COMMONWEALTH OF PENNSYLVANIA

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Public Utility Commission

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April 7, 1986

Jerry Rich, Secretary
Pennsylvania Public Utility
Commission
P.O. Box 3265
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Re: Pennsylvania Public Utility
Commission v. Philadelphia
Electric Company,
Docket No. R-850152

Dear Secretary Rich:

Enclosed for filing please find an original and nine (9) copies of the Office of Consumer Advocate's Main Brief in the above-captioned proceeding. As per attached Certificate of Service, copies have been served upon all parties of record.

Sincerely,

Scott J. Rubin
Assistant Consumer Advocate

Enclosure
2036X

cc: All parties of record

Re: Pennsylvania Public Utility Commission
v.
Philadelphia Electric Company
Docket No. R-850152

I hereby certify that I am this 7th day of April, 1986, serving either in person or by overnight delivery (to be received this day) the foregoing document, Main Brief, in the above-captioned proceeding.

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BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

PENNSYLVANIA PUBLIC UTILITY COMMISSION	:	
	:	
v.	:	Docket No. R-850152
	:	
PHILADELPHIA ELECTRIC COMPANY	:	

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DATED: April 7, 1986

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STATUTES AND REGULATIONS:

I. INTRODUCTION

On September 27, 1985, the Philadelphia Electric Company (PECO or the Company) filed a request for a $671 million, or 28.2 percent, net increase in its base rates. The specific elements of that rate request are as follows:

* A revenue requirement of $949 million associated with the proposed inclusion in rates of Unit 1 and 100 percent of common facilities at the Limerick Nuclear Generating Station (Limerick 1), including a return on PECO's entire $3.8 billion investment in that plant and recovery of all associated expenses.

* A net decrease of $71 million in the Company's non-Limerick related revenue requirements.

* A reduction of $207 million in the Company's base rate fuel expense to reflect the average of Limerick 1's projected annual fuel savings during its first two years of commercial operation.

In light of the magnitude of its proposed request, PECO proposed a six-year phase-in plan to implement the increase. Under the Company's proposal, rates would increase by one-third of the $671 million in each of the first three years. The difference between the phased-in amount and the amount which would have been collected if the entire $671 million were reflected in rates would be deferred. That deferred revenue would then be recovered from ratepayers during years four through six.

On October 8, 1985, David M. Barasch, the Consumer Advocate of Pennsylvania (hereafter referred to as the OCA), filed a complaint against PECO's proposed increase. In support of its complaint, the OCA presented the expert testimony of eight witnesses. Those witnesses are specialists in the areas of construction management (James J. O'Brien), nuclear plant technical and licensing requirements (Dr. Stephen H.

Hanauer), electric utility system planning and operation (Peter J. Lanzalotta), economics of nuclear power (Charles Komanoff), regulatory accounting and policy (Thomas E. Knudsen and Michael A. Bleiweis), utility finance (James A. Rothschild), and the design and structure of utility rates (Bruce R. Oliver).

Through the testimony of these witnesses, the OCA has demonstrated that PECO has greatly overstated the revenue requirement which would constitute a level of just and reasonable rates in this case. Specifically, rather than the $671 million net increase which PECO claims, the OCA submits that PECO is entitled to a rate increase of no more than $136 million, or approximately 5.4 percent, at the present time. OCA St. 7A at 1. The major issues which comprise the OCA's presentation in this case are as follows:

* PECO's request for inclusion in present rates of 100 percent of its Limerick common plant investment must be denied. The Commission has uniformly held that electric utilities are entitled to include only 50 percent of common plant investment in rates with the first unit at a two-unit station. Exclusion of the second half of Limerick common facilities has the effect of reducing the Company's claimed level of Plant in Service by $639,512,000. See Section II of this Brief.

* The Company's imprudence in managing the construction of Limerick 1 and its common facilities (including unreasonable delays which occurred in 1976 and 1978 and the inadequate design of the Mark II containment structure) increased the cost of Limerick 1 and 50 percent of common facilities by at least $804,400,000. These imprudent costs must be disallowed. See Section III of this Brief.

* A substantial portion of Limerick 1 represents excess capacity. This excess capacity is not needed for reliability purposes and provides no net economic benefits to PECO ratepayers. The

OCA recommends that PECO be denied an equity return on at least 450 megawatts of Limerick 1 capacity. Under OCA's proposed Limerick cost valuation and fair return on equity, this excess capacity adjustment results in an increase to PECO's income available for return of $54,335,000. See Section IV of this Brief.

* While PECO has incorporated $207 million of Limerick 1 annual energy savings as an offset to its base rate increase in this case, the Company has offered no assurance that these savings will actually be retained by ratepayers. The OCA proposes that the level of energy savings included by the Company in this case be guaranteed to ratepayers and not be subject to future ECR reconciliations. See Section V of this Brief.

* PECO has overstated its non-Limerick Measures of Value by more than $19 million. See Section VI of this Brief.

* The Company has overstated the rate of return which it should be allowed on its common equity investment. PECO claimed a rate of return on common equity of 15.75 percent. The OCA's expert financial witness estimates that a fair rate of return on common equity is no more than 14 percent at the present time. See Section VII of this Brief.

* PECO has included a number of revenue, expense, and tax claims which are not justified. See Section VIII of this Brief.

* With respect to cost of service and revenue allocation among customer classes, the Company's proposals are flawed in that they are based on the premise that the costs of Limerick 1 and other baseload plants are solely related to the customers' contribution to coincident peak demand. With respect to the design of rates within the residential class, the OCA strongly urges that lower than average increases be granted to the initial portion of monthly electric usage which is essential to meet basic human needs. This "essential needs" rate is necessary in order to prevent minimum basic electric service from becoming unaffordable to large segments of PECO's service population. See Section IX of this Brief.

* Finally, the OCA supports the Commission's 80/20 Energy Cost Rate initiative under which 20% of all PECO energy costs would not be subject to retrospective reconciliation. The OCA submits, however, that the initial level at which PECO's new ECR should be set must be lowered in order to reflect the recent dramatic reductions in the price of oil. See Section X of this Brief.

Clearly, the overriding issues in this proceeding are the exorbitant cost and limited benefit of Limerick 1. In the following sections of this Brief, the OCA will set forth the bases for its contentions that a substantial portion of Limerick 1's costs are not properly chargeable to PECO ratepayers at this time.

Before addressing these specific issues in depth, however, the OCA wishes to set forth by way of introduction certain principles which it respectfully urges the Administrative Law Judge and the Commission to consider in making their decisions in this complex and difficult proceeding.

First, as noted by OCA witness Knudsen, the Company should not be permitted to charge an excessive level of rates for Limerick 1 simply as a means of assuring adequate cash flow and financing ability for continued construction of Limerick 2. As stated by Mr. Knudsen, who has served as the OCA's chief accounting and policy witness in each of the last four PECO rate cases:

> [I]n undertaking the Limerick construction effort, PECO management has been obdurate in its efforts to push ahead with both units. Management made a business judgment which it has implemented at enormous cost to its shareholders and to its customers. It is now turning to those customers to support the first of two units, as well as all of the common facilities. This support is asked in light of the poor history of

performance of nuclear installations and management's failure to sell any part of the venture or the energy which it might potentially produce. The customers are, once again, the financial resource of last resort for PECO.

> At this juncture, the proposed burden on customers is somewhat more than one-half of the venture. Although the Company has announced its intention to complete Unit #2, the Commission must not allow the Company to charge excessive rates at the end of this rate proceeding simply as a means of facilitating the course management has selected relative to Unit #2. Where PECO goes relative to Unit #2 is at its own risk. Therefore, the rate recognition for Unit #1 must address what is fair to customers in this proceeding. The rate of return should make no provision for financial risks that management has assumed for Unit #2. The recognition of allowable costs must be on the merits of Limerick Unit #1 and not on what PECO may or may not need to meet future construction requirements on Limerick Unit #2.

OCA St. 7 at 11-12 (emphasis added).

Second, the Commission must not allow its ratemaking decisions in this case to be dictated or altered in any way in order to accommodate possible changes in utilities' financial reporting practices. Substantial testimony has been presented by the Company regarding the effects of various parties' ratemaking recommendations under proposed revisions to Financial Accounting Standards Board, Statement of Financial Accounting Standards No. 71, Accounting for the Effects of Certain Types of Regulation (FASB 71). See, e.g., PECO St. 3A; PECO St. 16A. Such testimony, however, is not relevant to this Commission's determination of whether the proposed ratemaking adjustments should be made in order to insure that the rates set in this proceeding are just and reasonable.

As its title implies, the purpose of FASB 71 is to account for the effects of regulation. The purpose of regulation is not to account for the effects of FASB 71.

Finally, the OCA would urge the Commission not to permit the phase-in of any rate increase allowed in this proceeding to serve as a substitute for the disallowance of that portion of the rate increase which is found to be excessive under appropriate ratemaking principles. If all or part of PECO's rate increase request is not just and reasonable, then such an increase does not become just and reasonable simply by deferring it and charging the increase to future ratepayers.

Based on what it submits are appropriate applications of valid ratemaking principles, the OCA is proposing that approximately four-fifths of PECO's requested net base rate increase be disallowed at this time. Because the OCA recommendation would increase rates by slightly more than 5%, the OCA has not proposed a phase-in of its recommendation. OCA witness Knudsen acknowledged, however, that

> should the Commission not accept OCA's positions and increase the revenue requirement by a substantially greater amount, then the Commission may wish to consider a phase-in of rates over a period of years.

OCA St. 7 at 7. Mr. Knudsen's and the OCA's final recommendation on this subject, however, is that while it may be

> advisable in this case to phase in any substantial rate increase over a period of time, the use of a phase-in should not be allowed to become a substitute for ratemaking disallowances based on the regulatory principles which have traditionally been followed by this Commission.

Id. at 12 (emphasis in original).

OCA's ratemaking adjustments and the specific regulatory principles under which they are proposed are set forth in the following sections of this Brief.

II. LIMERICK COMMON PLANT

The Company has included in its rate base and depreciation claims 100 percent of the Limerick 1 and 2 common facilities. Tr. 519. The OCA strongly opposes the Company's attempt to include all of the Limerick common facilities in rates with Limerick 1. Never before has a Pennsylvania utility been permitted to include 100 percent of a nuclear plant's common facilities in rates with the first unit. And, the OCA submits, the Company has presented no valid reason for creating an exception for Limerick.

Pennsylvania's first twin-unit nuclear plants were PECO's Peach Bottom 2 and 3. When PECO proposed that Peach Bottom 2 be included in rates, it asked that all of the common facilities be included in rates with that unit. Pa. PUC v. Philadelphia Electric Co., R.I.D. 129 (March 25, 1975), Order at 21. PECO supported its Peach Bottom request by arguing that "the Uniform System of Accounts requires that all common facilities necessary to operate one or more units be considered in service for accounting purposes, when the first unit goes into service." Id., Order at 22. The Commission rejected PECO's claim to include all of the Peach Bottom station's common plant in rates with Peach Bottom 2. Id., Order at 23. In so holding, the Commission stated that "adopted accounting regulations are not binding on this Commission for rate making purposes." Id.

This Commission next considered this issue when Three Mile Island 1 went into service. The Commission relied upon its Peach Bottom Order and rejected Metropolitan Edison Company's request to include 100 percent of common plant in rates with the first unit. Pa. PUC v.

Metropolitan Edison Co., 50 Pa. PUC 82 (1976). The Commission reasoned that the second half of common facilities were "property not used and useful in rendering electric service, until such time as the second unit goes into commercial operation." Id., 50 Pa. PUC at 100. The Commission, however, did permit the utility to accrue AFUDC on the second half of common until the second unit entered commercial operation. Id.

The last time a utility proposed the recovery of 100 percent of common plant with the first unit was nearly 10 years ago, when Beaver Valley 1 entered service. In Pa. PUC v. Duquesne Light Co., 52 Pa. PUC 552, 27 PUR 4th 555 (1978), the Commission again rejected the utility's attempt to include all of the common plant in rates with the first unit. Id., 52 Pa. PUC at 558-59. That decision was reaffirmed by the Commission in a subsequent Duquesne rate case, Pa. PUC v. Duquesne Light Co., 54 Pa. PUC 695, 714-15, 43 PUR 4th 27 (1981).

When Pennsylvania utilities' remaining nuclear plants -- Salem and Susquehanna -- were proposed for inclusion in rates, the utilities recognized this Commission's clear policy and only requested the inclusion in rates of 50 percent of the common facilities with the first unit. See Pa. PUC v. Philadelphia Electric Co., 52 Pa. PUC 772, 782, 31 PUR 4th 15 (1978) (Salem); Pa. PUC v. Pennsylvania Power and Light Co., 57 Pa. PUC 559 (1983) (Susquehanna).

In fact, when PECO proposed inclusion in its Pennsylvania jurisdictional rates of 50 percent of the Salem common plant, PECO provided the following rationale for this policy (including the accrual of AFUDC on the second half of common) to the Federal Power Commission with respect to FPC accounting:

> We believe that the above-described accounting is proper for Philadelphia Electric Company because it provides a better matching of costs and revenues and because it also meets the economic objective of allocating large common costs in proportion to savings and benefits of sequentially installed units.

OCA Exh. 70; Tr. 1519.*

The OCA submits that this Commission's policy, as explained nine years ago by PECO to the Federal Power Commission, continues to be appropriate. PECO has presented no reason for this Commission to overturn its long-standing policy.

In fact, as noted by the OCA's expert accounting witness, Thomas E. Knudsen, the reasons for this policy are even stronger today. Mr. Knudsen explained as follows how our experience with second units has proven the wisdom of this Commission's policy:

> Experience has shown that the ratemaking treatment applied to second units by this Commission often has been different from the treatment of the first units for the same plant.
>
> For example, when Salem 1 entered rates, only one-half of common facilities were included. When Salem 2 was sold to JCP&L, PECO ratepayers thus were not only relieved of the costs of that unit, but also the costs of the second half of common.
>
> Similarly, the Commission arrived at a different result for Susquehanna 2 and the second half of common than it allowed for Susquehanna 1 and the first half of common. The difference was that the excess capacity adjustment for the first unit involved a "slice of the system", while in the adjustment for Unit 2, the Commission identified Unit 2 itself as

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* The FPC did not grant PECO's petition to book AFUDC on the second half of Salem common plant. Yet, as PECO witness Hill noted, the PUC "allowed, for ratemaking purposes, the accrual of additional AFUDC for ratemaking pruposes on that 50 percent of common facilities." Tr. 4067. Because of the FPC's denial of PECO's petition, there were "no accounting adjustments on the books of the company to reflect that additional accrual of AFUDC." Tr. 4068.

being excess capacity and disallowed the equity return on this unit plus 50% of common.

Also, the events at TMI-2, and the extraordinary delays in completion of Beaver Valley 2, give added support to the Commission's policy on common plant.

OCA St. 7 at 22-23 (emphasis added).

Similarly, Michael Gruber, a Trial Staff witness, recommended that 50 percent of the Limerick common plant be removed from rates. Mr. Gruber stated the reasons for his recommendation as follows:

> One aspect of regulation is to provide the Company with an opportunity to earn a return on and a return of its investment in plant. However, the Commission must also balance the Company's needs against the service it provides. It has been and is the Commission's policy to allow a utility its return on investment and return of the investment over the asset's useful life. In the case of common plant, the Commission traditionally has split the cost of the plant, 50% to each unit, because while it is in service with the first unit it is there also to serve the second unit. Therefore, it is the Commission's position that the customer[s] served by each unit pay their own fair share. Therefore, I am recommending the disallowance of half of rate base costs associated with common plant.

Staff St. MJG-1 at 4 (emphasis added).

The OCA submits, therefore, that PECO should not be permitted to include the second half of Limerick's common facilities in rates at this time. As Mr. Knudsen stated:

> By dividing the common plant between two units, the Commission effectively divides the risks, costs, and benefits. This division is both fair and appropriate, and should be applied in this case.

OCA St. 7 at 23.

The allowance in rates of 50 percent of Limerick's common facilities, instead of the 100 percent requested by PECO, has the effect of reducing PECO's plant-in-service by $639,512,000. OCA St. 7A, Rev.

Sch. TEK-4.*

One further effect of this 50/50 split should be noted. That is, one-half of the Company's land held for future use claim related to the Bradshaw Reservoir project, or $1,258,000, should be eliminated from rate base. See OCA St. 4 at 14; PECO Exh. TPH-2A, C-9. PECO witness Boyer indicated that this project is part of Limerick's common plant (Tr. 1045) and the OCA submits that the costs of this project should be treated accordingly.**

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* Corresponding adjustments must also be made to depreciation expense, depreciation reserve, tax depreciation, excess tax depreciation, and investment tax credits. These adjustments were incorporated in OCA's final summary schedules and are described specifically in the notes to Appendix A to this Brief, which sets forth the various ratemaking effects of the OCA proposed adjustments.

** If the OCA's proposed exclusion of all of PECO's land held for future use claim is adopted (see, section VI, infra), then this adjustment would be duplicative and therefore should not be made.

III. PRUDENT COST OF LIMERICK UNIT 1

A. Introduction

The central focus of the analysis of the prudent cost of Limerick 1 and Common Facilities in this proceeding is the cost resulting from the 1976 and 1978 delays in construction of the unit. These delays in construction, imposed by PECO management, were reviewed by the Commission and found to be imprudent in the Limerick Investigation, 56 Pa. PUC 47, 48 PUR 4th 190 (1982). The OCA has presented extensive testimony by expert witnesses that, but for the delays in construction at Limerick 1, construction of the unit could have been completed and fuel loaded by July, 1982. Commercial operation of Limerick 1 could therefore have been achieved by November, 1983. The OCA recommends that the costs incurred by PECO due to the imprudent construction delays be disallowed from rates.

The OCA also has presented extensive evidence that the costs which resulted from errors by General Electric in designing Limerick's Mark II reactor containment were imprudently incurred. These errors resulted in a substantial increase in Limerick's cost which is not properly chargeable to PECO ratepayers. The Mark II design issues will be discussed in section III.G. below.

The total combined costs incurred due to the Mark II design errors and the imprudent delays in construction with respect to Limerick 1 and 50% of Common Facilities, are $804.4 million. These costs must be

disallowed from PECO's rate claim in this proceeding.*

B. The Only Issue To Be Resolved In This Case With Respect To The 1976 And 1978 Delays Is The Cost Of Those Delays.

The OCA submits that the Commission's findings of imprudence with respect to the 1976 and 1978 delays in construction of Limerick 1 are binding upon all parties to this case. The only issue for litigation in this proceeding is the costs of the delays. Further, the arguments reviewed by the Commission in reaching its decision in the Limerick Investigation are not properly subject to reargument here. In its Final Opinion and Order in that investigation, the Commission held as follows:

> Considering the foregoing, we are of the opinion that PECO management did not exercise judgment sufficient to meet our reasonable man standard in delaying construction at Limerick in 1976 and 1978.

56 Pa. PUC at 61.

The Commission reached that conclusion after discussing each of PECO's arguments relating to the delays. The Commission's discussion was as follows:

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* The individual components of the OCA's adjustment are as follows:
Mark II costs: $194 million
Delay costs (for Limerick 1 and 50% of common): $652.4 million. If both of these adjustments are made, however, there is some overlap. Thus, the two adjustments are not directly additive. Rather, as noted above, the total combined OCA adjustment is 804.4 million.
The OCA's final rate base disallowance recommendation is set forth in the Surrebuttal Schedule of OCA witness Knudsen. OCA St. 7A, Rev. Sch. TEK-2, TEK-4. OCA is also proposing that depreciation expense associated with the imprudent investments be disallowed. See OCA St. 7 at 14, 16. The required adjustments to depreciation expense, depreciation reserve and associated tax effects of these adjustment are set forth in Mr. Knudsen's Final Summary Schedule and in Appendix A to this Brief. OCA St. 7A, Rev. Sch. TEK-2, TEK-3, TEK-5, TEK-6, TEK-7.

It appears, from the record before us, that PECO's 1976 and 1978 construction delays were caused by PECO's financial difficulties, which in turn were caused by its ambitious construction program and its 1974 delay. While it is true that PECO's financial condition deteriorated from its 1974 levels, we are of the opinion that, at the least, PECO's ambitious construction plans exacerbated its financial difficulties. We are convinced that PECO's financial difficulties, proffered as a reason for delaying construction, would have been less acute if construction at Limerick had been terminated.

PECO now argues that one of the prime considerations in delaying construction was a continued reduction in PECO's load growth. Although PECO's spring 1976 load forecast projected a lower load growth than earlier anticipated, it appears that even this projection was overly optimistic. We note that in PECO's 1977-78 rate proceeding, PECO reduced its forecasted growth rate from 5% to 3%. Pennsylvania Public Utility Commission v. Philadelphia Electric Company, R.I.D. 438 (February 5, 1979). Apparently, this 1978 reduction was an acknowledgement that the trend evidenced in 1974 was continuing. Despite this now obvious trend, PECO delayed construction in the hope that load would improve.

PECO's final argument, that the relative economic benefits and detriments to ratepayers and shareholders of earlier versus later plant completion favored delay, is unpersuasive. We find this argument curious in light of the fact that PECO stresses that, because load growth has declined, the Limerick Units' main purpose is to replace oil fired generating capacity. If Limerick can be economically justified when compared to a combination of alternative sources of power and the retirement of oil fired plants, which by now have been extensively depreciated, the relative benefit to current ratepayers would have been greater if the oil capacity, and their associated costs, had been retired earlier by way of compressing rather than expanding the construction schedule. Further, as the nation as a whole experienced a period of double digit inflation and rising interest rates, delaying the necessary financing did and will continue to increase the ultimate costs of the plant financing.

56 Pa. PUC at 60-61.

In its Direct Testimony in this proceeding, PECO presented testimony on the prudence of the delays in construction. See, e.g., PECO Sts. 1, 3, 8, 10, 11 and 15. On November 20, 1985, the Commission Trial Staff filed a Motion in Limine/Motion to Strike. The Staff's motion sought a determination, at the start of the case, of whether PECO's imprudence in delaying construction in 1976 and 1978 would be subject to relitigation in this base rate case.

In a Bench Ruling on December 20, 1985, ALJ Matuschak held, inter alia:

> Three, that Trial Staff's motion that we determine that the Commission's prior findings at I-80100341 that Philadelphia Electric Company's decisions in 1976 and 1978 to delay Limerick construction were unreasonable are conclusive upon the parties in this proceeding is hereby granted.

Tr. 1374.

On December 26, 1985, PECO requested interlocutory review of the ALJ's Bench Ruling. On January 21, 1986, the Commission entered an Order affirming the ALJ's ruling on the scope of the construction issues in this proceeding. Opinion and Order entered January 21, 1986, Mimeo at 11.

As a result of the ALJ's and the Commission's ruling on the Staff's Motion in Limine, the ALJ and the parties discussed the scope of admissible evidence during a hearing on January 22, 1986. During the course of the discussion, ALJ Matuschak cited three issues that were relevant to the construction delay cost quantification analyses. Thus the ALJ stated as follows:

> JUDGE MATUSCHAK: Well, I think it's quite evident that it appears there are at least three categories that could be discussed here:

First is the cost, the additional cost, of construction of Limerick caused by the delay decisions;

Second, external matters which affected the construction; and

Third, any offsetting matters that could be used in evaluating the cost effect of those decisions.

Tr. 2044.

In the discussion at the hearing immediately preceding the ALJ's listing of issues for litigation, the issue of whether financial constraints were contained in the category of external factors was discussed, as follows:

MR. WERSAN...

[T]he company has referred to the financial constraints as an externally imposed condition and that, I think, is a key area of disagreement, certainly, that we have.

The Commission's decision was made in 1982. They had been aware of the company's financial condition through a number of rate cases --

JUDGE MATUSCHAK: Not only that but that matter was litigated in that investigation and I don't have the decision before me but I believe the Commission determined that the company was able to finance construction as originally planned. We think that clearly is out of the purview of our quantification issue.

Tr. 2041 (emphasis added).

Finally, by Order dated March 10, 1986, ALJ Matuschak set forth the issues which were stricken by his prior Bench Ruling. That Order stated as follows:

2. That to the extent that any testimony submitted or to be submitted by Philadelphia Electric Company which relates solely to the issue of the reasonableness of the Company's 1976 and 1978 decisions to delay construction of Limerick No. 1 is hereby stricken and may not be relied upon by the parties. For

clarification, such stricken testimony shall include, but not be limited to:

(a) Testimony relating to the financial constraints and the impact of such alleged constraints on the Company's 1976 and 1978 decisions, as fully litigated at I-80100341.

(b) Testimony as to load growth, capacity needs, excess capacity concerns, fear of Commission sanctions, and economic benefits of the Company as resulting in the Company as resulting in the 1976 and 1978 delay decisions, as fully litigated at I-80100341.

(c) Testimony relating to Company's concern for ratepayers' interests and extent of rate relief granted, as related to the reasonableness of Company's 1976 and 1978 delay decisions.

(d) Any other testimony to supplement the record at I-80100341 regarding the reasonableness of 1976 and 1978 delay decisions.

