expeditiously as prudently possible."

a) Please give a clear and complete definition of the meaning of the phrase "as expeditiously as prudently possible" as used in this context.

b) Is it true that your statement refers to as fast as technically and physically possible without regard to economics, load conditions, or financial circumstances?

c) What is the logic that leads you to the quoted opinion?

A. a) The phrase speaks for itself.

b) The statement speaks for itself. My testimony did not address economics, load conditions or financial circumstances.

c) See OCA St. No. 1, pp. 6-7, and the answer to IR-PECO-OCA-3-11.

16. In Mr. O'Brien's opinion , would reasonable and prudent project managers consider the potential level of rework that could be required in the future when determining a construction schedule that was "as expeditious . . . as prudently possible?"

16. The potential level of rework would be a consideration, among other things.

17. On pages 11 and 12 of your testimony, you describe the schedule modifications that you performed.

a) Which activities as shown in Exhibit JJO'B-13 were adjusted? Provide activity names and code numbers.

b) For all activities that were adjusted, were they adjusted by the same 34%

c) If not, how were they adjusted? Explain fully and provide all calculations, work papers or other support for the basis and derivation of said adjustments.

d) Is it true that the lengths of all tasks performed during your assumed cash flow restriction period were extended uniformly and arbitrarily to match the October 18, 1980 Fuel Load Date?

e) Please explain why all tasks or construction activities would be uniformly affected.

f) Were any other changes made to the schedule provided by PECO to OKA to reflect the October 18, 1980 fuel load date, in addition to the five changes listed on pages 11 and 12?

g) Have you calculated the annual expenditures implied by this hypothetical adjusted schedule? If so, please provide them.

h) Please provide OKA's rationale for adjusting the schedule provided by PECO to OKA to conform with a commercial operation date of April, 1981.

17. a) The activities adjusted to produce Exhibit JJO'B-13 are uniquely defined by their Node Numbers and are hereby provided at Attachment IR-PECO-OCA-3-17(a), along with their adjusted durations.

b) Yes.

c) N.A. See b)

d) All construction activities were extended uniformly but not arbitrarily as described at the refereced pages.

e) OKA's Exhibit JJO'B-4 demonstrates one way to complete construction of LGS and achieve commercial operation by the PECO-announced date of April, 1981. This schedule was created by adding 558 calendar days to PECO's schedule, spread uniformly over all construction activities in lieu of any PECO document or schedule which indicates another scheme.

f) An expanded description of the referenced changes has been provided as IR-PECO-OCA-9 (Revised) on December 27, 1985.

g) No calculation have been developed to quantify the cost of a schedule ending on October 18, 1980.

h) The rationale has been described at OCA Statement No. 1, p. 5, i.e., that the revised duration (under seven years) was accepted as reasonable without analysis but with consideration of the delay in gaining a Construction Permit, and plant scope increases due to added regulations (at p. 4).

Attachment to IR-PECO-OCA-3-17(a)

IMPACTED BY MARK II CONTAINMENT DESIGN

WA	1A	2	0197	A
WA	7A	8	0240	A
WA	17A	28	0370	A
WA	18A	28	0450	A
WA	19A	20	0070	A
WA	20A	22	0120	A
WA	21A	23	0150	A
WA	23A	16	0040	A
WA	23A	24	0054	A
WA	23A	28	0150	A
WA	23A	35	0201	A
WA	24A	25	0070	A
WA	25A	26	0161	A
WA	25A	31	0375	A
WA	26A	27	0220	A
WA	27A	30	0040	A
WA	28A	32	0091	A
WA	29A	26	0040	A
WA	30A	28	0090	A
WA	31A	32	0080	A
WA	33A	34	0060	A
WA	36A	31	0150	A
WA	35A	36	0080	A
WA	39A	35	0250	A
WA	40A	41	0040	A
WA	41A	13	0054	A
WA	41A	42	0040	A
WA	61A	63	0240	A
WA	41A	45	0136	A
WA	41A	48	0040	A
WA	42A	43	0442	A
WA	43A	44	0080	A
WA	45A	44	0040	A
WA	46A	47	0054	A
WA	47A	45	0040	A
WA	48A	47	0054	A
WA	49A	50	0040	A
WA	50A	51	0080	A
WA	51A	52	0054	A
WA	52A	304	0090	A
WA	52A	317	0010	A
WA	53A	54	0030	A
WA	54A	55	0040	A
WA	55A	56	0040	A
WA	56A	318	0030	A
WA	57A	58	0070	A
WA	61A	62	0030	A
WA	62A	63	0060	A
WA	63A	111	0040	A
WA	64A	65	0090	A
WA	65A	66	0090	A
WA	66A	99	0060	A
WA	66A	67	0090	A
WA	67A	68	0070	A
WA	68A	69	0100	A
WA	70A	91	0030	A
WA	71A	72	0496	A
WA	73A	74	0130	A
WA	74A	76	0130	A

