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Public Utility Commission

COMMONWEALTH OF PENNSYLVANIA

PUBLIC UTILITY COMMISSION

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Pennsylvania Public Utility Commission, et al. :
versus Philadelphia Electric Company. :
Investigation into a requested $660 million : Docket No.
annual rate increase. : R-850152
:
Further Hearing :
:

- -x

Pages 4821 through 5027

Hearing Room 1
North Office Building
Harrisburg, Pennsylvania

Friday, March 14, 1986

Met, pursuant to adjournment, at 9:35 a.m.

BEFORE:

JOSEPH MATUSCHAK, Administrative Law Judge

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DOCUMENT FOLDER

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P R O C E E D I N G S

ADMINISTRATIVE LAW JUDGE JOSEPH MATUSCHAK: Before we begin, Mr. Hall raised some question about a portion of the rate investigation portion of the Limerick investigation that should be incorporated in this proceeding.

Does counsel have any comments on that?

MR. DELANEY: I've --

JUDGE MATUSCHAK: We will preface by stating that we will make our order stating the conditions describing the prudency of the '76 and '78 delays relying on the parties to this proceeding and at the same time incorporate that part of the record of that investigation relating to those matters. I thought that we had done all we could.

I would like to have comments from counsel.

MR. DELANEY: Your Honor, I had some preliminary discussion with Mr. Hall about this last night. What the Staff proposes to do is to make an exhibit probably to be introduced on Monday which will have the sections of the prior record that we think are relevant to your direction to include portions of the prior Limerick record, and the Staff would not have any objection to the company doing a duplicate exhibit of the parts that it thought were relevant to your direction.

JUDGE MATUSCHAK: Very well.

MR. HALL: Your Honor, the company can do that as

well, although I'm not sure that we will have our exhibit on Monday.

The company will do that as well. We will prepare an exhibit, but I'm not sure that we will have it on Monday. We may have to ask Your Honor to permit its inclusion as a late-filed exhibit.

JUDGE MATUSCHAK: Of course, the parties understand that we don't expect argument in this proceeding on the prudency itself. That record may be relevant on appeal, but the record is closed as far as we are concerned on that issue.

You may proceed.

MR. HALL: Thank you, Your Honor. Your Honor, we have this morning Mr. Joseph Paquette, who has previously been sworn.

JUDGE MATUSCHAK: Very well.

Whereupon,

JOSEPH F. PAQUETTE, JR.

having previously been duly sworn, testified further as follows:

DIRECT EXAMINATION

BY MR. HALL:

Q. Mr. Paquette, do you have before you three documents upon which you are being presented for cross-examination today, those documents being PECo Statement 3A,

PECo Statement 3B, and PECo Statement 3C?

A. Yes, I do.

Q. Mr. Paquette, is PECo Statement 3A entitled "Rebuttal Testimony of Joseph F. Paquette, Jr." a document of some 19 pages with seven attached tables?

A. Yes.

Q. Is the material contained in PECo Statement 3A true and correct to the best of your knowledge and belief?

A. Yes, except to the extent that it was later corrected in Exhibit 3B.

Q. If I were to ask you the questions contained in PECo Statement 3A, would your answers there be as set forth therein, again accepting the corrections made in PECo Statement 3B?

A. Yes.

Q. Referring to the document entitled "PECo Statement 3B," which is entitled "Corrected Rebuttal Testimony of Joseph F. Paquette, Jr.," is that a document of some five pages with four or five attached tables?

A. Yes, it is.

Q. Similarly, is the material contained in that document true and correct to the best of your knowledge and belief?

A. Yes.

Q. Could you state briefly the reason for the filing

of PECo Statement 3B and the corrections that it makes to PECo Statement 3A?

A. Yes. In developing the hypothetical financing schedule that would have resulted from the OKA construction schedule, we utilized in Statement 3A a certain set of annual construction figures representing the net changes that would have taken place year by year under the OKA scenario.

We later discovered that we inadvertently did not assign some certain indirect costs on top of the OKA changes. So as a result, in Statement 3A we understated the savings that would have resulted from the OKA construction schedule, and Statement 3B is a correction to put in the proper net savings in terms of construction dollars including both directs, indirects and AFUDC.

Q. Finally, Mr. Paquette, referring to PECo Statement No. 3C, is this, in fact, your sur-surrebuttal testimony for use in this proceeding?

A. Yes.

Q. Is this a document of some seven pages with one attached table?

A. Yes.

Q. Is the material contained in PECo Statement No. 3C true and correct to the best of your knowledge and belief?

A. Yes.

MR. HALL: Your Honor, at this time I would ask that there be identified for use in this record as PECo Statements 3A, 3B and 3C the documents that I have described in the direct examination of Mr. Paquette.

JUDGE MATUSCHAK: The motion is granted.

(Whereupon, the documents were marked as PECo Statements Nos. 3A, 3B and 3C for identification.)

MR. HALL: I would also ask, Your Honor, that these documents be moved into evidence in this proceeding.

JUDGE MATUSCHAK: The motion is granted subject to any timely exceptions or objections.

(Whereupon, the documents marked as PECo Statements No. 3A, 3B and 3C were received in evidence.)

MR. HALL: Mr. Paquette is available for cross-examination.

JUDGE MATUSCHAK: Staff?

CROSS-EXAMINATION

BY MR. DELANEY:

Q. Good morning, Mr. Paquette.

A. Good morning.

Q. My name is Dan Delaney, and I have some questions for you on some of your testimony.

Initially, though, I have some questions on Mr. Brennan's testimony. We were informed that you would

be the person who could answer these.

What I am interested in is -- do you have Mr. Brennan's exhibit by any chance with you?

A. No.

Q. I have a copy of what I am interested in. It has some writing on it.

MR. DELANEY: Your Honor, this is just a page of Mr. Brennan's prior exhibit already put in. I just want him to explain the numbers for us.

BY MR. DELANEY:

Q. What I gave you, Mr. Paquette, is an exhibit previously put into evidence. I don't think Mr. Brennan came to testify about it.

What I would like to direct your attention to on the piece of paper I gave you is the portion of that exhibit which is JFB-3, Updated Schedule 4, Page 5a of 10.

Now, Mr. Paquette, are you familiar with the tender offers which PECo completed for its 17-5/8ths percent, 18 percent and 18-3/4ths percent first mortgage bonds in December of 1985?

A. Yes. I'm not sure if it was December or November, but I am familiar with that offer, yes.

Q. Am I correct that the premiums paid by PECo to accomplish these tender offers was in the amount of $44.801 million?

A. That sounds approximately correct, yes.

Q. The portion of Mr. Brennan's exhibit that I just gave you, in the first column he has a row of numbers and the second entry from the bottom is labelled "Tender and Call Premium." Do you see that?

A. Yes.

Q. The figure there is $51,255,000.

A. Yes.

Q. Now, would I be correct in stating that this premium is included in this amount indicated on Mr. Brennan's schedule?

A. It is included to the extent that it is deducted from the amount of bonds outstanding in arriving at the figure that is shown at the bottom of the table.

Q. Would I be correct in understanding that this $51 million figure in Mr. Brennan's schedule also includes a $6.4 million call premium associated with PECo's proposal to call the balance of its 17-5/8ths first mortgage bonds which, I believe, was scheduled on July 1?

A. Yes. I believe Mr. Brennan at our instructions included not only the actual tender offer that was made last fall, but our anticipated call of the remaining 17-5/8ths at its particular premium, which I believe are the numbers that you just quoted.

Q. And that's included in that $51 million amount?

A. Yes. It was intended that that be included.

Q. Mr. Paquette, in regard to the $44 million premium paid by PECo in 1985, could you explain to us the tax treatment of this payment on PECo's 1985 federal tax return?

A. We are allowed to claim that as a deduction in the year that the premium is paid. So that when we file our 1985 return later this year, it will be included as a deduction. However, because of the current status of the company, it will not produce any immediate tax benefits to the company because we're in a position where we're not able to utilize all of our tax credits.

So the fact that we put another $44 million of tax deductions will not make a significant change in the actual taxes that we pay to the federal government.

Q. And that deduction will be available in some form of tax carry-over?

A. Yes. It has the effect of increasing our tax credits that we can carry forward.

Q. Would the $6.4 million premium related to the call of the 17-5/8ths bonds be handled in the same manner on the '86 return?

A. Yes, it should be.

Q. Okay; that's all the questions I have on that, Mr. Paquette.

Could we turn to your rebuttal testimony, which is

PECo Statement 3A.

Now, I think initially in that testimony on pages 2, 3 and 4 and Tables 1 and 2, you talk about the financial impact from adoption by the Commission of the intervening proposals.

A. That is correct.

Q. Does your calculation of those impacts include any reduction in expense levels by the company?

A. Well, it reflects our best assessment of what expense levels will be in the forecast incorporating all of the changes that were reflected in the original forecast. We have not changed the numbers relative to my original testimony except -- may I ask a question?

(Witness conferring with PECo personnel.)

A. It is still the original information included in my original testimony.

Q. Mr. Paquette, are you familiar with an austerity program recently announced by the Duquesne Light Company?

A. Only to the extent that I've read an article in the paper about it.

Q. Let me ask you in your projection of the impact by the intervenors' positions whether your projection includes any expense reducing efforts that Duquesne is going to take. I would ask you: does your projection involve any prospective freezing of wages of company employees?

A. As I said, the data that I have included in these tables reflects the same level of expenses as incorporated in my original testimony filed last September. It was based on the forecast that we had prepared last summer.

Q. It would, I presume, include the same amount of financing for the construction of Limerick 2 through the period?

A. Yes. We have not changed the construction estimate for Limerick 2.

Q. And it would include budgeted amounts for the same level of employment by the company in that period, the same number of employees through the period?

A. Yes.

Q. And it would include the estimated pay increases of the company employees through this period?

A. Yes.

Q. Which would include regular increases in salary along with any merit increases that were paid?

A. We don't make a specific forecast of any kinds of individual increases, but it does reflect anticipated increases in overall levels of salaries paid to our employees through the forecast, yes.

Q. And it would also include the anticipated levels of company purchases of supplies and things of that nature?

A. Yes. It has all been prepared on the basis

that we would be an ongoing -- on the basis of continuing our present level of service to our customers.

Q. Mr. Paquette, so that I understand this -- and I think Mr. Hall asked you some questions when you identified your testimony -- your initial rebuttal testimony, which is 3A, contains a financial scenario in which you do a hypothetical financing of the increased expenses from the OKA proposed construction schedule for Limerick 1, and then you amended that in your second piece of testimony, 3B, to indicate the financing of a reduced amount to meet that proposed schedule; is that correct?

A. It is generally correct except that the original testimony did not deal with increased expenditures but, of course, a net decrease that would have resulted under the OKA plan. That number in Statement 3A was a net decrease in spending of about $407 million, and in the revised, corrected testimony, which was Statement 3B, we increased that reduction from $407 million to $638 million and then accordingly changed the financing plan to reflect that additional $232 million of lower spending.

Q. Mr. Paquette, looking at your tables at the back of 3B, your Table 5, I think along the left-hand margin under every year entry, you indicate the kinds of influence that were used for the financing issue hypothetically proposed in your testimony.

A. Yes.

Q. I would understand the initials that are on those columns to indicate MB would be mortgage bonds?

A. That's correct.

Q. CMN is common stock?

A. That's correct.

Q. And the STD would be short-term debt?

A. Yes.

Q. In the time period that is examined in the hypothetical financing and comparing that with the actual financing done by the company, the company did have other financing vehicles that it used that are not necessarily reflected in your hypothetical scheduling in your exhibits; is that correct?

A. I'm not sure I understand what you're getting at.

Q. On page 16 of 3A -- and I don't know if 3B has the same thing -- line 45 to the top of page 17 -- this is page 16 at the bottom.

A. Where it talks about the Limerick credit agreement?

Q. Right.

A. Yes.

Q. As I understand it, your use of the initials in the tables from my review of those, you did not include in your hypothetical financing use of any of the revolving credit agreements that you mentioned in your direct testimony

and your cross-examination.

A. Well, it was a little more dramatic than that. In the real world, in the actual world, we did negotiate and then utilize an $800 million Limerick credit agreement which became effective in 1984 and is still now in existence.

Now, the purpose of that agreement was to assure ourselves of the availability of debt capital in the years when we were finishing Limerick No. 1 while Limerick 2 was under suspension until such time as we would get Limerick No. 1 into rate base, and it was intended to be a bridge financing.

Originally, we had proposed to the Commission a Limerick credit agreement of $1.2 billion which we anticipated would be sufficient not only to finish Limerick 1 but to allow us to continue construction of Limerick 2 without interruption. The Commission refused to give us approval to do that. So we scaled it back to $800 million.

So when we went back and looked at the hypothetical financings that would have been required under the OKA schedule, it was very obvious that if under some circumstance we would have been able to finish Limerick 1 according to the OKA schedule, then we would have not needed to enter into that bridge financing because Limerick 1 would have been finished before we had a need for it. So that's why in the hypothetical program we just completely eliminated the

Limerick credit agreement altogther, because it would not have been necessary under the hypothetical circumstances.

Q. Reviewing your proposed hypothetical financing, I note that the periods it covers are '75 through '85.

A. Yes.

Q. Mr. Paquette, you mention in your direct testimony and when you were cross-examined on that in December the existence of other revolving credit agreements. Do you recall that testimony?

A. Yes.

Q. And do you recall those agreements?

A. Yes. We had outstanding for part of this period and still outstanding a $400 million domestic revolving line of credit, and we also had for a period of time a $100 million European line of credit.

Q. I would like to give you some exhibits here.

(Documents handed to witness.)

MR. DELANEY: Your Honor, I have a series of Commission orders involving the company's revolving credit agreements that I would like to have marked for identification. I will give you the numbers.

JUDGE MATUSCHAK: Very well.

MR. DELANEY: Your Honor, I would like to have marked for identification as Staff Exhibit 37 a copy of a Commission order adopted May 29, 1980 at Docket

Number S-80054561, which is captioned "Securities Certificate of Philadelphia Electric Company in the matter of a four hundred million dollar ($400,000,000) Revolving Credit/Term Loan."

JUDGE MATUSCHAK: So marked.

(Whereupon, the document was marked as Staff Exhibit No. 37 for identification.)

MR. DELANEY: As Staff Exhibit 38, I would like to have marked for identification an order of the Commission adopted April 3rd, 1981 at Commission Docket Number S-814655, which is captioned "Securities Certificate of Philadelphia Electric Company in the matter of a European Revolving Line of Credit not in excess of the principal amount of one hundred million dollars ($100,000,000)."

JUDGE MATUSCHAK: So marked.

(Whereupon, the document was marked as Staff Exhibit No. 38 for identification.)

MR. DELANEY: As Staff Exhibit 39, I would like to have marked for identification a Commission order adopted May 13, 1983 at Commission Docket Number S-834918, which is captioned "Securities Certificate of Philadelphia Electric Company in the matter of establishing a Eurodollar Revolving Line of Credit not in excess of $300,000,000."

And finally, as Staff Exhibit No. 40, I would like to have marked a Commission order adopted March 23, 1984

at Commission Docket Number S-845051, which is captioned "Securities Certificate of Philadelphia Electric Company in the matter of the Limerick Revolving Credit/Term Loan, not in excess of $800,000,000."

JUDGE MATUSCHAK: So marked.

(Whereupon, the documents were marked as Staff Exhibits Nos. 39 and 40 for identification.)

BY MR. DELANEY:

Q. Mr. Paquette, are you familiar with these Commission orders?

A. Yes, I am.

Q. When we asked you about these before in December, Mr. Paquette, I think you indicated that you negotiated the revolving line of credit to be used primarily as a back-up sort of line of insurance in the event you were precluded from accessing the permanent capital markets.

MR. HALL: Could you let Mr. Paquette see that?

(Document shown to witness by Counsel Delaney.)

THE WITNESS: That is true as it relates to the $400 million line of credit.

BY MR. DELANEY:

Q. Would that not also be true for the other credit agreements that the company had negotiated on Limerick?

A. There was only one other credit that was comparable to that, a line of credit, and that was the

$100 million. The $800 million was, of course, the Limerick revolving line of credit, and we did not enter into that as an insurance back-up line but to use and to actually draw down the funds. That was the purpose of that, and we did use it in accordance with our plan.

The other Securities Certificate you have referred to as Exhibit 39 was never culminated. We had engaged Morgan-Stanley to try to arrange a $300 million line of credit in the European market, and as you note it was 1983 when the Commission approved the Securities Certificate, and at that time up until I guess pretty much the middle of last year there was great, great uncertainties in both the markets here and in Europe regarding the nuclear generating units, and when Morgan-Stanley went into the market to try to arrange the line of credit, they were unsuccessful. So we never finished that line of credit and they were unable to arrange anything for us.

Q. Am I correct that at least one of the purposes of these revolving credit agreements was to stay out of the securities market when the company's interest coverages were substandard or when the market conditions were adverse to the company?

A. It wasn't designed to enable us to stay out, but rather in general when we couldn't access the capital markets for whatever reason, either being prevented because

of inadequate coverages or because of some catastrophic event that would dry up the sources of capital be it as a result of the company or anything else that would affect the markets.

These were intended to be back-up lines of credit and we used them for that purpose. They were only drawn down for very limited amounts of time and in limited amounts of the capacity.

Q. Mr. Paquette, let me show you a copy of the company's application to the Commission on the Limerick credit agreement?

A. The Limerick credit agreement?

Q. Yes.

(Witness perusing document.)

Q. As I understand it, in the bottom of the second paragraph of that page, it indicates, "The company proposes to utilize the new credit facility to postpone the need to raise long-term debt capital in the public market for the 1984-85 period when coverages would be substandard for the years beyond 1985 when the company's earnings and cash flow will be enhanced with Limerick Unit No. 1 and associated common plant in rate base."

A. Yes. That is entirely consistent with what I said five minutes ago that the Limerick credit agreement was intended to be utilized as a bridge financing to replace

other forms of debt until we finish Limerick No. 1.

The $400 million revolving line of credit and the $100 million European line of credit were intended to be back-up lines of credit.

Q. Would it be correct that the use of these kinds of credit facilities in the period examined in your financing scenario would not affect the company's coverage ratios under its indenture agreements?

A. The use of them?

Q. Yes.

A. Yes, that is essentially correct. The use of the Limerick credit agreement and the drawn down of the $800 million under that agreement did not affect our mortgage coverage ratio because mortgage debt was unsecured to borrowers.

Q. Would that also be true for the other credit agreements that are referenced in the exhibits you just examined?

A. Yes, to the extent we drew them down. Of course, you're talking about two different generally time frames, because the $400 million and the $100 million lines of credit were negotiated and originally in effect earlier than the Limerick credit agreement.

The $400 million line was, I believe, negotiated in 1980 and the Euro line was negotiated in 1981, and it was

common practice and I think good business practice to have back-up lines of credit for emergency purposes.

The concept of a revolving line of credit that would be utilized was not something that was common practice. I know in the utility industry at that time, it became more prevailing as we got into the troubled times of the mid-80s.

We were one of the first utilities to anticipate some of the problems that the capital markets would have with nuclear facilities, and we were one of the first ones to approach banks to form a syndicate to provide a large revolving line of credit that would be utilized rather than just one that would sit there as a back-up, and that is what the $800 million line evolved into.

Q. And the company's use of these kinds of innovative financing facilities at least began in 1980, is that correct, because that's the Staff Exhibit 37 which is, I think, the one you referenced, the $400 million line of credit?

A. Well, we have done a number of other things of a very innovative nature throughout this whole period, and all of that is documented in my original testimony.

Q. Where you discuss the innovative financing used by the company?

A. There are other things that we did; that is right.

MR. DELANEY: I think that's all the questions I have,

Your Honor, at this point.

I would like to move into evidence Staff Exhibits 37, 38, 39 and 40.

MR. HALL: No objection, Your Honor.

JUDGE MATUSCHAK: The motion is granted.

(Whereupon the documents marked as Staff Exhibits Nos. 37, 38, 39 and 40 were received in evidence.)

JUDGE MATUSCHAK: Consumer Advocate?

MR. POPOWSKY: Thank you, Your Honor.

CROSS-EXAMINATION

BY MR. POPOWSKY:

Q. Good morning, Mr. Paquette.

A. Good morning.

Q. Starting at page 11 of your rebuttal testimony, Statement 3A, you begin discussing the additional financing costs that you developed from Mr. Hill in preparing an analysis of the costs and benefits to PECo ratepayers of a later in-service date for Limerick 1; is that correct?

A. Yes.

Q. Your analysis, am I correct, specifies the additional capital financing that would have been required in order to meet the O'Brien-Kreitzeberg Associates proposed fuel load date; is that correct?

A. Well, the additional or the lower amounts, yes.

Q. And it would be additional in the years --

A. 1975 through 1982 would have required additional financings and then 1983 through 1985 considerably lower financing requirements.

Q. So in the years when additional financing was required, I take it you mean additional to what the company was doing anyway for other projects?

A. That's correct.

Q. So for the purpose of your analysis, just to get back to summarize, Mr. Hill also calculated the additional revenue requirement required to support that additional capital while maintaining the company's historic earnings per share at coverage ratios; is that also correct?

A. That is correct.

Q. As you said, the capital that you indicated had to be raised in those years was in addition to the capital that the company was already raising; is that correct?