Ruling on Commission Trial Staff Motion Dated January 6, 1986, To Strike Testimony of Philadelphia Electric Company, Mimeo at 6 (emphasis in original). As noted above, the Commission had already affirmed ALJ Matuschak's Bench Ruling on January 21, 1986.

Based upon all of the foregoing, the OCA submits that the issue to be resolved in this case is the effect of the 1976 and 1978 delays on the cost of Limerick 1 and Common Facilities. In reviewing the effect of the delays, only external factors which could have prevented earlier completion of the plant may be considered. The effects of internal PECO management decisions on issues such as the Limerick 1 construction budget and other alleged financial "constraints" may not be considered.

C. The Public Utility Code Places The Burden Of Proof On PECO To Show That The Costs Of Limerick 1 Were Prudently Incurred.

On July 6, 1984, the Pennsylvania Public Utility Code was amended to include the following provision:

> (f) Limitation on rate increases by certain public utilities.--Whenever there is filed with the commission any tariff stating a new rate based in whole or in part on the cost of constructing an electric generating unit, the commission shall compare the estimated construction cost filed in accordance with section 515(a) (relating to construction cost of electric generating units) with the actual construction cost submitted by the utility in support of that tariff. If the actual construction cost exceeds the estimated construction cost, the rate determined by the commission under this section shall not be based on any part of that excess unless the public utility proves that part of the excess to have been necessary and proper. In making its determination under this subsection, the commission shall consider all relevant and material evidence, including evidence obtained pursuant to section 515. For purposes of this subsection "construction includes any work performed on an electric generating unit which required, or is expected to require, the affected public utility to incur an aggregate of at least $100,000,000 of expenses which, in accordance with generally accepted accounting principles, are capital expenses and not operating or maintenance expenses.

66 Pa.C.S. §1308(f).

Section 1308(f) places a specific burden of proof on PECO to prove that the costs of Limerick 1 in excess of the Company's original estimate were necessary and proper. This specific burden of proof on the prudent cost of the plant is in addition to the general burden of proof with which all of PECO's claims in this case are reviewed under Section 315. 66 Pa.C.S. §315.

At the time of the Company's receipt of its Construction Permit in 1974, the estimated <u>total</u> cost for Limerick 1, Limerick 2 and Common Facilities was $1.738 billion. <u>Limerick 2 Investigation</u>, I-840381, (December 5, 1985), Order at 66. The final cost of Limerick Unit 1 and 100% of Common Facilities <u>alone</u> is $3.8 billion. PECO Exh. AW-3 at A5.

PECO has the burden in this case to prove that the costs of Limerick 1, and in particular, the costs incurred due to the construction delays are reasonable and prudent.

D. The Substantial Costs Incurred Due To The Construction Delays Must Be Disallowed From Rates.

The OCA's analysis in this proceeding concludes that, but for the 1976 and 1978 delays, Limerick 1 could have completed construction and loaded fuel by July, 1982, and been in commercial operation by November, 1983. The OCA submits that these dates are reasonable and could have been achieved had PECO sought to finish Limerick 1 as expeditiously as prudently possible. The substantial costs incurred by PECO due to the delays in construction are not properly chargeable to ratepayers. This determination is consistent with the findings of ALJ Klovekorn and the Commission in the Limerick Investigation and also the holdings of Commissions in other jurisdictions.

The OCA has presented three witnesses on the issue of the prudent cost to construct Limerick 1. Mr. James J. O'Brien presented a construction schedule and cost analysis of when Limerick 1 could have been completed but for the 1976 and 1978 delays.

Dr. Stephen H. Hanauer addressed the issue of the effect of Nuclear Regulatory Commission regulations on an earlier completion of the plant. Dr. Hanauer also addressed the issue of the imprudence of General Electric Company in specifying the design loads of the Limerick reactor containment pressure suppression system which ultimately resulted in increased construction costs which will be discussed in Section III.G. of this Brief.

Mr. Thomas E. Knudsen presented the OCA's ratemaking recommendation on the costs incurred due to the 1976 and 1978 delays and the Mark II errors.

Underlying the construction delay cost quantification and ratemaking adjustment proposed by the OCA in this proceeding is the discussion presented by ALJ Joseph J. Klovekorn in his Initial Decision from the Limerick Investigation. In his concluding paragraphs on the issue of PECO's delays in construction, ALJ Klovekorn stated as follows:

> It appears therefore that PECO's decision to postpone construction was influenced in part by the fear of an excess capacity adjustment by the Commission in a subsequent rate case. Rather than run the risk of such a revenue loss, the company chose to delay construction while at the same time continuing to accrue AFUDC on this plant-costs that will eventually be borne by the ratepayers.
>
> In the past this Commission has held that there should be some sharing of the risk associated with bringing large plants on line and the resultant excess capacity which typically results. See Pa. P.U.C. v. Pennsylvania Power Co., R-77110521; Pa. P.U.C. v. Philadelphia Electric Co., R-79060865. This risk should not be effectively placed entirely on the ratepayer by permitting a utility [to] delay the commercial operation of a plant until the optimal time, while still allowing the company to earn a return, albeit non-cash, on its investment during this interregnum.
>
> In summary, it appears that the company's action in postponing Limerick in 1976 and 1978 was made without careful analysis of the impact of such delay on its ratepayers.
>
> In addition, the record shows that a factor in these decisions was the potential impact of Limerick on the company's capacity and reserve margins[9] and the adverse effect this would have on the company's

---

[9] If Limerick were in service in 1981, PECO would have a summer reserve margin of 66% (PECO Statement No. 9, p. 18).

rate allowances. Consumers should not be expected to pay for delay which results from a conscious management decision to protect its own interests without adequate weight being given to its ratepayers' interest.

Initial Decision at 53-54 (emphasis added).

Addressing the issue of the underlying reasons for PECO's delays in construction as stated by Judge Klovekorn, OCA witness Knudsen stated, in part, the rationale for the OCA's adjustment in the present case as follows:

> The ALJ concluded that PECO may have essentially attempted to hedge its bet on Limerick #1--at ratepayer expense--by delaying the unit and thus avoiding the excess capacity adjustment that might have been imposed. The Company could finesse the issue of excess capacity simply by delaying the unit and accruing AFUDC during the delay.
>
> If this approach is not challenged, then the Company will escape the brunt of an excess capacity adjustment which could have applied in 1982/83, run up additional cost for the customers to pay back at a future period, and, in a real sense, receive a reward, or at least be held harmless, for the delay.

OCA St. 7 at 20 (emphasis added).

The OCA submits that there are strong regulatory policy reasons for holding PECO to task for its construction delays. Moreover, the delays have significantly increased the cost of the plant. As will be discussed at length below, the delays caused PECO to incur both direct and indirect costs, as well as substantial additional AFUDC. These costs are not properly chargeable to ratepayers.

OCA witness O'Brien quantified the effect which the delays had on the actual cost of the plant. Mr. Knudsen summarized Mr. O'Brien's cost analysis, and discussed other additional costs due to the delays, as follows:

Because the plant was not finished earlier, there were a number of corollary consequences. First, as noted by Mr. O'Brien, there were substantial overhead and other indirect costs that were a result of extending the schedule. Those costs, and the AFUDC on them, would have been totally avoided if the plant had been completed 27 months earlier. Second, it is reasonable to assume that customers paid higher fuel costs in the interim. If the customers had had to pay for a portion of the plant, they would have been entitled to fuel savings. But even if the output had been sold, the effect of 1000 megawatts of nuclear capacity on the PJM grid would have been to reduce the PJM running rate. Moreover, PECO's existing nuclear capacity operated so poorly during the past few years that the advantage of Limerick Unit #1 in terms of PECO energy savings might have been greater than otherwise expected.

Third, because the plant was not finished earlier, there was additional burden placed on existing facilities with concomitant expense increases.

Fourth, because the plant was not finished earlier, there were continuing pressures on capital markets which were reflected, for example, in an 18.75% debt issuance and a PUC allowed 17.75% return on equity in the relevant time period.

Lastly, delay not only raised the overall cost of the plant in terms of material and labor but, with an inflated AFUDC rate (incorporating the capital charges above), that cost escalation was compounded.

OCA St. 7 at 18-19.

PECO's response to the Commission's concern over imprudent delays is that ratepayers have benefited from the delays, since the plant was not in rates and was not being charged to ratepayers. PECO St. 18E at 3. This argument, which will be discussed in Section III.F. below in more detail, was reviewed and rejected by OCA witness Knudsen, as follows:

Q. MR. KNUDSEN, ASSUMING THE PLANT HAD BEEN COMPLETED EARLIER AND THAT IT HAD COST LESS, IS THE CUSTOMER BASICALLY INDIFFERENT WHETHER THE PLANT WAS COMPLETED

OR NOT? THAT IS, ISN'T THERE A TRADE OFF BETWEEN THE AFUDC CREDIT AND HAVING TO PAY A CURRENT RETURN ON THE INVESTMENT?

A. That argument concerning the comparative capital return on the investment presupposes that the rate treatment of the plant in a 1982-1983 time frame would have been to place it totally in base rates. In fact, there would have been two other options. First, the record indicates that Limerick 1 would have represented excess capacity on the PECO system in the relevant time frame. I believe it is very plausible, therefore, that all or a part of Limerick would have been excluded from rates on that basis.

Secondly, PECO was selling the output from Salem Unit #2 to Jersey Central Power and Light Company (JCP&L) in 1982 and 1983. That contract was set to expire at the end of 1984. It was no secret that JCP&L was actively looking for firm load to purchase and had, at that point, been foiled in its attempt to bring power (900 megawatts) from Canada under Lake Erie. JCP&L subsequently purchased 945 megawatts of capacity from Pennsylvania Power & Light Company (PP&L).

Thus, while it is true that PECO ratepayers avoided paying capital charges on Limerick #1 for 27 months, we can only speculate as to whether all or part of the plant would have been sold to another utility or excluded as excess capacity if it had been completed earlier. One cannot simply assume, therefore, that ratepayers would have had to pay 100% of Limerick costs if the plant had been completed on schedule.

OCA St. 7 at 17-18 (emphasis added).

State utility commissions in other jurisdictions have rejected identical utility arguments that construction and in-service delays are of no economic harm to ratepayers. Thus, the Kansas Corporation Commission (KCC) found delay costs imprudent in its review of the Wolf Creek Nuclear Power Plant. The KCC's Order stated as follows:

Both witnesses [for the utility] basically argue that if the construction schedule had not encountered delays, ratepayers may have had to pay for a lower cost plant but they would have had to pay for it

earlier. Consequently, the argument goes, ratepayers benefitted from the delays because they had use of their money longer than would have been the case with earlier completion of the project.

15. In this portion of the order, the Commission is determining what Wolf Creek plant construction costs are reasonable. This assumes that a utility, in constructing a plant, has an obligation to build the facility in an efficient manner and at a reasonable cost. There is no question that delays in the construction schedule increase the total costs of the plant, just as much as increases in direct cost of the plant. It strains credibility to suggest that when the total costs of the plant increase unreasonably, the ratepayers are not harmed because they avoid paying for the plant earlier. Such a determination would mean that utilities have no incentive to finish projects without unnecessary delays because increases in costs would be passed on automatically to ratepayers. Utilities could prolong construction indefinitely without facing any consequences of inefficient or unreasonable construction management practices.

16. This is not to suggest that recognition of the ratepayers' time value of money is always inappropriate. Clearly, in some circumstances, it is a factor which must be considered. In this context, however, it is not reasonable to even attempt to determine whether ratepayers benefited from construction delays. In addition to posing the wrong question, such an analysis requires questionable assumptions to be made. For instance, Mr. DeStefano's analysis assumed full rate base treatment of Wolf Creek under both the February 1984 and April, 1985 completion date scenarios. Given our decisions in other portions of this order, such assumptions are unwarranted. We cannot speculate what rate base treatment would have been accorded Wolf Creek had it been completed fourteen and one-half months earlier. We may safely assume, however, that under the considerations we apply today, the treatment of Wolf Creek could vary over time. We find that exclusion of AFUDC associated with the controllable delay is a reasonable method of quantifying the cost of that delay.

Re Wolf Creek Nuclear Generating Facility, 70 PUR 4th 475, 506-507, (1985) (emphasis added).

Similarly, the New York Public Service Commission (NYPSC) rejected Long Island Lighting Company's (LILCO) delay/benefit argument with respect to delays at the Shoreham Nuclear Plant. The NYPSC held as follows:

> LILCO and Shoreham-Wading River also argue that since the company's customers will be required to pay amounts which are almost equal on a present value basis, regardless of when the plant becomes operational, no delay adjustment should be made. The company bases this argument on a "revenue stream" analysis that compares the present value of customer-contributed funds under two scenarios: the first assumes that the plant enters service and all costs are deemed prudent for ratemaking purposes, while the second assumes that the plant remains out of service and AFUDC continues to accumulate.
>
> The company's analysis, however, does not take into account the fact that by failing to bring the plant into service in 1982, LILCO incurred a cash flow crisis that threatened its viability and increased its cost of capital. In addition, if Shoreham had begun operation on schedule, LILCO's customers would have been the beneficiaries of substantial savings in fuel costs.
>
> Shoreham-Wading River also argues that any delay adjustment will be overstated because it will erroneously include an amount representing AFUDC which, it alleges, is not properly disallowed as an imprudent expense. This argument lacks merit, for if a given cost was imprudently incurred, and is therefore not allowable as an element of rate base, it follows necessarily that interest charges, or AFUDC, upon that imprudent expenditure must also be disallowed. Therefore, we shall deny the exception on this point.

Re Long Island Lighting Co. 71 PUR 4th 262, 323 (1986) (emphasis added).

The goal of this proceeding, to go back now and ask "what if", presents a difficult task. PECO has pointed to what actually transpired and asserts that virtually nothing would have changed if the 1976 and

1978 delays had not occurred. In fact, PECO makes the incredible assertion that Limerick's completion date could only have been advanced by a few months and possibly by as little as 25 days if construction had not been delayed for a total of four years in 1976 and 1978. PECO St. 33 at 8. It is, of course, not difficult to prove that what actually occurred did occur. The Commission has found the delays imprudent, however, and the OCA submits that the evidence presented by its witnesses in this case shows that, had PECO not delayed, construction and licensing could have proceeded at a reasonable pace, and fuel load and commercial operation could have been achieved 27 months earlier than actually occurred, or by November, 1983. It must be noted in this regard that Pennsylvania Power & Light Company's Susquehanna Unit 1, a comparable GE Mark II BWR nuclear power plant was completed in July, 1982, and achieved commercial operation in June, 1983.

The OCA submits that Limerick 1 was not completed earlier than actually occurred due to management decisions, not insurmountable construction hold-ups. Further, these management decisions did affect actual construction. Mr. O'Brien discussed the effect of the announced delays on construction as follows:

> Q. Mr. O'Brien, can you explain why this [reactor pressure vessel set] and other activities highlighted by TBA were late, even compared to a contemporaneous construction schedule?
>
> A. Yes, the simplest explanation was given by Dr. Parkinson in his now-famous "law" which I will paraphrase as follows:
>
> > The quantity of work always expands to fill the available time.

> Thus, tasks were not completed timely with reference to the so-called "target schedules" because they were unrealistic - the targets could not be met because PECO had already announced that it did not intend for the targets to be met, and would not fund construction so that the targets could be met.
>
> PECO believed in 1976 that it had six years until fuel load, and in 1978, PECO delayed fuel load again so that there were still six years of construction ahead. Had PECO been at all serious about meeting its target schedules, everybody--craft labor, subcontractors, supervision, and management-would have approached the job very differently.

OCA St. 1B at 13 (emphasis added).

PECO's after-the-fact assertions that two planned delays totaling four years of schedule extension actually resulted in at most a few months and possibly as little as 25 days of construction delay is simply not believable and should not be accepted by this Commission.

E. Limerick 1 Could Have Been In Commercial Operation 27 Months Earlier If PECO Had Not Delayed In 1976 And 1978.

1. Introduction

The OCA has presented an analysis that the 1976 and 1978 delays in construction of Limerick 1 materially delayed the Commercial Operation date and significantly increased the cost of the plant. Based upon the testimony of OCA witnesses O'Brien and Hanauer, the OCA submits that but for the 1976 and 1978 delays, Limerick could have loaded fuel in July, 1982, and entered commercial operation by November, 1983. This would have been 27 months sooner than actually occurred. The cost of the delay for Limerick 1 and 100% of Common Facilities is $792.7 million and for Limerick 1 and 50% of Common Facilities is $652.4 million. OCA St. 1B at 35. These figures do not include the additional costs related to errors in the Mark II containment design which are discussed in Section III.G. of this Brief.

The OCA has presented two technical experts on the cost quantification of the 1976 and 1978 delays, Mr. James J. O'Brien and Dr. Stephen H. Hanauer.

Mr. O'Brien, who presented the actual construction schedule and cost analyses, is Chief Executive Officer of O'Brien-Kreitzberg and Associates (OKA). Mr. O'Brien is a registered professional engineer in the states of Pennsylvania, New Jersey, New York and Georgia. He is a Fellow of the American Society of Civil Engineers, a member of the Project Management Institute, the Society for Advancement of Management, the Institute of Industrial Engineers and the ANSI Committee on Network Standards, among others. OCA St. 1, Sch. JJO'B-1.1.

Mr. O'Brien is a recognized expert in the field of critical path management (CPM) and is one of the organizers of the Society of CPM Consultants. His book "CPM in Construction Management" (McGraw-Hill) has been recognized as one of the definitive works in the critical path management field. He has also written seven other books, including "Contractor's Management Handbook," "Management With Computers," and "Scheduling Handbook." OCA St. 1, Sch. JJO'B-1.1.

Mr. O'Brien has been responsible for the management or scheduling of a myriad of construction projects, including power plants, government buildings, hospitals, schools, water pollution control plants, highways, transit lines, industrial complexes, postal facilities, military facilities and others. OCA St. 1, Sch. JJO'B-1.1.

Mr. O'Brien's firm currently has responsibility for management or scheduling of projects valued at over $1 billion dollars. Tr. 5133.

Dr. Stephen H. Hanauer presented testimony on Nuclear Regulatory Commission (NRC) constraints to earlier plant completion and on General Electric's imprudence with respect to errors in the design of the Mark II pressure suppression containment. Dr. Hanauer has spent 35 years in the field of nuclear engineering, including 12 years with the NRC and its predecessor the Atomic Energy Commission (AEC) in senior technical and managerial positions. OCA St. 2, Sch. SHH-1. These positions included Director-Division of Safety Technology, Director-Division of Human Factors Safety, Director-Unresolved Safety Issues Program, Assistant Director for Plant Systems, Technical Advisor to the Executive Director for Operations, and member of the AEC's Advisory Committee on Reactor Safeguards. Dr. Hanauer has also held the positions of Professor of Nuclear Engineering and Professor of Mechanical Engineering.

Dr. Hanauer has previously testified for the OCA before the Pennsylvania PUC in the investigation of Philadelphia Electric Company's Energy Cost Rate Statement No. 8. Docket No. M-840375, etc. In that proceeding, Dr. Hanauer's testimony provided the evidentiary basis for the Comission's $25.9 million replacement power cost disallowance due to imprudent management practices on the part of PECO or its agents in operating the Salem 1 nuclear plant. See Order entered October 30, 1985, at 17-64, 70 PUR 4th 568 at 578-604 (1986).

The delay analysis presented by the OCA witnesses is based upon a specific critical path schedule analysis of Limerick 1. This analysis will be discussed extensively below. In addition, it is important to note that two similar nuclear plants were completed and reached fuel load and commercial operation in the same time period as projected by the OCA

for Limerick 1. These two plants are Pennsylvania Power and Light's Susquehanna Unit 1 and Commonwealth Edison's LaSalle Unit 1. Like Limerick, both plants are GE Boiling Water Reactors with a Mark II pressure suppression containment design. Susquehanna loaded fuel in July, 1982, and entered commercial operation in June, 1983. LaSalle loaded fuel in April, 1982, and entered commercial operation in January, 1984. Moreover, both plants cost considerably less than Limerick 1. PECO witness James J. Clarey's PECO St. 4, Sch. 2, shows a total direct cost excluding AFUDC for LaSalle of $1,043 million, for Susquehanna of $1,611 million and for Limerick of $2,357 million. See OCA Exh. 61 for names of plants.

Throughout this proceeding, comparisons have been made between Limerick and Susquehanna or LaSalle. The construction duration comparisons to the two other plants are quite informative. This was recognized by the Administrative Law Judges in the New York Public Service Commission's Shoreham Investigation which addressed schedule delays and mismanagement at another GE BWR Mark II, the Shoreham Nuclear Plant. In a discussion which was adopted by the Commission, the ALJs stated:

> Staff's schedule delay adjustment of $610,329,000 assumes that the plant should have been in commercial operation no later than August 1, 1982. This is based on 21 months of delay attributable to excessive craft manhours, a pre-diesel failure fuel load date of August 1983, and eight months for testing and fuel loading.
>
> Staff also compared Shoreham to Susquehanna I and LaSalle I, two plants with Mark II containment designs that received their construction permits soon after Shoreham. Shoreham's construction period, 133 months as of April 1984, exceeded that of LaSalle I and Susquehanna I. These two plants averaged 103.5 months

from construction permit date to fuel load date. The similar results of the two methods supports the conclusion that Shoreham should have gone into commercial operation no later than August 1, 1982.

Recommended Decision at 130-131, (March 1985) (emphasis added; footnote and citations omitted).

The NYPSC's final decision on Shoreham rejected the utilities' exceptions to the ALJs' plant duration comparisons by stating as follows:

> The company also takes issue with the Judge's acceptance of Staff's comparisons between Shoreham's construction schedule and the schedules at LaSalle and Susquehanna. According to LILCO, such a comparison unfairly neglects factors affecting construction that assertedly were unique to Shoreham, as well as other data which reflects more favorably upon Shoreham than upon the other plants. However, LILCO made no showing that factors it considered unique had any direct and actual impact on the Shoreham construction schedule. Moreover, the other two plants Staff selected satisfied relevant comparability criteria such as vintage, design, and geographic location. Accordingly, we find Staff's use of LaSalle and Susquehanna data reasonable, as a gauge of schedule delays.

71 PUR 4th 262, 325 (emphasis added).

The OCA submits that comparisons of Limerick's cost and schedule to those of Susquehanna and LaSalle are relevant to this proceeding. Both plants were completed on shorter schedules and for less cost than Limerick.

Staff witness Robert A. Rosenthal noted the significant cost differential between Limerick and Susquehanna. Thus, he stated as follows:

> Susquehanna 1 and 50% of common were recognized at $1,846,960,000, while unit 2 was $2,104,770,000. It should be noted that the respondent's claim for Limerick 1 and common is virtually equivalent to the combined claims for both Susquehanna units and their

common. Yet, these two projects were parallel in their 1974 timetables.

Staff St. RAR-1 at 6 (emphasis added). The OCA submits that it is incumbent upon PECO to show why its ratepayers should pay so much more for Limerick 1 than PP&L ratepayers are paying for a comparable plant. This is particularly relevant when one considers that the PUC found that PECO imprudently delayed Limerick, while it found that PP&L prudently constructed Susquehanna. See Pa. PUC v. Pennsylvania Power and Light Co., 57 Pa. PUC 559 (1983).

2. The OCA Presented A Limerick Specific Critical Path Analysis Of The Effects Of The 1976 And 1978 Delays.

The OCA delay analysis is based upon a reconstruction of the critical path schedule of Limerick 1. In developing this reconstruction, certain facts or conclusions were accepted by the OCA. First, the analysis started with the Commission's finding in the Limerick Investigation that the 1974 delay in construction of the plant was reasonable. OCA St. 1 at 11. Second, the analysis accepted that certain technical engineering or design constraints to construction completion, such as resolution of the Mark II design errors, had to be recognized. Finally, the impact of NRC regulatory requirements which could delay fuel load and commercial operation was reviewed.

Mr. O'Brien stated the purpose of his analysis as follows:

> [T]he primary task of OKA's analysis became the determination of when Unit 1 could have been completed, had PECO not delayed the project unnecessarily. For the purpose of this testimony, I have accepted the completion of Unit 1 as a given condition as PECO's management did. Once that decision was made, however, it must be recognized that a large component of the final cost of the plant would be time related, i.e., these costs would continue to

accrue until plant completion but would be independent of the level of construction activity. Examples of these kinds of costs, generally called "overheads", are taxes, legal, security, accounting, document and drawing control, and Project Management. Escalation and AFUDC would also have a significant impact on the final cost of the plant. Further, delayed completion would increase exposure to regulatory (and Owner) changes and/or fine tuning and financial pressure.

OCA St. 1 at 6-7.

Mr. O'Brien expanded upon this during cross-examination, as follows:

It was an attempt to identify the escalation costs, the AFDC increases and other delay-related costs in what we perceived to be a 27-month overrun.

* * *

We did not attempt to then go out and say: could the company have found this money, could they have avoided building their new headquarters; could they have done this, that or the other thing. We didn't get into that all.

Tr. 3136.