WA	76A	70	0090	A
WA	76A	77	0030	A
WA	77A	79	0060	A
WA	80A	81	0703	A
WA	81A	82	0090	A
WA	82A	83	0040	A
WA	83A	84	0150	A
WA	84A	85	0030	A
WA	85A	95	1470	A
WA	86A	74	0030	A
WA	87A	88	0030	A
WA	88A	89	0100	A
WA	89A	90	0060	A
WA	90A	91	0030	A
WA	91A	92	0030	A
WA	92A	93	0010	A
WA	93A	315	0130	A
WA	94A	61	0090	A
WA	96A	97	0121	A
WA	97A	98	0090	A
WA	99A	100	0080	A
WA	101A	105	0040	A
WA	102A	104	0210	A
WA	103A	104	0121	A
WA	104A	105	0080	A
WA	106A	107	0780	A
WA	107A	103	0281	A
WA	107A	104	0618	A
WA	107A	122	0121	A
WA	108A	109	0146	A
WA	109A	110	0094	A
WA	110A	113	0130	A
WA	111A	64	0130	A
WA	113A	101	1715	A
WA	113A	114	0201	A
WA	113A	118	0030	A
WA	115A	116	0281	A
WA	116A	103	1434	A
WA	116A	107	1091	A
WA	116A	117	0777	A
WA	117A	107	0281	A
WA	117A	126	0510	A
WA	118A	117	0250	A
WA	119A	104	0335	A
WA	120A	121	0150	A
WA	121A	137	0030	A
WA	123A	131	0131	A
WA	124A	125	0022	A
WA	125A	121	0090	A
WA	130A	121	0121	A
WA	136A	138	0127	A
WA	138A	139	0070	A
WA	139A	140	0070	A
WA	140A	121	0120	A
WA	142A	121	0271	A
WA	142A	280	0286	A
WA	145A	146	0221	A
WA	146A	147	0210	A
WA	147A	113	0150	A
WA	148A	149	1130	A

WA 150A 149	1130	A	
WA 151A 152	0080	A	
WA 152A 316	0010	A	
WA 153A 154	0094	A	
WA 154A 165	0030	A	
WA 154A 305	0030	A	
WA 155A 156	0442	A	
WA 155A 157	0040	A	
WA 155A 159	0330	A	
WA 155A 164	0094	A	
WA 156A 160	0040	A	
WA 157A 159	0737	A	
WA 158A 159	0121	A	
WA 159A 160	0080	A	
WA 161A 162	0241	A	
WA 162A 163	0094	A	
WA 164A 162	0241	A	
WA 165A 166	0190	A	
WA 166A 158	0335	A	
WA 167A 172	0460	A	
WA 168A 169	0090	A	
WA 169A 170	0090	A	
WA 170A 171	0300	A	
WA 171A 172	0150	A	
WA 173A 174	0121	A	
WA 174A 175	0040	A	
WA 175A 176	0040	A	
WA 176A 177	0090	A	
WA 177A 178	0090	A	
WA 178A 168	0120	A	
WA 179A 180	0150	A	
WA 180A 181	0630	A	
WA 180A 182	0255	A	
WA 180A 183	0030	A	
WA 180A 184	0420	A	
WA 180A 186	0040	A	
WA 182A 185	0040	A	
WA 183A 184	0657	A	
WA 184A 185	0080	A	
WA 186A 187	0134	A	
WA 187A 188	0134	A	
WA 187A 189	0201	A	
WA 188A 189	0054	A	
WA 189A 184	0121	A	
WA 190A 187	0210	A	
WA 192A 193	0040	A	
WA 194A 195	0030	A	
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18. Reference Exhibits JJO'B-4 and JJO'B-13. Concerning the network that you used in your CPM scheduling analysis upon which you base your conclusions:

a) Please describe completely and thoroughly how the data for the analysis was prepared, especially data on required times to complete activities and precedence relations between activities. Please give special attention to any data that would be different than (1) that presented in the two source documents (with dates of May 20, 1974 and June 4, 1974) that you cite on page 10 of your testimony; (2) as modified per the description on pages 11 and 12 of your testimony.

b) Was any of the data used in your analysis reflective of knowledge acquired or information that was developed after June 4, 1974 (with the exception of your cash flow stretch out and Mark II modification described in your testimony)?

c) Would activities related to the construction of facilities that were redesigned subsequent to June 1974 be included in your model based on their original design or based on the revised design?