A. Yes.

Q. So for the purpose of your comparison, you held other factors constant; is that also correct?

A. Yes.

Q. So for an example, on both analyses for the purposes of your comparison, did you assume that Limerick 2 was constructed on the same schedule?

A. Yes. We have not changed the construction

schedule of Limerick 2.

Q. And did you assume for both cases that Limerick 1 and for that matter Limerick 2 would be wholly owned by Philadelphia Electric Company and would not be sold in part or shared in part by any other utility?

A. Yes, that is correct.

Q. And you also assumed in both analyses that Philadelphia Electric Company would maintain its full 471 megawatts share of Salem 2 through the end of construction, and only upon completion of construction would you commence the sale of output to Jersey Central; is that correct?

A. We did not change anything relating to Salem 2.

Q. And you also assumed the same historic level of wage increases; is that correct.

A. Yes. We didn't change anything else.

Q. The employee levels?

A. I guess in theory we changed employee levels because of the need for additional construction workers to build the plant faster, but that's something that Mr. Boyer would address. But that wouldn't have impacted our income statement except that the wages get reflected in the construction expenditures.

Q. And then finally, you would have maintained constant, am I correct, the same level of non-Limerick construction expenditures?

A. That's correct.

Q. Also in your testimony you consider the effects on the company of the OCA's proposed revenue requirement reductions in this case; is that correct?

A. Yes.

Q. Did you note that one of the OCA adjustments in this case was based on alleged imprudence by General Electric Company -- it is based on part on alleged imprudence by General Electric Company with respect to the Mark II containment design?

A. Yes.

Q. Have you considered the possibility that Philadelphia Electric Company might have a source other than its ratepayers to recover costs related to that problem?

A. I believe -- are you talking about the possibility of a suit?

Q. Yes.

A. That would be one thing. I believe that is a possible source, yes.

Q. As the Financial Vice-President of Philadelphia Electric Company, have you made any efforts to determine whether legal action might have been or might still be taken against General Electric Company?

A. The area of filing suits is not within my jurisdiction.

Q. Are you aware from your dealings with perhaps executives of other utilities, particularly other nuclear utilities, are you aware of whether any other utilities have indeed filed suit against General Electric Company and others to recover the costs related to the Mark II containment problem?

A. I believe some of the other utilities have, yes.

Q. Could I ask you to examine an article that appeared in the "Wall Street Journal"? Perhaps you could take a moment to read it.

(Witness perusing document.)

Q. Have you had an opportunity to review that article?

A. Yes.

Q. Does this document that I handed to you appear to be an article dated February 24, 1986 from the "Wall Street Journal" headlined "GE Internal Data Show Firm Hid Flaws in Reactor Design, Zimmer Owners Claim"?

MR. HALL: Your Honor, I'd like to at this point make an objection unless Mr. Popowsky can tie this into Mr. Paquette's testimony and his background as a financial witness.

The article is a discussion of the Zimmer lawsuit which has been put forth by Dr. Hanauer in his testimony in this case. However, I believe, as Mr. Paquette has stated,

Mr. Paquette is not involved in the decision related to filing lawsuits by the company, nor is he an engineer who would be involved in evaluating this kind of data as described in this article.

Unless Mr. Popowsky can give us a significant reason as to why this would be related to Mr. Paquette's financial testimony in this case, I think it is improper cross-examination.

MR. POPOWSKY: First of all, Your Honor, I don't intend to make this article an exhibit. I don't intend to question Mr. Paquette about the engineering details of the issue that will be raised I am sure in later cross-examination of witnesses for both the OCA and the company today.

What I am trying to establish is what effort Mr. Paquette made in his position as a Financial Vice-President to determine what other sources of revenues related to this problem might be available rather than simply coming directly to the ratepayers and what efforts he made as Financial Vice-President to ensure that other avenues were explored.

MR. HALL: Your Honor, this article here really deals only with engineering related facts. I think that what Mr. Popowsky is really doing by cross-examining this witness with regard to this article is seeking to bring into the

record what are stated in the newspaper article as alleged facts. They are only alleged facts in the article. They are simply beyond Mr. Paquette's expertise to comment on or explain.

In fact, through this line of cross-examination what the Consumer Advocate will be seeking to do is to put into the record a number of statements from this article about engineering facts which this witness cannot respond to or explain, and the company would have to seek to try to do that through some other witness without any real procedural vehicle for doing it.

I think if Mr. Popowsky does have questions relative to this article, they should be directed to the company's experts on Mark II matters. Mr. Paquette has already stated or can generally explain what, if any, facts or consideration he has given to the possibility of revenues from a suit of General Electric, if any, without having to deal with the specific allegations made in this particular article.

MR. POPOWSKY: Your Honor, I certainly don't intend to use any facts or statements contained in this article for the truth of the matters contained therein. I wanted to cross-examine Mr. Paquette regarding what he knows about other utilities' efforts to take those lawsuits, the fact that hundreds of millions and in fact even more than

a billion dollars may be involved in some of these lawsuits and what efforts Mr. Paquette has made to see whether those kind of revenue sources can be obtained by the company through another source rather than simply come to this Commission and ask for this money from ratepayers.

He has detailed in his testimony the effect of a revenue disallowance--if the Commission adopts the OCA adjustments, Mr. Paquette has testified as to what he believes the effects would be on the company's coverage ratios, earnings per share, dividends.

The point of the cross-examination of Mr. Paquette is not to get into details as to the merits of any lawsuits or the merits of the engineering claims but rather to simply determine what efforts he and the company have made to tap these other potential sources of revenues particularly in the event of a disallowance in this case.

JUDGE MATUSCHAK: I can see your interrogation as to whether the company has considered doing what some other companies may have done concerning General Electric, but the company, I think as Mr. Paquette has indicated, may have considered that matter. I can't see how you could go any further than that. This is a legal matter concerning the company.

PECo is not obligated to file a lawsuit because somebody else did. Anybody could file a lawsuit. I don't

think you can impugn improper motives of this company by saying that some other companies filed a suit against GE. There is no judgment. There was no decision. There was nothing that was decided. It is merely an allegation.

MR. POPOWSKY: Your Honor, we're not trying to impugn the motives of PE. I am simply trying to establish what efforts the company is making or has made and whether Mr. Paquette, as the Financial Vice-President, was aware of these efforts prior to the publication of this article.

JUDGE MATUSCHAK: We'll allow you generally to question whether they considered these aspects, but what the internal deliberations of the company are and the conclusions of the company and the aspects they considered in concluding their course of action or non-action I think is beyond --

MR. HALL: If Your Honor please, the company has no objection to the Consumer Advocate asking Mr. Paquette questions about what he has considered or what he has not considered. I want to be clear that the company's objection is to the use of this article as a vehicle to do that.

I think the only reason for using the article as a vehicle to do that -- there is obviously no need to do it that way. The only reason for using the article is to try to inject in this record statements from the article which, while it may be said they are not offered for the truth,

really once they're in the record they are used for that purpose.

JUDGE MATUSCHAK: Yes. I think in that connection, we will sustain the objection. We think at least the implication is made that the allegations contained in this article are facts, and they are merely allegations and they haven't been tested.

MR. POPOWSKY: Let me just say, Your Honor, that I do not intend to use -- I will refrain from referring to the article, but certainly we will not in any way use the statements contained in the article for the truth of the facts contained therein.

What the purpose of simply questioning Mr. Paquette is is whether or not he is aware or had been aware that these lawsuits had been filed, the amount of money involved, and what efforts he has made perhaps to contact the officials of these other utilities as to what efforts PECo has or will make in this respect.

MR. HALL: We have no objection to the direct questions. We simply object to the use of the article.

MR. POPOWSKY: I will refrain from referencing the article.

JUDGE MATUSCHAK: Very well.

BY MR. POPOWSKY:

Q. Were you aware that the utilities involved in the

Zimmer plant -- were you personally aware that the utilities involved in this Zimmer plant had filed a lawsuit against General Electric?

A. Yes. I had read that in the newspapers.

Q. So that is how you became aware of that fact?

A. Yes.

Q. Have you talked to individuals at those companies involved concerning that lawsuit?

A. No, I have not. That is not within my area of responsibility in the company.

Q. Were you aware that the Washington Public Power Supply System had also filed a lawsuit involving the Mark II containment problems?

A. No, I was not generally aware. The one I know of is Cincinnati. I believe Cincinnati Gas and Electric had.

Q. So you weren't aware either prior to or after reading any newspaper articles about the lawsuit that Washington Public Power Supply System has also filed suit?

A. No, I wasn't aware of that.

Q. Do you have any idea or do you have any independent knowledge of how much money was involved in the Zimmer lawsuit against General Electric?

A. No, I do not.

MR. POPOWSKY: That's all the questions I have.

Thank you, Your Honor. Thank you, Mr. Paquette.

JUDGE MATUSCHAK: Is there any further cross-examination of this witness?

MR. CLARK: Yes, Your Honor.

JUDGE MATUSCHAK: Mr. Clark.

CROSS-EXAMINATION

BY MR. CLARK:

Q. Mr. Paquette, my name is Roger Clark and I am with the Governor's Energy Council.

Will you briefly tell us what has been happening with interest rates in the last three months?

A. Interest rates, particularly long maturity interest rates, have decreased considerably over the last three to four months. As a matter of fact, the decrease has been going on longer than that. It has accelerated in the last two to three months.

Q. Have these accelerating decreases in the last two or three months been reflected in the company's original filing in this case?

A. We have, through Mr. Brennan, put in some revised material reflecting the fact that we have tendered for some of our high coupon bonds and financed them with lower interest rate bonds.

I believe at some point -- I don't know whether we've done it already, but at some point before the record is

closed our interest claim is adjusted to reflect somewhat current conditions. Is that correct?

MR. HALL: I have no knowledge of that.

THE WITNESS: Perhaps Mr. Brennan has done that himself to reflect current interest rates to the extent that they need changing.

BY MR. CLARK:

Q. Are you aware if the current interest rates are reflected in the company's testimony concerning the various phase-in plans that have been offered by the intervenors in this case? Has that part of the company's testimony been revised?

A. I'm not sure that I understand what you're getting at with that question.

Q. Is it true that one of the major complaints yourself and several other company witnesses have about the sinking fund phase-in alternative that has been proposed by both the Governor's Energy Council and PAIEUG in this case is that such a proposal would sharply reduce cash flow to the company and require additional flows and so on to make up that cash flow decrease?

A. Yes.

Q. Is that true?

A. Yes. In our rebuttal testimony, we had made the point that the stretched out phase-in plan would require the

company to borrow more money that would have an interest cost associated with it and that interest cost would penalize earnings. We have reflected that penalty in the tables that I have presented showing the financial impact of the various intervenor rate and phase-in plans.

Q. Do those tables that show those financial impacts reflect interest rates that are currently available or interest rates of three or four months ago?

A. If I remember, we used an interest rate of around 12 to 13 percent -- 12-1/4 percent, which is not exactly maybe what we would have to pay if we were financing today, but it's not very far away from it.

So, yes, there would be some slightly lower interest penalties associated with the phase-in plans, but we're not talking about a big proportion of that, a big number, but these phase-in plans would hurt the company, and we're talking about billions of dollars penalties over a period of time due to the need to raise capital to offset the lack of revenue that would otherwise be deferred under the intervenor phase-in plans.

So instead of being billions, it may be 90 percent of those numbers, but still a huge number.

Q. Have you computed those financial impacts based on the currently available lower interest rates or is that simply your estimate?

A. No. That is just a rough estimate. I have not done that.

MR. CLARK: I have no further questions, Your Honor.

JUDGE MATUSCHAK: Any other cross-examination?

MR. DELANEY: Your Honor, I would like to ask Mr. Paquette one further question with your indulgence.

FURTHER CROSS-EXAMINATION

BY MR. DELANEY:

Q. Mr. Paquette, in response to one of my prior questions, you mentioned a $1.2 billion revolving credit facility that the company had negotiated. Do you remember that?

A. Yes.

Q. My recollection is that you also discussed this when we cross-examined you on your direct testimony and the Commission refused to approve that, refused to issue a Securities Certificate on that, and subsequently you came back with the $800 million Limerick credit agreement.

A. That is correct.

MR. DELANEY: Mr. Hall, I only have one copy of this.

(Document shown to witness by Counsel Delaney.)

BY MR. DELANEY:

Q. This is the application made to the Commission on the $1.2 billion credit agreement.

Could you look at that? I'm showing you page 2 of it.

(Witness perusing document.)

Q. What I be correct in stating that this agreement included a five-year revolving credit period as indicated on that page that I've just shown you?

A. Yes.

Q. Would I be correct that the $800 million revolving credit agreement has a four-year period?

A. Yes.

MR. DELANEY: That's all the questions I have.

Thank you, Your Honor. Thank you, Mr. Paquette.

MR. HALL: If Your Honor please, could we have a break to discuss redirect examination?

JUDGE MATUSCHAK: Yes. We will take a short break.

(Recess.)

JUDGE MATUSCHAK: When you're ready.

MR. HALL: Your Honor, I have several questions on redirect for Mr. Paquette.

REDIRECT EXAMINATION

BY MR. HALL:

Q. Mr. Paquette, Trial Staff counsel asked you a number of questions respecting certain lines of credit that you have had over the last five years that you have negotiated and gotten Commission approval to enter into.

Do you recall those questions?

A. Yes.

Q. In fact, I believe Trial Staff provided you with copies of the Commission orders as Trial Staff Exhibits 37 through 40 in which these lines of credit were approved by the Commission.

A. Yes.

Q. Mr. Paquette, looking at those orders, and based upon your knowledge of these lines of credit, their negotiation, their purposes, the applications that were filed with the Commission, can you describe for me the purposes of use of these lines and their function with the company?

A. Well, the $100 million Euro line and the $400 million domestic revolving line were specifically arranged for the purposes of being a backup line of credit, which

we intended to use only under extreme emergency conditions such as I mentioned earlier, unavailability of the capital markets or inability of the company to issue normal securities.

That was the understanding that we had with the lenders when we negotiated the agreements, and it was also recognized by the Commission in the securities certificate.

For instance, Staff Exhibit 37, the Commission securities certificate, says, in regards to the $400 million revolving line of credit, that "This issuance will not be in lieu of conventional securities offering, but will be used only when access to conventional capital markets is not available on acceptable terms."

Q. Is it correct, Mr. Paquette, that this specific purpose for these early revolving credit loan agreements was stated in the application provided to the Commission?

A. Yes. We must always state what the purpose and the use of proceeds would be for.

Q. Mr. Paquette, is this function and this limitation a normal condition of revolving credit lines that were available to utilities during this time period? And by that I mean the time period 1980 through, shall we say, 1982.

A. My recollection of what other utilities were doing at that time, throughout the whole '70s and until

the early 1980s, was that almost all utilities had some form of backup lines of credit for financial flexibility and to provide emergency capability.

We did not have, ourselves, a specific agreement until we signed the $400 million revolving line of credit, but we did have backup capability in terms of bank lines with local banks in Philadelphia, and we did arrange some specific loans from a number of banks during the '70s. Then in 1980 we formalized this $400 million revolving line of credit, which was comparable to what was being utilized by all the utilities that I can remember at the time, the terms of it and the purpose of it.

Q. Mr. Paquette, under the assumption that the company had had a revolving credit line during this period, or could have obtained one, and that you had used that assumption in your analysis of the costs of raising capital relative to the O'Brien-Kreitzeberg plan, what would the effect of that assumption have been on your analysis?

A. If we had assumed that we could have arranged a line of credit and had used that instead of, for example, issuing mortgage bonds or debentures in the hypothetical plan, I don't believe it would have had any significant impact on our final conclusions or on the calculation of the revenue requirements needed to maintain our financial integrity.

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We did develop two measures of revenue requirements for financial integrity, the first one being to maintain earnings per share, and the other one being to maintain mortgage coverage.

We could have also have developed another one to maintain our SEC coverage, which is also a very important measure used by the capital markets, and the substitution of bank credit for mortgage bonds would not have had a -- would still have had a need for substantial rate increases to maintain the SEC coverage, because both the unsecured and the mortgage debt is included in the SEC coverage, and in fact it might have required a greater rate increase under the SEC coverage test because we probably would have been paying or could have paid a higher interest rate for the term loans than the unsecured debt or mortgage bonds.

So I don't believe, even if we had a revolving line of credit available to us throughout the '70s and if we had used it, I don't think our conclusions about the revenue requirements needed to maintain financial integrity under the OKA plan would have changed significantly.

Q. Finally, Mr. Paquette, the Consumer Advocate asked you a number of questions about assumptions underlying your analysis respecting the construction of Limerick 2, whether Limerick 1 would be a solely-owned Philadelphia Electric facility and about assumptions

respecting the sale of Salem 2 capacity.

Could you state for me why you made the assumptions that you did in your analysis respecting those matters?

A. Particularly in regard to assumptions of not changing the Limerick 2 construction schedule when we changed the Limerick 1 construction schedule, as suggested by the OKA witness, if we had moved up the Limerick 2 construction schedule so that it remained approximately one or two years behind the Limerick 1 schedule, which had been our practice throughout the whole construction program, then we would have required in some years even more funds than we have put in the period 1975 through 1982. We felt that we could have been accused of trying to deliberately penalize the OKA plan if we had done that.

So to be deliberately conservative, we left the Limerick 2 construction schedule alone so that it would not add additional financing dollars on top of the OKA required additional dollars in the period 1975 through 1982.

Q. Mr. Paquette, I'm not sure I followed all of the answer, and I'm not sure it was directed to my question. Let me see if I understood the point that you're seeking to make. That is that in the analysis that you have presented here today and have been cross-examined on, you have simply looked at Limerick 1 and the effect of the O'Brien-Kreitzeberg proposal to advance Limerick 1; you have made

no assumptions -- or, in fact, you have conservatively assumed that there would not have been an advancement in the Limerick 2 construction date, and, therefore, there would be no additional financing related to that if you had tried to finish Limerick 1 in 1982.

Have I stated correctly?

A. Yes.

Q. Mr. Paquette, returning to several other parts of my question, why did you not assume joint ownership of Limerick 1 or cancellation of Limerick 2 or the sale of Salem 2 in your analysis in developing the additional financing and related revenue requirement effect?

A. Throughout the whole period, our studies continued to show that not only was Limerick 1 needed, but that Limerick 2 was needed fully, and that Salem 2 was also needed to come back to our system at the end of the contract with Jersey Central.

Q. When you say "needed," Mr. Paquette, do you mean by that needed to provide capacity to meet customer load, and also needed as an economic source of baseload generation?

A. Yes, I do.

MR. HALL: That's all the questions that I have, Your Honor.

MR. DELANEY: I have some recross, if I could have

a moment, Your Honor.

JUDGE MATUSCHAK: Yes.

(Pause.)

MR. HALL: If Your Honor please, and with Staff's indulgence, I did omit one question that I need to ask Mr. Paquette.

JUDGE MATUSCHAK: Very well.

BY MR. HALL:

Q. Mr. Paquette, relative to the cross-examination by counsel for the Governor's Energy Council, I believe a question was asked you about the use of a 12.25 percent debt cost rate and whether that was appropriate in your analysis of phase-in plans at this time given current interest rates.

Do you recall that question?

A. Yes.

Q. Do you have any additional comment to make relative to the appropriateness of that assumption in your analysis of phase-in plans?

A. In the selection of that 12.25 percent rate, once again, we attempted to be very conservative in terms of what the real cost of burden on the company would be with the extended deferred revenue phase-in plans.

While I did agree that interest rates are slightly lower today, I would like to establish the fact for the

record that that assumption of 12.25 percent assumed that all of the funds that we would have raised under the stretched out deferred phase-in plans would have been obtained from the debt markets, and so it is very, very conservative.

In reality, we probably would have to issue common stock as a part of the source of funds to make up for the deferred revenue, and, of course, equity would have a much greater cost than even the 12.25 percent that we assume for the funds being obtained from debt sources.

So that while interest rates may be lower today, I still believe that the 12.25 that we use is still a very conservative number considering the fact that in the real world we would also raise some of the funds from the equity markets.

MR. HALL: Your Honor, that's all that I have.

MR. DELANEY: I have some recross.

RECROSS-EXAMINATION

BY MR. DELANEY:

Q. Mr. Paquette, in response to some questions that Mr. Hall asked you, you discussed some language contained in the revolving agreements. I understood you to say -- I furiously scribbled it down -- that there was common language in those agreements at the time that said that they would be used in extreme circumstances or when

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access to capital markets was not available or on acceptable terms.

Is that correctly characterizing your response to --

A. No. I did not say there was common language. I said we had a common understanding with the lenders that the purpose of the $100 million Euro credit and the $400 million domestic credit was that it would be used only as a backup line of credit to be used in cases of emergencies.

Q. My recollection is you defined emergencies to be when you did not have access to the credit market or the access was not on acceptable terms.

A. Yes. Either when we could not access the markets or the markets weren't there, in either direction.

Q. I think you further testified that this was in some of the applications to the Commission?

A. My recollection is that we put that in all. I know I see it here in the securities certificate of the Commission with the $400 million, and I believe --

Q. Which is Staff Exhibit 37.

A. Yes; that is 37. And I believe we put those words or similar words in both the securities certificate that we filed with the Commission in connection with the $400 million, as well as the $100 million Euro credit.