A critical path analysis, as presented by Mr. O'Brien, focuses on those activities which limit or determine the progress toward completion of a job. These activities are important to or affect the construction schedule, and therefore, the duration of a project. Mr. O'Brien discussed the use of a critical path analysis as follows:

[T]he logic network is a construction road map for scheduling when things will be done and why, and also for monitoring the project's status during construction.

The overall duration of the project is fixed by computing the longest continuous string of activities from start to finish, and this route is defined as the Critical Path. With complex networks, computers can be programmed to do the counting and to calculate start and finish dates for each activity. Parallel paths of shorter overall duration are termed to have a

certain amount of "float", or scheduling flexibility. Clearly, delays suffered in progressing critical path work extend the project's duration, while problems in other areas do not, as long as they are resolved before the available float evaporates.

As a retrospective analysis tool, the CPM Network can be used to simulate the effect on the project completion date when various problems are inserted.

OCA St. 1 at 9.

The OCA analysis began with the 1974 critical path schedule for Limerick as developed by PECO and its architect/constructor, Bechtel Power Corporation. OCA St. 1 at 10. This schedule projected a construction completion and fuel load date of April 9, 1979. Id. at 10. This schedule was first adjusted by Mr. O'Brien to account for the 1974 delay in construction accepted by the PUC. This delay resulted in a projected October, 1980, construction completion date and an April, 1981, commercial operation date. The inclusion of this delay added 18 months of construction time to the original 1974 construction schedule. The development of this schedule simply reflected PECO's own 1974 delayed schedule. No other adjustments were made by Mr. O'Brien.

Mr. O'Brien explained how the schedule extension due to the 1974 delay was developed in his critical path analysis as follows:

[T]he next step in the analysis was to adjust this schedule to conform with the revised accepted As-Planned condition, or a Commercial Operation date of April, 1981. This equates to a required Fuel Load Date of October, 1980.

Technically, the schedule modification was effected by making five changes, which are listed as follows:

1. The actual date of June 19, 1974 was fixed as the date for the receipt of the Construction Permit.

2. The derived Fuel Load Date of October 18, 1980 was fixed so as to achieve the announced Commercial Operation Date of mid-April, 1981 - six months hence.

3. The duration of all construction activities scheduled to be performed wholly within the cash flow restricted years (as announced in October, 1974, i.e., 1975 - 1978) were expanded.

4. For those activities which were scheduled to start before 1975 but would be completed during the cash flow restricted years, their durations were expanded proportionate to the amount of time work was to be performed under the restriction.

5. For those construction activities which were scheduled to start during the cash flow restricted years but would be completed in 1979 and beyond, a proportionate expansion was made as above.

OCA St. 1 at 11-12.

Mr. O'Brien then reviewed the schedule as extended for the 1974 delay, to analyze the effect on construction durations of changes resulting from Mark II redesign and rework problems and NRC requirements. To develop the Mark II impacts on the critical path schedule, Dr. Hanauer reviewed the resolution of these problems at Susquehanna 1 and LaSalle 1. He stated the reasons for this comparison as follows:

> I chose those plants because they were the first Mark II plants to be licensed for operation by the NRC. Such licensing included review and approval by the NRC of the containment load definitions, the necessary re-analysis to include quenching loads, and the required modifications of the plants to withstand the quenching loads on all safety-related structures, systems and components.
>
> Therefore, NRC licensing of LaSalle in April 1982 represents the earliest actual approval of a Mark II plant's containment design, with inclusion of the dynamic quenching loads that had been under review since 1975.

OCA St. 2 at 40 (emphasis added).

As noted by Dr. Hanauer, both LaSalle and Susquehanna were GE BWR Mark II design plants. OCA St. 2 at 40. The owners of both plants had to analyze and correct for the effects of the original GE errors in specifying the Mark II loads on the overall plant design. Both plants did, in fact, resolve the Mark II design problem by mid-1982. Dr. Hanauer concluded, based upon analysis of the manner in which each plant corrected for the Mark II problem, as follows:

> If the Limerick plant had been completed in April 1982, and met all non-Mark II requirements, then the Mark II problem could have been resolved by that date on Limerick in the same way as it was on LaSalle. This would have required the Company to have decided, much earlier than 1982, to apply the Lead Plant Program criteria and to make, in the Limerick plant, the modifications necessary to meet those criteria.
>
> * * *
>
> Even with its plant-unique Mark II criteria, the Susquehanna containment design was approved and the plant licensed in July 1982, about three months after LaSalle. This reinforces my previous conclusion that the Mark II problem could have been resolved at Limerick by sometime in early- to mid-1982, and would not have constrained any later Limerick completion date, provided that the appropriate decisions and actions had been taken earlier.

OCA St. 2 at 42, 45.

Dr. Hanauer's conclusion on the 1982 resolution of the Mark II problem was accepted by PECO witness H. William Vollmer. Mr. Vollmer stated in his rebuttal testimony that the Mark II problem could have been resolved at Limerick 1 by early- to mid-1982 though he contended that such a resolution might have imposed additional risks and costs. PECO St. 31 at 9. Further he stated that PECO had always maintained the option to adopt the design basis and schedule of LaSalle and Susquehanna if needed to support earlier construction completion. Id.

Dr. Hanauer also analyzed whether any NRC requirements would have prevented completion of construction and fuel load by July, 1982, and commercial operation by November, 1983. His conclusion was that NRC requirements would not have prevented Limerick 1 from meeting that schedule. In his Direct Testimony, Dr. Hanauer discussed his analysis as follows:

> A. To supplement my review of possible Mark II schedule constraints, I considered whether other NRC requirements would have constrained the Limerick schedule to a date later than early- to mid-1982.
>
> Q. Which NRC requirements did you consider?
>
> A. I used the NRC requirements listed in PECO Exhibit 2, Schedule 1. (page 2a) The last "Miscellaneous" NRC item in that list is broken down in nine pages of details in PECO's response to Data Request OCA-4-29. (Pages 28-36)
>
> Q. Are any of these requirements special or peculiar to Limerick?
>
> A. PECO states that the requirements are the same as for other GE BWR Mark II plants. (PECO response to Data Request OCA-4-18, attached as Exhibit SHH-6.) PECO also notes that the schedule and/or scope of a number of requirements was different for Limerick.
>
> Actually, I believe at least one NRC requirement was imposed on Limerick and not on other Mark II plants; conducting a probabilistic risk assessment. However, it was completed in 1981, with later supplements.
>
> Q. Would any of these requirements have constrained Limerick Unit 1 and Common completion in early- or mid-1982?
>
> A. I don't believe they would. Both LaSalle and Susquehanna complied with NRC requirements when they were licensed to operate. The Limerick items with different scopes and/or schedules could have been accommodated at Limerick similarly to their accommodation at LaSalle and Susquehanna. The Limerick probabilistic risk assessment was completed well before 1982.

OCA St. 2 at 45-46 (emphasis added).

Mr. O'Brien used Dr. Hanauer's analysis of Mark II changes and NRC requirements in developing his final critical path analysis. OCA St. 1 at 13-14. It was determined that the Mark II required changes were on the critical path to completion of construction. Id. With this knowledge, the effect of Mark II work on the critical path schedule was analyzed.

Mr. O'Brien explained the process of reflecting the additional Mark II work on the critical path as follows:

> Q. Could you now explain your analysis made to determine when Unit 1 could have been ready to load fuel with consideration of the impact of the Mark II redesign and rework.
>
> A. In order to develop a critical path analysis, I needed to determine the amount of time required to accomplish the Mark II construction and rework. This time was then added to the schedule by increasing the durations of the appropriate activities. The schedule was re-run, which produced a new Fuel Load date. This is the exact opposite to what was done in recognizing the 1974 stretch-out where PECO fixed a new Fuel Load date. In that case, the new date was adopted and the computer was used to help determine the expanded durations of each activity. Here, the completion date was not an input, but the result of the analysis. Generally the analysis proceeded in the following manner:
>
> 1. OKA developed the manual manhours expended in executing the Mark II changes in the Containment Area.
>
> 2. An estimate was developed for the originally-scheduled manual manhours in the Containment Area.
>
> 3. The above two figures were reduced to a percentage increase of manual manhours required to implement the Mark II changes.
>
> 4. Using the Revised Overall Construction Schedule, the durations of all impacted construction activities in the Containment Area were increased by the percentage shown above.

5. Finally, the schedule was re-run to produce a Mark II Impacted Fuel Load date.

OCA St. 1 at 16-17 (emphasis added).

Mr. O'Brien's Mark II-impacted schedule resulted in a construction completion date of December, 1981. OCA St. 1, Sch. JJO'B-13. Based upon his knowledge of nuclear construction difficulties, however, and the status of contemporary GE BWRs, Mr. O'Brien added an additional 7 1/2 months to his construction schedule, for a July, 1982, completion and fuel load date. Tr. 3109.

Mr. O'Brien discussed the feasibility of his Mark II-impacted schedule as follows:

Q. Mr. O'Brien, is the OKA Impacted Schedule an accurate reflection of the construction at Limerick Unit 1 as it could have been performed?

A. It is very close, as I shall explain. PECO's answer to Interrogatory IR-OCA-4-46 (appended as Exhibit 14) gave the time frame for the actual Mark II construction additions and re-work. It shows that a great many structural changes were incorporated in the primary containment area in the last three quarters of 1975. This construction work marked the beginning of the Mark II additions, and this construction was never revised. As Dr. Hanauer described in his separate testimony, the Lead Plant Owners received initial NRC approval for their load specifications with the publication of NUREG-0487 in October of 1978. Thus, re-design could have started at Limerick immediately which would have permitted modified construction to begin early in 1979. As Dr. Hanauer has testified, many of the "interim" load specifications produced acceptable results at Susquehanna and LaSalle. The Long Term Program, however, was concluded with the issuance of NUREG-0808 for accident loads in August 1981, and the re-analysis based thereon did require changes. In fact, at around the time that NUREG-0808 was issued, Susquehanna reported that the installation of the (obviously) previously-designed hangers was lagging (reference: Hanauer Exhibit 4). The necessity of replacing or re-working some previously-installed hangers was indeed a burden to the PP&L management team. Nonetheless, Susquehanna's hangers were completed in May of 1982, and an

> Operating License (OL) was issued on July 17, 1982. An Operating License was issued to LaSalle several months earlier on April 17, 1982. Issuance of an OL permits immediate loading of fuel.

OCA St. 1 at 23-24.

Finally, Mr. O'Brien provided for a 16-month period from construction completion/fuel load to commercial operation. This is the actual length of time which transpired for Limerick 1. These 16 months include the effects of NRC emergency planning litigation and water use restrictions, as well as any other Limerick-specific experienced difficulties in reaching commercial operation. The end result of the analysis is that Limerick 1 could have been completed and in commercial operation by November, 1983, or 27 months earlier than actually occurred, February, 1986.

Completion of Limerick 1 in the time frame developed by Mr. O'Brien was, in fact, achieved by a number of nuclear plants. Mr. O'Brien noted these plants in his Rebutttal Testimony as follows:

> Chronologically, the next group of plants to gain operating licenses after TMI are given by Dr. Mattson at Schedule 1, PECO Exhibit RJM-1. These were Salem 2, Farley 2, McGuire 1, and Sequoyah 2. All achieved operating licenses in 1980-81, and although I have not performed the investigation, it is possible that Limerick might have been among these plants but for the fact that it had a Mark II containment. Again referring to Dr. Mattson's Schedule 1, it is noted that by August of 1982, an additional five plants gained operating licenses bringing the total to 10. Among these, of course, were LaSalle 1 and Susquehanna 1, as well as Grand Gulf 1, San Onofre 2 and Summer. As I stated in my previously submitted testimony, the inclusion of LaSalle and Susquehanna in this last-cited list demonstrates that the Mark II problem could have been resolved to permit an early 1982 fuel load.

OCA St. 1B at 5-6 (emphasis added).

PECO witness Boyer also agreed that resolution of the GE BWR Mark II problems would not necessarily have prevented NRC licensing of a plant as early as 1980 or 1981. Thus, on recross-examination he stated as follows:

> Q. Do you believe that [a] BWR would have been able to have been licensed and resolve the Mark II problems in 1980 or 1981?
>
> A. Well, I can't say without making a further study of it. The Mark II program had a lead plant program. Had there been another plant whose scheduled date was earlier than the others in the group, the total program would have been directed toward addressing that concern. And, undoubtedly, using bounding loads, they would have been able to design and construct that facility in a manner which would have been acceptable to the NRC, using bounding loads, and would have been able to get licensed earlier.

Tr. 5053-5054 (emphasis added).

The OCA submits that Mr. O'Brien's schedule is a fair representation of when Limerick 1 could have achieved commercial operation had PECO not deliberately delayed construction in 1976 and again in 1978.

3. The Costs Of Delays In Construction Are Substantial.

Mr. O'Brien calculated the costs of the 27-month extension of the Limerick 1 schedule to be $792.7 million for Limerick 1 and 100% of Common Facilities. In Section II of this Brief, the OCA proposes that only 50% of Common Facilities be included in rates with Limerick 1. Thus, for ratemaking purposes in this case, the effect of the delays on the cost for Limerick 1 and 50% of Common Facilities was calculated by Mr. O'Brien to be $652.4 million. OCA St. 1B at 35.

The quantification of the costs of delay has two components. The first component is identification of actual work or expenditures that would not have occurred if Commercial Operation had occurred 27 months

earlier. These costs are the result of what is commonly called Indirect Costs. Indirect Costs are the costs required to support construction as it proceeds over time. OCA St. 1 at 29-30. For Limerick, these costs are incurred by both PECO and Bechtel. The second component of the costs of the 27-month delay is the increased escalation and AFUDC which was incurred due to the longer period over which construction continued.

Addressing the Indirect Costs first, Mr. O'Brien quantified Bechtel's share of these costs as $171.9 million for Limerick 1 and 100% of Common Facilities, including AFUDC on those costs. For Limerick 1 and 50% of Common, the Bechtel Indirect Costs were $140.6 million including AFUDC on those costs. OCA St. 1A at 4, 6. Sch. JJO'B-21, 26.

The costs that were included in the Bechtel Indirect cost quantification were discussed by Mr. O'Brien as follows:

> The [Bechtel] 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.

OCA St. 1A at 3-4 (emphasis added).

The Bechtel Indirect costs were derived from PECO's cost reconciliation documents supporting PECO Exhibit 2. OCA St. 1A at 2.

They consist of excerpts from Bechtel's Forecasts of the costs of Limerick. Mr. O'Brien stated that he believed the information in Bechtel's Forecasts served to understate the total Bechtel Indirect costs of delay. OCA St. 13 at 33. The information in the cost reconciliations, however, was the best available. PECO was not able to provide information on Bechtel costs for other than broad categories on an annual basis. OCA Exh. 89. Moreover, these costs were not separated between Unit 1, Common and Unit 2 until sometime in 1981-1982. Tr. 5092.

Mr. O'Brien also has identified PECO Indirect Costs due to the 27-month delay. For Limerick 1 and 100% of Common, these costs totaled $101.5 million, including AFUDC. For Limerick 1 and 50% of Common, the PECO Indirect Costs total $83.0 million, including AFUDC. OCA St. 1A at 6-7. The analysis of PECO Indirect Costs was based upon a review of PECO expenditures in a number of areas. These included insurance, construction supervision, power, public notification, engineering, legal, training, plant/start-up staff, and maintenance. Mr. O'Brien attempted to quantify the PECO Indirect Costs which would not have been incurred had Limerick 1 been completed 27 months earlier.

Mr. O'Brien explained the derivation of his PECO Indirect Cost estimate as follows:

> Except for Taxes and Overheads which were given annually, I calculated that approximately 44.5%, or $77.7 million, of the indirect expenditures identified above were spent between July 1982 and October 1984 and thus could have been avoided. The basis for this calculation was my assumption that these expenditures were made at the same annual rate as the Direct Costs, i.e., 7.5% for the later half of 1982, 18% during 1983, and 19% in 1984. Thus, a total of $81 million

($77.7 million in indirects and $3.4 million in taxes and overheads) were expended between July '82 and October '84. With AFUDC added, the identified avoidable expenditure for Indirects/Overheads was $101.5 million.

OCA St. 1 at 32, as corrected at OCA St. 1A at 6-7.

The OCA submits that the Indirect Costs quantified by Mr. O'Brien represent a minimum level of costs which would have been avoided had Limerick 1 been completed 27 months earlier. It is noteworthy that in January, 1981, in a presentation to its Board of Directors, PECO calculated the various components of the cost increases in Limerick construction from October, 1975, to January, 1981. OCA Exh. 85. As part of that presentation, PECO estimated that "overheads associated with longer schedule" constituted $275 million (not including AFUDC) of the cost increase for the total station. OCA Exh. 85. These costs were estimated by PECO to represent 13% of the total cost increase in the plant since October, 1975.* OCA Exh. 85. This Company calculation, of course, was based upon January, 1981, estimates. In the present case, PECO has "unitized" costs between Unit 1, Unit 2, and Common Facilities because historic data were recorded on a total station basis. In unitizing costs, PECO generally assumed that 65% of total station costs which were not otherwise identifiable were associated with Unit 1 and 100% of Common Facilities. PECO St. 8 at 292. Assuming this 65% factor, the $275 million in total overhead costs attributed by the Company to delay in 1981 would translate into $179 million in costs for Unit 1 and Common, excluding AFUDC.

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* This post-dates the 1974 delay but was just 7 months prior to the delay in construction of May, 1976, and spans both delays under review in this case.

The total PECO and Bechtel Indirect Costs quantified by Mr. O'Brien for Limerick 1 and 100% of Common is $273.4 million, including AFUDC. For Limerick 1 and 50% of Common, the total is $223.6 million, including AFUDC. The OCA submits that this is a reasonable and conservative estimate of the cost of supporting this multi-billion dollar construction project for an additional 27 months.

The NYPSC addressed the issue of Indirect Costs in the Shoreham proceeding. In reducing LILCO's cost of Shoreham to account for increased Indirect Costs the NYPSC rejected LILCO's exceptions on this issue stating as follows:

> LILCO argues that costs such as training and organization, plant startup, property taxes, insurance, security, and fixed distributables should be excluded from the delay adjustment, because these costs assertedly would have been incurred regardless of whether Shoreham became operational in 1982 or at some later date. However, Staff calculated its delay adjustments based upon an August 1982 in-service date. Expenditures for items like start-up and training were substantially made by then, and they were included in the allowed cost of Shoreham. We have excluded expenditures for these items after August 1982, as well as property taxes, insurance and security costs for the delay period, because they were incurred due to LILCO's failure to complete the project within a reasonable time. Moreover, there was no corresponding benefit to ratepayers from incurring these costs during the delay period. Finally, contractor fixed distributable costs must be eliminated because they relate directly to construction that should have been terminated by August 1, 1982. Accordingly, we shall deny the company's exceptions on these points.

71 PUR 4th 262, 324 (1986) (emphasis added).

The other element of Mr. O'Brien's overall calculation is the quantification of the added costs to the project due to escalation and additional AFUDC as a result of the 27-month delay. His calculation of these costs of escalation and AFUDC assumed that PECO would have incurred

the same level of direct expenditures as actually occurred (excluding indirect costs), but would have incurred those costs earlier and ceased accruing AFUDC sooner. Thus, the Company would have avoided 27 months of cost escalation and 27 months of AFUDC on the entire project. OCA St. 1 at 28.

Mr. O'Brien explained the quantification process as follows:

> These actual annual direct expenditures through PECO's projected commercial operation date (February 15, 1986) were then converted to constant dollars using 1971, the year construction started, as a base. Escalation since 1971 was removed using the Handy-Whitman Index of Public Utility Nuclear Construction Costs for the North-Atlantic Region.
>
> Next, expenditures made between my recommended Fuel Load date (July 31, 1982) and the actual date (October 26, 1984) were spread between January 1, 1975 and July 31, 1982. Expenditures made between actual Fuel Load and Commercial Operation were simply shifted to the period following recommended Fuel Load (this implies that Commercial Operation should have been achieved no later than November 20, 1983).

OCA St. 1 at 28-29.

Based upon the re-scheduled and de-escalated expenditures, Mr. O'Brien calculated the new level of direct cost and AFUDC which would have been incurred during the course of construction. Leaving aside the PECO and Bechtel Indirect costs, the total increase in the cost of Limerick 1 and 100% of Common Facilities due to escalation and AFUDC is $552.4 million. OCA St. 1B, Sch. JJO'B-30.4. For Limerick 1 and 50% of Common the cost is $445.7 million. OCA St. 1B, Sch. JJO'B-30.1. When combined with the Indirect Costs noted above, the total cost of delay for Limerick 1 and 100% of Common would be $792.7 million.* For Limerick 1

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* Costs for escalation and AFUDC are not directly additive to Indirect Costs. To avoid a double count of certain costs, the entire calculation is re-run on a combined basis. OCA Exh. 86.

and 50% of Common, the total is $652.4 million. OCA St. 1B at 35.

This cost quantification can be compared to PECO's own cost analysis presented in OCA Exh. 85, as developed in January, 1981. The Company's analysis as of that date, presented to its Board of Directors, showed that on a total station basis for Limerick 1, 2 and Common, escalation comprised 19%, or $402 million, of the cost increase since October, 1975, and AFUDC comprised 50%, or $1,059 million, of the cost increase. OCA Exh. 85 at 13. As noted earlier, PECO's cost quantification was based upon January, 1981, cost estimates.

When one combines PECO's 1981 cost analysis for overhead/indirect costs cited above with its calculation of escalation and AFUDC, the Company's total estimate of the cost of the schedule extension was $1,736 million as of January, 1981. On a unitized 65% basis for Limerick 1 and Common, this would represent $1,128.4 million. This is out of a total cost increase as of that date of $2,118 million dollars. OCA Exh. 85.

In fact, PECO stated in OCA Exh. 85 that:

> The areas of escalation and AFUDC have shown the greatest increases due to the prolonged construction period. These are responsible for almost 70% of the increase.

OCA Exh. 85 at 13. By comparison, PECO calculated that Plant Design or scope changes represented $233 million, or just 11% of the cost increase as of 1981.

The OCA submits that the cost quantification prepared by PECO itself in 1981, unitized to a cost of $1,128.4 million, serves to show the magnitude of the costs which were incurred due to the stretch-out of

the schedule of Limerick 1. OCA's quantification of the cost of delay of $792.7 million for Limerick 1 and 100% of Common is quite reasonable compared to the Company's own early analysis.

F. PECO's Rebuttal On The Cost Of The Delays Must Be Rejected.

1. Introduction.

The Company has filed voluminous, and in many cases redundant, testimony on the issues involving the prudent cost of Limerick 1. The Company's testimony, in summary, presents five basic allegations. These are 1) The 1976 and 1978 delays were reasonable and prudent, contrary to the PUC's holding in the Limerick Investigation at Docket I-80100341; 2) The only things the PUC found imprudent in the Limerick Investigation were the Company's announcements of delay, but that no critical path delays actually occurred in 1976 and 1978; 3) The 1976 and 1978 delay announcements had no actual effect on the ultimate completion date of Limerick 1. Even if PECO had fully funded construction and pushed ahead with the plant, construction completion and fuel load could, at most, have been achieved only a few months earlier than actually occurred; 4) Even if the 1976 and 1978 delays had the effect of extending the commercial operation date of Limerick 1, ratepayers are actually better off as a result of the later plant completion; and 5) The OCA's quantification of the costs of the 27-month schedule delay is too high.

The OCA submits that the Commission's Orders and the evidence presented in this case reveal that PECO's positions are in error. The following sections of this Brief will address each of these points in turn. As will be seen from this discussion, PECO has not met its burden

of proof under Sections 315 and 1308(f) of the Public Utility Code that the cost increases in Limerick 1 due to the delays were prudently incurred. 66 Pa.C.S. §§315, 1308(f).

2. The Delays Have Already Been Found Imprudent.

In its Direct Testimony in this proceeding, PECO presented its position that the 1976 and 1978 delays were based upon prudent management decisions. As discussed in Section III.B. of this Brief, both the ALJ and the Commission have ruled that the findings of imprudence from the Limerick Inveatigation are binding on all parties to the present case. Thus, no further discussion is required on this issue.

3. The Commission Found The Delays, Not Just The Decisions, Imprudent.

Throughout its testimony in this case, the Company has referred to the 1976 and 1978 delays in construction as the 1976 and 1978 "deferral announcements." See, e.g. PECO St. 1A at 3, PECO St. 8A at 51. The Company's position on the delay issue appears to be that the Commission only found the decisions, and announcements of those decisions, imprudent, but not any specific construction schedule changes. In fact, PECO witness Love (from TB&A) stated that he was unclear as to what the PUC actually found imprudent. Tr. 5191.

Moreover, PECO asserts that it didn't actually delay construction when it announced the 1976 and 1978 delays. PECO St. 1 at 1. Thus, the Company contends that the decisions to delay, and the announcements, were of no real effect. PECO St. 1A.

The OCA submits that PECO has presented no information or evidence on the 1976 and 1978 delays which was not already considered by the PUC in the Limerick Investigation. Further, the Commission found

that PECO purposely and imprudently delayed construction financing and extended the construction schedule for Limerick 1. The Company's argument that it continued to fund critical path construction was considered by the Commission in that case and did not alter the conclusions of imprudence.