18. a) Exhibits JJO'B-4 and -13 were created by extending the durations of the activities noted at OCA Statement No. 1 and as further specified at the Attachment to IR-PECO-OCA-3-17(a). No activities were added nor deleted, nor were any precedence relations between activities changed.

b) Assuming the word "data" means "facts or information collected for analysis," all data was reflective of knowledge acquired after June 4, 1974.

c) Activities shown at JJO'B-3 relate to construction anticipated in May/June, 1974. Those shown at JJO'B-4 relate to construction anticipated in early 1976, at which time BPC Monthly Progress Reports were projecting an August, 1980 fuel load date (see Exhibit 6). Activities shown at JJO'B-13 anticipate LGS as built. Thus, for example, the duration of the activity, "Start Installation Small Pipe - 85%" reflects the quantity of small pipe to be installed at each of the three points noted above.

20. Please explain in what manner engineering and procurement constraints on construction activities are depicted or reflected in Exhibits JJO'B-3, JJO'B-4 and JJO'B-13. Please list and describe all such constraints considered and tell if each was rejected or accepted as applicable to Limerick Unit 1. If such constraints are not depicted or reflected in those Exhibits, please explain how they have been evaluated and/or considered by Mr. O'Brien in his critical path method analysis. If the recognition of these constraints in Exhibit JJO'B-13 differs in any way from their recognition in Exhibits JJO'B-3 and JJO'B-4, a full explanation should be given.

20. Exhibit JJO'B-3 is a duplicate of the Bechtel Overall Construction Schedule which contains no engineering or procurement activities (with the possible exception of the CB&I Unit 2 Restraint) and none were added by OKA. Engineering constraints were considered by Dr. Hanauer as described at OCA Statement No. 2.

21. Does the critical path method analysis in OCA Statement No. 1, Exhibit JJO'B-13, reflect or depict NRC licensing restraints which might have delayed the issuance of an Operating License? If so, how is this factor so reflected or depicted? If not, why was this factor not included in the analysis?

21. The Bechtel Overall Construction Schedule contains no NRC licensing restraints, and none were added by OKA. An analysis of such potential delays was performed by Dr. Hanauer as discussed at OCA Statement No. 2.

24. Reference OCA Statement No. 1, p. 15. Please provide the specific page and line reference of the Monthly Status Report dated August 27, 1981 which is believed to support Mr. O'Brien's assertion that "At the same time, however, Unit 2 was staffed at 713 Pipe Fitters and 462 Electricians." Provide a xerox copy of the page or pages containing said reference. If the Monthly Status Report dated August 27, 1981 is not Mr. O'Brien's support for the reference, provide all other documentary or other support upon which Mr. O'Brien relies.

24. The referenced Monthly Status Report is in the sole possession of PECO, however, OCA attorney David Wersan verified the accuracy of the assertion with PECO counsel, Jack Jerrett, in advance of the issuance of OCA Statement No. 1.

39. For the schedule implied in Exhibit JJO'B-13, please provide a milestone schedule, if available, including, but not limited to, start dates and completion dates of the following efforts:

a) all major design activities

i) designs to incorporate LOCA loads

ii) designs to incorporate SRV loads

iii) designs to incorporate chugging

iv) designs to incorporate condensation oscillation

v) designs to incorporate other new load specifications

vi) other major design activities

b) construction activities

c) licensing applications and NRC approval activities

39. A milestone schedule has not been created.

40. Does Mr. O'Brien's testimony assume in its answer to the question at the bottom of page 23 that Limerick would have proceeded as a Lead Plant, or effectively as a Lead Plant (i.e. such as Susquehanna), with respect to Mark II construction additions and rework? If not, please explain how modified construction at Limerick could have begun in early 1979.

40. Yes.

41. If PECO management had started Limerick re-design work in late 1978 and modified construction work in early 1979 on the basis of the lead plant "interim" load specifications, could they have been assured that these efforts would not require any subsequent modifications when these hydrodynamic load specifications were finalized? (Reference p. 24)

41. No.

44. Reference OCA Statement No. 1, p. 25. Provide the documentary or other basis of Mr. O'Brien's assertions that "structural concrete started at Limerick two months earlier than at Susquehanna," that "Large Pipe installation started at Limerick ten months earlier than at LaSalle" and "Large Pipe Hanger installation started over three years before LaSalle and over 1 1/2 years before Susquehanna," including a statement of the specific dates involved. Provide copies of all documents relied upon as support for the referenced statements.