Q. And your recollection is that would be true in all the ones that we have as Staff exhibits?

A. No. There is only two of these revolving back-up credits; that is the $100 million and the $400 million. Remember, the $300 million that we applied for we never went through with because we couldn't get the revolving credit arranged.

The $800 million Limerick credit agreement was not a backup, but it was to be actually that we would use the revolving line of credit, and we did use it.

Q. The language "being unable to go to the market on acceptable terms to the company," would that include avoiding the market when doing that might further degrade the company's coverage ratios? Do you interpret that kind of situation to be encompassed within that?

A. No, I wouldn't think so. As long as we had the capacity and we would not have to pay a rate that would be significantly above what other comparable credits would have to pay at that time, I think we would do what I call normal financing.

If we were forced into a condition for some reason or other that we would have had to pay an exorbitant excess above comparable credits, then that was one of the times that we would have anticipated that we would have used the revolving line of credit.

Also, there were times when we would have normally gone to the financial markets and we were maybe waiting

for a Commission rate order, and rather than to issue a long-term issue when the disposition of the rate order might have been uncertain -- I know there was one case where we just waited for the order to come out so that the investor would have a firm idea of what the ultimate outcome of the rate case was.

Q. If I understand your response then, you would utilize one of these in the meantime?

A. Yes.

Q. I think in response to some other of Mr. Hall's questions you indicated that you had informal arrangements of this kind before 1980, and in 1980 you formalized them in, I believe, Staff Exhibit 37?

A. No. What I meant to say was that in the early '70s -- and we still do today; we have available to us significant amounts of bank credit available from local banks through informal arrangements. So that was one layer of backup capacity to the company that has always been available.

Then as we got into the period of the '70s and our construction needs started to increase and the investors became a little more concerned about nuclear power and our ability to maintain our financial condition in sufficient status to raise the capital necessary, we felt it was desirable to add another layer of reserve capacity. That

is why we entered into the revolving lines of credit, the $400 million and the $100 million.

Then finally we entered into a Limerick credit agreement in 1983 and 1984 when the investor uncertainty about nuclear power seemed to be reaching a crescendo.

Q. I understand you to indicate that this move to a more formal arrangement happened in 1980?

A. Well, 1980 was the first, as I remember, official revolving line of credit that we had negotiated.

Q. Finally, Mr. Hall asked you some questions about assuming the use of these kinds of credit agreements in your analysis.

A. Yes.

Q. I think you responded about some concerns about the SEC coverage and the need for interim rate increases.

When we discussed the Limerick credit agreement you indicated that one of the features of the agreement was a bridging effect; is that correct? And maybe you could explain that.

A. In 1982, when the first Limerick investigation was coming to a conclusion and the Commission had indicated that we should either cancel Unit 2 or suspend its construction until Unit 1 was finished, it was indicated to us that the primary reason that they thought we should not try to continue simultaneous construction of both

units was that we didn't have financial capability to raise the capital to do so. So in order to address that concern, we negotiated the $1.2 billion revolving line of credit, which was intended to provide the debt capital to continue simultaneous construction of both Limerick Unit 1 and Unit No. 2 from that time until Limerick 1 was placed in rate base.

The agreement, as you indicated earlier, was intended to be a five-year agreement for a total of $1.2 billion. The five years being approximately from 1983 till 1988. At that time it was anticipated that Limerick No. 1 would be completed, in rate base, and our financial measures would start to be restored.

Now, that was the bridge aspect, to get where we were in 1982 until Limerick No. 1 would be fully in rate base.

Q. And I understand your allusion to a bridge is that the company could use the money to meet the building needs and bridge the repayment of those monies to a time when the internal cash flow would improve when the plants were completed and in rate base?

A. Well, yes, to bridge over the troubled years when we were finishing Limerick 1 and get to a point where Limerick 1 would be in rate base, and then we could use the cash flow from Limerick No. 1 being in rate base and the

improved earnings and coverages which would enhance our ability to raise capital in the capital markets, and to use those forecasted conditions to repay the Limerick No. 1 credit agreement beginning in 1988 through the period 1992.

Q. Which would bridge the time period between those two events.

A. That's right.

MR. DELANEY: Excuse me for a second.

(Pause.)

MR. DELANEY: That's all I have, Your Honor.

Thank you, Mr. Paquette.

MR. POPOWSKY: Your Honor, I have some questions.

RECROSS-EXAMINATION

BY MR. POPOWSKY:

Q. Regarding your testimony on Salem 2 and the need for completion of Salem 2, the company in fact did sell its share of the output of Salem 2 to Jersey Central starting in 1981 through 1984; is that correct?

A. Yes.

Q. Was that based on a determination at that time by members of your generation planning department that that was an appropriate sale and that the company, at least for that period, did not need Salem 2's output?

A. Yes. I believe the decision to do so was based on the consideration that we did not need that capacity to

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serve our customers' loads, and it also had the advantage of postponing for a considerable period of years the need to apply for a rate increase to get Salem No. 2 into our rate base.

MR. POPOWSKY: One moment, Your Honor.

(Pause.)

MR. POPOWSKY: That's all I have, Your Honor.

Thank you, Mr. Paquette.

JUDGE MATUSCHAK: Is there anything further?

MR. HALL: No, Your Honor.

JUDGE MATUSCHAK: Thank you.

(Witness excused.)

MR. HALL: If Your Honor please, could we have a five-minute break?

JUDGE MATUSCHAK: Very well.

(Recess.)

MR. KLEPPINGER: Your Honor, before we proceed with further cross-examination of company witnesses, I would like to have the opportunity to move the testimony and exhibits of Randall Falkenberg, his surrebuttal statement.

We have been advised by all parties that there is no cross-examination of that statement, so he is not here to appear today.

For purposes of identification, I would like to have marked as PAIEUG Statement No. 1A the surrebuttal and exhibits of Randall J. Falkenberg. Copies have been supplied to the court reporter and to all parties.

And if there are no further objections to this testimony, I would like to move that into the record at this time.

MR. HALL: I have no objection.

JUDGE MATUSCHAK: Will counsel stipulate to the statement being admitted without further authentication?

MR. HALL: Yes, Your Honor.

MR. DELANEY: Yes.

JUDGE MATUSCHAK: The motion is granted.

(Whereupon, the document was marked PAIEUG Statement No. 1A for identification and received in evidence.)

MR. KLEPPINGER: Thank you, Your Honor.

Finally, during the hearing on Monday, March 10, we had asked a data request of OCA Witness Oliver. He has

provided us with that response, and with the agreement of counsel from the OCA at that hearing, we have decided to mark that response as PAIEUG Exhibit No. 13, and I would also ask for admission of that exhibit into the record if there are no objections.

JUDGE MATUSCHAK: Will counsel stipulate that it may be admitted without further authentication?

MR. WERSAN: Yes.

MR. DELANEY: Yes.

MR. HALL: Yes.

JUDGE MATUSCHAK: It is admitted.

(Whereupon, the document was marked PAIEUG Exhibit No. 13 for identification and received in evidence.)

MR. KLEPPINGER: Thank you, Your Honor.

JUDGE MATUSCHAK: Mr. Hall?

MR. HALL: Your Honor, we have this morning for cross-examination Mr. Franklin D. Sanders. He has not been sworn.

Whereupon,

FRANKLIN D. SANDERS

having been duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. HALL:

Q. Mr. Sanders, would you state your name and business

affiliation for the record, please?

A. Franklin D. Sanders. I am affiliated as a management director of the First Boston Corporation.

Q. Mr. Sanders, do you have before you two documents which have been identified in the right hand corner as PECo Statement No. 35 and PECo Statement No. 35A?

A. I do.

Q. Referring to PECo Statement No. 35, Mr. Sanders, is this a document of some 14 pages with one attached table?

A. That is correct.

Q. Is this document in fact your rebuttal testimony for use in this proceeding?

A. It is so intended. I presume that the table attached is identified as Table 1 Revised.

Q. The one on mine is Table 1. You have a Table 1 Revised?

A. Yes. It was supplied to the company and to your firm. I don't know whether it has been supplied to other parties. It was revised as a result of the revisions in Mr. Paquette's testimony.

Q. I believe it was, as I recall.

MR. HALL: If any party doesn't have it and has a question, they can bring it to my attention, but my recollection is that we mailed that out. That has been sent out. The copies that will be provided for the record

will in fact reflect Table 1 Revised.

BY MR. HALL:

Q. Mr. Sanders, referring to PECo Statement No. 35A--

A. Excuse me. I thought you were going to ask me whether or not 35 is in the form in which I would adopt it as my testimony, because there are several corrections required to 35.

Q. I will get to that.

A. You will, all right. Excuse me for getting ahead of you.

Q. On PECo Statement No. 35A, Mr. Sanders, is that a document of some four pages in length?

A. That is correct.

Q. And is that in fact your sur-surrebuttal testimony for use in this proceeding?

A. That is correct.

Q. Mr. Sanders, do you have any corrections to make to either of these two documents at this time?

A. Yes. As to Statement No. 35, on four pages, there are corrections. On page 4, there is a reference to Mr. Paquette's Statement No. 3A in line number 9, which should be expanded to refer to his Statement No. 3A and 3B, and the reference to the tables attached should be to Tables 3 through 6 attached to Statement 3B.

Also in line 25, the cross-reference in the

parenthetical should be to Statement No. 3B; same change in line 31.

The year indicated in line 35 should be 1982. There is a word missing in line 49. The first several words should read, "without more revenue, maintain the quality."

On page 7, again as a result of the revisions to Mr. Paquette's testimony in Statement No. 3B, the sentence which begins on line 7 and runs through line 13 should read as follows:

"In particular, the repeated sales of common stock in three issues of 9 million shares in 1981 and 1982 and one issue of 7 million shares in 1982 would have strained the capacity of the common stock market for PECo's shares."

Q. Mr. Sanders, could I ask you to read that again, to be sure that we have it?

A. "In particular, the repeated sales of common stock in three issues of 9 million shares in 1981 and 1982 and one issue of 7 million shares in 1982 would have strained the capacity of the common stock market for PECo's shares."

On page 10, for clarity's sake, in line 27, where it says "book reporting," I think it should read "financial reporting."

And on page 14, there is a figure in line 13 of $1 billion which should read $3 billion. That completes the changes I would make.

Q. Mr. Sanders, with these corrections to your PECo Statement No. 35, is the material provided in PECo Statement No. 35 and Statement No. 35A true and correct to the best of your knowledge and belief?

A. It is.

Q. If I were to ask you the questions contained within those documents today, would your answers be as set forth therein?

A. They would.

MR. HALL: Your Honor, I would ask that Mr. Sanders' testimony, both rebuttal and sur-surrebuttal, be identified in this proceeding as PECo Statement No. 35 for the rebuttal testimony and PECo Statement No. 35A for the sur-surrebuttal testimony.

JUDGE MATUSCHAK: Very well.

(Whereupon, the documents were marked PECo Statements Nos. 35 and 35A for identification.)

MR. HALL: And I would ask that these two documents be admitted into the record.

JUDGE MATUSCHAK: Subject to any timely objection or exceptions, the motion is granted.

(Whereupon, the documents marked PECo Statements Nos. 35 and 35A were received in evidence.)

MR. HALL: Mr. Sanders is available for

cross-examination, Your Honor.

JUDGE MATUSCHAK: Staff?

CROSS-EXAMINATION

BY MR. DELANEY:

Q. Good morning, Mr. Sanders.

A. Good morning.

Q. My name is Dan Delaney. I have some questions on your testimony. Initially, I was a little confused about your statement about the revised table.

What I understand to be the situation is that you have one revised table that was subsequently mailed out after your testimony was filed?

A. Yes, and I just wanted to make sure that everyone was dealing with my revised table and not with the table which was circulated with my original production of Statement No. 35 because of the revisions which were made to that table.

Q. Let me just make sure I have the right table. I just want to show you what I have.

A. In the upper right hand corner, it should say Table 1, with "Revised" in parentheses under Table 1.

Q. Very well.

Looking first at your Statement No. 35, which is your rebuttal testimony, Mr. Sanders, as I understand your testimony, you reviewed the financing plan sponsored in

Mr. Paquette's rebuttal testimony?

A. That is correct.

Q. Could you turn to page 5 of your rebuttal testimony? On line 5 of page 5, you state that there are many alternative plans which PECo might have hypothesized to obtain the necessary additional financing. Do you see that reference?

A. Yes, I do.

Q. That's on page 5, line 5.

Did you examine the company's hypothetical financing schedule in Mr. Paquette's testimony year by year, issue by issue to see whether less expensive alternatives may have been available?

A. Not exactly. I examined it issue by issue, year by year to see whether the issues which were chosen were appropriate for the markets which were available at the time, and consistent with the objectives of meeting the parameters which are described on page 5 in my answer to the question at line 29, the answer beginning at line 33.

Q. If I understand your response then, in the initial answer that begins on line 5, you talk about alternatives. Did I correctly characterize your response to say that you did not necessarily examine alternatives for each issue, each year, but you examined the appropriateness of what Mr. Paquette had in his testimony?

A. That's right, as to whether those financings could have been achieved on the terms which were proposed and whether they were appropriate financings in light of market conditions.

Q. Your revised table that you just mentioned I think has revisions to reflect Mr. Paquette's subsequently revised rebuttal testimony.

A. That's correct.

Q. Now, as I understand it, the revision in Mr. Paquette's testimony reduced the amount of additional financing to meet the OKA construction schedule through 1982 by an amount of $177.6 million. Are you familiar with the fact of that change?

A. Yes, I have seen the original testimony in 3A and the finally adopted financing plan reflected in Mr. Paquette's Statement 3B.

Q. Mr. Sanders, in your opinion, is this difference in the financing amount a significant change?

A. $177 million spread over several years in which the aggregate financing program was -- let's put it into perspective for a moment.

(Witness perusing documents.)

A. That's in relation to a financing program which required approximately $800 million of additional funds through 1982 and before the reductions in financing

requirements of 1983 and 1984 occurred.

And that $800 million number, please understand, is done in my head quickly, looking at the years concerned, and ought to be checked.

But to me, a $160 million reduction or approximately 20 percent is significant. On the other hand, when you look at this financing against the total amount which was raised by the company during that period of time, it amounts to about one and a half bond issues, two common stock issues over that period of time, so it's not overwhelming.

Q. I would assume that this change did not affect any of the opinions expressed in your testimony?

A. No, it did not, well, with one exception. You notice that I changed the year on page 4 from 1979 to 1982. The effect of the revised financing program was to slow the buildup of financing and therefore the point at which the company's numbers would have made apparent the significant and increasing reductions in earnings. That was by about three years.

Q. The modification you are indicating is on page 4, line 35 of your testimony, where you changed the date from 1979 to 1982?

A. That is correct.

Q. Could you turn to page 6 of your testimony, Mr. Sanders?

A. Yes.

Q. There you indicate that in your opinion, the company's financial standing would have deteriorated even assuming it received additional revenues required to maintain earnings per share at historic levels.

A. Yes.

Q. And I think you also indicate there the possibility of reduction of interest coverages calculated according to rating agency methodologies. Could you explain to us how those interest coverages are calculated?

A. The interest coverages calculated according to rating agency methodology would be those consistent with the coverages calculated in my Table 1, which were done according to the formulas specified in the First Boston Credit and Equity Analysis Book, which has been prepared for approximately 10 years, widely circulated in the industry, and is believed by us to have coverages calculated consistent with the rating agency methodologies which are shown in their various publications.

Q. And these are a published list of calculated coverages prepared by First Boston and given to its clients?

A. Circulated to clients, public utility commissions, investors; it is broadly circulated.

Q. On that page also, page 6, lines 27 th 31, you state that the results of the hypothetical financing would

have, in your judgment, led to earlier reductions in PECo's securities by the recognized rating agencies. That's lines 27 to 31. Do you see that reference?

A. I do.

Q. To your knowledge, Mr. Sanders, were the company's securities downgraded in the 1970s?

A. Yes, they were.

Q. If you know, could you indicate to me how many times they were downgraded?

A. In the 1970s, they were downgraded twice by Moody's Investors' Service, twice by Standard & Poor's Corporation, and I don't have any information at this point with respect to the ratings of Fitch Investors' Service or Duff & Phelps, Incorporated.

Q. What about the 1980's, Mr. Sanders? Do you know whether the company's securities were downgraded in that time period?

A. Yes, they were.

Q. Could you indicate to me, if you know, how many times that occurred?

A. Twice in the case of Moody's Investors' Service, three times in the case of Standard & Poor's Corporation, twice in the case of Fitch Investors' Service, and I do not have the information on Duff & Phelps.

Q. These downgradings, to your understanding, were

a result of the company's financing efforts to complete Limerick 1 and 2 in this time period?

A. I would not attribute it in that fashion. I believe that there are a number of factors affecting the company's securities ratings, including the response of the Public Utility Commission to its request for rate relief in order to maintain its measurements of financial quality necessary to raise funds during its construction program.

Q. Mr. Sanders, in the period that's examined in Mr. Paquette's hypothetical financing scenario, was the Philadelphia Electric Company a client of First Boston?

A. Yes, it has been a client from time to time during that period of time for securities financing.

Q. If you know, could you list what kinds of services the company was receiving from First Boston at this time?

A. To the best of my knowledge -- and this is not a client for which I am personally responsible or on whose financing I have worked since the early 1970s -- to the best of my knowledge, our services have been limited to the sale of new issues of bonds, debentures, preferred and common stock in the marketplace from time to time.

And to the best of my knowledge, we have provided no advisement services other than my appearing in an emergency rate case some years ago; this appearance. I believe that

that is the scope of the services involved.

Q. Mr. Sanders, are you familiar with the use of revolving loan agreements as utility financing vehicles in this period?

A. Generally, yes.

Q. Are you familiar with the Eurodollar revolving loan agreement arranged for PECo by an affiliate of First Boston in 1981?

A. I am not.

Q. Let me show you a document which is a Commission order previously identified and moved into evidence as Staff Exhibit No. 38. I just direct you to the second paragraph of that Commission order, which indicates the agent for the company in getting that line.

A. Credit Suisse First Boston, Limited, which is an affiliate of First Boston's, yes.

Q. Are you also familiar with the $800 million Limerick revolving credit agreement negotiated by the company in 1984 and referenced in Mr. Paquette's testimony this morning?

A. I have heard it described by Mr. Paquette this morning, and I have read the footnotes to the company's financial statements, but that is the extent of my knowledge of that revolving credit agreement.

Q. Are you familiar with why the company sought this

kind of financing?

A. Yes, I am.

Q. Could you indicate to us what your understanding is?

A. My understanding is much as Mr. Paquette has described this morning, as -- you're talking about the $800 million?

Q. Yes.

A. I am going to retract on that and say that I am not sufficiently familiar with that agreement or the manner in which it was arranged or the purposes for which it was arranged that I can respond to the question. I don't have sufficient knowledge of the circumstances.

Q. Mr. Sanders, are you familiar with the fact that the company had negotiated a $1.2 billion revolving credit agreement in 1983?

A. Aware that they had done it, yes.

Q. Are you familiar with the reasons why the company sought that kind of financing?

A. Yes, I am.

Q. Could you indicate what your understanding is?

A. My understanding is, as Mr. Paquette has indicated, that the purpose was to assure the company's ability to access funds sufficient to meet its cash flow requirements for construction purposes during a period of time in which

its ability to raise capital might be challenged either by its own financial standing or interruptions in the capital markets, which could make it impossible or unfeasible for utilities to complete financing.

Q. Mr. Sanders, would you agree that interest paid on lendings under this credit facility or these types of credit facilities do not affect PECo's interest coverage for indenture purposes?

A. For indenture purposes, but that's a very narrow matter.

Q. The answer is yes, then?

A. As explained.

MR. DELANEY: Excuse me for a second.

(Pause.)

BY MR. DELANEY:

Q. Mr. Sanders, in the final portion of your testimony, you discuss the potential financial impacts on the company of the Commission's acceptance of the intervenors' position. I think that discussion concludes your rebuttal testimony, which is Statement No. 35.

A. Yes.

Q. Now, in making these projections, did you independently examine what could possibly be the effect of the company reducing its expenses if the Commission were to accept the intervenors' position in this case?

A. No, I did not.

Q. So, specifically, you didn't examine the effect on the company's financial condition of suspending or cancellation of Limerick 2?

A. No, I did not.

Q. Or of freezing salaries or hirings?

A. No. That wouldn't be within the scope of my assignment.

Q. Then I understand that you have accepted the data on this that was provided by Mr. Paquette?

A. Yes, and it seems to be reasonsable to do so, because the data would be common either to the company's request for rates or any of the other operative plans for phase-in of rates during that time period. You have to have a common base against which to analyze the effects of the various plans.

MR. DELANEY: Excuse me for a second.

(Pause.)

BY MR. DELANEY:

Q. Mr. Sanders, going to your revised table, could you turn also to page 13 of your PECo Statement No. 35 -- I am sorry. Do you have a copy of Mr. Paquette's testimony with you?

A. I do.

Q. Could you turn to Statement 3A?

A. Yes.

Q. Would you turn initially to page 12 at the bottom?

A. (Witness complying.)

Q. In the discussion that begins on the bottom of page 12, Mr. Paquette talks about adjustments and the initial one that he describes begins on line 47 where he talks about adjusting revenue up and down each year to maintain earnings per share at exactly the same amount each year as was historically recorded. Do you see that?