ALJ Klovekorn's Initial Decision from the Limerick Investigation discusses the 1976 and 1978 delays at length. I.D. at 35-55. His discussion encompasses both the reasons for PECO's decisions to delay and the actions taken by the Company during that time period.

With respect to the 1976 delay, ALJ Klovekorn stated as follows:

> In the spring of 1976, PECO lowered its five-year construction program by about $750 million. On average, PECO was able to reduce its outside financings in those years by about $60 million per year, or about 20%.
>
> Mr. Paquette also testified that in evaluating the 1976 postponement, "it is also important to appreciate the context within which these decisions were being made." (PECO Statement No. 9, p. 10).
>
> When growth forecasts began to level off and it became apparent that it would not need Limerick's capacity in 1981 and 1983, Mr. Paquette stated, it was entirely consistent with corporate and regulatory policy to slow down the construction of that plant in order to avoid bringing it on line in advance of its need. This concern about excess capacity came to the surface in the company's 1975 and 1976 rate proceedings, when questions were raised by the Commonwealth of Pennsylvania concerning reserve margins and the possibility that the company then had "excess capacity" which should be eliminated from its rate base. Although the PUC rejected the Commonwealth's arguments in that case, it did indicate that the company would be required to justify its installed capacity in the next rate case. According to Mr. Paquette, in such an environment the company concluded that the public interest did not warrant a speedy completion of Limerick. Indeed, the company felt that there was some risk that if it brought on the Limerick units in 1981 and 1983, this Commission

might exclude it from rate base with very dire financial consequences to the Company (PECO Statement No. 9, p. 11).

Initial Decision at 37 (emphasis added). As can be seen, Mr. Paquette stated in 1981 that it was PECO's intent in 1976 to avoid bringing Limerick 1 on line until at least 1983. With this goal in mind, PECO lowered its 5-year construction program by $750 million, or by an average of $150 million per year. Id. Thus, PECO did more than just decide to slow down construction in 1976; it reduced its expenditures in aid of that objective.

Similarly, with respect to the 1978 delay, ALJ Klovekorn stated as follows:

> In May 1978 PECO announced a decision to reschedule Units I and II from 1983-85 to 1985-87. PECO Witness Mr. Paquette testified that PECO did not in fact change the critical path of the construction schedule from 1978 through 1980, and that in those years PECO authorized and spent the additional dollars to maintain the 1983-85 service dates in the event that it became desirable to complete the units earlier than 1985-1987 (PECO Statement No. 9, p. 12; Tr. 495). The record shows, however, that PECO reduced its direct expenditures from 1978-1980 from the budgeted amount of $529 million to $479 million (OCA Exh. 23, Tr. 1, 7). PECO explains, however, that it funded all major construction activities required to maintain the earlier completion dates, but not activities of lesser importance (PECO R.B., p. 96, fn. 7).
>
> The reasons for announcing a delay in 1978, according to PECO witness Paquette, were similar to those which were involved in the 1976 decision. In other words, by 1978 there were two more no-growth years. PECO's load forecasters lowered peak load estimates from 5% to 3% per year. In addition, PECO claims, the Commission permitted inadequate rate relief during this period. One important factor in this decision to postpone was apparently the recommendation of Administrative Law Judge Joseph

> Matuschak at R.I.D. 438 that an adjustment be made to PECO's rate base for "excess capacity." This was viewed as a message to the company not to optimize installed capacity but to minimize current costs and rates.
>
> PECO, however, continued to preserve its options to maintain the earlier timetable due to the fact that escalating oil costs now made it appear that completion of Limerick at an early date might be advantageous to customers even if the capacity was not required, since the fuel cost savings resulting from Limerick's operations would more than offset the carrying costs of the plant (PECO Statement No. 9, p. 14).

I.D. at 44-45 (emphasis added). Thus, in 1978, PECO reduced its construction budget below the already reduced levels from 1976. Once again, from the ALJ's discussion it is clear that PECO's position regarding the 1978 delay, and its implementation in the construction schedule, was known to the Commission when it concluded that the delays were imprudent. While PECO asserted that it maintained the option to advance the construction timetable in this period, it never exercised that option. In fact, ALJ Klovekorn noted that PECO abandoned the option of maintaining a 1983/1985 completion schedule in 1980. I.D. at 46.

The Commission Order on the issue of the construction delays was adopted in 1982. The history of PECO's delay decisions, and the implementation of the delays, was known to the Commission when it made its determination on this issue. The Commission's Order on this issue stated as follows:

> [W]e are of the opinion that PECO management did not excercise judgment sufficient to meet our reasonable man standard in delaying construction at Limerick in 1976 and 1978.

56 Pa. PUC at 61 (emphasis added).

The OCA submits that the record is clear that the Commission's Order found delays in construction imprudent, not merely decisions to delay, or deferral announcements.

4. The Company's Schedule Analyses Are Flawed And Must Be Rejected.

a. Introduction.

It is undisputed in this record that in 1978, PECO publicly announced its intention to not complete Limerick 1 construction and load fuel prior to late 1984. It is also undisputed that PECO was successful in accomplishing that goal. The OCA has presented evidence to show that, but for the delays in construction, PECO could have completed construction and loaded fuel at Limerick 1 by July, 1982, and placed the plant into commercial operation by November, 1983. PECO has taken the position that no matter what it would have done in the late 1970's, Limerick 1 construction could not have been completed any earlier than actually occurred or at most a few months earlier. PECO St. 33. In support of its position, PECO has presented numerous, and often redundant, pieces of testimony. The OCA submits that, as discussed below, the Company's testimony proves only that what actually happened did, in fact, occur. PECO's testimony cannot, however, be relied upon to determine when Limerick 1 could have been completed but for the 1976 and 1978 delays.

PECO has presented a number of analyses purporting to show that Limerick 1 construction could not have been completed and fuel loaded much, if any, earlier than actually occurred, October, 1984. In this portion of the Brief the OCA will discuss the major flaws in the Company's presentations.

Perhaps the fundamental flaw was noted by Mr. O'Brien when he stated,

> As a professional construction manager, I have worked on numerous complex projects in an effort to complete them timely, and have further dedicated myself to the study, development and broad dissemination of state-of-the-art project management systems to aid the construction industry accomplish that goal. I have never heard of a project that was completed earlier than the owner's stated intentions and funding limitations. Thus, in spite of all of PECO's "even if" speculations, the simple fact is that Limerick was not completed sooner because PECO did not try to complete it sooner.

OCA St. 1B at 3 (emphasis added).

It should be noted that in PECO's direct testimony very little specific analysis or discussion was presented regarding the cost or schedule impact of the 1976 and 1978 delays. Rather, PECO devoted its direct case primarily to a relitigation of the Commission's findings of imprudence.

b. PECO's Construction Schedule Analyses Are Based Upon Improper Manipulation Of Mr. O'Brien's Schedule.

The first analyses PECO presented on the issue of an earlier construction completion were included in the Company's Rebuttal Testimony and were based upon the critical path schedule presented by OCA witness O'Brien. Through a variety of manipulations, PECO adjusted Mr. O'Brien's schedule in an attempt to show that Limerick 1 could not have been completed by the date he developed. The manipulations by PECO of Mr. O'Brien's critical path schedule, however, are improper and should be rejected as a basis for measuring the effects of the 1976 and 1978 delays.

Through PECO witnesses Coughlin and Clarey, the Company presented four critical path schedule analyses. PECO Exh. JCC-1/JRC-1.

The first two analyses, Cases 1 & 2, were based upon improper adjustments to Mr. O'Brien's schedule for "as-built" considerations and purported manpower density limits. PECO St. 33 at 6-8. Case 3 added alleged cash restrictions to the schedules, and Case 4 added NRC impacts as suggested by other Company witnesses. Id. at 7-8. The Cases were developed from Mr. O'Brien's Exhibit JJO'B-13, the critical path analysis which provides the basis for the OCA's quantification of the effects of the delays.

The Company's schedule analyses contained numerous errors. The primary error, however, was that, by relying heavily on as-built schedules, PECO constricted the available work time in critical areas in Mr. O'Brien's schedule. This served to improperly inflate the apparent manpower density levels needed to get the work done in the shorter time allowed for in PECO's adjusted schedules. Mr. O'Brien more fully explained the errors in PECO Cases 1 and 2 as follows:

> Mr. Coughlin made changes to Exhibit JJO'B-13 for his Case 1 analysis which artificially inflated the manpower requirements in Containment. Mr. Coughlin states at page 10, line 23, the following:
>
> > Employment of actual startup activities and logic increased the startup length from the originally scheduled 21 months employed by OKA to the actually achieved duration of 27 months (i.e., as measured from initial energization to fuel load). This had the effect of reducing the amount of time available for mechanical/electrical work, but accurately reflected the proper time required for startup testing. (Emphasis added).
>
> In addition, however, Mr. Coughlin states he made other changes as follows (at page 9, line 9):
>
> > Adjustments were then made to reflect the July 1982 fuel load date proposed by OKA . . . the adjustment from the OKA MSCS December 11, 1981 fuel load date to the July 1982 fuel load date proposed by OKA was

> developed by extending the completion date for critical path activities in OKA's schedule by 7 1/2 months. This was accomplished by adding . . . one month to startup and preoperation and testing activities.
>
> The sum of these statements indicates that the actual as-built duration of startup was imposed upon my network, plus an additional month, but CASE 1 shows energization as February 23, 1980, and fuel load as July 28, 1982. Thus, Mr. Coughlin scheduled over 29 months for start-up and not the as-built duration of 27 months. For Case 2, Mr. Coughlin imposed actual as-built durations on all activities up until June of 1976, and I have already noted that this included unexplained and avoidable delays. Thus, the civil/structural phase at the front of the network was expanded, the startup and testing phase at the back of the network was expanded, and the pinch in the middle severely reduced the amount of time Mr. Coughlin asserts would have been available for mechanical/electric work. This, in turn, significantly inflated the apparent size of the daily work force which was then compared to suddenly-reduced maximum density limits. I believe that Mr. Coughlin's manipulation of my schedule in this fashion is wrong.

OCA St. 1B at 18-19 (emphasis added).

As can be seen from this discussion, the Company's adjustments to Mr. O'Brien's critical path schedule analysis serve to impose extensive "as-built" activity durations on the schedule. Obviously, the more "as-built" activities one includes in the schedule, the more the hypothetical looks like the actual. That, however, assumes that PECO would not have done anything differently if it had been attempting to complete Limerick 1 construction and load fuel sooner than October, 1984.

As a result of its schedule manipulation in Cases 1 and 2, PECO erroneously claimed that manpower density limits would prevent completion of the plant on Mr. O'Brien's 1982 schedule. Mr. Coughlin claimed that Mr. O'Brien's schedule would require sustained manpower levels of 379

people. PECO St. 33 at 12; PECO Exh. JJC-2/JRC-2, Sch. 3. A review of the basis for Mr. Coughlin's calculation of the 379 manpower requirement, however, shows it is not, in fact, representative of the manpower required by Mr. O'Brien's schedule. The 379 manpower level only results from Mr. Coughlin's improper adjustments to Mr. O'Brien's critical path analysis.

Mr. O'Brien's schedule actually only required sustained manpower densities of from 260 to 290 people. These levels are based upon available worktime in the critical path drywell of from 224 to 250 weeks. Tr. 5131. Mr. Coughlin's derived manpower level of 379 people is based upon his schedule manipulations and is quantified in PECO Exh. JJC-2/JRC-2, Sch. 3, Chart 1. Mr. Coughlin's schedule shows 171 weeks of drywell worktime. Id. The 379 manpower density requirement is derived from Chart 1 by dividing total drywell manhours of 2,598,000 by 6840 (40 hours per week times 171 weeks). Tr. 5096. Repeating this equation for the actual number of weeks in Mr. O'Brien's schedule shows that at a 224 week schedule the manpower density level is 290 people, and at a 250 week schedule, the level is 260 people. Mr. Coughlin's stated allowable manpower density for Limerick 1 was 284 people. PECO Exh. JJC-2/JRC-2, Sch. 4, Chart 4. As can be seen, Mr. O'Brien's schedule would not require manpower density limits above the maximum level which PECO asserts could be sustained at Limerick 1.

Mr. O'Brien discussed density during cross-examination on his Direct Testimony. He noted that his analysis assumed the same space restrictions in the containment drywell as did PECO and Bechtel. Thus he stated as follows:

[O]ur approach assumes the same level of density of equipment and people with the exception that the Mark II does make the hangers heavier and there are other changes like that, so you may have some additional crowding or density; but by and large, by assuming the same crew size we assumed that Bechtel had properly projected how long it would take them to do the basic drywell work.

Tr. 3106.

The fact that there was enough time in Mr. O'Brien's schedule to accomodate Limerick's manpower and manhours also means that his schedule included all of Limerick's actual bulk commodities such as concrete, pipes, hangers, etc. This is due to the fact that manhours are spent installing commodities and thus the two are intrinsically related. In its continual effort to distinguish Limerick from Susquehanna and LaSalle, PECO has stated that Limerick installed greater quantities of concrete, pipe, etc. than those two plants. PECO thus asserts that Limerick could not have finished construction in the same time frame as Susquehanna and LaSalle. PECO St. 33 at 22. The Limerick/Susquehanna comparison will be discussed more below. However, with regard to the amount of commodities installed at Limerick, Mr. O'Brien indicated that his analysis assumed installation of Limerick's actual commodities, not some hypothetical Susquehanna or LaSalle amount. Thus, Mr. O'Brien stated as follows:

Q. What conclusions do you draw from your manpower density analysis?

A. The simple result is that it shows that reasonable manpower density limits would not have prevented the completion of Limerick Unit 1 by July 1982. Because that is true, however, it also shows that JJO'B-13 was properly expanded to include all of the as-built direct manhours it actually took to build the plant. Direct manhours are expended to install commodities. Therefore all of the commodities that manpower

> installed are also embraced in my network. And, once again it is proven that if you don't try to complete your facility, you won't. The means, however, were available.

OCA St. 1B at 21 (emphasis added).

Finally, while PECO has stated that Limerick had greater quantities of certain commodities than at Susquehanna, Mr. O'Brien noted during cross-examination that Susquehanna's Mark II work, which was on the critical path, was more extensive. Thus he stated as follows:

> It is my belief that the work within the dry well relating to Mark II -- now, I'm not saying the concrete work, but the pipe work and conduit -- if anything, Susquehanna is slightly heavier. They took the conservative -- they used the German design, and I base my comment upon what Dr. Hanauer has said having been in both dry wells.

Tr. 3111 (emphasis added).

c. PECO's Susquehanna Schedule Comparison Does Not Support The Company's Position.

Turning to PECO's Susquehanna/Limerick construction schedule comparison, the OCA submits that the Company's analysis serves to prove OCA's position regarding both when Limerick 1 could have been done and the reasonableness of using Susquehanna as an appropriate reference plant.

PECO witness Coughlin prepared PECO Exhibit JRC-2 which is his Susquehanna/Limerick commodity and unit installation rate comparison. Mr. Coughlin's stated intention was to try to show that if Susquehanna had had to install Limerick's commodities, Susquehanna's schedule would have been much longer. Mr. Coughlin's analysis was developed by inserting Limerick's commodity levels into a simplified schedule of Susquehanna 1. His analysis has Susquehanna beginning construction on June 21, 1974, the date Limerick received its Construction Permit. Tr.

5097. Using Susquehanna's unit installation rates, and Limerick's commodities, he developed an earliest possible Susquehanna 1 completion date.

Both the results of Mr. Coughlin's analysis, and his supporting data, provide useful insights into Limerick's schedule. In fact, they actually serve to show the reasonableness of Mr. O'Brien's schedule analysis. Mr. Coughlin presented plant information on major commodities and the dates on which those commodities were 10% and 90% complete for Limerick and Susquehanna. Comparing the 10% and 90% installed dates for Limerick and Susquehanna shows that in the early years (prior to the 1976 and 1978 delay decisions) Limerick construction was substantially ahead of Susquehanna. In fact, Limerick actually started site work earlier than Susquehanna. Mr. O'Brien discussed Limerick's headstart and Mr. Coughlin's schedule comparison results, in part, as follows:

> PECO witness Clarey has criticized my direct testimony with regard to the same Limerick/Susquehanna comparison [as Mr. Coughlin]. He states (at Statement No. 4A; page 18, line 41) the following:
>
> > Mr. O'Brien has ignored the earlier construction permit issuance dates at . . . Susquehanna . . . the construction permit date for Susquehanna was November 1973 - a full seven months ahead of Limerick 1. . . . .
>
> What Mr. Clarey has declined to mention is that construction at Limerick actually started in August 1970, years before the issuance of a Construction Permit in 1974. Reference to the previously discussed Coughlin Exhibit JRC-2, along with Attachment IR-OCA-25-9(c)(3) (revised) is particularly revealing of the head-start this afforded Limerick. Attachment IR-OCA-25-9(c)(3) (appended as JJO'B-29) gives the dates on which 10 percent and 90 percent of various bulk commodities were actually installed at Limerick. A comparison of those two documents reveals the following:

- o While JRC-2 alleges that only 10 percent of structural concrete could have been theoretically placed at Susquehanna by the end of August 1975, Limerick actually achieved that same milestone 10 months earlier in October of 1974.

- o While Structural Concrete is shown on JRC-2 to be 90 percent theoretically completed at Susquehanna at the end of September 1981, this milestone was achieved at Limerick nearly a year earlier in November of 1980.

- o While Large Pipe is shown on JRC-2 to be 10 percent complete for Susquehanna at the end of February 1977, this happened at Limerick a full year earlier in February of 1976.

OCA St. 1B at 24-25 (emphasis added).

These earlier actual completion dates for Limerick as compared to Susquehanna were achieved despite Susquehanna's better actual unit installation rates. The installation rates at Susquehanna compared to Limerick were stated by Mr. O'Brien to be as follows:

> Attachment IR-OCA-25-9(c)(1) (revised) (appended as JJO'B-28) gives the monthly installation rate for various commodities at both Susquehanna and Limerick for the period during which 10 percent through 90 percent of each bulk commodity was installed. The results are as follows:
>
> | | |
> |---|---|
> | Concrete | 27 percent better at Susquehanna |
> | Large Pipe | 38 percent better at Susquehanna |
> | Large Pipe Hangers | 21 percent better at Susquehanna |
> | Small Pipe | 12 percent better at Susquehanna |
> | Cable Tray & Gutter | 8 percent better at Susquehanna |
> | Conduit | 40 percent better at Susquehanna |
>
> Only in the areas of Wire and Cable, and Connections did Limerick produce higher sustained monthly installation rates. Thus, in six out of eight bulk commodities compared, Susquehanna bettered Limerick installation rates by significant amounts....

OCA St. 1B at 23 (emphasis in original).

As noted above, although Limerick received its Construction Permit 7 months later than Susquehanna, its construction was actually ahead of Susquehanna in many respects. One example was Susquehanna's 13-month post-Construction Permit mobilization period followed by a 1-month engineer strike. PECO Exh. JRC-2; Tr. 5097. This period substantially exceeded the post-Construction Permit mobilization at Limerick. Mr. O'Brien commented on this as follows:

> JRC-2 also shows that Limerick was in a far better position than Susquehanna to "hit the ground running" when its Construction Permit was issued, and this momentum is clearly evident in the early construction activities and through the time period until Limerick's funding was cut back. For example, even a quick review of JRC-2 indicates over one full year for mobilization at Susquehanna 1, while Limerick had mobilized in 1970 and again in 1973, and as noted above, had achieved 10% concrete poured within 5 months of receipt of its Construction Permit. If this unnecessary year of mobilization is removed from Mr. Coughlin's JRC-2 schedule, his fuel load date would be reduced from April, 1984, to March, 1983.

OCA St. 1B at 25-26 (emphasis added).

Mr. O'Brien put the Limerick/Susquehanna commodity/installation rate comparison into perspective as follows:

> I have prepared the following table to illustrate what we are discussing.

Commodities	Monthly Instal. Rate at Susquehanna Compared to Limerick	Commodity Diff. at Limerick Compared to Susq.
Concrete	+27% (SSES better than LGS)	+10%
Large Pipe	+38%	+30%
Large Pipe Hangers	+21%	+36%
Small Pipe	+21%	+18%
Cable Tray & Gutter	+ 8%	- 6%
Conduit	+40%	-17%
Wire & Cable	-14%	-15%
Connections	-29%	+ 2%

> This table compares the Susquehanna and Limerick installation rates and commodities. As noted previously, and as seen above, Susquehanna had monthly commodity installation rates which were substantially better than Limerick. Thus, even though Limerick had increased quantities for some commodities, I believe that if Limerick's construction performance had matched Susquehanna's, Limerick's fuel load would have been achieved substantially earlier than PECO suggests was possible.

OCA St. 1B at 26-27 (emphasis in original; footnotes omitted).

Mr. Coughlin's efforts to distinguish Limerick 1 from Susquehanna 1, thus, only serve to show that, but for the 1976 and 1978 delays, Limerick 1 could have been completed substantially earlier. Susquehanna 1, of course, was completed substantially earlier and at a substantially lower cost than Limerick 1. In fact, based on PECO witness Clarey's Sch. 2, Susquehanna's Total Direct Costs (excluding AFUDC) were $1,611 million as compared to Limerick's Direct Cost of $2,357 million. See OCA Exh. 61.

PECO's Cases 1 and 2 and its Susquehanna/Limerick commodity/installation rate analyses comprise the Company's major construction schedule presentations. PECO Case 3 is a financial analysis of historic cash flow projections. PECO Case 4 is an NRC restraint analysis. From PECO's construction based analyses, Cases 1 and 2 and Exh. JRC-2, the OCA submits that it is quite clear that Limerick 1 could have been completed on the Schedule presented by Mr. O'Brien. Mr. O'Brien's schedule allows ample time to complete critical path containment work with what PECO has called reasonable manpower density levels. This schedule also allows for installation of all of Limerick's commodities. Further, PECO's comparison of Limerick to Susquehanna only serves to show that early Limerick construction was ahead of Susquehanna

and that the Limerick schedule would not have been extended due to construction related activities.

d. The Company's Other Construction Schedule-Based Arguments Are Also Flawed.

The Company has asserted that Mr. O'Brien's analysis is wrong because it is based upon the original 1974 construction schedule. This assertion is misplaced. As noted above, with the inclusion of sufficient manhours, all of the commodities associated with those manhours are also accounted for. Mr. O'Brien stated that, in fact, his construction schedule gave PECO credit for the 1974 delay, additional time to remedy the Mark II problem, plus 7 1/2 extra months. Mr. O'Brien stated:

> Q. And is it not correct that you have not made any adjustments to your analysis to reflect construction logic changes that might have occurred or increased commodities to be installed associated with those additional regulatory events?
>
> A. That's correct, and it's based upon both the review of Bechtel trends and forecasts into 1980, which appear confident they can complete the work without regulatory impact, and also specifically on Dr. Hanauer's opinion that in the post-TMI environment that the controlling factor as to regulatory was Mark II, and that would more than encompass any remaining changes that Limerick had not accomplished.
>
> * * *
>
> Q. And similarly, your analysis would not reflect any construction logic changes that occurred after June 1974 to reflect these estimate omissions or other similar items; is that not correct?
>
> A. Again, repeating myself, not specifically, but we had added a window of time, or let me say PECO added a window of time, which the Commission found prudent, and then subsequently Mark II added an additional window of time. So in total, I believe there was time enough.

Tr. 3112-3113, 3117 (emphasis added).

Further, he stated,

> I believe by adding two substantial increments of time, one which we added when we made the adjustment in JJO'B-4 and, secondly, the one which we believe was imposed upon Limerick by the error in the Mark II, these two substantial amounts of time would have taken the schedule out of being an optimistic one, if it was, into being one that was achievable.

Tr. 3139.

In his Surrebuttal Testimony, Mr. O'Brien addressed this issue further, as follows:

> Q. Your analysis has been criticized because of your use of a June 1974 MSCS schedule which was later revised as to scope and activity sequences. Do these modifications affect your analysis in any way?
>
> A. No, they do not. I added two years plus 7 1/2 months to the 1974 schedule which allows for all additional scope changes and the manpower to install them. I will show when I discuss Mr. Coughlin's Case 1 and 2 analyses that by the addition of this time, as reflected in JJO'B-13, activity durations were sufficiently expanded to embrace all as-built, installed commodities and manpower. Moreover, I reject the assertion that just because the Baseline BPC Schedule was created in June 1974 it is somehow flawed. For example, much has been made of the fact that while this BPC Baseline Schedule (JJO'B-3) shows Containment work as a single activity, it was later separated into two activities, thereby splitting work in the Drywell and Wetwell. This change does not render the original network wrong or less useful. PECO admits that the Wetwell would have been completed relatively quickly and that the overall duration of my Containment activity would have been controlled by work in the Drywell. Either way, the critical path was exactly as shown at JJO'B-13 - in Containment. Further, I will show that when the actiivies in Containment are split by PECO, sufficient time is available to complete the critical Drywell work under reasonable manpower density limitations.

OCA St. 1B at 14 (emphasis added).