44. The documentation has been previously provided at Exhibit SHH-3, OCA Statement No. 2.

45. Has Mr. O'Brien reviewed the start dates and completion dates of other commodities at Limerick, Susquehanna and LaSalle, including specifically

a) structural steel

b) large pipe

c) large pipe hangers

d) small pipe

e) cabletray (including gutter)

f) metallic conduit (power and control)

g) wire and cable (power and control)

h) connections

45. No.

46. Reference OCA Statement No. 1, p. 26. Please explain fully Mr. O'Brien's basis for stating "that nearly all of the pertinent (to Limerick Fuel Load) changes were known by 1980." Please list and briefly explain all such changes that were not known by June 1, 1980. Please list and briefly explain all such changes that were known by June 1, 1980, in Mr. O'Brien's opinion.

46. This statement is predicated on the research of Dr. Hanauer.

47. Is it Mr. O'Brien's position that all regulatory changes resulting from the accident at Three Mile Island that would be pertinent to Limerick, were known or knowable by the end of May 1980? If that is Mr. O'Brien's position, please provide any and all support for such position, including the reasoning why any subsequent regulatory changes would be forthcoming?

A. As stated at pages 15 and 26 of OCA St. No. 1, nearly all of the pertinent (to Limerick Fuel Load) changes were known by 1980. These changes did not prevent either LaSalle or Susquehanna from receiving operating licenses in early 1982.

47. Is it Mr. O'Brien's position that all regulatory changes resulting from the accident at Three Mile Island that would be pertinent to Limerick, were known or knowable by the end of May 1980? If that is Mr. O'Brien's position, please provide any and all support for such position, including the reasoning why any subsequent regulatory changes would not be forthcoming?

47. This is identical to the original question 47 and has been answered.

50. Reference OCA Sts. No. 1, p. 27, which states that Limerick could have reasonably gained an operating license in early 1982. What open items did OKA assume would exist in the Limerick operating license if PECO had obtained an operating license at that time?

50. OKA made no such assumptions.

52. Reference OCA Statement No. 1, p. 32. Please explain the basis of and provide all data and/or logic which was relied upon to support Mr. O'Brien's "assumption that these [indirect expenditures] were made at the same annual rate as the Direct Costs."

52. In the absence of better information from PECO, it was a reasonable assumption.

56. Please explain the basis of and supply all data that was relied upon by Mr. O'Brien is making the assessment that PECO could have raised sufficient capital to provide the cashflow for Limerick 1 and Common assumed as needed for a July 1982 completion date as shown on Exhibit JJO'B-17, page JJO'B-17.4.

56. No such assessment is contained at OCA Statement No. 1. PECO's ability to raise capital was not a subject addressed by Mr. O'Brien.

58. In reference to Exhibit JJO'B-17, page 17.4, explain why the annual AFUDC accruals as calculated by OKA differ from the actual annual AFUDC accruals as booked by PECO for calendar years 1971 through 1974.

58. Exhibit JJO'B-17.4 has been revised at OCA Statement No. 1A.

INTERROGATORIES OF
PHILADELPHIA ELECTRIC COMPANY
SET V

1. Please provide the following schedule information for Exhibits JJO'B-3, JJO'B-4 and JJO'B-13:

   a. Manpower curves for:

      (1) Bechtel manpower;

      (2) subcontract manpower;

      (3) pipefitters;

      (4) electricians;

      (5) sheetmetal workers.

   b. Installation curves depicting feet per month for:

      (1) large pipe

      (2) large pipe hangers

      (3) small pipe

      (4) structural concrete

      (5) cable tray

      (6) conduit

      (7) wire and cable

      (8) terminations

   c. Total commodity quantity information for:

      (1) large pipe

      (2) large pipe hangers

(3) small pipe

(4) structural concrete

(5) cable tray

(6) conduit

(7) wire and cable

(8) terminations

d. Manpower density limitations for each facility/elevation in the plant.

e. Total manhours used for the schedule.

f. Unit rates (manhours per foot) used for:

(1) large pipe

(2) large pipe hangers

(3) small pipe

(4) structural concrete

(5) cable tray

(6) conduit

(7) wire and cable

(8) terminations

All of the requested information, to the extent that it exists, is in the sole possession of PECO. Exhibit JJO'B-3 is a duplication of the PECO/BPC schedule of May/June, 1974 and is a reflection of scheduling parameters a. through f. developed at that time.