A. Yes, I do.

Q. Now, the discussion continues up onto the next page, page 13.

A. Yes.

Q. I think on the sentence that begins midway through the second line on that page, I believe he there describes the second adjustment, which is, "We also calculated the amount of revenue increases required to maintain the same mortgage coverage ratios throughout the construction period."

Now, looking at your Revised Table 1, I see a footnote that you placed there which says at the bottom, line 47, "Additional revenues as designed to maintain historic earnings per share."

A. That's right.

Q. Did you also make the adjustment that's described beginning on the second line of page 13 of Mr. Paquette's testimony, calculating the amount of revenue increases required to maintain the same mortgage coverage ratios throughout the construction period?

A. No. I have not seen data which would be consistent with that statement, and am thus not in a position to calculate those coverages.

Q. So that the answer is no?

A. The answer is no.

MR. DELANEY: Thank you, Mr. Sanders. That's all the questions I have, Your Honor.

MR. POPOWSKY: No questions, Your Honor.

JUDGE MATUSCHAK: Is there any other cross?

MR. CLARK: Yes.

CROSS-EXAMINATION

BY MR. CLARK:

Q. Mr. Sanders, my name is Roger Clark. I represent the Governor's Energy Council. Are you familiar with FASB Exposure Draft No. 71?

A. Generally so. I have read it.

Q. In your Statement on page 11 of Statement No. 35, beginning at line 19, where you are discussing your understanding of the impact of the Exposure Draft, is that understanding based upon the testimony of David Farling or

upon your own independent understanding of the draft and its impact on the phase-in plans?

A. Statement No. 35, page 11, lines what, 19?

Q. 19.

A. It is based upon Mr. Farling's testimony as checked by my own understanding of FASB-71, that it is consistent with my understanding of the effects of FASB-71.

MR. CLARK: I have no further questions, thank you.

JUDGE MATUSCHAK: Any further cross-examination of this witness?

(No response.)

JUDGE MATUSCHAK: Is there redirect?

MR. HALL: If Your Honor would give us a moment, please?

(Recess.)

MR. HALL: If Your Honor please, there will be no redirect.

JUDGE MATUSCHAK: Thank you.

(Witness excused.)

MR. HALL: If Your Honor please, we would plan to present Mr. Helwig next for the remainder of his cross-examination, David Helwig. Mr. Helwig was cross-examined on certain of his matters yesterday, but I believe that the Consumer Advocate and also perhaps the Staff had reserved some additional cross.

MS. CHESTNUT: Mr. Delaney stepped out for just a moment.

(Pause.)

JUDGE MATUSCHAK: Is counsel ready to proceed? Does Staff have any cross-examination?

MR. DELANEY: I think we already crossed Mr. Helwig yesterday, Your Honor.

MR. WERSAN: There is no cross-examination of Mr. Helwig.

MR. HALL: I believe we have already moved all of his testimony into the record, so I don't think there is anything else to be done.

If Your Honor please, we could go different ways from here on. We have Mr. Mattson, who we could present for items other than his Mark II material. Thus, that could be gotten out of the way now before we get into Mark II this afternoon.

We also have Mr. Vollmer, which we may present at this time. What is the Consumer Advocate's preference?

MR. WERSAN: I thought we were going to put Dr. Hanauer on.

MR. HALL: I can also begin cross-examination of Dr. Hanauer, but I will not be able to do all of it until after lunch. I guess my preference would be that we do all of Dr. Hanauer immediately following lunch.

MR. WERSAN: My preference is to do Mr. Vollmer first, and then Dr. Levy and then Dr. Mattson. My cross for Dr. Mattson is not lengthy, but it is sort of interrelated and I don't want to break him up.

So, either we could go with Dr. Hanauer now, or we could take lunch now, I guess, and then we could do everyone after lunch.

MR. HALL: We could take lunch now. I have no problem with that.

JUDGE MATUSCHAK: We could take an early lunch and then come back, if that is the consensus of counsel to do that.

MR. WERSAN: Is there cross by Staff for Mr. Boyer?

MR. DELANEY: I have a few short questions for Mr. Boyer. We could do that now.

MR. HALL: We would just as soon do that later today to be sure we get through all of the -- well, our reasoning there is that Mr. Boyer is going to be here Monday, too, and we have a bunch of consultants here, and we would just as soon not take the time to deal with Mr. Boyer.

MR. DELANEY: That's fine.

JUDGE MATUSCHAK: Let's recess until quarter to one.

(Whereupon, at 11:45 a.m., the hearing was adjourned, to be reconvened at 12:45 p.m., this same day.)

AFTERNOON SESSION

(12:55 p.m.)

JUDGE MATUSCHAK: Whenever you're ready.

MR. WERSAN: Your Honor, at this time the Office of Consumer Advocate would like to present Dr. Stephen H. Hanauer. Dr. Hanauer has been previously sworn in this case.

JUDGE MATUSCHAK: Very well.

MR. WERSAN: At this time I would like to mark for identification as OCA Statement No. 2A a document entitled "Surrebuttal Testimony and Exhibits of Stephen H. Hanauer."

JUDGE MATUSCHAK: So marked.

(Whereupon, the document was marked as OCA Statement No. 2A for identification.)

Whereupon,

STEPHEN H. HANAUER

having previously been duly sworn, testified further as follows:

DIRECT EXAMINATION

BY MR. WERSAN:

Q. Dr. Hanauer, do you have before you a document that has now been identified as OCA Statement No. 2A entitled the "Surrebuttal Testimony and Exhibits of Stephen H. Hanauer"?

A. Yes, I do.

Q. Does this testimony and the attached exhibits represent your surrebuttal testimony in this proceeding?

A. Yes, it does.

Q. Was OCA Statement No. 2A prepared by you or under your direction and supervision?

A. Yes, it was.

Q. Do you have any corrections, changes or additions at this time?

A. No, sir.

Q. If I were to ask you the questions contained in OCA Statement No. 2A, would your answers today be the same as set forth therein?

A. Yes, sir.

Q. Would those answers be true and accurate to the best of your knowledge, information and belief?

A. Yes, sir.

MR. WERSAN: Your Honor, at this time I would like to move into evidence, subject to any motions to strike, OCA Statement No. 2A, and present Dr. Hanauer for cross-examination.

JUDGE MATUSCHAK: The motion is granted.

(Whereupon, the document marked as OCA Statement No. 2A was received in evidence.)

MR. HALL: Thank you, Your Honor.

CROSS-EXAMINATION

BY MR. HALL:

Q. Dr. Hanauer, referring to your OCA Statement 2A, I notice that attached to that statement as an Exhibit SHH-9 you have attached a copy of a portion of a complaint filed by the owners of the Zimmer plant against the General Electric Company and its architect/engineer, or the architect/engineer for the Zimmer plant; is that correct?

A. That's correct.

Q. Dr. Hanauer, I believe you have indicated to us in a previous interrogatory response that you have no personal involvement in the Zimmer litigation.

A. That is correct.

Q. I take it it would be correct that you did not participate in any way in the drafting of this complaint?

A. That's correct.

Q. Would it further be correct that you did not participate in any way in the discovery or any other litigation-related process related to the Zimmer lawsuit in Ohio?

A. That's correct.

MR. HALL: Your Honor, with that I would move to strike that portion of Dr. Hanauer's testimony which discusses the Zimmer complaint, and also the attachment of that document to his testimony. It is hearsay evidence.

It is not evidence which Dr. Hanauer, based upon his answers to my questions, has prepared himself or has first-hand knowledge of, and, therefore, is not a matter that I believe he can properly testify to in this proceeding.

I would like to call Your Honor's attention to several Pennsylvania cases which have excluded from evidence pleadings which have been filed in actions not the one in which the motion was made.

I would cite to Your Honor the case of Century 21 Shows versus Owens at 400 F. 2nd 603, 610; that is a federal case from the 8th Circuit in 1968.

The case of Stevenson versus Hearst Consolidated Publications, 214 F. 2nd 902, 907; that is a 2nd Circuit case in 1954.

There are several additional cases in Pennsylvania, those including Stauffer versus McCrory Stores Corporation, 155 F. Supp. 710, Western District of Pennsylvania, 1957; Bowers versus Garfield, 382 F. Supp. 503, Eastern District of Pennsylvania, 1974 decision. Each of those were decisions of the federal courts applying Pennsylvania law with regard to the probative value and the admissibility into evidence of pleadings from other cases in a separate case being tried.

Finally, I would cite to you, Your Honor, Dektor versus Overbrook National Bank of Philadelphia, 10 F. Supp.

894; that's a case in the Eastern District of Pennsylvania in 1934. Buehler versus United States Fashion Plate Company, 269 Pennsylvania 428, 1921; and Skillman versus Magill, a Pennsylvania Superior Court Case at 98 Pennsylvania Superior 72, 1930.

Now, what these cases hold is two things; one, that pleadings in a proceeding other than the one being tried are not admissible into evidence for two reasons: one, because they are hearsay, they do not constitute facts, they do not constitute the proof of facts, they are merely allegations made by parties other than those who are in this litigation and as to which a witness -- in this case, this witness -- has no connection and has no knowledge of how the allegations were put forward.

Secondly, pleadings have been stricken under Pennsylvania law, and are stricken under Pennsylvania law, because they are perceived to have no probative value, being only allegations and not facts, and, therefore, they are considered to be irrelevant to any matter that is being litigated, any matter which requires factual proof or factual assertion.

I would note, Your Honor, that under Pennsylvania law in the last series of cases that I cited, that even in a case which is going forward, the pleadings of that case are not permitted into evidence in Pennsylvania because

they are not proof of any fact; they are simply allegations.

For those reasons, we would seek to strike Exhibit SHH-9 from Dr. Hanauer's testimony, and also we would seek to strike the discussion of Dr. Hanauer at page 30 -- there is no line number, but it is the question that starts on page 30, and the answer -- as well as the references to the Zimmer suit on page 31 at the top of the page.

They are irrelevant and not probative of any factual matter, and they are hearsay.

MR. WERSAN: Your Honor, Dr. Hanauer and the OCA have not offered the pleadings to assert that the facts in the complaints are true or not true, but to show and to assert proof of the fact that in fact a lawsuit has been filed by the owners of the Zimmer nuclear station.

We believe that that information is relevant to this case. For one reason, that suit, to our knowledge, was filed subsequent to the Commission's decision in the Susquehanna 1 case in which this Commission first reviewed the Mark II allegations.

Secondly, we believe that this pleading shows that the utilities are not unanimous in their assertions about whether or not GE's involvement in the Mark II design was completely reasonable.

Once again, I want to repeat that we are not asserting that the facts in the complaint are true; simply

that the complaint has been filed by those parties and that information should be before the Commission.

JUDGE MATUSCHAK: If you want to show that the complaint was filed, why do you have to assert all of the allegations of that complaint?

MR. WERSAN: I think the fact that allegations have been asserted that GE was imprudent and that those utilities believe they have information to support those assertions is also relevant.

JUDGE MATUSCHAK: We think the material is not relevant and not proper, it is hearsay, and although we are not bound by the hearsay rule strictly, we do believe that the hearsay rule shouldn't apply in this matter and that the allegations set forth are prejudicial to the company as they are submitted here in this proceeding and it has no purpose in this case. They have no probative value; they don't prove anything. Anyone can sue anybody. That doesn't prove anything to me or to anyone else.

MR. WERSAN: I would like to note my exception, Your Honor.

JUDGE MATUSCHAK: Your exception is noted.

The motion to strike SHH-9 and the portion of the 2A and the testimony relating thereto on page 30 is granted.

MR. HALL: Thank you, Your Honor.

BY MR. HALL:

Q. Dr. Hanauer, referring to page 29 of your testimony, in two paragraphs on that page you mention the fact or you point out the fact that in the Humboldt Bay Final Hazards Report it notes that there was tank vibration and also pressure oscillations when the water in what I believe is the condensing tank facility exceeded a temperature of 130 degrees; is that correct?

A. That's correct.

Q. And I am correct that this is the condensing tank facility test that we're speaking of?

A. Yes, sir.

Q. Would I be correct that vibrations only occurred under those conditions, conditions of temperature at or exceeding 120 to 130 degrees, if you know?

A. That is what they say, and I presume it is correct.

Q. You have no independent knowledge, but your reading of the Humboldt Bay Hazards Report indicates that that is the only information stated in that report?

A. That's the only information stated in that report. I have read other condensing tank facility reports, but I don't know any reason to doubt this.

Q. If you know, Dr. Hanauer, is it not also correct that in subsequent tests of the pressure suppression

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containment concept conducted in scale facilities for the Humboldt Bay and Bodega Bay reactors, there were no vibrations experienced in those facilities during those tests at temperatures below 163 degrees?

A. I am trying to recall. You furnished to us last night some reports I hadn't seen before. I will have to say I don't recall whether they confirmed what you just said.

The Humboldt Bay and Bodega Bay AEC papers that I have seen confirm what you said.

Q. I believe the reports that I provided you last night did not deal with the Bodega Bay tests at all, did they? They were earlier tests.

A. There were some early papers on the early tests, and there was one 1970 paper that summarized a number of tests, and I frankly don't recall whether it confirms the question you started this with or not.

Q. Would you agree, Dr. Hanauer, that there are operating restrictions imposed upon the operation of nuclear power plants that are designed and have been designed since pressure suppression containments were first constructed to restrict or prevent plant operation at temperatures in the 120 to 163 degree range?

A. Yes; plant operation is constrained below that value, and the intention is that it be sufficiently below

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that value that a loss of coolant accident or a safety valve discharge will not bring the tank up into that range.

What happens in the event of some kind of accident, which we have not yet seen in real plants, may or may not violate that, but the intention is to stay away from it.

Q. Would you agree, sir, that that is the intention of the Atomic Energy Commission in making that requirement of operating PWRs? That is a requirement the AEC imposes.

A. Yes, it is the NRC now, but it is included in the technical specifications and the plants have to shut down if the pool gets too hot.

Q. Would you agree, Dr. Hanauer, that the tests conducted by General Electric, if you know, at the Valecitos test facility and at the condensing tank facility of Pacific Gas and Electric, were in fact conducted for the purpose of demonstrating the ability of a pool of water to condense steam?

A. That is their stated intention, and I see no reason to doubt it.

Q. But you have no independent knowledge one way or the other?

A. No.

Q. Would you agree, Dr. Hanauer, if you know, that the tests at those two facilities were designed to stretch the pressure suppression concept and its ability to function

to and beyond the expected limit for both operating conditions and expected transient conditions? If you know.

A. I don't quite understand your language. Let me put it in my words and see if it is an answer.

The tests were conducted over a range of the parameters, temperatures, pressures, flows, and so on. It was intended that this range be greater than the range of these variables that would occur under operation and transients. And, in fact, the design of the pressure suppression containment was required later by the AEC to stay within these bounds.

I don't quite know whether that answers your question or not.

Q. I believe it does. It is a good faith effort at least, to the extent I can tell.

I take it, Dr. Hanauer, you have no independent knowledge or information to provide as to what extent these tests exceeded these anticipated operating parameters, either operating or transient condition parameters?

A. No.

Q. Do you know how much they pushed it beyond what they expected to occur?

A. I have these reports that give some of these ranges. I have not since last night compared the numbers against the operating range. I really don't know. I

presume that the operating range is within the parameters, but I haven't checked it.

Q. So the answer to my question is you don't know?

A. No, I don't know.

Q. Referring to pages 34 to 35 of your testimony, Dr. Hanauer, would you agree with me that the general thrust of this portion of your testimony relative to the Mark II containment is that the concerns which the NRC had with regard to safety relative to that containment and relative to the hydrodynamic loads focused upon in 1974 and 1975 were not borne out by the facts obtained from the testing program in 1975 through and up to 1982?

A. No, sir, that is not -- that is too strong.

Q. How would you express it, Doctor?

A. In my original testimony, which I quote here, I had implied, although I didn't quite say it, that the containment structure might not have withstood the forces; and to the extent that I implied that, I was incorrect. It is now clear that the overall concrete structure could have withstood the forces.

What I said was, "may well have failed to perform its necessary safety function." The necessary addition of braces to keep the downcomers in the water and the addition of quenchers to the safety relief valves, which was required and which was done, does not show that without any

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changes the containments as originally designed could have performed their safety function. But the outer structure, the massive walls, would not have broken.

Q. And, thus, would it not be correct that whatever radioactive release there was from the reactor vessel into the containment would have been contained within the concrete structure; is that not correct?

A. That is correct only if the downcomers stayed in place and the steam was in fact quenched, a subject which, as far as I know, has not been discussed in any of the papers I reviewed.

I don't know whether it is known that the containment would have performed its entire function. I do know that few changes were required in the strength of the outer shell.

Q. Could we say that the containment would have performed its principal function of containing the radioactive steam? Would you agree with that?

A. No, not necessarily. That is true only if the steam was quenched. If the steam was not quenched, the pressure would have been very much greater than the rating of the containment, and I don't know if it would have held or not. It is, however, very strong.

Q. Dr. Hanauer, let's look at the two changes that were made as the result of the Mark II investigation

program that you have identified.

The first is the addition of a quencher; is that not right?

A. That's correct.

Q. Am I correct that a quencher is simply a pipe placed at the end of the downcomer which has a pattern of holes related to it, which pattern spreads the steam throughout the water pool in a somewhat more patterned and complete fashion than with the case of no quencher?

A. Well, it is on the safety release valve pipe, rather than the downcomer.

Q. But is my statement correct --

A. But it's purpose is to spread the steam out and avoid the large forces that were encountered without the quencher.

Q. Would it be correct that the principal effect of a quencher is to permit an assurance of quenching of the steam at a higher temperature than otherwise would occur?

A. Well, no, I don't think so. The steam, I think, would have been quenched anyway. The steam was quenched at Wurgassen. It was the forces that went with the quenching that were too high without the quenchers.

Q. Let me restate the question. Would it not be the case that the effect of the quencher is to increase the temperature at which the suppression pool could be

counted upon with complete assurance or reasonable assurance of safety as identified by the NRC of quenching steam without forces from approximately the 160 degree level to the 220 degree level?

A. Well, I am not going to buy your numbers, but the purpose of the quencher is to decrease the forces which otherwise would be encountered at higher temperatures to an acceptable range.

Q. I take it you don't buy my numbers because you are not familiar with the specific numbers that would be involved?

A. Yes, I am familiar with the numbers, and my colleagues and I at the NRC decided that even with the quenchers, the maximum pool temperature was somewhat lower than your 220 degrees is my recollection. It is in NUREG-0802 or 0808, I think.

Q. Is it less than 200 degrees?

A. I think it is just about 200 degrees.

Q. Would it be correct, Dr. Hanauer, that quenchers were originally added to the SRV pipes to avoid high local temperatures in the pool rather than for the purpose of countering loads as the result of quenching?

A. My hesitation comes about because there were two occasions on which quenchers were added. Originally, the so-called ram's head quencher was added, and that could

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indeed have been its purpose. I no longer recall.

Later when the pipes with holes in them were added, the basic intention was to decrease the forces, and one of the ways in which this was done was to avoid the high local temperatures.

MR. HALL: If I could have just a moment, Your Honor.

(Pause.)

BY MR. HALL:

Q. Would you agree, Dr. Hanauer, that the concrete Mark II containment design as used at Limerick has a design strength that is three times that that is required to quench the anticipated steam from a transient condition? If you know.

A. There are two things I don't understand about your question. When you say quench the steam from the anticipated transient --

Q. That is an error on my part; not quench it, but contain it.

A. Are you talking about safety relief valve discharges now, or are you talking about accidents?

Q. I am talking about accidents.

A. Accidents. The structure is indeed designed to withstand a pressure three times higher than is calculated would occur in the design basis accident; that's correct.

Q. Thank you. Dr. Hanauer, would you agree with me

that the Atomic Energy Commission initially, and now the Nuclear Regulatory Commission, establishes the criteria to which the BWR Mark II containment design is designed to?

A. Yes, in a less direct way than that. A new system such as a pressure suppression containment is proposed by somebody, either by General Electric directly or by General Electric and some applicant who wants a license to build a plant.

For the Mark I it was GE and Pacific Gas and Electric on Humboldt Bay, although GE came in and talked to the Commission themselves. On the Mark II it was GE and the Long Island Lighting Company on Shoreham.

When they propose a new thing like a pressure suppression containment, they also generally, and in this case, propose what the acceptance -- what the criteria should be. Although there are general design criteria which cover it in general terms, a new device or a new system like this will need specific criteria, which are often proposed by the applicant. And eventually the criteria to be applied are decided by the AEC.

I hope that answered your question.

Q. I believe it does.

You would not contend here, would you, Dr. Hanauer, that the AEC, in this process of reviewing an applicant's proposed design criteria, is a passive bystander who simply

rubberstamps those criteria, would you?

A. No, sir.

Q. Is it not correct that the Atomic Energy Commission carefully and thoroughly evaluates those criteria; that it in fact has independent employed consultants drawn from the top universities of this country that review those criteria and whether the design will meet them?

A. That is often the case.

Q. Was that not the case with respect to the Mark II containment design?

A. I don't guess I remember, but it is likely. It is certainly true with regard to the later Mark II program results and proposed criteria.