The Company has also asserted that the publicly announced delayed schedules were not, in fact, the construction schedules. PECO

St. 1B at 1. The Company thereby attempted to show that workers were either not cognizant of, or ignored, the public schedules. The Company's position on this is not credible. The publicly announced schedules were used in all Annual Reports, Securities and Exchange Commission Reports, PUC Reports, etc. Tr. 5052-5053. All parties concerned knew what the real, financed schedule was. As long as PECO did not finance additional work, the internal construction schedules were just facades.

The OCA submits that Limerick 1 was not completed earlier than actually occurred due to management decisions, not insurmountable construction hold-ups. These management decisions affected actual construction. As previously noted, Mr. O'Brien discussed the effect of the announced delays on construction as follows:

> Q. Mr. O'Brien, can you explain why this [reactor pressure vessel set] and other activities highlighted by TBA were late, even compared to a contemporaneous construction schedule?
>
> * * *
>
> Thus, tasks were not completed timely with reference to the so-called "target schedules" because they were unrealistic - the targets could not be met because PECO had already announced that it did not intend for the targets to be met, and would not fund construction so that the targets could be met.
>
> PECO believed in 1976 that it had six years until fuel load, and in 1978, PECO delayed fuel load again so that there were still six years of construction ahead. Had PECO been at all serious about meeting its target schedules, everybody--craft labor, subcontractors, supervision, and management-would have approached the job very differently.

OCA St. 1B at 13 (emphasis added).

Finally, PECO's Case 3 is a flawed analysis which relies on its Case 2. Case 3 purports to show that, even if Limerick construction had

been funded at the levels the Bechtel forecasts projected, construction could not have been completed and fuel loaded any earlier than July, 1984, or just 3 months earlier than its actual date of October, 1984. PECO St. 33 at 8. PECO Case 3, however, also includes all of the Company's other adjustments to Mr. O'Brien Schedule JJO'B-13. Id. Therefore, Case 3, presents little additional scheduling information. In fact, Mr. Coughlin states that Case 3 results in the same fuel load as Case 2 because construction in the containment drywell remains the critical path activity. Id. Since PECO Case 2 is an unreliable analysis relying heavily on as-built data, Case 3 is of little independent assistance.

Further, while Case 3 purports to be a financial restraint analysis, the financial restraints in Case 3 are not based on real restraints, but simply apply forecasted cash flows from each Bechtel Forecast. They obviously ignore the fact that such cash flows could have been supplemented as needed if construction so required or the Company desired.

Since the OCA submits that PECO's Cases 1, 2 and 3 do not provide support for a construction completion date later than July, 1982, the regulatory and licensing restraints in PECO's Case 4 will be discussed, in the following Section, apart from the construction schedule.

5. PECO's Regulatory Constraint Argument Is Unrealistic And Should Be Rejected.

In addition to its construction analyses, PECO has presented testimony asserting that even if Limerick 1 construction had been properly completed by mid-1982 in conformance with the then-existing NRC

regulations, including all quality assurance documentation requirements, the NRC would have kept Limerick shutdown for over two additional years. PECO Sts. 5A, 6A and 9A. The OCA submits that PECO's position on the effect of NRC regulation is unrealistic. Mr. O'Brien characterized Company witness Mattson's position on this as follows:

> Dr. Mattson has testified that the critical path to fuel load was not at Limerick at all, but at the offices of the NRC.
>
> * * *
>
> It is inconceivable to me to suggest that if Limerick Unit 1 had been properly completed in conformance with the then-existing NRC regulations, including the requirement for documentation, by early to mid-1982, the NRC would nonetheless have forced the plant to remain idle for two years before issuing an operating license. Even in the immediate wake of TMI, the licensing moratorium only lasted just over a year as described above regarding North Anna.

OCA St. 1B at 7.

PECO's position on NRC requirements for Limerick 1 improperly relies heavily upon what actually transpired. Through Dr. Mattson, and Messrs. Helwig and Sproat, PECO presented a purported analysis of when Limerick 1 could have been completed taking into consideration NRC requirements. These witnesses concluded that the earliest Limerick 1 could have received an operating license was May, 1984. PECO St. 9A at 39. Incredibly, however, they also noted that several items at Limerick 1 could not have been completed to support fuel load any earlier than October 1, 1984, or only 25 days sooner than actually occurred. PECO St. 33 at 8, PECO St. 6A at 10. The major flaw in the Company's analysis was discussed by OCA witness Dr. Hanauer as follows:

> The analysis of Company witnesses has concentrated on what actually happened; that is, how plant construction actually proceeded and how NRC licensing actually proceeded. In fact, the construction of the plant was completed in the Fall of 1984 and initial licensing for operation was accomplished by the NRC in October 1984. Indeed, Company witness Dr. Mattson develops "an earliest possible schedule for completion of the low power licensing process for Limerick 1." (PECO Exhibit RJM-1, starting at page 27) However, in general this exercise assumes that all NRC requirements were immutable; that is, the NRC would have imposed the same requirements on Limerick Unit 1 if construction had been completed in 1982 as was the case for Limerick Unit 1 whose construction was completed in late 1984.

OCA St. 2A at 10-11 (emphasis added).

The OCA submits that the Company's assumptions about the NRC licensing process are unrealistic. The OCA does not dispute that NRC requirements would have been implemented at Limerick 1; rather, it is the timing of implementation as compared to plant fuel load and commercial operation that is at issue. PECO assumes that all NRC requirements were not only immutable, but that the schedule for implementation, i.e. pre-fuel load, was immutable. Dr. Hanauer responded to this position as follows:

> Q. Could the NRC review have been completed by mid 1982?
>
> A. I believe it could. It wasn't attempted, because plant completion was still two years away.
>
> Q. What would have been the licensing requirements?
>
> A. The basic requirements of Limerick would probably have ended up looking pretty much like the requirements that Limerick actually had to meet. However, the implementation schedule for these requirements would not necessarily have been the same. Evidence from the other licensing reviews during this period shows that a large number of requirements for plants licensed in 1980-82 had their implementation postponed to a later time. The problem was that these plants were nearing

completion when the additional TMI licensing requirements were specified and people realized just exactly what was necessary to implement them. Originally, such groups as the NRC Lessons Learned Task Force and the NRC group which developed the TMI Action Plan had developed deadlines for implementation of the various new requirements on operating plants, plants then in licensing review, and future new plants (if there ever are any). However, we can see now, and the utilities and the NRC soon began to see at the time, that these schedules had been developed without an adequate appreciation of what was required to implement the various new requirements. The result was a wholesale postponement of implementation of many of the requirements. That is, another priority scheme had to be devised, to make sure that the TMI changes most necessary to safety were made promptly, while others that might be important but less urgent were deferred. Even in 1986, TMI-related changes are still being implemented on some plants.

OCA St. 2A at 16-18 (emphasis added).

PECO has unrealistically asserted that the NRC would have been completely inflexible in licensing a Limerick 1 completed in 1982 due to the higher population around the plant and the licensing contentions filed by intervenors. PECO St. 9A at 28-31. With regard to the high population density issue, PECO cites to the requirement that a Probabilistic Risk Assessment (PRA) and a subsequent Severe Accident Risk Analysis (SARA), be performed for Limerick and evaluated prior to licensing. PECO states that even if Limerick 1 had been completed two years earlier, the NRC would have required a PRA, and an analysis of that PRA, in the same manner and on the same schedule.

Dr. Hanauer commented on PECO's inflexible assumptions as follows:

A. I think the full-blown review of the PRA and the SARA would have taken several years, just as it did in fact. However, I do not believe that licensing of Limerick would have been delayed until the PRA and the SARA had been developed and fully reviewed by the NRC,

and litigated in the contested hearing. Rather, I believe that PECO and the NRC would have devised a way to accomplish an abbreviated review of the essential features of the Limerick plant and the Limerick site, so as to enable a preliminary safety decision to be made on a schedule consistent with the mid 1982 construction completion date of Limerick Unit 1. Such a review was in fact performed on Indian Point and Zion, to enable the NRC to decide whether operation in the interim was acceptable pending completion and review of their PRAs, which also took several years. These interim measures included the "60-day studies" performed by the Indian Point and Zion owners (PECO Exhibit RJM-1, p. 18) and also, for Indian Point at least, an initial NRC staff study based on WASH 1400, the Reactor Safety Study, and the known facts about the Indian Point site.

Q. Dr. Hanauer, what do you conclude about the role of the PRA in a mid 1982 Limerick schedule.

A. I believe that because of the high population density surrounding the Limerick site, the NRC would have required PECO to perform the PRA and the SARA, and that these reports would have been thoroughly reviewed by the NRC and its contractors, as actually occurred. However, I believe that some combination of preliminary work, staged work and reviews and license conditions would have been found so that the generation of the PRA and its review would not have impacted the mid 1982 completion and licensing date of Limerick Unit 1.

OCA St. 2A at 22-23 (emphasis added).

Dr. Hanauer also indicated that higher population, while possibly affecting commercial operation, would not normally affect the construction schedule itself. Thus he stated during cross-examination as follows:

Q. Would you agree, Dr. Hanauer, and I believe you have previously testified to this fact in other proceedings, that site-related aspects of plants may contribute significantly to the plant's cost and its scheduled performance as compared to other plants?

A. As a general proposition I do believe that.

Q. And similarly I believe, as you have also testified in other proceedings, that a plant in a high population density zone would experience greater costs and quite possibly greater schedules than a plant located in a lower population density zone?

A. I don't really know that. If we are talking now about construction costs it would cost more only if it had different design features, and I have testified that this plant did not end up with significantly different design features as far as I know due to its high population density.

The cost of the licensing procedure, which is small but not insignificant, might be more in a highly populated plant. And the cost of analysis, for example, the probablistic risk assessment, would be higher.

I don't know any reason for the construction schedule to be affected by the high population density.

Q. Would you not expect, Dr. Hanauer, that the Nuclear Regulatory Commission would require a plant located in a high population density area to install greater safety features of an engineering and construction nature than in a plant not located in such a zone?

A. I feel that this is not the case and it used to be a very strongly held position of the Atomic Energy Commission and the later NRC that they would not do this.

Tr. 2818-2819 (emphasis added).

PECO witness Mattson presented a schedule analysis in which he made the incredible assumption that a completed Limerick 1 would have stood idle for over two years while the PRA was waiting to be reviewed by the NRC. PECO St. 9A. Dr. Mattson's schedule analysis assumed that the PRA was required in the same time frame, mid-1980. Dr. Mattson's schedule, however, then posits that from the time the PRA was requested, until the time it was finally actually reviewed, Limerick would not have been licensed by the NRC even if all construction had been completed and

properly qualified by the NRC in conformance with its quality assurance requirements. For a portion of this time period, Dr. Mattson assumed no NRC review of Limerick's PRA at all, but simply Limerick standing idle while the NRC reviewed Indian Point's and Zion's PRAs. One must question whether PECO and the NRC would have required a completed Limerick 1 to stand idle up to two years while the NRC reviewed risk analysis reports at two other nuclear plants, which were already in operation.

Mr. O'Brien addressed Dr. Mattson's contentions on the effects of a PRA on licensing delay as follows:

A. The basis for Dr. Mattson's conclusion is given at Schedule 4 (Exhibit RJM-1) entitled "Hypothetical Earliest Possible Licensing Schedule For Limerick Unit 1." The problem is that it is only half "hypothetical." It demands that we accept a great deal of history as it actually transpired. For example, Dr. Mattson's Schedule 3 gives the As-Built Licensing Schedule, and shows that the NRC requested a Probabilistic Risk Assessment on May 6, 1980, informed PECO early in 1981 that the PRA had to accompany PECO's license application, and that the PRA printing was complete and submitted with the application in March, 1981.

Compare the beginning of this string of activities with Dr. Mattson's Schedule 4: it shows PECO's hypothetical application being submitted at the end of the third quarter of 1978, but it maintains the same actual date for the PRA request as shown at Schedule 3.

Q. Why was the PRA not required to accompany the hypothetical application back in 1978?

A. Dr. Hanauer has addressed this at length but the simple answer is that the NRC did not require PRA's in the pre-TMI era.

Dr. Mattson would have us believe, however, that even if the plant had been completed earlier, the consequences of the PRA could have been satisfied only in the way that they were, regardless of how much that delayed operations. I contend that the matter was handled as it was because it was assured that it would not delay the construction critical path to Fuel Load.

> The Company's approach on this issue demands that we accept the hypothesis that the sense of the NRC would have been the same in 1977-78 with regard to a plant scheduled for completion in 1982 as it was in 1980-81 for a plant scheduled to be completed in 1984. It most certainly would not.
>
> In sum, I cannot accept the constant insistence by PECO licensing witnesses that history as it was negotiated or transpired would have been precisely the same three years earlier.

OCA St. 1B at 8-9 (emphasis in added).

Obviously, all of these analyses have to make assumptions regarding what the NRC would have done if Limerick had been completed 27 months earlier. We do know, however, that the NRC did not delay actual construction completion and fuel load for Limerick and that the NRC was ready for Susquehanna in July, 1982.

PECO has also asserted that litigation surrounding PECO's license application would have impeded earlier completion. PECO St. 9A at 29. In actuality, litigation did not impact upon Limerick 1's construction completion or low-power operating license in October, 1984. Further, the effect of NRC litigation on Limerick's full power testing and commercial operation has been specifically allowed for in Mr. O'Brien's analysis. For example, while Susquehanna took just one year to go from fuel load to commercial operation, Mr. O'Brien used PECO's actual duration of 16 months. This provided for all effects of litigation on Limerick's full power license and commercial operation.

Focusing on PECO's allegation about the impact of contentions on the NRC's review of Limerick's license application, however, shows that, once again PECO has referred to what actually happened to assert that no

other alternative would have been possible. Dr. Hanauer discussed PECO's position, and the Company's erroneous conclusion as follows:

> Dr. Mattson has pointed out at least 2 collateral effects of the heavily contested proceeding on the licensing of Limerick: (1) the fact that their work might be reviewed and heavily cross-examined served to make NRC Staff reviewers more demanding and more rigid in their application of NRC licensing requirements; and (2) in order to settle some contentions, PECO committed to implementing various new (TMI and other) licensing requirements before fuel loading, even though the NRC might have allowed implementation to have been postponed.

Q. Do you agree with Dr. Mattson?

A. Yes, he is describing what actually happened on the time scale of the actual Limerick project.

Q. What would have happened in this respect if Limerick construction had been completed by mid 1982?

A. I believe that in these circumstances the NRC reviewers and their management and the Company would have had a different attitude toward what could have been accomplished by the fuel load date and what could and should be postponed until after that time. This might have resulted in more issues being litigated in the hearing before the Board, since presumably the Company would not have caved in and agreed to have implemented items whose implementation was not possible or practicable before the mid 1982 fuel load date.

* * *

Q. Dr. Hanauer, what do you conclude regarding the effect of the heavily contested proceeding on Limerick's licensing schedule if construction had been completed by mid 1982.

A. I believe that, if Limerick construction had been completed by mid 1982, the heavily contested proceeding would have begun much earlier than it actually did, and the schedule and implementation requirements of the NRC and the willingness of PECO to implement required changes before fuel loading would have been very different, taking into account what was possible and practicable on the mid 1982 schedule. This may have resulted in additional litigated

> contentions in the hearing, but I believe that favorable Board decisions related to low-power operating license issuance could have been made consistent with the mid 1982 hypothesized construction completion.

OCA 1A at 25-26 (emphasis added).

PECO has attempted to support its NRC-imposed delay argument by comparing Limerick to other nuclear plants. The plants PECO relies upon, however, clearly do not fit into the category of completed plants with all NRC requirements for quality assurance satisfied. Thus, for example, Dr. Mattson cited the Diablo Canyon Nuclear Plant. PECO St. 9B at 18. Diablo Canyon, however, had a number of design errors. In fact, Diablo Canyon was referred to by Dr. Hanauer as one of the plants the NRC delayed because it was "in a mess of its own making." OCA St. 2A at 13. The mess resulted from drastic NRC safety concerns,

> such as those associated with the discovery that the design process at Diablo Canyon Nuclear Station had been mismanaged and resulted in an unknown but probably large number of design errors.

OCA St. 1A at 11.

Dr. Mattson also cited to the Shoreham Nuclear Plant. It should be noted that the New York Public Service Commission found Long Island Lighting Company's management of Shoreham construction imprudent and disallowed construction costs of $1.39 billion. 71 PUR 4th 262, 327 (1986). The NYPSC found that LILCO's management of Shoreham's quality assurance program was imprudent, Id. at 308; that LILCO imprudently managed the procurement of Shoreham's emergency generator, Id. at 325-326; that LILCO failed to manage engineering manhours by the Architect-Engineer Stone and Webster, Id. at 320; and that LILCO failed to properly manage overall construction manhours at Shoreham, Id. at

322. The NYPSC also found that Shoreham construction should have been completed by December, 1981, and that the plant should have been in-service by August, 1982. Id. at 332. Considering all of the problems found at Shoreham and the NYPSC's holdings, PECO's reliance on the plant as a point of comparison with Limerick 1 is clearly misplaced.

As can be seen from the above discussion, PECO's position on NRC licensing constraints to earlier commercial operation relies heavily upon what actually transpired at Limerick 1. No one knows with certainty what the NRC would have done if faced with a competently built Limerick 1 in 1982. The OCA submits, however, that PECO's position on this issue is unrealistic. Dr. Hanauer's position more appropriately reflects what would have happened when he stated:

> If the plant construction had been completed in mid 1982, and the Company had filed its application in a timely way in mid 1978 or before, Limerick Unit 1 would have found its place in the priority scheme, and the requirements and schedules of the NRC licensing review would in all likelihood have been adjusted so as to succeed in making the required licensing decision by this time.

OCA St. 2A at 18.

6. PECO's Criticisms Of The OCA's Quantification Of The Cost Of The Delays Are Flawed.

a. Introduction

The OCA has quantified the cost of the 1976 and 1978 delays through the testimony of Mr. O'Brien. PECO has presented two types of rebuttal to the OCA's quantification. First, while not disagreeing that Limerick 1's overall cost was higher due to the longer schedule, PECO criticized Mr. O'Brien's actual delay quantification calculations.

Second, PECO asserts that ratepayers are actually better off as a result of the two delays in construction. These two Company positions will be addressed below.

b. The OCA's Quantification Of The Costs Of The 27-Month Delay Is Reasonable.

The Company has asserted that there are two errors in the OCA's quantification of the costs of the delays in Limerick 1's construction. PECO witness Hill asserted that Mr. O'Brien failed to include certain PURTA taxes in his delay calculation. PECO St. 18 E, K. PECO witness Clarey asserted that Mr. O'Brien's PECO Indirect Cost calculation is too high. PECO St. 4C. The OCA submits that the Company's positions on the quantification issues are in error. Further, it should be noted that the Company has not challenged Mr. O'Brien's calculation of the Bechtel Indirect Costs.

The OCA's quantification of the cost of the 27 months of delay is presented in OCA St. 1B, at 35, and Sch. JJO'B-30.1-30.6. The quantification presented therein includes two revisions to the OCA's original calculation. The first revision was to eliminate a possible double count of escalation and AFUDC on the Indirect Costs for Bechtel and PECO. OCA Exh. 86. The second revision was to include additional overheads and PURTA taxes where necessary. PECO witness Hill incorrectly asserted that Mr. O'Brien failed to include all appropriate PURTA taxes. PECO St. 18E, K. In fact, Mr. O'Brien's calculations as shown in Sch. JJO'B-30.1-30.6 properly include all necessary PURTA taxes. Compare Sch. JJO-B-17.4 (revised), 24.1-26 to Sch. JJO'B-30.1-30.6.

Mr. O'Brien responded to Mr. Clarey's assertions regarding PECO Indirect costs as follows:

As to the PECO overhead figures, Mr. Clarey states (at Statement No. 4A; page 16, line 37) the following:

> ...Public Notification costs relate to design and installation of the NRC-mandated Emergency Notification System at Limerick, and would all have been incurred regardless of the completion date.

Mr. Clarey continues at page 16, line 43) as follows:

> ...Training costs are related to the training and qualification of the plant operating staff and would all have been incurred earlier if the plant was completed in July 1982.

I am not willing to accept these assertions without additional proof. The fact is that PECO was repeatedly asked by OKA to supply annual overhead figures from which it would have been possible to determine when charges for these items were started. It would then be possible to correlate charges with events so as to assess what excessive costs might have been incurred. For example, the plant operating staff is usually deeply involved in startup and testing activities as part of their training. The Staff is generally brought to the plant when it is about 50% complete. This completion point was recorded in Limerick Forecasts beginning in 1979; at which point Bechtel was projecting an October, 1982, fuel load date. It is not very likely that the plant operating staff was reassigned elsewhere or laid-off when the fuel load date was officially slipped until October, 1984. It is very likely that this large group remained at the plant and continued doing something for that additional two years at considerable cost. Likewise, Plant/Start-up Staff and Maintenance costs were also accumulated during the delayed startup phase. Excess power costs were incurred during the 27-month delay period. In any event, these are insignificant matters when compared with PECO's failure to divulge the entirety of Bechtel Power Corporation's overhead and indirect costs during the 27-month period.

OCA St. 1B at 34-35 (emphasis added).

The OCA submits that calculations presented by Mr. O'Brien reasonably quantify the costs incurred by PECO due to the 27-month available delay in the completion of construction of Limerick 1.

c. PECO's Delay Cost/Benefit Analyses Should Be Rejected.

After years of claiming that delay in Limerick 1 would cost millions or hundreds of millions of ratepayer dollars, PECO now asserts that it has found a flaw in its previous analyses and that ratepayers are better off due to the later in-service date of the plant. The OCA submits that PECO's benefit of delay argument should be rejected.

This Commission has, in fact, already rejected this argument once. In its Order in the Limerick Investigation the Commission addressed this issue and stated as follows:

> PECO's final argument, that the relative economic benefits and detriments to ratepayers and shareholders of earlier versus later plant completion favored delay, is unpersuasive. We find this argument curious in light of the fact that PECO stresses that, because load growth has declined, the Limerick Units' main purpose is to replace oil fired generating capacity. If Limerick can be economically justified when compared to a combination of alternative sources of power and the retirement of oil fired plants, which by now have been extensively depreciated, the relative benefit to current ratepayers would have been greater if the oil capacity, and their associated costs, had been retired earlier by way of compressing rather than expanding the construction schedule. Further, as the nation as a whole experienced a period of double digit inflation and rising interest rates, delaying the necessary financing did and will continue to increase the ultimate costs of the plant financing.

56 Pa. PUC at 61 (emphasis added).

In reviewing the Company's assertions on this issue, prior PECO statements contradicting its current position on the cost of delay in Limerick's in-service date will first be discussed.

In PECO's rate case request docketed at R.I.D. 438, PECO's Senior Vice-President for Nuclear Power, Mr. Vincent Boyer, presented testimony regarding the cost effects of delaying the completion date of

Limerick 1. OCA Exh. 56. In that testimony, Mr. Boyer made a number of statements, both qualitative and quantitative, regarding the cost of delay. First, concerning delays at both Salem 2 and Limerick 1 and 2, Mr. Boyer stated:

> All three have been delayed from their original service dates. Further delay in the installation of these units would be uneconomical.

OCA Exh. 56 and Tr. 1049 (emphasis added).

In supplemental testimony in that proceeding, Mr. Boyer stated:

> The completion of the generating units [Limerick and Salem] on a timely schedule insures the lowest possible construction costs for the unit because the equipment can be purchased at a lower cost and there would be less AFUDC if the schedule is not delayed.

OCA Exh. 56 and Tr. 1050.

Mr. Boyer also stated as follows:

> If the Limerick construction schedule were delayed from its planned installation dates of 1983 and 1985 the final costs of the unit would be increased by approximately $140 million for each year that a unit is delayed.

OCA Exh. 56, Tr. 1050 (emphasis added).

In a presentation Mr. Boyer made to the PUC Staff on July 22, 1980, he discussed:

> Additional economic studies ... made to ... further demonstrate the advantage of completing Limerick as soon as possible.

OCA Exh. 57. One scenario analyzed by Mr. Boyer in the 1980 report was the advancement of Limerick 1 and 2 by one year from 1985-1987 to 1984-1986 in-service dates. The revenue requirement result of this analysis indicated:

> These savings average over $70 million per year for the 10 years, 1985-94.

Id. at 4.

In an April, 1985, PECO application to the Delaware River Basin Commission (DRBC), Mr. Boyer also discussed the cost of delaying Limerick 1, even by a month. In his statement to the DRBC Mr. Boyer stated as follows:

> There is a need for the power to be generated by Limerick Unit 1. Delays in full power operation will increase the cost of Unit 1 by $34 million per month. In addition, the fuel costs of PECO's customers will be increased by $15 million per month. Thus, the cost of delaying the ascension to full power program is estimated to be $49 million per month.

OCA Exh. 58, Attach. 3 at 3 (emphasis added). Thus, by April, 1985, PECO was claiming that the cost of a year of delay for Limerick 1 was $588 million (12 months X $49 million per month).