Exhibit JJO'B-4 is a reflection of the scheduling parameters developed around early 1976 and used by PECO to project a fuel load date in August, 1980.

Exhibit JJO'B-13 assumes the exact same Manpower (a.), Total Commodities (c.), Total Manhours (e.) as were actually employed, but it requires that PECO adjust the Installation curves (b.) and Unit rates (f.) in order to complete the work in order to support an early-1982 fuel load date. Manpower density limitations have not been submitted to OKA, are a consideration, but are assumed to have been high enough to permit completion of the work required to support the fuel load date, as indeed they were at LaSalle and Susquehanna.

Q. On pages 2-4 of Mr. O'Brien's supplemental direct testimony (OCA Statement No. 1A), he discusses the calculation of an amount of $137.2 million without AFUDC ($171.9 million with AFUDC) that he describes as Bechtel indirect costs resulting from the 27-month delay for Limerick 1 and 100% of common facilities. With respect to this calculation:

a. Are any of these costs duplicative of other costs elsewhere estimated by Mr. O'Brien in this proceeding?

A. Each of the delay cost calculations presented by Mr. O'Brien is an independently accurate estimation of the costs for each item. Thus, the PECO and Bechtel Indirect cost calculations are accurate and not duplicative. If one sums the total costs of delay, however, as developed item by item, i.e. Bechtel and PECO Indirect costs, Mark II costs, and the revised costs to complete construction by July, 1982, the component costs of escalation, and AFUDC on that escalation, for the Indirect and Mark II costs included in the revised cost to completion for a July, 1982 fuel load, will be duplicative.

Should the PUC make a rate base adjustment for the costs of delay and sum the overall delay costs to a July, 1982 fuel load date with the Indirect and Mark II costs, the proper costs figures should be as follows:

% of Common	revised costs to 6/82 fuelload	Bechtel Ind.	PECO Ind.	MarkII	Total
100%	$542.1m	171.9m	101.5m	194.1m	1,009.6m
50%	$430.0m	140.4m	83.0m	194.1m	847.7m

If the PUC makes an adjustment for the overall delay costs, including Bechtel and PECO Indirect costs, but not for the Mark II costs, the costs figures are as follows:

% of Common	revised costs to 6/82 fuelload	Bechtel Ind.	PECO Ind.	Total
100%	$568.3m	171.9m	101.5m	841.7m
50%	$456.4m	140.6m	83.0m	680.0m

If the PUC makes an adjustment for the overall costs of delay, but not for the Bechtel and PECO Indirect costs or the Mark II costs, the figures are as stated in OCA Statement 1A, as follows:

% of Common	revised costs to 6/82 fuelload	Total
100%	$604.4m	$604.4m
50%	$485.8m	$485.8m

b. If the response to part (a) of this question is that they are not duplicative, please explain why they are not duplicative with respect to each of the other costs of delay estimated by Mr. O'Brien.

A. b. NA

Q. On page 5 of Mr. O'Brien's supplemental direct testimony, he cites a figure of $37.356 million through December 31, 1984 for the AFUDC associated with Mark II redesign. On page 5 of his direct testimony, Mr. O'Brien provides a figure of $24.6 million for this same AFUDC. Please explain the discrepancy between these two figures.

A. The AFUDC figure of $37.356 million in OCA St. 1A is based on PECO's own calculation of AFUDC on Mark II expenditures through December 31, 1984. See Sch. JJO'B-23.3. The $24.6 million AFUDC figure was based upon the AFUDC formula presented in the workpapers of Mr. John Plunkett.

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MAJOR COMMODITY MANPOWER BY FACILITY

Unit I & Common

Facility	Pipefitters Planned	Pipefitters Actual	Electricians Planned	Electricians Actual
Containment	77	48	26	20
Reactor	281	195	105	92
Turbine & Turbine Aux.	100	103	7	13
Control	26	17	57	59
Other	91	102	95	66
Total	575	465* -19%	290	250** -14%

	Pipefitters Planned	Pipefitters Actual	Electricians Planned	Electricians Actual
Unit II	115	111	10	16
Distribs., Misc. Piping & other categories support, Shops, unscheduled elec.	100	137	210	196
Total	790	713	510	462

* Includes large pipe, LP welds, LP hangers, small pipe, instrumentation.

** Includes metallic conduit, cable tray, gutter, wire & cable terminations.

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