Q. I take it what you are saying is that you don't know whether the initial Mark II containment design as proposed to the Atomic Energy Commission went through this particular process, a process whereby the Commission reviewed it, obtained the opinions of experts throughout the country unrelated to the utility or the vendor, and accepted that containment and the design to meet it as being appropriate?

A. It was certainly reviewed in detail. Whether they got outside consultants for that particular review, I no longer remember.

Q. So that is the only part that you were uncertain

about, --

A. That's correct.

Q. -- the rest of my question you agree with?

A. That's right.

Q. What about the Mark I design, Dr. Hanauer, does your memory permit you to know whether the Atomic Energy Commission obtained outside consultants to thoroughly review that design before permitting it to be built?

A. The Mark I is before my time. I was not involved with the Commission in this kind of a way. I was an employee of a national laboratory, and I don't know whether they got consultants or not.

Q. Dr. Hanauer, referring to the first portion of your testimony with regard to licensing issues, are you familiar with what is referred to as the WASH-1400 test, or the WASH-1400 report I believe it is?

A. Yes, sir.

Q. Would you agree with me that that was a probablistic risk assessment which was developed for a reference General Electric BWR facility in the mid-1970s?

A. I don't understand "reference." It was developed for Peach Bottom 2 and 3, the BWR part.

Q. It wasn't specific Peach Bottom 2 and 3. They were used as an example of a generic facility, if I recall.

A. No, sir; it was specific. In order to do a

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probablistic risk assessment in that kind of a detail, you have to have a specific plant, and they used Peach Bottom 2 and 3.

Q. I will accept that.

I think we can cut through this, Dr. Hanauer. It is correct that the plant design used was Peach Bottom, but the site was a generic site?

A. That's correct.

Q. Is it not correct, Dr. Hanauer, that WASH-1400 established a level of risk based upon a quantified analysis of nuclear plant operation as perceived by the authors of that report?

A. I am having trouble with some of the language. I don't know what establishing a level of risk -- it was a calculation based on probablistic models and those other things you said. It was a calculation of the risk.

I don't use the words "established a level of risk" for what was done in WASH-1400.

Q. It was a calculation of the level of risk that society bore from the operation of a nuclear power plant, in that case Peach Bottom, a generic site.

A. Yes. It was for both individuals and society as a whole.

Q. If I recall, that report functions in the following manner: a risk is calculated relative to the

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possibility of a core meltdown accident, I believe, and a quantitative probability is established for that based upon individual probabilities that various things will happen that could lead to that effect; is that not correct?

A. No; that is too simplistic. A variety of initiating events and the course of accidents which are affected by various things that happen is established, and only the ones where the core melts turns out to be important. After the core melts, the accident is followed into how the core materials and the containment function, and also how the radioactive materials are released, if they are released, and dispersed, if they are dispersed; and the risks of these various sequences are then added up in accordance with their probabilities.

Q. Once that step is completed, is it not the case that a review is made of the effects of such a possible accident upon the population surrounding the plant to determine the societal risk or I guess we could say cost of those postulated events?

A. That certainly was done in WASH-1400, although it is not done in all probablistic risk assessments. Of course, there was a variety of accidents considered.

Q. Referring to the Limerick facility, Dr. Hanauer, is it not correct that a probablistic risk assessment, and even a more refined analysis called a severe accident risk

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assessment, was performed for the Limerick 1 facility at the direction of the Nuclear Regulatory Commission and was used in the licensing process of that plant?

A. That is certainly correct for the probablistic risk assessment. The use of the severe accident risk assessment in licensing is less clear, although it was indeed required to be performed, required by the NRC to be performed.

Q. And it was included in --

A. It was reviewed when the risk of the plant was being considered.

Q. And it was included, I believe, in the docket record, was it not?

A. Yes, sir.

Q. Is it not correct that there were contentions made with regard to its results and its importance, that being the severe accident risk assessment, by intervenors in the litigated hearing proceeding?

A. Yes, sir, that is my understanding. I haven't checked it directly, but I think it is in company testimony and I accept it.

Q. Would it not be correct that those two assessments demonstrated that the risk of operation of Limerick even despite its population-dense site was no greater than the WASH-1400 reference reactor?

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A. That's my understanding, although that comparison needs a lot of caveats because the assessments were done in different ways and the art of such assessment had greatly improved by the time the Limerick assessment was done. But that was the conclusion.

Q. Wasn't it in fact true that to achieve that result, significant additional safety systems were required at Limerick in order for this societal risk to be limited to the WASH-1400 level?

A. It depends on exactly which piece of paper you read exactly how the NRC viewed this. In the end, the changes were required, the changes were performed, and the risk was reduced, which was considered to be required or highly desirable, depending on which NRC paper you read, because of the high population density.

Some of the NRC documents talk about the possibility of cost/risk-effective improvements in the plant, and others do not.

Q. Would you agree, Dr. Hanauer, that the statement that you just made with regard to NRC documents reflecting cost-effective considerations did not apply to the ATWS modification?

A. Yes, I will agree.

Q. Is it not true, therefore, that in achieving a risk level for Limerick equal to the WASH-1400 standard,

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the NRC documents reflect the need for the completion in the plant of the ATWS facility?

A. That's correct.

Q. Would that not also be similarly correct with regard to the fire protection improvements that were performed prior to fuel load? And by "fire protection improvements" let me note I mean compliance with the NRC's fire protection requirements that were issued in the early 1980s.

A. The trouble is there are several fire protection requirements. My short answer is, I don't recall. My impression is that the last set of written fire protection requirements, not the inspection which resulted in the '84-'85 changes, but the issuance of Appendix R and its application by the staff to Limerick and other reactors which it did not originally apply to, which occurred in, I believe, 1981--I no longer remember whether that risk reduction was required or not.

Q. How about with regard to the environmental qualification efforts of the company, was that not required to achieve the reduction in risk?

A. I don't know.

Q. If I ask you the same question with regard to the CRDR modification, control room design review, would your answer be the same?

A. The short answer is, I don't know. These

increments in risk were calculated, and I no longer remember the numbers.

Q. Would you agree with me, Dr. Hanauer, that in the licensing of the McGuire facility, that that plant was delayed in receiving an operating license for several months despite having completed its construction activities and its testing activities solely by the litigation of licensing concerns related to the effects or possible effects of severe accidents at the facility?

A. Yes, that is so.

Q. Is it not correct, Dr. Hanauer, that the Shoreham plant facility has been delayed in receiving an operating license for several years by concerns over and the failure to complete emergency planning activities?

A. That has certainly been one of the causes. There were other causes at Shoreham.

Q. But is it not correct that those initial causes were completed and resolved early during the process and a substantial period of delay at the end has occurred solely because of emergency planning concerns?

A. Well, I won't accept "early," but yes, the most recent delay has been caused by emergency preparedness.

Q. Is not that most recent delay a delay that runs into a year or more?

A. Oh, yes.

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Q. Would it be correct, Dr. Hanauer, that the Grand Gulf facility has been delayed in obtaining an operating license for more than a year with regard to concerns related to the appropriate terms of its technical specifications?

A. That delay has been in its full power operating license. They received their low power operating license, and then various deficiencies in plant technical specifications and operations were revealed and the NRC did not permit them to go forward till they cleaned up their operation.

Q. Is it not correct that there has been litigation involving that and the need for a substantial period while the plant sat idle to review those concerns and alleged concerns prior to granting the operating license?

A. I don't know anything about litigation on Grand Gulf.

Q. No litigation; it has simply been a matter of discussion with the NRC?

A. No, no; I really meant it. I don't know of any litigation.

Q. Finally, Dr. Hanauer, would you agree that with regard to the Diablo Canyon facility, is it not correct that there have been several years of delay in receipt of its operating license due solely to allegations by

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intervenors at hearings in litigation of those allegations related to alleged design deficiencies in that plant?

A. There has certainly been a substantial delay. I don't know whether I buy several years, but it has been more than a year; whether it is two or three or several, I don't recall. But, yes, there was a substantial delay for litigation of allegations.

MR. HALL: Your Honor, those are all the questions that I have.

JUDGE MATUSCHAK: Is there any other cross-examination of this witness?

MR. DELANEY: We have no cross.

MR. WERSAN: Could we have a short break?

JUDGE MATUSCHAK: Yes.

(Recess.)

JUDGE MATUSCHAK: We can begin.

REDIRECT EXAMINATION

BY MR. WERSAN:

Q. Dr. Hanauer, you were asked a number of questions by Dr. Hall with respect to four nuclear power plants: McGuire, Shoreham, Grand Gulf and Diablo Canyon, and delays in licensing or completion of construction in those units.

Were you aware of these plants and their history at the time you prepared your testimony in this case?

A. Certainly. I know that plants, those four and others, have been delayed by licensing considerations. Others have been delayed by what I will describe as licensing problems of their own making.

For example, the Grand Gulf inadequacies were pretty much of their own making. Some of the delays were not of their own making, but were externally imposed. I knew all this.

I also knew that many plants have been licensed or the licensing decision had been made consistent with the completion of construction.

And the company witnesses have testified to that, too. I knew all this. I presumed in my analysis, in reaching my conclusion that had Limerick been completed at the earlier time that we contend, that Philadelphia Electric

and the NRC would both have done competent jobs in resolving these licensing issues in the time frame of that earlier completion rather than the later one as actually happened.

MR. WERSAN: That's all I have, Your Honor. Thank you.

RECROSS-EXAMINATION

BY MR. HALL:

Q. Dr. Hanauer, just one question: would you agree with me in the Gulf circumstance, the technical specifications that are at issue and in fact have been found inadequate and are resulting in delay of the operating license were in fact technical specifications developed by Grand Gulf and provided to the Nuclear Regulatory Commission for review and approval and were in fact approved before they were ultimately found inadequate by the NRC, resulting in the delay in licensing?

A. Well, that was only part of the reasons for the delay in their full power license, but yes, your description of the technical specification problem is correct.

Q. Do you, Dr. Hanauer, in your testimony today, mean to suggest that with regard to the various cases that I have cited, that being McGuire, Diablo Canyon, Shoreham and Grand Gulf, that the NRC or the utility in those circumstances were incompetent?

A. No, no, although there may have been work done that was less than ideal in those and other cases. No, that

was not my point at all. Each one of these licensing cases is different. Circumstances associated with each one either result in a delay or don't.

The issues are different. The presentations, the applications by the utility and its team are different. The NRC reviewers have differences. The ability of the NRC to respond changes with people and with time, depending on what else is going on.

MR. HALL: That's all the questions that I have.

JUDGE MATUSCHAK: Anything further of this witness?

(No response.)

JUDGE MATUSCHAK: Then you are excused.

(Witness excused.)

MR. HALL: Your Honor, we have three major witnesses left this afternoon, and also a fourth witness. We would plan to go with Dr. Levy, Dr. Mattson and Mr. Vollmer. I don't know if there is a preferred order.

MR. WERSAN: Could I ask for Mr. Vollmer first?

Whereupon,

H. WILLIAM VOLLMER

having been duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. HALL:

Q. Mr. Vollmer, would you state your full name and position with the Philadelphia Electric Company, for the

record?

A. My name is H. William Vollmer, and I am a supervising engineer in the Mechanical Engineering Department at Philadelphia Electric Company.

Q. Mr. Vollmer, do you have before you two documents, one being titled, PECo Statement No. 31 and the other being titled, PECo Statement No. 31A, each in the right hand corner?

A. Yes, I do.

Q. Referring to the document entitled PECO Statement No. 31, is that entitled, "Rebuttal Testimony of H. William Vollmer, Mark II Containment Issues"?

A. Yes, it is.

Q. Is that a document of some 16 pages, with several attached schedules?

A. Yes, it is.

Q. Referring to the document entitled, PECO Statement No. 31A, is that entitled, "Sur-surrebuttal Testimony of H. William Vollmer, Mark II Containment Issues"?

A. Yes, it is.

Q. And is that a document of some 10 pages?

A. Yes, that's correct.

Q. Mr. Vollmer, do you have any corrections to make to these documents at this time?

A. Yes, I would like to make one correction to

Statement No. 31. On page 13, line 21 should read, "An additional $13 million of distributable costs."

Q. And has that particular change and figure been provided to the other parties by interrogatory response previously?

A. That's correct.

JUDGE MATUSCHAK: What is that correction?

THE WITNESS: Line 21, page 13, and it shows as $8.5 million, and we're changing that to $13 million. That was an error.

BY MR. HALL:

Q. Mr. Vollmer, if I were to ask you the questions contained in PECo Statement No. 31 and PECo Statement No. 31A, would your answers be as set forth therein and would they be true and correct as of this time?

A. Yes, they would.

MR. HALL: I would ask that PECo Statements Nos. 31 and No. 31A be identified in the manner in which I have identified them and that they be admitted into the record, Your Honor.

JUDGE MATUSCHAK: Subject to any timely objections or motions to strike, the motion is granted.

(Whereupon, the documents were marked PECo Statements Nos. 31 and 31A for identification and received in evidence.)

MR. HALL: Mr. Vollmer is available for cross-examination.

JUDGE MATUSCHAK: Staff?

MR. DELANEY: We have no questions, Your Honor.

JUDGE MATUSCHAK: OCA?

CROSS-EXAMINATION

BY MR. WERSAN:

Q. Good afternoon, Mr. Vollmer.

A. Mr. Wersan.

Q. I'd like to start out with your rebuttal testimony, PECo Statement No. 31, on page 2. You state at line 35, "In February, 1975, when the Philadelphia Electric Company became aware of the questions concerning adequacy of the Mark II containment design," indicating, I take it, that it was in February, 1975 that Philadelphia Electric first became aware of questions concerning the adequacy of Mark II?

A. 1975, February, was the initiation of when Philadelphia Electric Company was first notified of the concern on the loss of coolant accident.

Prior to that, Philadelphia Electric Company was aware of the Wurgassen accident and some of the testing that was being conducted at Browns Ferry and at Quad Cities on safety relief valve discharge.

Q. You were aware of that testing, but I take it from the way you structured your testimony, you were not

concerned about the results of those events or tests?

A. That's correct. Philadelphia Electric Company controlled by tech spec the maximum full temperature that Peach Bottom, which was our operating plant, was allowed to reach before they initiated a shutdown. That was controlled, I believe, at 110 degrees.

Q. And then did you become concerned in February, 1975?

A. In February, 1975, when we were notified of these additional concerns, we formed a task force that was looking into the problem to see how extensive it was. And our initial notification was a short letter, and then the program kind of built from there as we started to look at it further.

And we eventually got into the Mark II owners' group, which did testing, and ran through 1982.

Q. And was this a letter from the NRC?

A. It was a letter from the NRC in April, 1975. There were two letters, actually, one covering the loss of coolant accident and one covering the SRV, the safety relief valve.

Q. And I assume that there were events that prompted the NRC to write this letter to Philadelphia Electric Company and other utilities?

A. General Electric Company sent us a letter in late January or February of 1975. The utilities started

working on the program, and in fact we notified the NRC that we were looking at this problem further because of these recent phenomena that had become available.

So, we had called the NRC. I imagine GE had contacted them, also. So, everybody was involved in bringing the problem to the front.

Q. You're talking about now in January or February, 1975?

A. I am not sure of the date of the letter from GE to us. It was late January or early February.

Q. And the events that prompted GE to contact the NRC and that prompted the concerns, when did those specific events occur?

A. I am not sure exactly what prompted them to notify us when they did. It's related to their development testing on the Mark III, and they had felt I guess that they had a large enough data base to indicate that it required more work, and that they came out and presented that information to the utilities.

Q. When did you join Philadelphia Electric Company, Mr. Vollmer?

A. April of 1970.

Q. When did you first become aware of, first of all, the Mark II containment itself?

A. February, 1975.

Q. So, before February, 1975, you were not familiar with the Mark II or concerns or issues relating to Mark II?

A. That's correct. As stated in my testimony, I worked in a different department.

Q. So, I take it your knowledge of what transpired prior to February, 1975 is based upon information from other individuals at Philadelphia Electric?

A. That is correct.

Q. Do you know what kind of information Philadelphia Electric had about the Mark II or, for that matter I guess, the Mark I containment, about hydrodynamic loads prior to 1975?

A. If you refer to one of my schedules in my surrebuttal, there is a copy of the page from the preliminary safety evaluation report for Limerick which identifies five references.

One of those is the Hazards Study. One of those is a paper published by Miller. Another one is a textbook, and I don't recall the other one. But that was all the information that was submitted on the Limerick docket for the pressure suppression containment.

Q. Is that all the information that Philadelphia Electric had in its possession regarding the Mark II containment?

A. That is all the information that the

Philadelphia Electric Company had on its docket concerning the phenomena and the basis for the pressure suppression -- I'm sorry, that's not correct. Correspondence that I have reviewed in the time period of our licensing of the containment phenomena involved in-depth discussion with the NRC and with General Electric Company on the modeling criteria as far as what the blowdown transient, how that would be represented, what the times, what the maximum pressures would be, what the maximum temperatures would be.

So, the Philadelphia Electric Company people were in-depth involved in the modeling and the definition of the criteria for Limerick.

Q. When you say the modeling and the criteria, you are talking about theoretical analyses of the containment?

A. Theoretical analyses of the containment phenomenan, not the containment structure.

Q. Now, do you know if there were any other additional General Electric test results or analyses in the possession of Philadelphia Electric other than those items that are on your Schedule 1 to your sur-surrebuttal testimony?

A. They are the only ones that I have been able to come up with other than these discussions I refer to where we were developing the models.

Q. Do you recall who those discussions were between?

A. General Electric Company engineers, AEC licensing personnel, and some of the Philadelphia Electric Company personnel.

Q. And when would those discussions have taken place --

A. Excuse me, Bechtel was also involved in those.

From the initial contract with General Electric Company, so it would be in the 1970 to 1975 time frame, in that period.

Q. And during that time period, apart from these discussions about the modeling and analytical process of looking at the containment -- I am afraid the proper technical term eludes me -- the modeling of the containment, no other documents to your knowledge or no other results of analyses or GE discussions about the containment were given to Philadelphia Electric Company?

A. The criteria that they were designing to was, they assumed that the design basis criteria was a major pipe break, and the criteria that they were discussing was the ability of the containment to contain the pressure resulting from this pipe break and the temperature, resulting temperature in the pool. That is what the discussions were centered on.

And it was felt that there was significant conservatism applied to those loads, and it was felt that that

bounded all other nuances that appeared in the data.

Q. I understand. I have read your testimony on that. My question was: apart from the discussions on the analysis of the loss of coolant accident and the ability of the pressure suppression to deal with that loss of coolant accident, no other analyses, internal GE documents or reports were presented to Philadelphia Electric to your knowledge in the search that you have done?

A. Not to my knowledge.

Q. I take it that since you were not familiar with or involved in the Mark II issue before 1975, you were not involved in discussions between Philadelphia Electric Company and General Electric in which PECo initially decided to purchase a GE-BWR Mark II design for the Limerick site?

A. That is correct. I have reviewed documents and letters and things on that decision process, but I was not involved in it.

Q. Since you reviewed documents, do you know what the discussions revolved around when it came to picking the Mark II design?

A. The Mark II design had advantages over the Mark I, the Peach Bottom type design because it was felt that, number one, would be easier to construct. It would be less expensive. It provided more room to install the equipment in the drywell. It was felt to be a better design.

Q. In your review of documents or correspondence or minutes of meetings regarding the choice of the BWR Mark II, do you know whether or not General Electric presented any information to PECo, apart from the information that is in your Schedule 1 to your sur-surrebuttal testimony?

A. I don't know.

Q. Do you know whether or not results of any tests at General Electric testing facilities that preceded throughout the 1960s were presented to Philadelphia Electric?

A. Well, they are part of -- the referenced report there, the Hazards Study, had both the Humboldt test and the Bodega test incorporated in it, and there were several appendices of the Pacific Gas and Electric development work included in that.

Q. And that was a 1962 document, right?

A. That is correct.

Q. Do you know whether or not General Electric ever suggested or implied to Philadelphia Electric Company that within General Electric there were concerns about hydrodynamic loads or -- I guess I'll stay with hydrodynamic loads -- as a result of the design of the Mark II containment?

A. In 1975, they had discussions with us, and from that time forth they worked with us to resolve those problems

Q. How about at the time that General Electric was selling PECo the GE-BWR?

A. I have no knowledge of that.

Q. But in the documents that you reviewed, you didn't see any information expressing concerns on the part of General Electric about of the ability of the BWR to deal with hydrodynamic loads?

A. Most of the documents that I reviewed were associated with the discussion on the modeling techniques and the maximum pressures and things.

Q. In the documents you reviewed, do you recall whether or not Dr. Levy, another PECo witness in this case, was involved in the negotiations between GE and PECo?

A. The only reference I found to Dr. Levy was on a transmittal letter. I don't know. He signed a transmittal letter of one of the reference reports to the NRC.

I don't know whether he was involved in discussions with PECo or not.

Q. To your knowledge, at the time that General Electric was negotiating with Philadelphia Electric Company about the Limerick station and then subsequent from that date to, say for example, 1974, do you know whether GE was conducting studies into hydrodynamic loads?

A. In that time period, they were doing, as I understand, the development work for the Mark III, their

later product line.