Finally, as a point of reference, Mr. Boyer presented an Affidavit in September, 1982, to the Commonwealth Court of Pennsylvania in PECO's appeal of the Commission's Order in the Limerick Investigation at I-80100341. His affidavit addressed, inter alia, the cost of delaying construction of Limerick 2 by one year. This affidavit was reviewed with Mr. Boyer during cross-examination as follows:

Q. Am I correct that as part of this testimony you were discussing the cost of a one-year deferral of Unit 2?

A. Yes.

Q. And you quantified the cost of a one-year deferral on page 8 of that affidavit; is that correct -- or you summarize your quantification on page 8?

A. Yes.

Q. And am I correct that under the company's analysis, as shown in your affidavit, at the time this document was filed the cost of the one-year deferral of Unit 2 was $469 million?

A. That's as stated in the summary, yes.

Q. And of that the largest amount for $291 million was for AFUDC, $84 million for escalation and $82 million for loss of efficiency?

A. Yes.

Tr. 1058 (emphasis added).

Mr. Boyer has not disputed the fact that if Limerick had been completed sooner, it would have cost less. Thus, for example, he stated during cross-examination as follows:

> The Engineering Department's view was always that the quicker we could get the plant completed, the capital costs would be the least amount, since AFUDC is an overriding cost.

Tr. 5052.

PECO witness Dr. Lewis Perl has also previously presented testimony to the Commission on the costs of delay in Limerick's construction schedule. In his testimony in the Limerick Investigation I-80100341, Dr. Perl discussed the cost of delaying Limerick by two years from the then 1985-1987 schedule. In his testimony on this issue, Dr. Perl stated as follows:

Q. What would be the effect on your estimate of shifts in the construction schedule for the Limerick facility?

A. Obviously, the savings from construction of Limerick are also sensitive to the construction schedule for these facilities. The savings from Limerick will decrease significantly if completion of this facility is further delayed; this delay will increase the cost of Limerick and decrease the savings in economy interchange cost that occurs if the facility is completed in time. In order to test the sensitivity of my conclusions to this result, I examined the savings from constructing Limerick if this facility is delayed so that the first unit is completed in 1987 and the second unit in 1989. The results of this analysis are examined in Table 4A. The present value of the savings from constructing Limerick is $4.4

billion if the schedule is delayed to 1987 versus $5.7 billion if it is completed on time. As we can see from this table, even with a delay of this magnitude, there are still significant savings from completion of the Limerick facility. They are reduced substantially, however, by comparison with those occurring in the base case.

OCA Exh. 44 (emphasis added).

As can be seen, Dr. Perl found a $1.3 billion present value cost of a two year delay in in-service dates for both units. In a PECO rate case in the same time period, Dr. Perl testified regarding a 6 month delay in the in-service dates of the Limerick station. In testimony dated December, 1981, Dr. Perl stated as follows:

> [I]t appears to me that without the inclusion of CWIP in rate base PE could find it quite difficult to maintain the construction schedule for Limerick. Without CWIP, maintenance of the construction schedule requires PE to raise $1.6 billion from external sources over the period 1983 to 1985. Raising this large sum could pose serious financial difficulties given PE's current price/book ratio and bond rating. If the sum cannot be raised, the only alternative is to spend less and allow some slippage in the construction schedule. However, given the amount already invested in the project and the current stage of construction, such slippage would be very expensive to consumers. To calculate the costs of slippage, I compared the effect on PE's revenue requirements of on-time completion with a six-month slippage in the construction schedule for both units. The estimated effect on revenue requirements, which takes account of both higher completion costs and increased energy costs during the period of delay, has a present value of $274 million (at a discount rate of 13.7 percent).

OCA Exh. 45 (emphasis added).

Now that Limerick 1 is completed, 27 months later than necessary, however, PECO takes the position that these substantial delays either had no economic effect or that they actually benefitted

ratepayers. The Company's position, however, is based upon unrealistic and in some cases, extreme, assumptions.

The basis for PECO's current analysis that ratepayers are better off due to the construction delays can be found in PECO witness Hill's testimony, PECO St. 18 E at 4-5, as well as a parallel analysis by Dr. Perl in PECO St. 11A at 17-19. Mr. Hill's analysis, however, relies upon three unrealistic assumptions about pre-commercial costs, post-retirement costs, and lower capacity factors to show the purported benefits of delay. Thus, out of his calculation of a $352 million present value benefit of delay for Limerick 1 and 100% of Common, Mr. Hill calculates a present value benefit of $234 million due to an assumed cost in the years 2022-2024 to replace Limerick, and a present value benefit of $339 million due to supposed higher financing requirements in the years 1975-1985. PECO St. 18E at 4. Also, as staff witness Robert Rosenthal pointed out, Mr. Hill's analysis includes a hypothetical derating of Limerick 1 in summer months due to water unavailability. Staff St. RAR-2 at 6. This may represent the only public analysis PECO has ever done which assumed water shortages and unit deratings for Limerick. It is noteworthy that it has been employed solely to show how fortunate ratepayers were that Limerick was delayed for two years. Each of the assumptions underlying Mr. Hill's analysis should be rejected as a basis for quantifying costs of delay.

The OCA submits that Mr. Hill's first purported benefit of delay--delay of a replacement unit in the year 2022--is extremely speculative. Staff witness Rosenthal called Mr. Hill's analysis,

> a significant departure form the analytical framework employed by the Company during the course of

construction of Limerick #1.

Staff St. RAR-2 at 5. Mr. Rosenthal also noted that:

> The departure from prior techniques has produced a net present value cost of $169 million in carrying charges and $65 million in operating costs for a total of $234 million. This amount is over 66% of Mr. Hill's postulated delay benefit and represents extreme speculation on the course of events in the years 2022 to 2024.

Id. (emphasis added).

Similar criticisms regarding PECO witness Perl's delay benefit analysis were made by UUC/UP witness Chernick, thus, Mr. Chernick noted:

> Q. Dr. Perl (PECO Statement 11) has suggested that the delays in Limerick construction in the 1970's were advantageous to ratepayers, since the increased cost of the plant will be more than recouped in higher fuel savings in the last years of the plant's life. Do you have any comment on this position?
>
> A. Yes. there are two major flaws in this argument. First, the economic benefits of the unit near the end of its life are quite uncertain. If Limerick 1 is in operation in the second and third decades of the twenty-first century, its operating costs may not be much less than the savings it creates. We simply have no way of knowing whether Limerick 1 would be backing out expensive fossil fuels, very inexpensive fluidized-bed coal cogeneration, or some power source now scarcely imagined. It is difficult to believe that rational decision-makers would voluntarily incur the enormous current costs of the delayed Limerick 1, and have sacrificed the benefits of having Limerick 1 in service some years earlier, simply to have a chance at some highly speculative benefits which the unit might deliver after the year 2010.

UUC/UP St. 1 at 43 (emphasis added).

Mr. Hill's second purported benefit from the 27 month delay is the avoidance of higher financing requirements during Limerick's construction. Mr. Hill's testimony on this point is based upon Mr.

Paquette's testimony on the cost of earlier construction financing. Mr. Paquette's construction financing analysis, however, is flawed for a number of reasons and should not be relied upon.

Mr. Paquette's analysis assumed that had Limerick 1's construction schedule been advanced, PECO would not have made any other changes to its operating or construction budgets or priorities. As he agreed on cross-examination, Mr. Paquette held all other factors in his analysis constant. Tr. 4844. Thus, he assumed Limerick Unit 2 was constructed and completed 2 years after Limerick 1, even though construction on Unit 2 was suspended 4 years before Limerick 1's actual commercial operation date. He assumed that under a shorter construction schedule, PECO would retain 100% ownership of both Limerick units even though efforts to sell or share portions of the station were made throughout the 1970's and into 1982. Tr. 4845. Mr. Paquette also assumed that Salem 2 ownership would have been retained by PECO throughout its construction period even though the output of the plant was sold as soon as it went into commercial operation. Tr. 4845. Finally, Mr. Paquette assumed the same level of wage increases for PECO employees; the same number of PECO employees; and the same level of non-Limerick construction expenditures. Id.

Obviously, if Mr. Paquette assumes that all additional earlier Limerick 1 financing is incremental to other concurrent actual financing, the Company's financing costs will increase. There is no dispute that PECO was having some financial difficulties in the late 1970's, due primarily to its ambitious multi-plant construction projects and particularly to simultaneous construction of Limerick 1 and 2. As Mr. O'Brien stated:

> It should be noted that, to the extent manpower availability and cash flow uncertainty were jeopardizing the Unit 1 fuel load date, the conditions were exacerbated by the simultaneous construction of Unit 2.

OCA St. 1 at 15.

Mr. Paquette's hypothetical assumptions, however, are completely unrealistic. The OCA submits that PECO would have been able to reorder its financing priorities had it really desired to complete Limerick on a timely schedule.

The Commission addressed PECO's financial activities in its Decision in the Limerick Investigation as follows:

> It appears, from the record before us, that PECO's 1976 and 1978 construction delays were caused by PECO's financial difficulties, which in turn were caused by its ambitious construction program and its ever decreasing load growth; conditions similar to those causing the 1974 delay. While it is true that PECO's financial condition deteriorated from its 1974 levels, we are of the opinion that, at the least, PECO's ambitious construction plans exacerbated its financial difficulties.

56 Pa. PUC at 60.

Mr. Hill's present value revenue requirement analysis also suffers from the assumption that Limerick 1 necessarily would have been granted 100% rate treatment if it had entered commercial operation in 1983. One of the reasons cited by ALJ Klovekorn for PECO's delay in construction was the fear of an excess capacity adjustment. I.D. at 53. Mr. Paquette's testimony in the Limerick Investigation, in fact, cited a 66% reserve level in 1981 if Limerick 1 had been on line at that time. Staff Exh. 14 at 18.

OCA witness Knudsen commented on PECO's position with respect to rate treatment of a completed Limerick 1 in 1983. He noted that the

Company's position is quite speculative in light of both the excess capacity Limerick 1 would have represented in 1983 and also the power markets in that time frame. Thus, Mr. Knudsen stated as follows:

> That argument concerning the comparative capital return on the investment presupposes that the rate treatment of the plant in a 1982-1983 time frame would have been to place it totally in base rates. In fact, there would have been two other options. First, the record indicates that Limerick 1 would have represented excess capacity on the PECO system in the relevant time frame. I believe it is very plausible, therefore, that all or a part of Limerick would have been excluded from rates on that basis.
>
> Secondly, PECO was selling the output from Salem Unit #2 to Jersey Central Power and Light Company (JCP&L) in 1982 and 1983. That contract was set to expire at the end of 1984. It was no secret that JCP&L was actively looking for firm load to purchase and had, at that point, been foiled in its attempt to bring power (900 megawatts) from Canada under Lake Erie. JCP&L subsequently purchased 945 megawatts of capacity from Pennsylvania Power & Light Company (PP&L).
>
> Thus, while it is true that PECO ratepayers avoided paying capital charges on Limerick #1 for 27 months, we can only speculate as to whether all or part of the plant would have been sold to another utility or excluded as excess capacity if it had been completed earlier. One cannot simply assume, therefore, that ratepayers would have had to pay 100% of Limerick costs if the plant had been completed on schedule.

OCA St. 7 at 17-18 (emphasis added).

The Kansas Corporation Commission adopted a position quite similar to Mr. Knudsen's on this issue in its Wolf Creek decision as follows:

> In this context, however, it is not reasonable to even attempt to determine whether ratepayers benefited from construction delays. In addition to posing the wrong question, such an analysis requires questionable assumptions to be made. For instance, Mr. DeStefano's

analysis assumed full rate base treatment of Wolf Creek under both the February 1984 and April 1985 completion date scenarios. Given our decision in other portions of this order, such assumptions are unwarranted. We cannot speculate what rate base treatment would have been accorded Wolf Creek had it been completed fourteen and one-half months earlier. We may safely assume, however, that under the considerations we apply today, the treatment of Wolf Creek could vary over time. We find that exclusion of AFUDC associated with the controllable delay is a reasonable method of quantifying the cost of that delay.

70 PUR 4th 475, 507 (1985) (emphasis added).*

Finally, if the additional direct, indirect and AFUDC costs resulting from PECO's delays are permitted in rates, this would result in inequitable and incorrect regulatory responses to utility actions. OCA witness Knudsen addressed this issue as follows:

> Assuming these circumstances, it would then be particularly difficult to reconcile the treatment accorded the Limerick plant with that accorded PP&L's Susquehanna Units 1 and 2. In the latter cases, the Susquehanna units were found to be prudently constructed at costs much lower than those of Limerick. Management was found to have completed the plants prudently, but was confronted with excess capacity adjustments in both instances when rate recognition was requested. In response, PP&L moved in the first instance to sell its excess capacity and in the second was required to bear the consequences in terms of a denial of all equity return on the unit.
>
> Compare this to a plant which was delayed at substantial expense to avoid an excess capacity adjustment. On one hand, where a plant is efficiently built, but unneeded, the Commission orders a sharing of the costs of excess capacity. On the other hand, a plant is not efficiently built but is delayed in order to avoid a penalty. The proposal to recover a return on and a return of all costs of the latter plant, including the cost of delay, is patently unfair.

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* The Commission also adopted excess capacity adjustments for the various Wolf Creek owners.

> It is also instructive to compare PECO's proposed treatment of Limerick Unit #1 with its own treatment of Salem Unit #2. In the latter instance, PECO sold its share of the output from the unit and moved all the costs and benefits below the line until the sale was terminated. When PECO sought base rate inclusion for Salem Unit #2, the plant certainly did not include an allowance for AFUDC and direct and indirect costs that would have been incurred if the plant had been delayed rather than sold.
>
> If PECO is unchecked on this issue, any incentive a utility would have for efficiency in construction is defeated. Indeed, utilities would be given an incentive not to manage effectively.

OCA St. 7 at 20-21 (emphasis added).

The "qualitative benefit" argument presented by PECO relating to the longer schedule at Limerick 1 is also invalid. As part of its efforts to distinguish Limerick from Susquehanna and LaSalle, PECO asserts that, while Limerick has a higher cost, the plant should also be more reliable, with additional operability and safety features. PECO St. 5A at 18. Mr. O'Brien responded to PECO's claim as follows:

> I should caution, however, that PECO's assumed correlation between better reliability, operability and safety, and higher cost and longer schedule is tantamount to counting chickens before they are hatched. Among all of the nuclear plant owners I have interviewed, there has been a universal claim of the same benefits. I do not doubt their intent, but the achievement of these benefits has been less than universal.

OCA St. 1B at 4 (emphasis added).

The OCA submits that for all of the above stated reasons, PECO's analysis of the benefits of delay should be rejected as both inaccurate and improper.

7. PECO's Limerick Cost Presentations Are Based Upon Imprecise Retrospective Cost Estimates.

The OCA has presented a quantification of both the costs of the 1976 and 1978 delays in the construction of Limerick 1, and the costs of the Mark II design error. The OCA believes that these quantifications are reasonable best estimates of the costs incurred by PECO. The Company has presented rebuttal testimony attempting to show errors in the OCA's calculations. The implied precision with which PECO develops its calculations, however, must be recognized as a facade.

The vast majority of the cost information on Limerick 1 presented by PECO is a result of retrospective engineering estimates. This is due both to the fact that cost accounting was done on a total station basis for most of the time construction was proceeding and that PECO and Bechtel did not track actual expended costs by work task.

The OCA asked numerous discovery questions of PECO seeking cost data. One example is contained in OCA St. 1, Sch. JJO'B-16. The questions were as follows:

DR-OCA-6-1

> PECO's answer to DR-OCA-1-6b (attached) gave semi-annual AFUDC interest rates and the yearly dollar amount accrued for Unit 1 and Common Facilities.
>
> DR-OCA-1-10 requested the yearly project expenditures expressed separately for each unit and for Common Facilities, and subdivided as to direct costs, indirect costs excluding AFUDC, and AFUDC. PECO responded that the Forecasts provided in answer to DR-OCA-1-7 contained the data.
>
> The BPC Forecasts were not created yearly, do not give yearly expenditures, and most do not provide sufficient data from which Unit 1 and Common can be extrapolated.

Please provide the actual total BPC costs for Limerick 1 and Common on either an annual or semi-annual basis.

* * *

DR-OCA-6-2

PECO's answer to DR-OCA-II-I gave the company's budgeted construction costs contemporaneous with each Forecast through No. 6.

OCA requires actual annual or semi-annual (at the company's discretion) PECO project expenditures through 1984 (and a later update for 1985 to the Comm. Ops. date) for Unit 1 and Common Facilities.

Also, provide a breakdown of these periodic costs into major components, e.g., equipment and bulk commodity procurement, Field Management, Home Office Staff, Taxes and Overhead, and AFUDC for each period.

PECO's response was to combine both interrogatories into one answer as follows:

Actual PECO project expenditures for Limerick 1 and Common on either an annual or semi-annual basis are not available. These costs were tracked on a total project basis, that is, with Unit 1, Common and Unit 2 combined.

Recently, actual costs associated with the total Limerick project were separated into two categories: 1) Limerick 1 and Common, and 2) Limerick 2. As of 12/31/84, the actual total PE direct cost for Limerick 1 and Common was $427.2 million. These data are not available by years.

In lieu of the BPC annual data requested in DR-OCA-6-1 and the PECO annual data requested in DR-OCA-6-2, we are supplying the data contained in Attachment DR-OCA-6-2(a), which is annual data for combined BPC and PECO. These data have been developed using our professional experience to provide an estimate of the annual expenditures for Limerick 1 and Limerick Common, with BPC and PECO expenditures combined.

Id. at Sch. JJO'B-16.7 (emphasis added).

In a follow-up interrogatory, OCA attempted to gain additional cost information. This interrogatory asked PECO for actual annual cost data segregating PECO costs from Bechtel costs. The Company's response was as follows:

> As previously stated in response to DR-OCA-6-2, actual project expenditures for Limerick Unit #1 and Common facilities on either an annual or semi-annual basis are not available.
>
> The estimating process used to develop Attachment DR-OCA-6-2(a) did not require a further breakdown of annual expenditures into the requested Bechtel and PECO expenditure categories. Consequently, no such breakdown was performed. However, one method for arriving at this breakdown is to assume that the annual relationship of these direct costs was identical to the relationship that existed on a cumulative basis at 12.31.84. It should be noted, however, that such an approach could be subject to significant inaccuracy in certain years.
>
> The Company's response to DR-OCA-7-3 provides the latest available actual data together with estimated expenditures to completion for Limerick Unit #1 and common facilities on a combined Bechtel and PECO basis.

OCA Exh. 89 (emphasis added).

As these Company answers show, PECO had to go back and estimate what expenditures in each year were Bechtel or PECO costs and then separate (or unitize) these costs between Unit 1, Unit 2 and Common Facilities. PECO witnesses Love and Kononetz discussed the development of the Limerick 1 cost estimates in their Direct Testimony as follows:

> Cost Unitization. Individual project cost increases, with the exception of Forecast 7 and subsequent trends, were prepared and reported on a station basis with little or no "unitization" of costs, i.e., allocation of costs to Unit 1, 2, or Common Plant, specifically. Forecast 6 provided the initial unitization of costs between units, but it did so only on an account basis, not for individual cost increases. Additionally, all PECO Capital Authorizations, with the exception of Capital

> Authorization Supplement 3 issued in July 1984, reported costs on a station basis. Consequently, to reconcile those costs attributable to Unit 1 and Common a unitization of Forecast entries and Capital Authorization accounts was necessitated.

PECO St. 8 at 291 (emphasis added).

All of the cost breakdowns in this case, including those of the Company, are only estimates. The OCA submits that its quantification of the costs of the 1976 and 1978 delays, as well as the costs of the Mark II design errors discussed below, are reasonable and should be adopted by the Commission.

G. Costs Resulting From General Electric's Imprudence In Designing The Mark II Containment Should Be Disallowed From Rates.

1. Introduction

Limerick 1 is a General Electric (GE) Boiling Water Reactor (BWR) based on a Mark II reactor containment design. Due to problems resulting from initial inadequacies in the Mark II design, the owners of plants with that design, including Limerick 1, had to incur substantial costs to correct the designs of their plants. As will be discussed below, the cause of the inadequacy in the Mark II design was General Electric's imprudent failure to adequately analyze the design and specify the forces that would occur in the containment. The OCA submits that the costs which were incurred at Limerick 1 due to the original improper design should not be passed on to ratepayers. As quantified in this case, those costs total $194 million, including AFUDC.

2. General Electric Was Imprudent In Designing And Testing The Mark II Containment.

OCA witness Dr. Stephen H. Hanauer* described the Limerick Mark II containment as follows:

> All containments provide an enclosure around the reactor and the primary system to "contain" radioactive fluids. The Limerick plant uses a containment concept developed at General Electric called "pressure suppression," which includes, inside the containment enclosure, a large pool of water to absorb the heat and steam released from any leaks in the primary reactor system. The Limerick plant uses the Mark II configuration of the GE pressure suppression containment. The containment system includes the large pool of water, called the suppression pool, and a separate large enclosed space, called the drywell, in which the reactor and the primary system are located. The drywell is connected to the suppression pool by large pipes called downcomers, which have open ends located far below the surface of the water in the suppression pool.
>
> Steam or hot water coming out of a leak or break in the primary system is directed by the downcomers into the suppression pool, where the relatively cool water absorbs the heat and turns the steam back into additional water. This process is called "quenching".
>
> In a boiling water reactor, such as Limerick, there are valves on the main steam pipes which open automatically if the pressure gets too high, and let out some of the steam to lower the pressure and protect the primary system against overpressure. These valves open not only during accidents, but during certain plant maneuvers which are expected typically a few times a year in a power plant. The steam coming out of these safety/relief valves is another source of high temperature fluid. Pipes from these valves are used to carry this steam below the surface of the suppression pool so the water can absorb the energy in this steam just as it would in an accident. The suppression pool thus serves to quench

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* For a portion of his 12-year tenure at the NRC (1979-1982), Dr. Hanauer was directly responsible for that agency's review of Mark II issues. Tr. 2791.

> hot water and steam from two sources: (1) from the safety/relief valves during plant maneuvers and certain accidents, via the safety/relief valve discharge pipes; and (2) from leaks or breaks in the primary system (and other classes of accidents) via the downcomers..

OCA St. 2 at 7-8.

The original GE pressure suppression system was designed in the 1950's. OCA St. 2 at 9. The tests performed at that time provided the basis for future development of the Mark II design, its predecessor the Mark I, and the later Mark III. The error in GE's design and analysis was explained by Dr. Hanauer as follows:

> The original design considered the mechanical loads associated with accidents in the drywell, including pressure and temperature increases, earthquake loads, the load from the jet of water coming out of the downcomer, and the usual dead loads, hydrostatic loads and test loads required for the design of any structure. However, the design did not include any allowance for the large dynamic loads from the quenching process which had now been shown to occur for both safety/relief valve events and accidents in the drywell.
>
> * * *
>
> The basic problem with the Mark II containment was the inadequate load specification provided in its original design. Had the containment and the equipment in it been built as originally specified, there is a substantial probability that safety/relief valve actuations would have caused damage. The safety/relief valve quenchers, the suppression chamber, and the equipment in the drywell were inadequately designed to withstand the shaking caused by the quenching process. This could likely have occurred during normal operation and anticipated transients over the life-time of the plant, which routinely involve multiple actuations of the safety/ relief valves. The plants where damage has actually been experienced are earlier pressure suppression containment designs, where the drywell is supported separately from, and relatively independently of, the suppression chamber.

OCA St. 2 at 13-14 (emphasis added).

The design of the Mark II containment was developed by GE. It was GE that did not adequately measure, predict, or specify the loads and forces which the Mark II would develop during the steam quenching process. OCA St. 2 at 15. GE did not adequately measure these loads for either the potential loss-of-coolant accident or the more common safety/relief valve discharges . Id.

It is PECO's position that the Company was not aware of the problems with the Mark II design until 1975. The forces in the Mark II which GE had failed to adequately consider in designing the containment did not, however, first reveal themselves in 1975. They had been known since the first early tests. As Dr. Hanauer stated:

> No new laws of nature were discovered that showed the need for new design loads. The forces generated during quenching have been known for a long time. During some of the GE pressure suppression tests in the early 1960's, noises were heard indicating large pressure pulses, which would lead to large potential forces. The technology for measuring pressures and forces was available then, and could and should have been employed at the tests.
>
> * * *
>
> Sufficient theoretical and experimental work should have been done to enable developing an acceptable Mark II design in the first place. GE's failure to do so was unreasonable and imprudent.

OCA St. 2 at 14, 20 (emphasis added).

Due to the errors by GE in specifying the forces which could be exerted on the Mark II containment, the design of Limerick's containment structures, systems and components, and also other equipment subject to shaking because of its attachment or proximity to the containment, had to be re-analyzed and, where necessary, redesigned and reworked. OCA St. 2 at 18.

With the industry's acknowledgement of the Mark II forces in 1975, programs were developed to resolve the problem. These programs continued throughout the 1970's and 1980's. The first two Mark II plants to resolve the design and construction problems and complete construction were LaSalle 1 and Susquehanna 1. These plants, as noted in previous sections, completed construction in April and July, 1982, respectively.