Q. Do you know of any studies besides the studies for the Mark III?

A. No, I don't.

Q. Do you know what kind of information General Electric gave to Philadelphia Electric regarding the Mark III studies?

A. Eventually, I have seen NEDO reports on some of the testing.

Q. NEDO?

A. NEDO reports on some of the testing they did on the product line that they were developing. I am not sure where they fall in time sequence, but some of the horizontal vest testing they have done, which was in the 1974 time frame, I would imagine.

Q. And were those presented to Philadelphia Electric at the same time that they were prepared, do you know?

A. I don't know.

Q. So, you don't know whether PECo got those reports after February, 1975?

A. I would assume they were later than that.

Q. On page 5 of your Statement No. 31 at the very top of the page, you state that PECo was not along in choosing the pressure suppression containment concept, is that correct?

A. That is correct.

Q. Do you know whether General Electric presented the same information to PECo that are presented to all other potential purchases of the GE-BWR Mark II?

A. The report that is referenced in the PSAR as the Hazards Study was submitted on another docket, Carolina -- I am not sure -- it was referenced to us. I assume that everybody got the same information, that that was supported on all dockets.

Q. Do you have any reason to believe that GE would give PECo information that it did not give other utilities thinking of purchasing a Mark II design?

A. I have no reason to believe that we got information that nobody else got.

Q. So, it's your assumption also that utilities thinking of purchasing a Mark II design in the same time period as Limerick would have been presented with basically the same documents that are listed in your Schedule 1?

A. Yes.

Q. Do you know how many of the utilities which were looking at purchasing Mark II designs had already built and had experience with a Mark I design, for example?

A. There's three utilities that bought Mark II that had Mark I operating plants or Mark I plants under construction.

Q. And the rest I assume then did not have Mark I plants?

A. That's right.

Q. And would it be fair to say that the utilities purchasing the GE-BWR Mark II relied upon the studies or predominantly relied upon the studies and analyses presented by GE to them and to the NRC supporting use of the Mark II design?

A. Yes.

Q. Do I take it from your testimony in this case that you believe that GE knew about hydrodynamic loads in the 1950s and 1960s and 1970s, but did not consider it a significant concern?

A. I am not sure that they perceived it to be a concern. I am not sure that they -- when you run tests, you get all kinds of spurious information that, when you read these reports, the engineers identified something but then they had a rational reason why they thought it had occurred.

To look back with what we know today on their decisions, you may or may not draw different conclusions. But when you see it and you address it, they had a reason for what they saw.

Q. Let me try the question again, because I don't think you completely answered it. Do you think that General Electric was aware of phenomena that we now call

hydrodynamic loads when it was doing its tests in the 1950s, 1960s and early 1970s?

A. That's a difficult question, because as we know hydrodynamic loads today, it's a rather broad subject. When they were looking at their tests, they were seeing what I would refer to as nuances in the tests, and they addressed them.

I don't feel they had the ability to -- the instrumentation, the computers, everything didn't exist then to really understand the impact that we were able to understand in the 1970s.

Q. Apart from whether or not they could understand them or in your opinion adequately measure them, were there phenomena there that they were seeing that resembled hydrodynamic loads?

A. It's reasonable to believe that some of the pheonomena that they saw may have been the same phenomena that we saw later. Some of the phenomena may not have been, because they were not testing the same kinds of conditions that we tested later, where we really zeroed in on the problems.

Some of the hydrodynamic loads were not quantified until 1978, 1979, and 1980, until we had done very sophisticated prototypical testing.

So, to take a general test facility which doesn't in

any way have the factors scaled properly, you may not have seen the loads that you actually designed for in the late 1970s.

Q. Your an engineer, Mr. Vollmer. If you were doing tests of a new design, and phenomena occurred during those tests which you hadn't anticipated, would you try to explain them or to understand them more fully or to do more tests to attempt to explain or measure them more fully?

A. The purposes of the tests were to prove that steam could be condensed in water and that the pressure in the accident could be contained, and they accomplished their purpose.

They didn't have -- in just my cursory review of the report that's referenced there -- they didn't have instrumentation to quantify it as we did in the 1970s. They didn't have the modeling capabilities. They didn't have computers.

We had some of the scientific community from the universities working on this problem. We had the largest computers in the country dedicated to working on this problem. Those things didn't exist. The data was reduced manually.

A man would take a scale and he would measure across a trace on a piece of paper, and that was how he arrived at the loads. Today, you take a digital tape, you can run it

back 1,000 times until you decide that you are satisfied with what you see.

Q. I understand your position on that, Mr. Vollmer. Let me try rephrasing the question. Suppose you are doing these tests to find out whether or not steam will be quenched, and in the process of doing that, the tank jumps around, makes a lot of noises and vibrates quite a bit.

Would you also want to inquire into those events in addition to concluding that yes, the steam was condensed?

A. I think you would want to understand the reason why the tank jumped, and whether it was a non-prototypical or whether -- you know, understanding whether we were running steady state tests or transient tests, there can be a variety of reasons for why you get into that situation.

Q. But would you ignore it, Mr. Vollmer?

A. No.

Q. If I could refer you to page 6 of your rebuttal testimony at line 25, you state that design concerns related to hydrodynamic loads were first noted during an event at the Wurgassen Power Plant in Germany in 1972, is that correct?

A. Yes. I think that has been testified to by Dr. Hanauer, also.

Q. No argument on the fact that the loads were noted. It's your position, however, that prior to that event, in

1972, there were not design concerns related to hydrodynamic loads either at GE or in the utility industry, or at the NRC?

A. Well, from my frame of study on the problem in 1975, it's hard for me to say, other than looking at what actually occurred.

Q. When you wrote the sentence on page 6 that they were first noted in 1972, I take it then you are not aware of whether or not concerns had been expressed by other parties but you just hadn't come across them?

A. That's correct.

I'd like to expand on that. If you read some of the articles that were published in the ASME and Nuclear Engineering, which discussed hydrodynamic loads, there were some indications that there was some frothing or some vibration. So, there was some discussion out in the scientific community.

Q. When the event at the Wurgassen power plant occurred, was this considered a new revelation by the industry as to a sudden appearance or sudden concern about loads that hadn't been experienced before?

MR. HALL: Your Honor, I am going to object. I don't believe that Mr. Vollmer has been presented as a complete expert on the contemporaneous time period as to what the industry would have felt or would not have felt in the early

1970s. I think he has testified here today that his knowledge comes from 1975 onward when he first became familiar with this matter and began to work with it, and also from the reading of documents and that type of activities, which have been selective reading, as well.

So, I don't think he is in a position to answer that type of question.

JUDGE MATUSCHAK: The objection is sustained.

BY MR. WERSAN:

Q. In light of that, let me ask you this, Mr. Vollmer: is it your position that all you can state in this case is your knowledge of what happened after February 1975, except for those documents that you have read that precede 1975?

A. I think that's a correct characterization.

Q. And all the documents that you have read are in Schedule 1?

A. No. I have read the correspondence between our company, I have read the meeting notes of our company and the NRC meeting or AEC meetings. I have read correspondence between Bechtel and GE and Philadelphia Electric Company concerning this.

Q. In looking through the Philadelphia Electric files, did you find any reports or information on the Wurgassen event that predated February, 1975?

A. There was a service information letter issued from General Electric Company concerning the sensitivity of the pool temperature to the vibrations-- I am not sure what the date on that was -- plus, there had been some incidence at Peach Bottom where a relief valve had stuck open and I believe a pipe support or a snubber was locked up.

We had installed the Ram's Heads at Peach Bottom during the construction period, which was a change from the original design.

So, there was some correspondence back there. I don't know the sequencing of it, though.

Q. And from that correspondence, did you see any concern on the part of Philadelphia Electric Company with regard to the Mark I or Mark II containment?

A. Philadelphia Electric Company installed the Ram's Heads. They controlled the pool temperature. The instituted, even after the NRC letter came out to Peach Bottom in 1975, the pool temperature problem or the safety/relief valves was not felt to be an immediate concern.

It was more of a fatigue concern. And we responded to the NRC, saying that we were controlling the pool temperature and we would shut down if the pool temperature got beyond a certain limit.

Q. Did you see any documents in Philadelphia Electric files discussing consideration of the Wurgassen

event as it would relate to Limerick Unit 1?

A. I don't recall. All the correspondence would have been probably focused, I think, on the operating plant.

Q. So, based upon your recollection of the documents you reviewed, Philadelphia Electric Company did not apparently pose a concern about whether or not the Wurgassen event would or could affect the Limerick 1 Mark II?

A. I don't think that's correct. I think the people that were dealing with the Peach Bottom also discussed things with the Limerick people on the project, so that they were aware of the same concerns.

Q. There's just no documentation on it, then?

A. It's the same people. I am not aware of any unique documentation. Well, let me back up. The Limerick design originally incorporated the Ram's Heads, so there was some response to that concern. Where the Peach Bottom design, which was part of Wurgassen, had a straight pipe and was changed to a Ram's Head, the original Limerick design included the Ram's Head.

So, they were aware of the problem, and I think the Ram's Head in the end probably would have been an acceptable solution. We went beyond where we had to be.

Q. To clear something up in my mind, on page 7 at line 19, speaking about Limerick 1, you state, "When the loads were identified, construction of the containment was

suspended for approximately two months while the situation was evaluated."

When you state loads were identified, are you talking about when the importance of the loads was identified as a result of the Mark III testing?

A. In February of 1975, we were notified by GE. In April of 1975, we were notified by the NRC that they wanted a program.

We stopped construction to assess what the risk would be to resume construction. We made some bounding assumptions and evaluated the capacity of the concrete structure to contain the loads.

Q. But just on point, you are not suggesting that hydrodynamic loads were first identified at that time, but rather the concerns were first identified?

A. I think that's a correct characterization.

Q. If I could refer you to your Statement No. 31A, your sur-surrebuttal testimony, on the bottom of page 2 you are discussing the information in Schedule 1 attached to that Statement No. 31A.

And on the last line of that page, you say, "It is my understanding that internal proprietary GE reports containing additional information on these tests were provided to the AEC as part of the Mark II containment licensing process," is that correct?

Q. What is your understanding based upon?

A. If you review some of the hazard studies, there are other documents referenced in there.

Q. When you say the hazard studies --

A. The hazard study referenced on our PSAR. If you review the Bodega report, there are other references in that report, and generally the NRC tracks back the references.

Q. So, what you are asserting there is that you have some general understanding that proprietary reports or some proprietary reports were provided to the AEC, but you don't know specifically which reports?

A. That's correct.

Q. You don't know specifically which reports the AEC obtained or reviewed?

A. No.

Q. In fact, subsequent to the preparation of your Statement No. 31A, have you reviewed any GE proprietary documents regarding the Mark II containment?

A. I have reviewed -- as part of the Mark II program, we generated a lot of GE proprietary reports, which in fact were submitted to the NRC. This morning, I glanced at several reports, but did not review them in depth.

Q. At this time, Mr. Vollmer, I would like to show you a document that has been provided to the Office of Consumer Advocate yesterday under a protective agreement

between Philadelphia Electric Company and the Office of Consumer Advocate, which is one of the proprietary GE documents that I think you were referring to just a moment ago that you may have glanced at.

The one I am referring to here is Document GEAP 3143.

A. I did not see that one.

Q. You did not see that one.

MR. HALL: Your Honor, before we begin with this series relative to General Electric proprietary documents, I think it is important for the record to reflect how these have been obtained and the restrictions related to their use.

The Consumer Advocate asked the Philadelphia Electric Company and Dr. Salomon Levy, a witness with the company who is unaffiliated with General Electric at this time, a series of interrogatories in which they requested that the company and Dr. Levy provide the Consumer Advocate with four specific General Electric proprietary documents.

Philadelphia Electric Company did not have those documents, nor did Dr. Levy, and the circumstances and reasons for that were explained in the interrogatory answers that were provided to the Consumer Advocate.

However, so that there would be no concerns related to the flow of information on the subject and the information would be available to the Commission, the company requested that General Electric make those documents

available to it so that the documents could be made available to the Consumer Advocate's office.

General Electric agreed to do that subject to a confidentiality restriction upon the company and also upon the Consumer Advocate, and we have made the documents available to the Consumer Advocate subject to the terms of that agreement.

The agreement generally is that the Advocate is permitted to refer and to read even portions of the document into this record, but that the documents themselves will not be put into the record or otherwise distributed.

I felt it was important to note that. I would note that the documents were generally provided relative to the testimony of Dr. Levy, who from the company's perspective has the greatest knowledge and experience relative to both these particular documents and also the subject matters which Mr. Wersan is addressing.

MR. WERSAN: Your Honor, that is correct, and I certainly intend to abide by our agreements. The only use that will be made would be discussions about review of these documents by Mr. Vollmer, whether he is familiar with them, and to the extent that any information was to go into the record, it would simply be read by Philadelphia Electric witnesses and no copies will be made or kept by our office.

JUDGE MATUSCHAK: Very well.

MR. HALL: I would simply note one other thing, and that is that if the Consumer Advocate is going to ask Mr. Vollmer to read portions of this document into the record or otherwise comment on it, I am afraid I am going to object since he is not familiar with the document.

So, we might argue that one before you start.

MR. WERSAN: Why don't you wait and see how I use it, and then we'll see whether or not I do anything you want to object to.

JUDGE MATUSCHAK: I think he testified that he didn't see that document.

MR. HALL: He testified that he didn't see it, and I see no purpose as to why it is being used in his cross-examination if he has not seen it.

MR. WERSAN: The fact that he said he didn't see it, I would like to just expand a little bit, Your Honor. I think that is relevant, considering that he is the responsible witness for what Philadelphia Electric had at all times.

MR. HALL: I would not say Mr. Vollmer was the responsible witness for what Philadelphia Electric had at all times. Mr. Vollmer is responsible for what is in his written testimony only.

MR. WERSAN: Let me ask the questions and we'll see how we go.

BY MR. WERSAN:

Q. Mr. Vollmer, let me show you a document that is titled, "Test Report for the Pressure Suppression Development Program Prepared for Pacific Gas and Electric Company," dated April 2, 1959, with the code GEAP-3143.

Have you ever seen this document before?

A. I have seen the cover.

Q. I take it by that you have not looked through this document?

A. That is correct.

Q. In your search of Philadelphia Electric's files or correspondence or information relating to Mark II, did you ever come across a reference to this document?

A. I don't recall.

Q. In your review of the documents that are in your Schedule No. 1 to your sur-surrebuttal testimony, do you ever recall seeing a reference to this document?

A. There may be. I don't recall the numbers.

Q. Do you recall the title of GEAP-3143?

A. No.

Q. So, to the best of your knowledge, based upon the reviews that you have done, this document was not provided by General Electric to the company or, to the best of your recollection, referred to in the documents that are contained in your Schedule 1?

A. My study was not exhaustive going through the files, but I didn't locate it.

Q. Did you attempt to do the best job you could in looking through the files?

MR. HALL: Objection, Your Honor. That implies that Mr. Vollmer in fact did a study directed at whether or not GEAP-3143 was in the files or not. I don't believe Mr. Wersan has asked that question.

JUDGE MATUSCHAK: Objection sustained.

BY MR. WERSAN:

Q. Mr. Vollmer, let me show you another document that was also received pursuant to the protective agreement, and ask if you have seen this document.

It is entitled, "Pressure Suppression Pool Investigations, Report No. 1, July, 1970, Atomic Power Equipment Department, General Electric Company," entitled, "NEDM-13036-1."

A. I saw this and the other two documents for about 10 minutes prior to going to lunch, so it was a leaf through the pages.

Q. And so, again, the questions I asked you about whether or not you had come across this in the review that you did would be the same?

A. That's correct.

Q. You did not come across this document?

A. Right.

Q. And to the best of your recollection, you didn't come across a reference to this document in the documents in your Schedule 1?

A. I don't recall.

Q. I would like to refer you to your sur-surrebuttal testimony at page 5, line 11, talking about the cost of the Mark II changes at Limerick -- I'm sorry, not line 11. Starting at line 9, you state, "The $162 million figure cited by Mr. O'Brien as inconsistent with the cost reconciliation identified cost, was a preliminary estimate of Mark II costs for Limerick Units 1 and 2 provided to the OCA well before the completion of the cost reconciliation," is that correct?

A. That is correct.

Q. Is it your assertion that based upon the answer to the interrogatory which you have attached to your schedules as Schedule No. 3, that it is possible to determine whether or not that figure is for Limerick 1, Limerick 2 or both?

A. The interrogatory refers only to Limerick, and the cost -- I didn't prepare the figure, but it's my understanding that it is for both units, talking to the person that did submit the figure.

Q. You would agree with me that that is not revealed

by the question or answer in Schedule 3?

A. Right. It doesn't say Unit 1 and common. It says Limerick, and I think that's the context it was submitted on.

Q. But that's not stated in the answer, is it?

A. No.

Q. In your Schedule 4 to your sur-surrebuttal testimony, you enclose your response to an OCA Interrogatory 29-2, is that correct?

A. That is correct.

Q. And I take it that the information in this is the corrected cost for Mark II as you corrected for the cost of distributables and also includes AFUDC on those costs?

A. That is correct.

Q. Could you please tell me what those numbers total?

A. The cost of the Unit 1 and common was $24.8 million; plus the $13 million distributable, equals $37.8 million.

Adding the AFUDC for both those figures brings the total up to $55 million.

Q. So, based upon the analysis that you have done for Philadelphia Electric Company, putting aside any arguments about whether or not the costs were prudent or imprudent, you have calculated that a cost of $55 million would have been or could have been avoided had the load

been defined prior to the start of construction?

A. That is correct.

Q. And on page 9 of your sur-surrebuttal testimony at line 6, you discuss Item M.3, which includes engineering and field work associated with the consideration of Mark II loads on pipe hangers in the adjacent construction, is that correct?

A. That is correct.

Q. I take it from the cost analysis you did here that there was work done at Limerick Unit 1 in structures adjacent to the containment as a result of the Mark II loads?

A. Right. The position we have taken is that had you known the Mark II loads even when you started construction, you would have to have done a good bit of that work, and that is what these figures represent.

Q. I understand that, but you contend that there was work in adjacent structures to compensation for Mark II loads?

A. That's correct.

Q. So, Mark II loads had an effect beyond the containment and in fact on the adjacent structures?

A. That is correct.

Q. Mr. Vollmer, you discuss in your testimony the cost of the Mark II corrections at the Susquehanna plant as presented by Mr. Dale Bridenbaugh in the Susquehanna

Unit 1 case, is that correct?

A. Bridenbaugh or Minor. It was a joint testimony.

Q. Yes. I take it you reviewed that testimony?

A. Yes.

Q. Do you believe that that testimony represents the full cost of Susquehanna due to the Mark II rework and analysis?

A. I can only base that on what I read there. Mr. Curtis had -- I think it's based on what I read. I think Mr. Curtis felt it was less.

Q. Mr. Curtis for PP&L?

A. PP&L.

Q. Do you know whether or not Mr. Bridenbaugh and Mr. Minor also asserted that Susquehanna Unit 1 construction was delayed by six months to compensate for the Mark II rework and analysis?

A. I don't recall that. I jumped into the section where they summed the dollars. I didn't read the entire transcript.

Q. You have referenced a cost of Mark II identified at the Susquehanna Station. Have you also reviewed cost analyses for Mark II work at other nuclear stations?

A. No, I haven't.

Q. Are you familiar with what the owners of the Zimmer plant believe Mark II cost them?

A. I looked through the complaint. That is perhaps--the problem with comparing different plants, it's hard to make sure they have included the same description in what they are calling Mark II.

We are defining ours to be the hydrodynamic loads. Somebody else may have added some other thing in the cost. I chose Susquehanna because it's a parallel plan and it was easier to make the comparison.

Q. Is it your opinion that Mr. Bridenbaugh and Mr. Minor included the same items that you included in your analysis?

A. I have no way of knowing. I didn't check their itemization. They characterized rework and additional pipe supports that had to be added. I came up with my own characterization. I felt they were in the same neighborhood, but I didn't go through their in-depth comparison.

Q. Do you know if they looked at costs of engineering?

A. I don't know.

MR. WERSAN: That's all I have, Your Honor. Thank you, Mr. Vollmer.

JUDGE MATUSCHAK: Is there redirect?

MR. HALL: Yes, Your Honor, if Your Honor would give us a minute, please.

JUDGE MATUSCHAK: We'll take a 10 minute recess.

(Recess.)

T6

JUDGE MATUSCHAK: Whenever you are ready.

MR. HALL: If Your Honor, please I have three questions on redirect.

JUDGE MATUSCHAK: Go ahead.

REDIRECT EXAMINATION

BY MR. HALL:

Q Mr. Vollmer, Mr. Wersan asked you whether or not a certain preliminary interrogatory response that the company had provided to the Office of Consumer Advocate and Mr. O'Brien setting forth the $162 million cost figure identified whether or not that figure was related to one or two units, and I believe you answered that question. Do you recall the question?

A Yes, I do.

Q Have you had occasion to refresh your recollection as to whether there was any other interrogatory response by which the company supplied that information to the Consumer Advocate?

A Yes, I have. In response to OCA-4-48 (Revised) the interrogatory was answered as follows, "The $164.2 million previously set forth as the estimate cost associated with the Mark II redesign was an estimate of station costs based on a preliminary review of the cost estimates," and then it goes on.

Q Mr. Vollmer, Mr. Wersan asked you a series of

questions as to whether you had discovered references to certain GE proprietary documents in other documents in Philadelphia Electric Company's files. Do you recall that question, or line of questions?

A Yes, I do.

Q In your review of Philadelphia Electric Company files and documents, were you specifically looking to determine what references, or if there were references to the documents that the Consumer Advocate mentioned?

A No, I was not.

Q Finally, Mr. Vollmer, Mr. Wersan asked you a question about whether it was your opinion that General Electric should test and examine properly any phenomena that they might uncover in their testing of the Mark II containment; do you recall that series of questions?

A Yes.

Q Do you have an opinion as to whether General Electric did so test or not,at this time?

A I'm sorry; could you repeat that?

Q Yes. Mr Vollmer, did you in your testimony previously here today in response to Mr Wersan's questions about whether General Electric should or should not test in light of the observation of certain phenomena or activities, did you mean to imply that they had or they had not done the appropriate testing, in your opinion; did

you make any qualitative judgment in those statements relative to whether they had done appropriate testing or not?

A Based on the state of the art at the time, it was my opinion that they had evaluated the situation.

Q Thank you.

MR. HALL: That's all I have.

MR. WERSAN: I have just one question.

RECROSS-EXAMINATION

BY MR. WERSAN:

Q Mr. Vollmer, I thought that the gist of my question on the testing was -- at least one of them was a hypothetical that if you were involved in a test looking at one item, and during that test another phenomena emerged which seemed to, for example in this situation, cause the test facility to jump or vibrate severely, would that have prompted you to look any further; and what is your response to that question?

MR. HALL: Excuse me. You are asking that as a hypothetical, as I understood it?

MR. WERSAN: Yes. I understand Mr. Vollmer did not and was not present at those tests. I'm asking it as a hypothetical.

THE WITNESS: That's a difficult question because based on the state of the art at the time I think you would try to present an understanding of what you were seeing;

and based on what your knowledge level was at the time, you would try to explain the nuances.

MR. WERSAN: That's all I have, Your Honor.

MR. HALL: If I could ask one question?

FURTHER REDIRECT EXAMINATION

BY MR. HALL:

Q Mr. Vollmer, my question to you was: you are not testifying here today that GE did not do that?

A No.

MR. HALL: That's all I have.

JUDGE MATUSCHAK: Thank you.

(Witness excused.)

MR. HALL: Your Honor, at this time we have Dr. Salomon Levy.

Whereupon

SALOMON LEVY

having been duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. HALL:

Q Dr. Levy, would you state your full name and your business affiliation for the record please?

A My name is Salomon Levy. I'm the President of S. Levy, Incorporated.

Q Dr. Levy, do you have before you six documents, the first two of which are identified in the right-hand

corners as PECo Statement Number 34 and PECo Statement Number 34A?

A Yes.

Q Do you also have either before you or available to you documents which are identified in their right-hand corner as PECo Exhibit SL-1, SL-2, SL-3 and SL-4?

A Yes, I do.

Q Dr. Levy, referring to the documents identified as PECo Statements 34 and 34A, would I be correct that the document identified as Statement Number 34 is identified on the cover as "Rebuttal Testimony of Salomon Levy, Mark II Containment Issues," and is a document of some 31 pages with attached schedules?

A Yes.

Q Similarly, Dr. Levy, PECo Statement Number 34A, is that a document of some 10 pages with no attached schedules?

A The answer is yes.

Q Dr. Levy, do you have any corrections to make to these documents at this time?

A No.

Q Dr. Levy, referring to PECo Exhibit SL-1, is that a document which contains a number of interrogatory responses which you prepared or which were prepared subject to your direction and supervision relative to interrogatories

asked of you by the Office of Consumer Advocate?

A That's correct.

Q Dr. Levy, I note that in that document there is reference made to certain proprietary General Electric reports, being GEAP-3013, GEAP-3143, and I believe a NEDM document -- you may have the number; I do not.

A There is a reference to NEDM and a NUSA document, NUSA-86 by Dr. Moody, and NEDM --

MR. WERSAN: Instead of saying "NUSA" you might want to state the letters so the reporter can record them.

THE WITNESS: Okay, I will go back; Nuclear Systems Analysis Unit memorandum, NUSA-86, dated October 12, 1964; and also Nuclear Safety Development Engineering memorandum report, NEDM-13036-1, dated July 1970.

BY MR. HALL:

Q Dr. Levy, I believe, as indicated in your answers to interrogatories, you did not have copies of these documents in your possession at the time that you prepared you rebuttal and sur-surrebuttal testimony or the interrogatory responses; is that correct?

A That is correct.

Q Have you since had occasion to review those documents briefly?

A I was given a set of these documents last night at 10:00 and had the opportunity to review them briefly

last night and somewhat this morning.

Q Dr. Levy, I take it you have reviewed certain of these documents previously in connection with your employment with General Electric?

A That is correct.

Q However, since leaving General Electric they have not been available to you because of their proprietary nature with the General Electric Company?

A That's correct.

Q Dr. Levy, going forth, PECo Exhibit SL-2, that document is a copy of a paper by Mr. D.R. Miller, published in the "Journal for Engineering for Power," "Pressure Suppression Containment Design, Current State of the Art;" is that not correct?

A That is correct.

Q PECo Exhibit SL-2 is a copy of Appendices 4 and 5 of the Final Hazards Summary Report on the Humboldt Bay Power Plant, Unit Number 3, filed by the Pacific Gas and Electric Company with the Atomic Energy Commmission; is that not correct?

A That's correct.

Q PECo Exhibit SL-4 is a document of Appendix 1 of the Preliminary Hazards Summary Report involving Bodega Bay Unit 1, also filed with the Atomic Energy Commission; is that not correct?

A That's correct.

Q Dr. Levy, is the data contained in PECo Exhibit SL-1 true and correct to the best of your knowledge and belief?

A I would like to make one small correction please.

Q Certainly.

A I think in one of the responses there is a typographical error. I said that I became Manager of Systems Engineering in 1968. That's question 28-3. That should read 1966.

Q Dr. Levy, referring again to PECo Exhibit SL-2, SL-3 and SL-4, are these true and correct copies of the documents that they purport to represent?

A Yes.

Q Referring to your rebuttal and sur-surrebuttal testimony, Dr. Levy, is the data contained in those two documents true and correct to the best of your knowledge and belief?

A At the time they were prepared, the answer is yes.

Q Would you at this time care to make any revisions to those documents relative to your review of the additional General Electric proprietary documents?

A I would like to make a minor change to one of the responses. In reviewing the General Electric proprietary

documents, I find that the word "chugging" appears in some of the earlier documents, and I had indicated on my responses that no chugging was referred to in those documents. I think I indicated in my responses that some pressure oscillations and some intermittent condensation was reported with that event, which was the way General Electric described that phenomena in some of their published literature. I think I discovered last night when reading the proprietary documents that they actually referred to it as "chugging" in those documents.

Q Does that discovery, Dr. Levy, change any of your conclusions with respect to whether the hydrodynamic phenomena that were investigated in 1974 and 1975 could have been examined and investigated at an earlier time?

A It does not change my position.

MR. HALL: Your Honor, I would ask that PECo Statements Numbers 34 and 34A be identified in the manner I have described for use in this record, and that PECo Exhibits SL-1, SL-2, SL-3 and SL-4 also be so identified.

JUDGE MATUSCHAK: So identified.

(Whereupon, the documents were marked as PECo Statements Nos. 34 and 34A and PECo Exhibits Nos. SL-1, SL-2, SL-3 and SL-4 for identification.)

MR. HALL: Your Honor, I would ask that they be admitted into the record.

JUDGE MATUSCHAK: Subject to motions to strike and exceptions or objections, the motion is granted.

(Whereupon, the documents marked as PECo Statements Nos. 34 and 34A and PECo Exhibits Nos. SL-1, SL-2, SL-3 and SL-4 were received in evidence.)

JUDGE MATUSCHAK: Staff?

MR. DELANEY: We have no cross for the witness, Your Honor.

JUDGE MATUSCHAK: OCA?

MR. WERSAN: Thank you, Your Honor.

CROSS-EXAMINATION

BY MR. WERSAN:

Q Good afternoon, Dr. Levy. My name is David Wersan; I'm with the Office of Consumer Advocate.

A Good afternoon.

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.

Q Now, on page 8 and 9 of that same testimony you discuss safety relief valves in BWRs; is that correct?

A That's correct.

Q Can you state when General Electric first decided to use the pressure suppression pool for safety relief discharge?

A The history, as I recall it -- I'm just going by memory now -- is that the Humboldt Bay design actually piped their safety relief valve to the suppression pool. Then subsequent to that many plants did not pipe their relief valve to the pool, and then they were converted to have the relief valve piping going back to the pool.

Q Which plants and which time frame are you referring to that converted back to having the safety relief valve going to the suppression pool?

A I'm talking about the original Oyster Creek and Dresden plants 2 and 3. The Oyster Creek plants, for

example, were subsequently converted to piping their relief valve into the pool. The Dresden 2 plant actually, to the best of my knowledge, went operational without having the relief valve piped into the pool.

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 relief valve would be smaller than those 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 Are the kinds of loads exerted by discharges from safety relief valves different in manner for operation than loss of coolant accident type loads?

A They are actually similar in some ways, and they are different in one place. They are very similar in terms of what I call the water clearing and the air

clearing loads. There was water at the bottom of the pipe and there was air within the pipe until the steam reaches that relief valve pipe. Those loads are very similar.

Then there are condensation loads associated with the relief valve pipes, and there are condensation loads associated with LOCA.

I think there is a difference between the condensation loads that are associated with the relief valves versus the loss of coolant type of condensation load.

Without getting too technical, there is a major difference in the mass flow rate. The relief valve condensation loads occur at a very high mass flow rate. The loss of coolant condensation loads occur at a much smaller flow rate. Furthermore, they also occur generally at a much lower pool temperature.

Q Which occurs at a lower pool temperature?

A The loss of coolant accident load occurs at a lower temperature.

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.

Q On page 11 of Statement 34 at line 14 when discussing early tests for Humboldt Bay and I believe Bodega Bay, you state, "During these early tests, minimal vibrations, pressure oscillations and water swell were noted, but these activities were either not relevant to the proposed pressure suppression design or they were simply too minor to affect test operations or its equipment;" is that correct?

A That's correct.

MR. WERSAN: May I have a moment, please?

(Pause.)

BY MR. WERSAN:

Q If I could refer you along that same line to page 5 of your sur-surrebuttal testimony at line 43, in discussing tests at the Moss Landing Power Plant, the test condensing facility, you state, "Tank vibrations were observed at high pool temperatures. They started at 120 to 130° F and became severe at increased pool temperatures;" is that correct?

A That is correct. That should be 130 degrees Fahrenheit.

Q Is what you are stating then on page 5 of your sur-surrebuttal testimony relating to a different early test in vibrations that were measured?

A Yes. I think in my original testimony I was dealing with the full scale test of the Humboldt Bay facility, or at least a segment of that facility; and similarly the full scale test of a segment of the Bodega Bay test. The condensing test facility were performed prior to those tests and did not simulate a containment design. They were primarily oriented to support the fact that steam could be condensed in a large pool of water. And during those tests some tank vibrations were actually observed.

I think in my testimony I pointed out that those

kinds of vibrations were excluded in the design of the pressure suppression system by limiting the temperatures that do exceed during the loss of coolant accident.

Q Just so I'm clear, the minimal vibrations you refer to on page 11 of your first piece of testimony refer to different tests and later tests than the ones that are discussed as severe on page 5 of your sur-surrebuttal testimony?

A That's correct. My minimal vibration and these pressure oscillations refer specifically to the Humboldt Bay and the Bodega Bay tests that you see, which I have discussed in the paragraph along with the answer to that question.

Q Dr. Levy, you stated you reviewed certain GE proprietary documents in your analysis of this case; certainly last night you reviewed them, probably at about the same time I as reviewing them.

I would like to show you first one of those documents that I earlier showed to Mr. Vollmer, GEAP-3143, "Test Report for the Pressure Suppression Development Program Prepared for Pacific Gas and Electric." I take it this is one of the documents you reviewed?

A Yes.

Q Since I only have one copy, I have to work with you right here. Would you agree with me that this document

was prepared on April 2, 1959?

A Yes.

Q And based upon the distribution page to that document, I take it you were provided with a copy of this document when it first came out?

A Yes.

Q I would like to refer you to page III-7 of this document, and at the same time I will give you the errata sheet to that document, just to make sure we are reading it properly. If I refer you to the third paragraph on page III-7, I would ask if you could read that paragraph into the record, since that is the way we have to deal with this document.

A The third paragraph?

Q Yes, starting with "During a run."

A "During a run with a four-inch single vertical injector, closed tank, six-inch depth of submergence, and maxiumum 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."

Q If you could read the next paragraph on II-7 please?

A "A 14-inch injector was too large for the steam supply available. At the low line pressure it was not possible to obtain jet flow with this injector, and chugging occurred. With the tank closed, shaking and banging occurred, but the intensity was less severe than that of the smaller injectors with higher velocities."

Q If I could refer you to page III-8 and ask you to read the second and third paragraphs on that page?

A Yes. "The bottom four-inch injector operated the same as the previously run top horizontal injector. The operation was smooth at six inches depth of submergence, and gradually increased in roughness at six foot depth of submergence as the pool water temperature increased.

"The operation of the bottom 14-inch injector proved to be a serious problem since the steam line ran horizontally from the control valve into the tank. With hot steam on one side of the valve and cold water on the other, along with insufficient pressure to produce jet flow, the water hammer was quite severe. The tank shook severely

during the run, which was made at sinx-inch depth of submergence with the tank open. As the steam valve was being closed at a slow rate, the severity of the water hammer increased to a point where everything in the vicinity of the tank was shaking."

Q And then if I could refer you to III-9 and have you read the top paragraph on that page?

A "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 timewide coincided with this run."

Q I should note that "timewide" is actually "timewise" according to the errata sheet.

A "Photographs taken during this run show peak pressure fluctuations of 6 psi while photographs taken when the anchor to the tank was removed show peak pressure fluctuations of 10 psi during the same run with less severe reaction of the facility and no bouncing of the tank. In this same unanchored series of four-foot depth of submergence and a recorded mass flow rate of 105,000 pounds per hour, the peak pressure was 24 psi, as compared to 3 psi when anchored. At two-foot depth of submergence a peak pressure

of 40 psi-plus as compared to 6 psi when the injector was anchored."

Q And if I could have you read the last paragraph on that page, and note that on the errata sheet one additional sentence is added at the end of that paragraph?

A "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 second paragraph, last line after period insert: The intensity of the vibration increased with increased steam flow rates under all conditions."

Q Dr. Levy, in your testimony in this case am I correct that you discuss some of the allegations made in the Zimmer lawsuit complaint?

A That's correct.

Q I take it, therefore, that you have reviewed that complaint?

A I reviewed it by looking at Dr. Hanauer's rebuttal to which it was attached.

Q Did you note whether or not in that complaint the document you just read from, GEAP-3143, was referenced

by the complainants?

A It was.

Q Do you recall whether or not some of the portions of that document I just had you read were referenced in that document?

A I wouldn't want to vouch for that. I know there were some references to it.

Q How about if I show you -- I realize it has been stricken, but in terms of the page numbers of the complaint, at page 47 of the complaint would you agree with me that that document, GEAP-3143, is referenced by the complainants?

A Yes.

Q You also, I take it, reviewed a document prepared by GE entitled "Pressure Suppression Pool Investigation, Report No. 1," dated July, 1970?

A Yes.

Q And that document is NEDM-13036-1?

A Yes.

Q Do you recall whether or not you received this document when you were with General Electric?

A I indicated in my response that, to the best of my recollection, I did not receive that document.

Q But you were with General Electric at the time this document was prepared and circulated?

A Yes.

Q If I show you the distribution page of that document, you would agree with me that it was circulated to a number of GE personnel?

A It was circulated to a large number of GE personnel, but I would like to say that they were very primarily in the Development Engineering organization.

Q And which organization were you in in 1970?

A I was manager of Design Engnineering.

Q Which is therefore different from Development Engineering?

A It's a parallel organization, and it is in the Development Engineering organization.

Q What is the interface between those two divisions?

A We both report to the same general manager.

Q Do you provide information between the two divisions -- or did you?

A I think that when we needed a test, a very specific test, we would ask Development Engineering to do so.

Q And if I could show you again pages from this document and ask you to read pieces from it -- let me find that. If you could read the third paragraph on the page entitled "Introduction" to that report?

A "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 run 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."

Q And if I were to refer you now to page 10 of this document under III it states the objective of investigations. Could you please read that paragraph?

A "The objective of these investigations was to explain the pressure fluctuations and vibrations which were noted in the downcomer and suppression tank during several recent test series in the small test stand. Only limited results have been obtained, and only tentative

conclusions can be drawn since specific tests have not been designed and the measurements made were only incidental to the primary objectives of the test series investigators."

Q And if you could read paragraph B, Applicable tests?

A "During early high pressure blowdown tests performed in the smll 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."

Q I think that's enough.

A Very well.

Q And if I could refer you to page 13, the last paragraph on that page -- the copy is difficult to read from, but do the best you can.

A "This phenomena is probably not significant with respect to reactor installation since the drywell volume will effectively buffer the initial surge following a sudden line break. 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."

Q And just so it is clear, the first sentence discussed "This phenomena is probably not significant." Maybe you could look at the preceding paragraph to state what phenomena is being referred to.

A The phenomena that is being referred to is the phenomena that is referred to as "initial shock and tank jump."

Q Now if I could have you look at page 16, and have you read the last paragraph on that page?

A "The report of the initial condensing tests at Moss Landing indicated that under certain test conditions there were severe pressure fluctuations in the pool accompanied by shaking and banging. It was concluded from these tests that the roughness was temperature-related and that it commenced as the pool temperature reached 120 degrees Fahrenheit to 130 degrees Fahrenheit, and increased in intensity as the temperature increased. The most severe banging occurred with the suppression tank seal, and after several minutes of operation when the vapor space pressure would be higher due to accumulated condency. One case of tank bouncing was reported while flow was being reduced. At another place in the report it is indicated that sonic velocity at the vent outlet was suspected due to reaching

the critical pressure ratio of 2.1. Although the banging and the suspected sonic velocity were not tied together in the report, they occurred during the same test."

Q And on page 17, if you could read the last two paragraphs on that page?

A "The chugging phenomenon is observed when steam is injected into water at low mass velocities. This chugging apparently occurs when the rate of condensation is momentarily greater than the steam flow rate and the vapor bubble rapidly collapses, causing the steam interface with the water to withdraw into the injection piping until the pressure increases sufficiently to force the water from the piping and to reestablish the jet in the water.

"The occurrence of chugging was noted in the report of the initial condensing tests at Moss Landing for the largest pipe sizes. The report of the Humboldt 1/48th segment test at Moss Landing, references 7 and 8, indicated that water hammer was noted at low flow rates. The pressure traces for these tests gave indications similar to those which accompanied chugging during the suppression pool effectiveness tests with indicated pressure oscillations in the vent pipe of up to plus or minus 3 psi at frequencies of 1 to 2 cycles per second. The Bodega Bay 1/12th segment test at Moss Landing, references 8 and 9, also gave indications of chugging with pressure oscillations of plus or

minus 3 to 7 psi at up to 12 cycles per second. Some of these tests were run to determine the magnitude and frequency of vent line water level oscillations, and it was found that the water level rose to a maximum of 5.5 feet above the end of the vent, and that about 5 seconds was required for the level to complete its cycle of rising to the maximum and falling back to the average level."

Q On page 18 if you could read the first paragraph?

A "Several of the suppression pool effectiveness tests which were run at low flow rates were accompanied by chugging and sharp steam hammer knocks as well as by relatively large fluctuations in the pressure and flow indications within the downcomer. During some of the tests run with an elbow on the end of the downcomer in order to vent the flow horizontally the steam jet was observed to disappear and reform with an accompanying sharp steam hammer knock. The chugging was found to begin as the flow ratios decreased to the range of 7 to 12 pounds per second per square foot (extrapolation of the jet shape model proposed by Honeycut, reference 1 to zero jet depth would indicate a corresponding mass velocity in the range from 14.5 to 16 pounds per second per square foot). Pressure oscillations of up to plus or minus 5 psi were noted in the piping in conjunction with the chugging, and pressure

pulses of up to 1 psi were noted at the pressure tab at the wall of the tank."

Q And if you could read the next paragraph please on that page?

A "The significance of chugging for current containment designs utilizing a large number of vertical downcomers cannot be properly evaluated. Although the flow area per vent is relatively small, all vents have the same submergent depth and little is known about the interaction between multiple vents. Advanced designs incorporating features such as different vent shapes, horizontal discharge directions, and lower peak containment pressures emphasize the need for further investigation of the phenomena. In the ACCESS IV inverted wier vent design, for example, although the flow areas per vent is much larger the variable flow area inherent in the design may significantly reduce any chugging effects."

Q Then under IV entitled Suggestions for Additional Testing, if you could read the last paragraph on page 19.

A "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."

Q And in your review, Dr. Levy, of the Zimmer complaint, as you reviewed it, would you agree with me that the document you just read from is referred to at page 68 of that complaint as part of the allegations?

A Yes.

Q As you understand part of what you read of the document NEDM-13036-1, does that document discuss safety relief valves and loads from those valves?