3. PECO May Not Legally Charge To Ratepayers Costs Incurred Due To Imprudence By General Electric.

The OCA submits that, as discussed above, the costs incurred by PECO to correct for the Mark II design errors stemmed from the imprudence of PECO's contractor, GE. Based upon the law of Pennsylvania, these costs cannot be passed on to ratepayers. The OCA recognizes that in Pa. PUC v. Pennsylvania Power and Light Co., 57 Pa. PUC 559 (1983), the Commission did not disallow Mark II costs incurred at Susquehanna 1. The OCA submits, however, that based upon the evidence in this proceeding including the additional information which has become available since the PP&L case, a finding of GE's imprudence in the design of the Mark II is fully supported by the record.

The OCA submits that the law of Pennsylvania utility regulation is that imprudently incurred costs may not be charged to ratepayers. The fact that, as with Mark II, the imprudence was on the part of an agent or contractor of the utility is irrelevant. The most recent and comprehensive discussion of this Commission's standard for review of imprudently incurred utility costs can be found in the case of Re Salem Nuclear Generating Station, 70 PUR 4th 568 (1985) (PECO ECR 8).

In PECO ECR 8, the Commission reviewed extended outages at PECO's baseload nuclear plants. The Commission found, inter alia, that two outages at PECO's Salem Unit 1 were extended due to imprudent actions by PECO or its agents, Public Service Electric and Gas Company (PSE&G) and Westinghouse. The first PECO ECR 8 outage involved maintenance and operating related activities. The second outage resulted from the failure of the Unit's generator due to a manufacturing defect. With respect to both outages, PECO argued that it properly selected PSE&G and Westinghouse to construct, operate and maintain Salem. PECO therefore asserted that it could not be held liable for the mistakes of PSE&G or Westinghouse. In rejecting PECO's position on this issue the Commission quoted with approval from the ALJ's Recommended Decision as follows:

> [T]he question thus becomes whether PECO is entitled to recover replacement power costs where the failure was the apparent result of a manufacturing error. PECO quite naturally argues that the errors of an independent expert are not properly imputed to the utility in determining the recovery of replacement power costs. In support of its argument, PECO cites us to Pennsylvania P.U.C. v. Pennsylvania Power & Light Co., 55 PUR 4th 185 (1983), together with two cites from other jurisdictions; Re Boston Edison Co., DPU Docket 1009-G (July 27, 1982, and Central Maine Power Co., Docket No. U. #3360 (August 27, 1980).
>
> We disagree with PECO's assessment and adopt the position set forth by Staff and the OCA to the effect that prior Commission action supports holding PECO liable.
>
> * * *
>
> The Staff and the OCA submit and we agree that the rule applied by the Commission in the Met-Ed case is the appropriate one for the present case. It must be recognized that the basic question is who should pay for the cost of the improper design and manufacture of the Salem 1 generator. The cost is represented by replacement power costs in this ECR. Including those costs in PECO's ECR means that all ratepayers are

> charged for Westinghouse's actions. This insulates both PECO and Westinghouse from responsibility for the generator failure. Conversely, denying ECR recovery places the costs on the party most capable of pursuing legal remedies and negotiating future contractual protections, PECO. Only PECO can structure its operations in such a fashion as to minimize the costs of contractor error or pursue damages should errors occur.

70 PUR 4th at 606 (emphasis added). The Commission Order further stated as follows:

> Prior decisions of this Commission, cited in the first part of this Opinion and Order, clearly indicate that this Commission does not share PECO's views concerning a utilities' responsibilities for contractor errors. We continue of the view that a utility such as PECO which selected the contractor through its agent, PSE&G, should bear the risk of contractor performance failures.

70 PUR 4th at 597 (emphasis added; footnote omitted).

The prior decisions referred to by the Commission in its Order in PECO ECR 8 addressed both construction related issues and replacement power cost recovery. In the case of Pa. PUC v. Metropolitan Edison Co., 28 PUR 4th 555 (1979), the Commission disallowed Met-Ed a return on costs of construction which were imprudently incurred. The Commission found that the imprudence resulted from actions by Met-Ed's contractor, and not Met-Ed itself; however, it also recognized that Met-Ed's ratepayers were free from fault. Thus the Commission stated as follows:

> We concluded that, although the malfunctioning of the TMI-2 steam safety valve is not attributable to a lack of prudent judgment on the part of management, and while Respondent asserts that it should not bear any costs that are not recovered in a pending suit against [the supplier of the valves] we believe that this situation is analogous to that of the TMI-I girder ring, (R.I.D. 170-171, 50 PUC 17, 102) and, as there, we are of the opinion that Respondent's ratepayers should not be made to bear the burden of the costs of

> replacing the malfunctioning steam valves, for it was the respondent, not its ratepayers, which selected the contractor to provide the valves and respondent and stockholders should bear the risk of performance failure.

28 PUR 4th at 562-63 (emphasis added).

In the Met-Ed case, R.I.D. 170-171, Pa. PUC v. Metropolitan Edison Co., 50 Pa. PUC 82 (1976), referred to by the Commission in the discussion above, Met-Ed was denied the recovery of a return on that portion of the cost of TMI-I attributable to the faulty concrete pour of a ring girder. The Commission excluded the amount of the additional cost from the Company's rates without finding it necessary to assign responsibility between the utility and its contractor, declaring that:

> It is apparent from the record that imprudent procedures were followed in connection with the concrete pour at TMI. Respondent was reluctant to provide detailed evidence of the culpability for the faulty pour pending completion of its investigation and possible litigation. Regardless of subsequent litigation which may determine the responsibility for the faulty concrete pour at TMI, we are of the opinion that respondent's ratepayers should not be made to bear this burden. Consequently, we disallowed $4,500,000 from rate base which represents respondent's share [GPU subsidiaries, Pennsylvania Electric Company and Jersey Central Power & Light Company, own the other shares] of an estimate of the faulty concrete pour for the purpose of these proceedings.

50 Pa. PUC at 102 (emphasis added). The Commission's ratemaking treatment of the faulty pour was re-affirmed in the next Met-Ed rate proceeding. Pa. PUC v. Metropolitan Edison Co., 26 PUR 4th 176, 181 (1978).

In the case of Parktowne v. Pa. PUC, 61 Pa. Commw. 285, 433 A.2d 610 (1981), the Commonwealth Court reviewed an appeal of the Commission's rate base disallowance of $10.5 million associated with

imprudence in the construction of Salem Unit 1. The Commission found that PSE&G had inadequately managed the construction of Salem 1, and that PECO had not properly monitored PSE&G's operations. While reversing and remanding the Commission decision as to the total amount of the costs associated with mismanagement, the Court stated:

> We agree with the Commission that PECO's customers are not required to reimburse the utility, through rate charges, for expenditures imprudently made.

61 Pa. Commw. at 295, 433 A.2d at 615. On remand, the Commission reinstituted the Salem 1 rate base adjustment, but at a $5.9 million rather than a $10.5 million level. See Pa. PUC v. Philadelphia Electric Co., 56 Pa. PUC 82, 89 (1982).

In the PP&L Susquehanna 1 rate case, Pa. PUC v. Pennsylvania Power and Light Co., 57 Pa. PUC 559 (1983), this Commission, while not finding PP&L's construction costs at the Susquehanna Unit 1 nuclear power plant imprudent, stated:

> The Commission's standard continues to be one of disallowing any construction costs that are unnecessarily or imprudently incurred, unmindful of any potential contractual litigation between the utility and its contractor.

Order on Reconsideration at 6.

The Commission has also discussed disallowance of imprudently incurred costs in the context of energy cost rate or fuel adjustment clauses.

In the Commission's Investigation into the extended outages of the Beaver Valley I Generating Station, this Commission held that Duquesne Light Company had failed to meet its burden of proof that costs

of replacement power were prudently incurred. Pa. PUC v. Duquesne Light Co., 54 Pa. PUC 695, 755 (1981). The Beaver Valley plant was shut down due to NRC concerns about an incorrect seismic analysis used in the original design of the plant. In discussing Duquesne's actions, the Commission stated as follows:

> The question naturally arises as to whether some action on the part of Duquesne could have avoided the shut down on March 13, 1979. The evidence of record from Mr. Russell an NRC employee indicates that had the NRC staff had in hand the information which Duquesne did produce by April 20, 1979, some five weeks later, in all probability the plant would not have been shut down (See Tr. 616). Had Duquesne meaningfully addressed the problem some two or three months prior to March 8, 1979, the type and amount of information which would have been available almost certainly would have prevented a shut down. Duquesne has taken the position that this shutdown was a risk to be borne by ratepayers (Duquesne Brief, page 212). Duquesne however, has the burden of proof that its expenditures are reasonable or prudent. We do not find that Duquesne has met its burden to establish that its conduct was prudent during the October 26, 1978-March 13, 1979 period.

Id. at 754 (emphasis added).*

As the above discussion makes clear, PECO can, and must, be held responsible for costs resulting from GE's identified imprudence.

4. PECO's Defense Of General Electric Must Be Rejected.

PECO has responded to the OCA's position on the Mark II imprudence through the testimony of at least five witnesses. These various witnesses all assert that GE was not imprudent and that to have anticipated the Mark II problem would have required "impossible foresight". See e.g. PECO St. 1A at 5.

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* The Beaver Valley case has been remanded to the PUC on other grounds. Duquesne Light Co. v. Pa. PUC, No. 3102 C.D. 1921, No. 1853 C.D. 1983 (Slip Opinion dated March 26, 1986).

Before discussing PECO's rebuttal and sur-surrebuttal on the Mark II design issue, it is important to note the words by which PECO described the Mark II design problem in its original testimony. In PECO Exhibit 2, which is the Company's explanation for the cost and schedule growth of Limerick 1, the Mark II design issue is introduced with the following paragraph:

> 4. IMPACT OF MARK II $136.1 Million
>
> A new category of load phenomena associated with BWR Mark II containments was identified in 1975. This was comprised of the hydrodynamic loading conditions during a safety relief valve (SRV) discharge or loss-of-coolant accident (LOCA). These hydrodynamic SRV and LOCA loads have come to be known simply as Mark II loads.

PECO Exh. 2 at 8 (emphasis added).

Similarly, PECO witnesses Love and Kononetz began their discussion of the Mark II issue as follows:

> Q. WHAT ARE THE MARK II CONTAINMENT NEW LOADS?
>
> A. A previously unidentified category of forces associated with GE-BWR Mark II containments was identified by GE in 1975. These forces (known as hydrodynamic loads) could be generated in the reactor containment following a LOCA and the lifting of the safety relief valves as a result of air and steam being rapidly forced into a water filled suppression pool located in the containment.

PECO St. 8 at 143 (emphasis added).

As can be seen, in its Direct Testimony, the Company described the Mark II loads as "new" and "previously unidentified". This description, however, changed during the course of the rate case such that by the Rebuttal phase of the case, Company witnesses were asserting that it was only the "significance" of the Mark II loads, not the loads

themselves, which were identified in 1975. Thus, for example, PECO witness Dr. Salomon Levy stated during cross-examination as follows:

> Q. I would like to start out with your rebuttal testimony, Statement Number 34, referring you to the discussion on page 5. At line 7 you state, "The characterization and significance of the hydrodynamic loads referenced by Dr. Hanauer were not known by the utilities, vendors or the AEC until after Limerick licensing and construction were initiated." Is that correct?
>
> A. That's correct.
>
> Q. I take it that the key words there are "characterization and significance" as compared to "existence;" is that correct?
>
> A. That is correct.
>
> Q. Would you agree with me that the existence of hydrodynamic load was known since at least the 1958-59 tests?
>
> A. Some of these loads were known at that time, but their significance from the data taken at that time was not recognized.

Tr. 4968-4969 (emphasis added).

Although the industry did not acknowledge the significance of the hydrodynamic loads until 1975, the OCA submits that the hydrodynamic loads were very much in evidence as early as the late 1950's. GE, however, completely failed to analyze the significance of these loads for either loss-of-coolant-accidents, or more importantly, safety-relief valve discharges. In the late 1950's, GE did perform certain tests on the pressure suppression system. These tests, however, were inadequate in that they ignored readily apparent hydrodynamic loads.

Through proprietary GE documents which the OCA received on March 13, 1986, the day before PECO witness Levy was cross-examined and four days before the close of the record in this case, information on the

early GE tests was revealed. This information was not in PECO's possession prior to the week of March 10, 1986. Tr. 4932, 4936, 4952, 4953. The existence of these documents was only discovered by the OCA through a review of the pleadings filed by the owners of the Zimmer Nuclear Generating Station in their lawsuit against GE. These utilities, rather than defending GE, have sued GE for its alleged negligence and misrepresentations in the design and sale of the Mark II containment.

In a GE proprietary document dated April 2, 1959, the following discussion of the results of one series of tests was reported:

> During a run with a four-inch single vertical injector, closed tank, six-inch depth of submergence, and maximum flow rate at 58,000 pounds per hour, the tank was quiet during the first 16 minutes of operation. At this point the pressure in the tank rose to about six inches of mercury due to the accumulated condensate, and the tank commenced shaking. Two minutes later the tank began to shudder and then bang severely. This banging literally sounded like rapid fire from a rifle. After five minutes of this the vibration was severe enough to shake open the safety relief valve, and the run was secured. It was concluded from this run that the pool vibration phenomena was temperature-sensitive, and that the frequency and magnitude of the vibration should be investigated.

Tr. 4976-4977 (emphasis added).

The report also stated:

> During the operation of the six-inch injector anchored to the tank wall and specifically during the run where the mass flow rate was being reduced following the heating of the pool, the facility became so rough that the tank appeared to be bouncing on its foundation. Personnel in the control room of the power station recorded a mild earthquake which timewise coincided with this run.

Tr. 4978 (emphasis added).

Finally, the report stated:

It was observed during the entire series of tests in this group that as the pool temperature reached 120 degrees to 130 degrees Fahrenheit, the roughness commenced and increased in intensity with the increase in temperature. The operation of the facility was smooth in all cases as long as the pool temperature remained below 120 degrees Fahrenheit. The intensity of the vibration increased with increased steam flow rates under all conditions.

Tr. 4979 (emphasis added).

The Company improperly asserts that the information reported in the above GE proprietary document is based upon tests which were only preliminary, small scale, and which could not be relied upon. Tr. 4988, 5008. PECO asserts that the early tests were only to establish the feasibility of the pressure suppression concept. PECO St. 34 at 10. Dr. Hanauer explained during cross-examination that the tests had a much broader purpose. Thus, he stated as follows:

Q. Would you agree with me, Dr. Hanauer, that the test which occurred in these non-nuclear facilities were viewed by the industry as establishing the feasibiltiy of use of a pressure suppression containment concept?

A. No. I think that's incomplete. They were certainly viewed that way but there were other things in addition that the tests were to do.

Q. And what were those things, in your opinion, sir?

A. They were intended to supply the data which were required to design these pressure suppression containments. So establishing the feasibility was not the end but only the beginning of their purpose.

Tr. 2765-2766 (emphasis added).

GE, however, apparently did little further analysis of the loads being manifested in these early tests until the 1970's. Rather, GE hypothesized the loads away. This is particularly true for the safety relief valve loads. The Company stated that the early tests were only

designed to measure steam condensation for loss-of-coolant accidents. PECO St. 34 at 11. GE, thus, incorrectly assumed that safety relief valves loads would be accounted for by the accident analyses. This is best demonstrated from the following cross-examination of Dr. Levy:

Q. For those plants that you cite that in their initial designs did not pipe the safety relief valve discharges into the pressure pool, did the analyses done by the NRC and by General Electric ever consider the effects of safety relief valve discharges on the loading in the suppression pool?

A. As I pointed out in my testimony, when these plants were being designed the relief valve loads were not considered because they were considered to be insignificant compared to the loss of coolant accident loads, and at that time we were not required to add the loss of coolant accident loads to the relief valve loads.

Q. And when you say they were not considered significant, have you provided any documents or analyses in which discussion is contained that specifically shows tests to support the position that the safety relief valve loads were not significant?

A. I cannot recall any such document having been generated.

Q. Do you know whether or not there were specific tests to review the impact of safety relief valve loads on the suppression pool?

A. I think, to the best of my knowledge, the assumption at that time was that the seismic load would be the dominant one, and then the loss of coolant accident had some major loads incorporated for it in the original design. These were the pressure forces associated with the containment, the temperature, and there were also some depth forces included in the original design. Furthermore, these loads were incorporated for the largest break that was considered credible, which is a very large pipe break, and that pipe was considerably greater than any of the relief valve pipe being used at that time. The plants associated with those pipes were quite a bit bigger, and, therefore, you could practically say by looking at the size of the pipes that the loads associated with the loss of coolant accident. So it was a

deduction type of argument looking at the flow rates and the size of the pipes involved.

* * *

Q. At what point was safety relief valve loads first analyzed or considered by General Electric as a separate load on the pool?

A. The safety relief valve loads were considered as an additional load after the 1975 NRC letter which brought attention to those loads having to have — that they should be considered in the containment design.

Q. To your knowledge prior to 1975 did General Electric do any studies or present any documents discussing the effects of safety relief valves on the pressure suppression pool?

A. They presented many oral discussions in response to questions about why those loads were not significant, and I've already given you the arguments, which is that they were considered not to be as significant as the loss of coolant accident, and the containment was already designed for seismic load plus the loss of coolant accident.

Q. Do you know whether there are any internal General Electric documents that discuss the effect of safety relief valve loads on the pool?

A. I'm not aware of any.

I should be careful, prior to 1975. There are some after.

Tr. 4970-4973 (emphasis added).

General Electric's failure to analyze the hydrodynamic effects of safety relief valve discharges is particularly striking when one considers a 1970 internal GE report on this very subject. In a GE document entitled "Pressure Suppression Pool Investigation Report No. 1", dated July 1, 1970, there was a discussion of both the late 1950's tests and also a series of tests performed in 1969. That document stated as follows:

Pressure fluctuations and vibrations in the suppression pool and vent piping are of interest in order to develop background to explain the severe jumping and banging of the suppression tank which was observed during certain of the Humboldt Bay initial condensing test runs of the Moss Landing facility in 1958, and during certain blowdown tests run recently in the small test stand. It was concluded from the Moss Landing results that the phenomena were temperature and flow-dependent and were felt to result from hitting the natural frequency of the tank. It appears that the more violent action is associated with flows which result in near sonic conditions at the pipe exit. Although these pressure fluctuations and vibrations are not expected in the conditions associated with drywell to wetwell vent flow following the LOCA, it is desirable to define the relationships which caused them in order to adequately answer questions should they arise.

Tr. 4982 (emphasis added).

Discussing certain tests performed in 1969, the 1970 GE document stated as follows:

During the early high pressure blowdown tests performed in the small test stand in 1969 it was noted that the suppression tank appeared to jump as the test was initiated and that a loud vibration-like noise occurred during much of the blowdown period. These events were similar to those recorded during initial condensing tests conducted at the Moss Landing facility in 1958, and further investigation seems justified.

* * *

A possible area of concern could be the automatic or manual depressurization of the pressure vessel through the relief valves which are piped directly to the suppression pool. This action could produce an initial shock by the mechanism postulated and result in a shock wave in the pool.

Tr. 4983-4984 (emphasis added).

Finally, the 1970 GE report made the following suggestion:

Both the tank vibration and the chugging apparently occur at mass velocities which could be involved in reactor containment design (50 pounds per second per

square foot and 10 pounds per second per square foot respectively) and both could have serious design implications.

Tr. 4987-4988 (emphasis added).

This 1970 GE document recognized that both the tests from the 1950's and the test from 1969 exhibited hydrodynamic loads. Further, it stated that these loads needed to be analyzed. Finally, it noted a serious design concern for safety relief valve discharges. There was nothing particularly new or important noted by the authors of the 1970 report that occurred since the 1958 tests to prompt the concerns noted in the report. The 1969 tests simply exhibited the same loads as the 1958 tests. Rather, the report noted consideration of forces which were known to GE personnel and were considered of serious concern.

The concerns expressed in the 1970 GE report were evidently not presented to the utility industry or the NRC. Dr. Levy was not aware whether the 1970 GE report was provided to the NRC. Tr. 4997. PECO witness Vollmer did not find a copy in PECO's file. Tr. 4953.

Dr. Levy's response, and presumably GE's, to the issue of the Mark II loads, and especially the safety relief valve discharges was that at some point you stop testing. Tr. 5010. When asked about this further, he responded as follows:

Q. You also state that sometimes you can test and test and test too much. Could you tell me what tests were conducted by General Electric into these phenomena between the Humboldt Bay and Bodega Bay time period and the 1969 small stand test?

A. Very few pressure suppression tests except probably some incidental types of tests where people were measuring other kinds of mechanisms.

Tr. 5011 (emphasis added).

Rather than perform additional tests, GE improperly relied upon the Humboldt Bay and Bodega Bay tests. Tr. 5011. These tests, however, never analyzed the effects of safety relief valve discharges. Tr. 4970-4973.

The above discussion shows that the Company's position in Direct Testimony that the Mark II loads were new, unforeseeable, or first identified in 1975, is clearly wrong. The Company now relies upon the position that the loads were observed as early as 1959, but not considered significant until 1975. This new argument only highlights GE's imprudence. The existence of the loads was known, but GE only tested for certain of the loads, and inadequately at that, and completely failed to test for some very important loads--those resulting from safety relief valve discharges. The Company's final position serves to support Dr. Hanauer's conclusions on the Mark II issue, in which he stated as follows:

> General Electric, in developing the pressure suppression containment concepts and basic designs, imprudently failed to adequately measure, predict, or specify the loads and forces to which this type of containment would be subjected in the quenching process, both from loss-of-coolant accidents and from safety/relief valve operation during normal operation and anticipated transients. The technology was available in the 1960's to make such measurements and specifications.
>
> The omitted loads and forces were known to General Electric people, but the errors were not reported or correctly evaluated by General Electric, the plant owners or the regulatory authorities until actual plant damage occurred during transients, and additional tests confirmed that the problem would exist for both safety/relief valve discharge and accident circumstances.

OCA St. 2A at 6-7 (emphasis added).

5. PECO's Other Mark II Defenses Are Also Unfounded.

PECO presented two other reasons why it did not consider GE's actions on the Mark II design imprudent. The first assertion was that the equipment was not available in the 1950's and 1960's to measure the forces generated by hydrodynamic loads. The second defense was that the Atomic Energy Commission (AEC) was involved in the design and testing of the containment and therefore GE should be absolved of responsibility for its errors.

PECO witness Vollmer testified to the claimed difficulties in analyzing and measuring the Mark II loads. PECO St. 31 at 5-6. Initially, it must be noted that an inability to measure a force precisely is not grounds for ignoring it. More importantly, however, there were, in fact, devices for measuring the loads in the containment in the 1950's and 1960's. Thus, Dr. Hanauer described the testing instrumentation used in the Humboldt Bay tests as follows:

> My colleagues and I went back into the recorded documents of the pressure suppression containment and found some relevant statements in the Humboldt Bay Final Hazards Summary Report issued in September 1961. Humboldt Bay was the first pressure suppression containment. Exhibit SHH-8 attached to this surrebuttal testimony contains selected pages from that report. In particular, Appendix 4, "Pressure Suppression Development Program," contains several revealing statements.
>
> Q. How were the tests instrumented?
>
> A. The facility was equipped with instrumentation to obtain pressures and temperatures in the drywell, the pool and the air space above the pool. (Exhibit SHH-8, p. 4).
>
> Provision is made for the measurement of pressures and temperatures at points shown in Figure 9. A light beam oscillograph is used to record transient pressures in the simulated reactor vessel, the drywell

and the suppression chamber. (Exhibit SHH-8, p. 7) Thus instruments were provided to observe the transient pressure. Reduction of such data would have been tedious without computers but it could be and was done in various applications at that time, using people instead of computers.

The drywell pressure built up rapidly, reaching a peak in about .06 seconds and then fell back rapidly. (Exhibit SHH-8, p. 5) Thus, fast-response sensors and recording equipment were evidently provided and used, contrary to assertions in Company testimony.

OCA St. 2A at 28 (emphasis added).

PECO has also attempted to put the NRC/AEC's stamp of approval on GE's imprudence. Dr. Hanauer described the NRC's role in the Mark II development as follows:

The NRC's sole role in the Mark II was its safety regulatory responsibility. This means that a utility proposing to build and operate a nuclear power plant that has a Mark II containment must convince the NRC of its safety acceptability. As part of its licensing review, NRC evaluates the conformance of the Mark II containment to the NRC regulatory requirements.

NRC played no role in the development by GE of the Mark II concept and load definitions. The first proposed Mark II was reviewed extensively by the NRC in connection with the application for a Construction Permit for Shoreham. Years later, the NRC Operating License reviews for all the Mark II plants included reviews of containment design in the light of the problems identified in the interim.

OCA 2 at 19 (emphasis added).

Moreover, the reviews performed by the AEC for the original Mark I designs were limited by the size of the Commission's Staff. Thus, Dr. Hanauer stated during cross-examination as follows:

Q. And did not that determination involve a review of the specific designs of the containments, the loads employed as the basis of that design, by the Atomic Energy Commission and the Nuclear Regulatory Commission?

A. Probably not. The review at the time the construction permits were granted were performed by what was then a small staff and they reviewed the concepts and some technical data to a greater or lesser extent in their reviews of these different plants. But to say that they had reviewed the design is certainly not correct. The design consists of thousands of drawings and calculations which underlie these drawings and neither the AEC nor the NRC ever purported to review the details of the design.

Tr. 2768-2769 (emphasis added).

It was GE that conceived the idea for the Mark II pressure suppression design. It was GE that performed the inadequate tests and then sold the design to the utilities. The OCA submits that PECO cannot simply pass these imprudent costs on to ratepayers. Other utilities that purchased the Mark II containment have sued GE; PECO has effectively sued its ratepayers. PECO, however, has the burden of proof to show that the Mark II errors and resulting costs were prudently incurred. The OCA submits that PECO has not met this burden. Moreover, since this Commission's decision in the PP&L Susquehanna 1 rate case on this issue, extensive new information has become available regarding what GE actually knew in the 1950's and 1960's. For all of the above-stated reasons, the arguments by PECO on the Mark II issue should be rejected.

6. The Mark II Design Error Resulted In A Cost Of $194.0 Million.

PECO Exhibit 2 identifies $136.1 million of direct costs which were added to the original cost of Limerick 1 due to the costs of correcting for the inadequately specified Mark II forces. Further, PECO has quantified the AFUDC associated with these expenditures. With AFUDC, the total cost increase at Limerick 1 due to Mark II work is $194.0 million. OCA St. 1A, Sch. JJO'B-23.

There is no dispute in this case that PECO spent at least this amount on Mark II work. The dispute is whether all or a portion of these costs would have been incurred even if Mark II forces had been adequately specified at the time Limerick 1 was first designed. PECO witness H. William Vollmer has asserted that only $55 million, including AFUDC, would not have been spent if the Mark II loads had been known in the beginning. PECO St. 31A, Sch. 5; Tr. 955.

OCA witness O'Brien stated his opinion as to the total additional costs incurred by PECO to correct for the Mark II errors as follows:

> As I have testified under cross-examination, my belief is that the total cost of Mark II changes at the Zimmer plant would have exceeded $400 million had that plant been completed. The utilities which own Zimmer have in fact sued GE for at least $360 million as a result of Mark II containment problems. Given that, as well as for the reasons set forth [below], it is my belief that the $136.1 million figure given by PECO for Limerick represents a conservative estimate of excess costs that need not have been spent had the Containment been properly designed in the first place.

OCA St. 1B at 33.

The OCA submits that PECO witness Vollmer's calculation understates the costs attributable to Mark II rework and re-analysis. The reasons for this understatement were discussed by OCA witness O'Brien. Mr. O'Brien noted that Mr. Vollmer's calculations are based upon a review of Bechtel's estimates contained in Forecasts and Trends as they were made over the course of construction. Bechtel and PECO never calculated the actual cost of work performed to do particular tasks as construction progressed. Thus, Mr. Vollmer's numbers are not actual costs, but

predictions made by Bechtel in advance of actually doing the work. OCA St. 1B at 29. Mr. O'Brien commented on the Forecast numbers as follows:

> [T]he history of the Limerick job is a history of cost overruns in both engineering and field work. Therefore, I would have to believe that these cost estimates are most likely lower than the actual cost incurred for these items.

OCA St. 1B at 30 (emphasis added).

Mr. O'Brien also noted that Mr. Vollmer's calculations excluded costs for the original Limerick 1 analyses and construction which had to be discarded or redone later. OCA St. 1B at 31. For example, the design, construction and installation of approximately 1000 pipe hangers was wasted and had to be done over entirely. OCA St. 1B at 30. Additionally, Mr. O'Brien listed a number of other problems with Mr. Vollmer's calculation. These were as follows:

> Mr. Vollmer's figure also excluded the cost of the delay in plant completion calculated from 1981 when reasonably built non-Mark II contemporaneous plants were completed.
>
> The items which involved field work (Items J, K, L, M, N and O) are all (except J1) allocated 50-50 between Units 1 and 2. This is consistent with the idea that all the Trends and Forecasts (up to Forecast 7) are for both units, undifferentiated. It is not consistent with the facts. The equipment dealt with in these Trends and Forecasts has not yet been installed in Unit 2. Therefore, it can be done right the first time and there will be, one hopes, no rework and no low productivity due to shoehorning changes in at the last minute. Either the estimation (which is all that we have) of these changes was done incorrectly, by imputing the shoehorning and poor productivity incorrectly to Unit 2 as well as Unit 1, or it was divided incorrectly and the lion's share of the cost should go to Unit 1 rather than half as was done by the Company's reckoning.
>
> Many of the analytical and engineering tasks (Items A-I) read like the same work. Examples are Item B, "Engineering to perform Mark II containment analysis"

and Item E, "Mark II analysis." Some of the other analytical items also look similar. They do come from different Forecasts, so maybe this is the usual continual ballooning of analytical costs. However, there seems not to have been adequate consideration of how much of these costs were for work which later had to be thrown away.

The cost of delay during the 2 month Containment Hold and subsequent placement of additional rebar is not included.

OCA St. 1B at 31-33 (emphasis added).

The Company's cost estimate of the effects of Mark II rework seems particularly suspect when one considers PECO testimony on the difficulty of working in the containment and of the effects of rework on productivity. For example, PECO witness John S. Kemper, PECO Vice-President of Engineering and Research, noted in his testimony the added costs of Limerick 1 due to,

> less than optimal activity sequencing and reduced labor effectiveness caused by increased congestion, complexity and additional scope, and from the need to provide increased support services to the Project as the result of the regulatory imposed increased work scope.

PECO St. 2 at 38.

Mr. Kemper also stated that:

> Increases in craft manpower represent a good example of the disruptive influence that regulatory change had on work sequencing at Limerick. When the Project plan called for a reduction in manpower at a certain point in time and an unexpected change created a need for additional manpower, it was often difficult to obtain sufficient, qualified personnel. Moreover, once additional manpower was obtained, a less efficient and more costly plan generally resulted. Construction manpower increases required to implement regulatory required design changes also increased construction congestion. Many of these design changes were located in areas that were already space limited, such as the Reactor and Control buildings, where the most critical schedule activities during the

completion of the Project took place. These areas normally had high levels of construction manpower in order to minimize the duration of critical path activities. The design changes further increased the manpower congestion in these areas which resulted in lower than anticipated unit rates.

PECO St. 2 at 42 (emphasis added).

Mr. Kemper's remarks about the actual construction difficulties of working in the reactor building serve to highlight the inadequacies of relying solely on a reconstruction of Mark II costs based on the Bechtel Forecasts. The Forecasts were merely predictions of future costs; they did not account for the actual effects of additional Mark II design changes and rework, either on Mark II items or on adjacent work not necessarily identified as Mark II related.

For all of the above reasons, the OCA submits that the cost identified by Mr. O'Brien of $136.1 million in direct costs, or $194.0 million with AFUDC, is the most accurate and appropriate quantification of the costs attributable to the imprudence in the Mark II design at Limerick 1. It should be noted that the OCA's quantification of the costs of the Mark II error are not directly additive to the quantification of the costs of the delays. As noted above, the cost of the delays for Limerick 1 and 100% of Common is $792.7 million; the cost of the delay for Limerick 1 and 50% of Common is $652.4 million. If both the delay and Mark II adjustments are made there is some overlap. Thus, the total adjustment for Mark II and the cost of delay for Limerick 1 and 100% of Common is $944.7 million; the total adjustment for Mark II and the cost of delay for Limerick 1 and 50% of Common is $804.4 million. OCA St. 1B at 35, Sch. JJO'B-30.1-30.6.

IV. EXCESS CAPACITY

A. Introduction.

The present proceeding represents both a challenge to the Public Utility Commission's policy regarding excess electric generating capacity and a test of whether that policy can be manipulated by utility management decisions that are harmful to the interests of ratepayers.

The challenge to the PUC's policy comes in the Direct Testimony of PECO witness William Hieronymus, who argues at great length that -- contrary to established Pennsylvania regulatory precedent -- the only relevant consideration in determining whether a plant should be included in rates is whether the decisions to initiate and continue the construction of the unit were prudent when made. PECO St. 15 at 11-57. Dr. Hieronymus argues, in particular, that to apply some other standard, such as the used and useful test, is to somehow change the rules of the regulatory game without "due notice" to investors who have come to rely on the prudent investment standard. See, e.g., id. at 17-20.

Whatever validity Dr. Hieronymus's views on regulatory history may have in other jurisdictions, they are certainly of questionable value in Pennsylvania. Here, the principle that the costs of excess electric generating capacity must be shared between ratepayers and stockholders -- even if those costs were prudently incurred -- has been established since at least 1978 when the Commission adopted ALJ Matuschak's excess capacity recommendation in Pennsylvania Public Utility Commission v. Pennsylvania Power Company, 52 Pa. PUC 459, 27 PUR 4th 426 (1978). As will be discussed below, this principle was applied to PECO itself in its 1979-1980 rate case and was specifically upheld by the Pennsylvania

Commonwealth Court. Pennsylvania Public Utility Commission v. Philadelphia Electric Co., 54 Pa. PUC 220, 37 PUR 4th 381 (1980), Philadelphia Electric Co. v. Pennsylvania Public Utility Commission, 61 Pa. Commw. 325, 433 A.2d 620 (1981).

Thus, while Dr. Hieronymus may disagree with Pennsylvania precedent in this matter (see, e.g., the colloquy between Judge Matuschak and Dr. Hieronymus at Tr. 771-72), it is he, not the parties opposing Limerick's inclusion in rates, who is trying to change the standard under which such issues are adjudicated in this Commonwealth.

The test of this Commission's excess capacity policy comes in deciding whether a utility may evade the regulatory consequences of adding enormously uneconomical excess capacity simply by prematurely retiring extremely low-cost existing capacity.

The only capacity "need" which is being filled by Limerick 1 is a need of the Company's own making -- a need created by the Company's premature retirement of a substantial amount of extraordinarily low-cost peaking capacity, much of which is only 15 years old. While such a replacement might well be justified on economic grounds (i.e. if the new plant reduced, rather than increased, total system costs), Limerick 1 is an economic disaster. Now, and for many years into the future Limerick's economic costs certainly will exceed its benefits.

Limerick 1 is neither needed by PECO at this time for reliability purposes, nor will it provide net economic benefits to ratepayers now or in the reasonably foreseeable future. Some sharing of the costs of Limerick 1 between shareholders and ratepayers must therefore be ordered.

While all of Limerick 1 currently represents excess capacity -- both in terms of reliability and economics -- the OCA has not proposed that the entire cost of the plant be removed from rates at this time. Rather, after reviewing the Company's capacity needs through 1990, as well as the overall economics of the Limerick plant, OCA's expert witnesses have concluded that at least 450 megawatts of Limerick 1 must be deemed to be excess capacity. In light of this analysis, and in accordance with Commission precedent discussed below, the OCA is recommending that the Commission deny the Company an equity return on 450 megawatts of Limerick 1's capacity at this time.

As set forth below, the OCA submits that this adjustment is the minimum adjustment required in order to prevent ratepayers from bearing an excessive share of the costs of PECO's unneeded and uneconomic capacity addition in Limerick 1.

B. This Commission's Previous Decisions Establish That A Plant Is Excess Capacity If It Is Not Needed For System Reliability And Will Not Provide An Immediate Net Economic Benefit.

This Commission has often considered the legal standard to be applied to the determination of whether an electric utility has capacity in excess of its needs. This Commission's most thorough and most relevant discussion of excess capacity appears in its recent decision concerning Pennsylvania Power and Light Company's Susquehanna Steam Electric Station Unit 2. Pa. PUC v. Pennsylvania Power and Light Co., R-842651 (April 26, 1985) (hereafter cited as PP&L SSES 2). As the Commission recognized in that case, its earlier decisions in two other cases provide the legal framework for excess capacity determinations. Pa. PUC v. Philadelphia Electric Co., 54 Pa. PUC 220, 37 PUR 4th 381 (1980) (hereafter cited as PECO 1980); Pa. PUC v. Pennsylvania

Power Co., 52 Pa. PUC 459, 27 PUR 4th 426 (1978) (hereafter cited as Penn Power).

As noted above, this Commission's first significant excess capacity adjustment was made in Penn Power, based upon the recommendation of Administrative Law Judge Matuschak. The Commission there held:

> We share Judge Matuschak's concern over the impact upon the ratepayers by the sudden doubling of the investment of the company since February 1975, and the large amounts of capacity generated thereby that is not now needed.
>
> For purposes of this proceeding we agree with the judge that the sudden burden of this new plant investment on the company's customers was no fault of Penn Power or of its investors; but neither was it the fault of the ratepayers. Under these circumstances there must be some sharing of the risk associated with bringing large plants on line.

Penn Power, 52 Pa. PUC at 471 (emphasis added). The Commission thus held that, when a utility had capacity which was substantially in excess of its requirements (including a reasonable reserve margin), the costs of supporting the excess capacity should be apportioned between ratepayers and investors.

This same risk-sharing principle has been followed by the Commission in subsequent excess capacity cases. For example, in PECO 1980, the Commission, after restating its Penn Power holding, stated:

> We continue to subscribe to this sharing of risk and will make adjustments for excessive capacity when adequately supported by the record.

PECO 1980, 54 Pa. PUC at 225. The Commission there determined that approximately 775 megawatts of PECO's capacity was excess to its needs. The Commission made this determination over the objections of PECO which argued that, if the generating facilities were prudently constructed, the Commission could not make an adjustment for excess capacity. The

Commission rejected a prudency basis for excess capacity adjustments, by holding as follows:

> Philadelphia Electric Company argues that the standard we must apply in our determination of necessary capacity is one of prudency viewed at a time when the units in question were built. As stated above, we find this to be partially true. We also see our duty to review continually the functioning of a utility to insure reliable service at just and reasonable rates. While not questioning PECO's management decisions made when these units were constructed, we are of the opinion that they have served the purpose for which they were constructed and cannot be considered used and useful for rate-making purposes.

PECO 1980, 54 Pa. PUC at 227 (emphasis added).

The Commission thus reemphasized that, before a return will be granted on a particular investment, the utility must demonstrate:

> (1) that the investments were prudent when made, and
> (2) that the property invested in will be used and useful during the time the rates will be in effect.

Id., 54 Pa. PUC at 225.

In PECO 1980, the Commission continued to apply its risk-sharing principle. The Commission thus removed the excess plant from rate base, but required ratepayers to pay all operation and maintenance expenses, fuel inventories, and depreciation expense associated with that capacity. As the Commission stated:

> This sharing will have the effect of requiring the stockholders to bear the return on investment (although we have taken our capacity adjustment into account in determining rate of return), and requiring the ratepayers to continue to be responsible for the return of investment (depreciation).

Id., 54 Pa. PUC at 227 (emphasis in original).

In 1981, this Commission's decision in PECO 1980 was affirmed by the Commonwealth Court, which held:

> It does not follow that a unit prudently constructed must always be included in the rate base. The touchstone for determining whether or not a prudently constructed unit should be included in a utility's rate base is whether or not, during the test year involved, the unit will be used and useful in rendering service to the public.

Philadelphia Electric Co. v. Pa. PUC, 61 Pa. Commw. 325, 329, 433 A.2d 620, 623 (1981) (emphasis added). The Court thus held that it is necessary for the Commission to look beyond the mere prudency of the decision to construct the plant. It is indeed necessary for the Commission to determine whether the generating plant in question is used and useful in rendering service to the public.

This two-part test -- prudency and used and useful -- has remained the basis for the Commission's excess capacity determinations. See, e.g., Pa. PUC v. Pennsylvania Power and Light Co., 57 Pa. PUC 559, 575, 55 PUR 4th 185, 199-200 (1983) (hereafter cited as PP&L SSES 1); Pa. PUC v. Pennsylvania Power Co., 58 Pa. PUC 305, 311-12, 60 PUR 4th 593, 599-600 (1984).

In PP&L SSES 1, this Commission considered whether a generating plant could meet the "used and useful" part of the excess capacity analysis by being shown to be "economically beneficial to ratepayers over a period of time, although not needed on a reliability basis." PP&L SSES 1, 57 Pa. PUC at 576. The Commission was there presented with a series of net economic analyses which, even under the assumptions most favorable to the utility, showed that the plant would not produce a net economic benefit to ratepayers for a number of years. Under those facts, the Commission held that such economic studies did not prove that the plant would be "useful" to ratepayers, and in fact helped show that the plant was excess to the utility's needs. Specifically, the Commission stated:

[A]s noted by ALJ Klovekorn:

> "..., it is clear that under the company's base case the Susquehanna plant will not start producing net savings for ratepayers until the end of this decade and that the plant will not produce cumulative net benefits until the mid-1990s at the earliest. ...
>
> "The bottom line, however, of all these studies is that the ratepayer would be better off without Susquehanna from an economic standpoint now and for the foreseeable future."

This conclusion is further supported by the fact that under the company's own economic analysis, the net economic benefits of Susquehanna Unit 1 are directly affected by a number of highly likely alternative assumptions, which make those benefits speculative in nature.

In the final analysis, the ALJ properly concludes that while the economic viability studies are unsupportive of the inclusion of the excess capacity in rate base, these studies clearly support the ultimate conclusion that from an economic perspective the company indeed has excess capacity.

PP&L SSES 1, 57 Pa. PUC at 576 (emphasis added; citations omitted).

Thus, in PP&L SSES 1, the Commission held that where the generating plant was not needed for reliability purposes and did not provide an immediate (or near-term) net economic benefit, the plant was not "useful" for ratemaking purposes. In such circumstances, an excess capacity adjustment was appropriate.

The Commission, therefore, ordered the removal from rates of a 945-megawatt "slice of the system." Id., 57 Pa. PUC at 574, 577. The Commission found this method to be reasonable based on the facts of that case. Id., 57 Pa. PUC at 577.

This same standard was applied in PP&L SSES 2. In that case, the Commission again held that in order to show that a plant is "useful," the utility must show (1) that the plant is needed for system reliability

or, (2) that it will provide an immediate (or near-term) net economic benefit. Thus, the Commission stated:

> The primary meaning of "useful" in the present context is that the plant and its associated capacity contribute no more than necessary to system reliability in the accepted, technical sense. In other words, the question is whether the Company's total capacity, including the plant in question, is commensurate with the requirements for peak demand plus a reasonable reserve margin relative to the Company's own system and to its PJM obligation.
>
> This is the heart of any excess capacity determination. It means, among other things, that the Company's alternative definitions of "reliability" as fuel diversity or available capacity are peripheral. If there is excess capacity in the primary reliability sense, then the threshold condition for an adjustment has been satisfied.
>
> * * *
>
> In addition to the primary reliability sense of usefulness, the Company proposed a second one, consisting of present value net economic benefit. From a broader perspective, this present value approach is one aspect of the Company's general argument that long range generation planning cannot be judged on a short term basis. Other aspects of this theme are that addition of large base load plant necessarily results in temporary excess capacity and that this Commission was aware of and even approved the long Susquehanna construction program from the beginning.
>
> We considered and rejected most of these contentions in the previous PP&L general rate increase proceeding [PP&L SSES 1].
>
> The net present value argument assumes that a large base load plant will not yield a positive balance of energy savings over high capital costs until some years after it begins operation. Through projections of a variety of factors, the method attempts to predict future net benefits and then discounts them to a present value basis.
>
> We have carefully reviewed the discussion of this approach in the last PP&L case, including both our Opinion and Order quoted above and ALJ Klovekorn's Recommended Decision. Although the specific components of the present value claim in that case

differ in detail from those in the present case, the general principles are the same.

In particular, we hold, first, that there is reason to believe that the Company's present value estimates for SSES 2 are overstated or, at least, uncertain. Second, and more important, we hold that even on the Company's best case, future economic benefits will not accrue until the next decade. The sheer magnitude of the delay combined with the uncertainty of the projections render the net present value approach meaningless on the record before us. As ALJ Klovekorn put it in the last case:

> The only certainty is that any benefits will first occur on an annual basis well after the rates set here are just a dim memory.

* * *

The sheer magnitude of the present excess capacity and the number of years which it will persist render meaningless the Company's arguments about the temporary effect of adding large base load plants.

PP&L SSES 2, Order at 17-19 (emphasis added; citations omitted).

In PP&L SSES 2, the Commission then continued its policy of sharing the costs of excess capacity between ratepayers and investors. Specifically, because SSES 2 was the "cause of the excess capacity on PP&L's system," the Commission held that ratepayers would not be required to pay a return on equity associated with the plant. Id., at 21-22. Ratepayers, however, were required to support the remainder of the plant's costs in rates (operation and maintenance expenses, depreciation expense, debt and preferred return). Id., at 23. As the Commission noted:

> The common shareholders assumed the risk that the investment in SSES 2 would succeed, and this risk has presumably been reflected in their authorized rate of return. Even though there has been no finding of imprudence, that risk remains on the shareholders. This is not a penalty, but rather a proper allocation of risk and its consequences.

Id., at 22.

In summary, this Commission has previously held that the standard to be applied to excess capacity determinations is as follows:

* Will the plant be used? AND

* Is the plant needed for system reliability? OR

* Will the plant provide an immediate economic benefit?

Obviously, the plant must be used in order for it to be considered for inclusion in rates. In addition, however, if the plant is neither needed for reliability purposes nor providing an economic benefit, then the plant is not "useful" and is excess capacity. Once a plant is found to be excess capacity, the Commission must then determine the appropriate ratemaking mechanism by which the costs of that plant should be shared between ratepayers and investors.

The OCA submits that at least 450 megawatts of Limerick 1 are not "useful" and, therefore, constitute excess capacity. Specifically, at least that amount of capacity is not needed for system reliability now and through 1990, and will not provide a net economic benefit to ratepayers now or for many years to come, if ever. The OCA urges this Commission, therefore, to deny the Company an equity return on 450 megawatts of Limerick 1.

The following sections discuss the evidence supporting the OCA's adjustment and discuss the quantification of that adjustment.

C. At Least 450 Megawatts Of Limerick 1 Are Not Needed For System Reliability.

1. Introduction

Expert witnesses presented by the OCA, PAIEUG, and UUC/UP all agree that all or a substantial part of Limerick 1 is not needed for

system reliability for at least the next five years. This is true even under the Company's load growth and reserve margin assumptions.

Thus, for example, the OCA's system reliability expert, Peter Lanzalotta*, concluded:

> All of Limerick 1 is excess to the needs of PECO in 1986 and 1987 and a substantial portion of Limerick 1 remains excess capacity through 1990. Specifically, I would conclude that at least 450 MW of Limerick 1 represents excess capacity at least through 1990.

OCA St. 5 at 4 (emphasis added).

Specifically, if PECO were not prematurely retiring existing capacity, Mr. Lanzalotta demonstrated that, with Limerick 1, PECO would have the following capacity in excess of its needs (including it full PJM reserve obligations) in each year through 1990:

Year	Excess Capacity
1986	1106 MW
1987	1119
1988	752
1989	604
1990	554

OCA St. 5, Sch. 1.**

Similarly, PAIEUG witness Falkenberg stated:

> [T]he removal of several hundred megawatts of capacity from the PECO system is proof of the fact that Limerick Unit 1 is not needed for reliable service. Based on PECO's load forecast and the 25% PJM reserve

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* Mr. Lanzalotta is a registered, professional electrical engineer who has significant experience in operating and planning electric utility systems. OCA St. 5 at 2-3. Mr. Lanzalotta is now a partner with Whitfield Russell Associates, specializing in the areas of bulk power sales and system operation, among others. Id. at 2.

** The use of a constant 25% reserve margin instead of PECO's actual PJM obligation would not affect these conclusions. Under the 25% assumption, PECO would still have more than 500 MW of excess capacity in each year. OCA St. 5 at 10.

> requirement, PECO does not begin to need the capacity of Limerick Unit 1 until 1989. With PECO's load growing less than 60 MW per year at that time, it would be a long time before the capacity of Limerick Unit 1 is fully needed.

PAIEUG St. 1 at 25 (emphasis added).

Mr. Falkenberg also indicated as follows that Limerick 1 is clearly excess to PECO's needs:

> The Limerick plant is not needed for reliability purposes, and it is not needed because it is uneconomic. Uneconomical capacity is never needed.
>
> * * *
>
> The Company has taken out of service a number of generating plants which it has previously indicated could continue to serve to meet the load, and which we believe can serve to meet the load more economically than the Limerick plant.

Tr. 3490-91.

UUC/UP witness Chernick also found that PECO does not need Limerick 1 at the present time. He stated:

> Until 1991, there would be no need for new capacity to meet PJM requirements, even under PECO's load and supply forecast, except to allow the retirement of existing units. After 1991, Limerick 1 would eliminate the need for inexpensive combustion turbines. PECO's demand forecast, and especially its supply forecast, may overstate the (already small) value of Limerick 1.

UUC/UP St. 1 at 10 (emphasis added).

Simply stated, even if none of Limerick 1's capacity were placed in service, PECO would have sufficient capacity to provide reliable service at least until 1988 (and well beyond if the lives of certain existing units were extended). The OCA submits, therefore, that none of Limerick 1 is needed for reliability purposes in at least 1986 and 1987. Further, in 1988 through 1990 (and, again, well beyond if life extensions