A The document describes a series of specific tests performed with a high pressure tank in which the steam/water mixture is released and is piped to an open pool of water. The pipe size, the characteristics of it, as far as I'm concerned, are quite different from the full size relief valve configuration in a containment, and similarly is quite different from any configuration for a loss of coolant accident in a real design containment.

Q Would you agree with me that some of the loads discussed in that document represent phenomena that we now call hydrodynamic loads?

A Okay, I'll try to give you as short an answer as I can. It might take a little while because there is a variety of hydrodynamic flows, and I'd like to maybe take them one at a time if I can, if you don't object.

I think the first set of hydrodynamic loads that

really was observed were those hydrodynamic loads that occurred from the condensing test facility. That facility in no way is similar to a containment arrangement. It is primarily taking steam and piping it into a pool and seeing if the steam condenses. I think during those tests they observed what I call high temperature unstable condensation. These type of unstable condensation phenomena, which clearly the report shows there are hydrodynamic loads associated with -- I mean they reported vibration, banging of the tank, jumping of the tank, so there are hydrodynamic loads associated with that phenomena.

That phenomena occurs -- again reading the reports carefully and thoroughly -- that phenomena occurs under two very important conditions; one, pool temperature in those tests had to exceed 120 to 130 degrees Fahrenheit, and the steam flow rate had to be quite large. Actually if you looked at the latest report that you made me read from, it tells that those velocities actually were approaching sonic velocity in the pipes.

Those conditions are nowhere near similar to anything that you have in the loss of coolant accident event. I have already pointed that out.

Furthermore, in the loss of coolant accident event actions were taken to prevent the occurrence of such temperatures. As a matter of fact, the Bodega Bay and the

Humboldt Bay tests performed full-scale tests at much higher pool temperatures with the loss of coolant being simulated. During that event the flow starts high and drops rather sharply, and if you look at those reports you will find that actually they did not observe vibration up to 160 degrees Fahrenheit. Actually they went as high as 162 degrees Fahrenheit in the Bodega Bay tests and 161 degrees Fahrenheit in the Humboldt Bay tests, to be precise.

So what happens is that the condensation phenomena that was seen with a steady steam flow rate did not occur in the loss of coolant accident at a much higher temperature, and that's understandable because the flow rate was coming down and therefore it allowed it to go to a much higher temperature before you see it.

So, in fact, the condensation test oscillation and the hydrodynamic loads that were associated with them, as I've said repeatedly in the testimony and in some of my answers to the questions, were precluded from occurring during a loss of coolant accident.

They are not relevant hydrodynamic loads to that event.

I think I have to say that they are relevant events to relief valve where you have rather high steam flow; but, again, if you look back at some of my testimony and answers to questions, General Electric imposed limits on the pool

suppression temperature to avoid the occurrence of such phenomena in the pressure suppression designs of General Electric.

Furthermore, General Electric provided the Ram's Head at the bottom of the relief valve pipe, and, as pointed out in several documents, those Ram's Heads provide much greater mixing of the pool, and therefore that says that when you reach 160 degrees with a straight pipe you probably can reach a much greater temperature before the Ram's Head would give you the same impact.

So the point I'm trying to make is that again even though those hydrodynamic loads are relevant to the safety relief valve configuration, action was taken by temperature limits and different configurations at the end of the pipe to preclude them from having that event occur in the domestic U.S. plants.

Q Let me ask you this, Dr. Levy: what are the loads described in the two documents that you just read from, hydrodynamic loads that ultimately became a concern of the industry and the NRC in the 1975 time frame?

A In the 1975 time frame the NRC decided to relook at the relief valve loads, and decided that it would be wise to provide additional margin.

Let me explain. If you have an open relief valve that is supposed to close after it does its mission, if

it sticks open you are supposed to take action in the domestic plants; if you see that you are supposed to depressurize the plant, therefore avoiding a possibility of having a loss of coolant accident from the high pressure so you wouldn't get a high load.

I think what I'm trying to say is that in 1975 the NRC felt that it was wise to provide some additional margin for this event.

Q But the loads discussed in those two documents are the kinds of loads, one relating to SRV and one relating to LOCA -- or a number relating to LOCA, that the NRC became concerned about?

A No, again I think the NRC became concerned about a certain type of SRV load, again the clearing loads; they became concerned about the clearing loads and the water loads that come with the initial events. I think the condensation loads, themselves, by imposing the temperature limit you can make those loads quite small so they actually aren't relevant. They are so small that even if you add them to the others they practically contribute such a small percent. Now you do that by either imposing the temperature limit or later on as they wanted to drive these plants to be able to operate at higher temperatures with relief valves stuck and things of this type; and I think particularly as a result of ATWS consideration, the anticipated

transient without scrubbers, we were dealing with higher pool temperatures.

I think that's a very rare event, but we had to deal with it. And then with that very rare event there was a desire to get up to higher pool temperatures.

As a result of this, the plants were asked to put quenchers on. So again the condensation oscillation loads that would occur by operation of these higher temperatures would be quite minimal or negligible compared to the other loads that we are going to add them with.

Q If I understand your answer then, initially General Electric thought that the problem relating to safety relief valve loads could be dealt with by keeping the temperature of the pressure suppression pool down, but when discussions about anticipated transients without scrambler emerged and the need to actually have elevated pool temperatures arose those prior beliefs about loads from the SRV loads had to be rethought?

A My view is that without the ATWS event the plant with a temperature limit actually operated satisfactorily. Actually there are events with stuck-open relief valves that were without serious vibration.

I think the concept of ATWS that emerged about that time dealt with the fact that you needed to get the higher pool temperature, and I think that plus the desire of the NRC to provide additional margin in the temperature

you might see with a stuck-open relief valve. The reason they wanted additional margin is they made a survey of all the operating plants and they actually found that they were not all taking the same action at the same time, so the NRC decided at that point that it would be wise to require all the licensees to provide additional margin.

See, we were saying if this event were monitored we could keep the pool temperature below it, but they felt that it would be wise to provide an additional 20 to 30 degrees Fahrenheit for the anticipated transient without scrambler event that was occurring at the same time; so this led them to actually feel that we should go for something that reduces the condensation loads.

Q When was the ATWS issue raised, first raised at the NRC or at GC?

A The ATWS issue was raised -- I think probably Dr. Hanauer can probably answer that better than I can. But it was raised -- let's see, it was raised I think in the late '60s. It was argued for years and years with the industry arguing that it was an event that cannot occur, and the NRC insisting that we try to do some design provision for it.

Q So the ATWS that you describe as arising in the late '60s then was arising at the same time frame that the July 1970 report was published; is that correct?

A I think in the late '60s I think the arguments that -- I speak for General Electric because I made some presentations. The arguments that were made at that time were that the ATWS event was an incredible event, that we should not design for it in terms of a cost/benefit basis.

Q But first answer my question, if the time frames that I'm giving you are similar; the late '60s and then the July 1970 report?

A I believe that we did not deal with much higher pool temperatures until much later.

Q First answer my question, and then get on to that.

A I would say that the original ATWS consideration came up about that time, but I want to caution you; the issue having been raised, that doesn't prescribe the pool temperatures, because we had to define the event and what is the end temperature. And the temperatures were not argued, I think, until many years later.

Q Would keeping the pool temperature low also resolve concerns about a loss of coolant accident?

A Keeping the temperature low is also helpful to a loss of coolant accident. I think the tests that were performed much later in the late '70s would show that some of the loads that we measured much later actually benefit from a reduced temperature.

Q But was it as controlling a consideration as you suggested it was for SRV loads?

A No, I would say the temperature was very important to the SRV load in the sense that you now enter the set of hydrodynamic loads which had been identified and of which the significance was realized.

Let me deal with the other hydrodynamic loads. We were just dealing with this condensing kind of load, and those hydrodynamic loads were recognized in the late '50s and early '60s, if you want to call it that, but they were dealt with by design.

I think it is true that the tests performed at that time also showed some chugging, as I pointed out, but efforts were made to measure the currents of the forces associated with chugging. I think some of the documents that I looked at last night, for example -- since you made me read some paragraphs, you don't mind if I read a few others?

Q Actually I would prefer it you did it on redirect.

A Why don't I do it then your way? I think some of those documents show that when chugging occurred there was an effort to measure the pressure pulses associated with it. They actually installed transducers in the water, and they reported on these that the pressure that they

measured that were associated with these were quite small.

Q Referring back to GEAP-3143, which came out in 1959, and which you received a copy of, do you recall whether or not you provided that to the AEC at that time?

A That report was furnished to the AEC.

Q And how about the report, NEDM-13036-1?

A I'm afraid I cannot answer that question.

Q Dr. Levy, you were with General Electric for 24 years; is that correct?

A That's correct.

Q And you were with them throughout the time period when the Mark containment was conceived, designed and tested through when you left in 1977; is that correct?

A Yes, recognizing that I had positions in and out associated with that design. I actually started to do design work in 1966.

Then for a period of time from 1971 to 1973 I left that work to go run the Fuel Department so I was no longer associated with the design of the plants.

Q On page 3 of your rebuttal testimony at line 10 you state, "In the 1968 to 1971 period I was responsible for all nuclear systems being offered by GE and all recent and future project management functions of domestic nuclear systems, which included development of the Mark II concept." Is that correct?

A That's correct.

Q Does that mean that you participated in engineering presentations to utilities concerning purchases of GE BWRs?

A As I pointed out in one of my answers, I participated in presentations to customers.

Q Did you participate in a presentation to Philadelphia Electric Company with respect to either Peach Bottom or Limerick?

A I don't believe I participated in either presentation, but I wouldn't be absolutely sure.

Q In presentations that you did make to utilities did you provide documents, for example GEAP-3143?

A No. GEAP-3143 was made available to the AEC/NRC. I think the clients knew that we would make available a proprietary report to the AEC/NRC if the AEC/NRC considered it necessary.

I think if I could describe the process to you, General Electric, who performed these tests, would put them in proprietary reports primarily for commercial advantages. We would then write a non-proprietary version of those reports, which actually is appended to the Safety Analysis Report. As a matter of fact, the condensing test facility and the transient pressure facility in GEAP-3143 are described in the Humboldt Bay Safety Analysis Report in

summary form.

Q Are the chugging events and other events described in that report?

A I think that you would find in that report some mention of some vent pressure oscillations and potential intermittent condensation. I know that such a sentence appeared in a published paper, so it has been described. It wasn't called chugging, but it has been described.

And I believe the NRC was aware that these kinds of events were taking place.

Q When you say these documents were made available to the AEC, does that mean you actually gave them to them or they would have been available if they asked for them?

A I think -- let me describe the process. I think we would generally first make a presentation of our data to the NRC. We would then, depending on the amount of questions we were asked at that presentation, try to go home and try to write a non-proprietary version which they felt was adequate for the public to have to make sure that we had dealt with some of the safety issues and that we had described the kind of data that was obtained.

If that was satisfactory, then I think the issue was terminated at that point. If as a result of listening to our presentation in which we tended to present a lot more information that wasn't in the Safety Analysis Report,

the NRC felt there was some additional information they wanted, we would make the proprietary report available to them on a proprietary basis, and they would so accept it.

Q To tie it back to GEAP-3143, did you actually give that document to the AEC or make it available?

A To the best of my knowledge, that document was sent to the NRC to keep. It was the AEC at that time.

Q And you describe how a non-proprietary report -- you discuss in this information, and you have provided the Final Hazards Summary Report on Humboldt Bay Power Plant in your Exhibit SL-3?

A Yes.

Q When you say in a summary report, would you agree with me that there are really only two sentences in that entire document that I could find that discuss the tank vibrations? One would be at page 8 and the other at page 13.

A Yes, I believe that is correct. But let me point your attention to some other published papers, published in 1959 and 1960 that have additional information in terms of the tank vibrations and the temperature limits that you have to observe.

Q Do they discuss the chugging and the banging and the measured earthquake at the early tests?

A They do not discuss the measured earthquake,

but they discuss the fact that there was some severe vibration of the tank, and the paper on nuclear engineering that we provided to you discusses pressure oscillations within the vent and intermittent condensation within the vent, which is another way of describing chugging.

MR. WERSAN: That's all I have, Your Honor.

Thank you, Dr. Levy.

JUDGE MATUSCHAK: Is there any further cross-examination?

(No response.)

JUDGE MATUSCHAK: Is there redirect?

MR. HALL: Yes, Your Honor. Could I have about a 15 minute recess please?

JUDGE MATUSCHAK: Yes, we will recess for 15 minutes.

(Recess.)

JUDGE MATUSCHAK: Whenever you are ready.

MR. HALL: Thank you, Your Honor. Your Honor, I have a few redirect questions of Dr. Levy.

REDIRECT EXAMINATION

BY MR. HALL:

Q. Dr. Levy, you were asked to read by the Consumer Advocate several quotations from the GE proprietary documents which the company had provided to the Consumer Advocate.

Do you have two additional passages that you believe should be read, the first of which deals with conclusions drawn from the Valecitos test?

A. Yes. I am going to read from the comments section on page 5.

JUDGE MATUSCHAK: You better identify what he is reading from.

BY MR. HALL:

Q. Would you identify which document you are reading from?

A. I am reading from GEAP-3013. I am reading from page 5. I am going to read the first paragraph under "Comments." The same statement appears under the second conclusion.

The first paragraph says, "The purposes of the test were completely fulfilled in that the water hammer problem

at least for low steam flow rates was found to be non-existent and deficiency of steam condensation very high and rapid." In previous pages, it is pointed out that a low steam flow rate is when you get chugging, and the measurements that were made with tranducers showed that the pressure involved with that kind of an event was quite small.

Q. Secondly, Dr. Levy, do you have a passage which you wish to read from the NEDM report, and would you describe the purpose that you have in reading that passage?

A. I'm going to read from page 17 of NEDM-13036-1, the second paragraph, the first sentence and second sentence. "At the present time, there does not appear to be sufficient data available to permit drawing conclusions with regard to plant design as affected by the vibration phenomenon. It would seem prudent, however, to limit vent mass velocities to values less than those which correspond to sonic velocity until further data is available."

This paragraph deals with the vibrations that were seen in the condensing test facility, and some of them were reproduced in this memorandum. I think as pointed out someplace else in this document and it was made a requirement in the design of the pressure supression containment designs, there was a requirement that the vent mass velocity in the vents during the loss of coolant accident be kept quite a bit below the sonic velocity. Actually, the velocity was

kept at approximately one-third the sonic velocity in those vents.

Q. Dr. Levy, one of the paragraphs that the Consumer Advocate had you read into the record, which I believe is a paragraph that was from the NEDM document, referenced a 14-inch injector in various tests that were run with a 14-inch injector and that as the results of those tests various phenomena or things were observed.

Could you describe for me what a 14-inch injector is and what the purpose of that test is and what significance, if any, it has to you?

A. This is in GEAP-3143 rather than in the NEDM document.

Q. Do you have the page at which that appears?

A. Yes. I actually read that paragraph. It's on page III-8.

In this particular case, a 14-inch injector was installed, but in contrast to the other vents that were employed in this facility, this 14-inch injector was allowed to penetrate horizontally at the bottom of the tank. Then it was bent upward, and then there was finally another horizontal run, and then it was only submerged six inches in the water.

Q. Dr. Levy, if I could stop you, you are describing the configuration of the pipe as it came into the tank and

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the bends in it and so forth?

A. First I would like to say that such a configuration is not used in pressure supression design. There are no horizontal runs in the vents.

I think in this particular case, as pointed out in that paragraph, because of the horizontal vent, actually you can creat a water hammer effect. The very severe effects that were noticed in this particular case were actually created by what I call a true water hammer effect.

That says that they were beginning to take a little water in, and then you run into these horizontal sections of pipe. What you actually do is condense that steam very rapidly, build a vacuum, and you actually create a true water hammer effect that speeds out that water. It probably took it all the way back down all the way to the valve and therefore shook the whole piping, the tank and the valve.

I want to point out simply that that kind of a configuration does not occur in a pressure supression design.

Q. I take it that kind of a configuration is not contained in the Mark II containment?

A. No.

Q. Would I be correct that the reason for that is that this test showed it was an unsuccessful configuration?

A. Well, I'm not too sure if I'm going to attribute

it to this test or not; but if you want to avoid a water hammer in steam water mixture, you try to avoid horizontal runs.

Q. Dr. Levy, in your testimony and in your interrogatory responses which were provided to the Office of Consumer Advocate, you explain certain facts about the condensing tank facility and the purpose of the tests that were run there which I believe may be related to the significance to be attached to the paragraphs that the Consumer Advocate had you read from those various reports.

Could you describe that for us and reference the parts of your interrogatory responses or testimony upon which you are relying in that description?

MR. WERSAN: Your Honor, I believe that if the interrogatory is already in the record as part of his testimony, he doesn't need to reread those at this time.

MR. HALL: We're not asking him to reread it. I simply wanted him to reference it and note its applicability to the paragraphs you had him read and the various phenomena and statements that were contained in those paragraphs.

MR. WERSAN: Okay.

THE WITNESS: If you would give me a minute to find it.

(Witness perusing documents.)

THE WITNESS: I think there is a detailed discussion

of these vibrations and the water hammer effect in the reply to Question 12 highlighting the difference between that configuration and a pressure supression design and also pointing out that there are temperature limits to avoid these type of tank vibrations.

Excuse me. I think those tank vibrations are detailed -- it's not the answer to 12. They are actually detailed in 18 and 19.

BY MR. HALL:

Q. Have you finished, Dr. Levy?

A. Yes.

Q. In light of the explanations that you have provided in your interrogatory responses 18 and 19, does it surprise you that there is discussion in the documents with respect to vibrations and other phenomena?

A. No. Actually these tests were run even though the vibration was first noticed. Many of the tests were carried beyond the initial vibration to see whether there would be a much higher temperature finally turned out in these vibrations.

So it is not surprising that some of these tests produced some very high vibration, some tank shaking, jumping and things of this type.

Q. Would it be a correct statement, Dr. Levy, to say that that was in part the purpose of the test?

MR. WERSAN: Objection. That's a leading question.

MR. HALL: I will withdraw the question.

BY MR. HALL:

Q. Dr. Levy, one last series of questions. You were asked a number of questions about the NEDM document and a series of tests in that document that occurred in 1969 to '70.

Do you recall generally that line of questioning?

A. Yes.

Q. Dr. Levy, could you state for me the size of that test facility and contrast it with the size of an actual containment design such as Limerick?

A. I think the vent sizes employed in that facility range from about 1 inch to 2 inches by comparison to a 24-inch diameter vent at Limerick. The size of the pool is 3 foot in diameter compared to approximately 80 to 90 foot diameter pool at Limerick.

I think one of the comments that I have often made in my responses to the question is that really in dealing with hydrodynamic load, it is most important to deal with the exact configuration actually full scale. I think this comes out in many of the documents that have been referenced that the condensation mechanism and the loads associated with it had to be measured at full scale, because that's the only meaningful scale at which you could get meaningful data.

Q. Did General Electric prior to proposing and seeking to license the pressure supression concept which ultimately was incorporated into the Limerick Mark II conduct full scale tests?

A. I think the configuration of the Mark II configuration can be found in the original Humboldt Bay and Bodega Bay tests. That is why those tests are referenced in the Limerick final safety analysis report or the preliminary safety analysis report.

There were tests performed at a 24-inch size vent with the kind of water size, the kind of submergence that actually was finally employed in the design of Limerick.

Q. Finally, Dr. Levy, have any of the statements which the Consumer Advocate has referenced you to and had you read into the record changed any of the opinions or conclusions that you have presented in your testimony or interrogatory responses in this proceeding?

A. No.

MR. HALL: That's all that I have.

MR. WERSAN: One second, Your Honor.

(Pause.)

RECROSS-EXAMINATION

BY MR. WERSAN:

Q. Dr. Levy, you stated on redirect that in your opinion, the prudent course in response to some of the

results of the tests done by General Electric was to limit the flows into the pressure supression pool?

A. It was to limit the flow in the downcomers during a loss of coolant accident.

Q. Would it also have been prudent to do additional testing and analyses to better understand the vibrations that were the result of these flows that you were attempting to limit?

A. A significant amount of tests were performed in the condensing test facility. The NEDM report started to reproduce some of these tests and perform some additional tests. That's in 1970.

Speaking as an engineer, you can sometimes continue to study a problem on and on, but it sometimes also wise to avoid the problem, and in this particular case action was taken to put limits on pool temperatures and therefore avoid it. Sometimes from an engineering viewpoint, you can sometimes study something on and on, but if you can actually stop it from happening by a pool temperature limit and a velocity limit, you try to do so and then stop at that point.

Q. Two questions. First of all, attempting to stop this didn't result in limiting or avoiding the problem that eventually arose in the 1970s; is that correct?

A. The problem resurfaced again in 1972 as a result

of the Wurgassen relief valve. But again, as I mentioned several times, action had been taken with the changing configuration by putting a Ram's Head at the bottom of the relief valve pipe and also by imposing temperature limits again to prevent it from recurring.

The event occurred in a foreign plant in Germany, not in a domestic plant.

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 supression tests except probably some incidental types of tests where people were measuring other kinds of mechanisms.

At that point, the reliance was placed on the substantial amount of testing on Humboldt and Bodega Bay and to try to develop design configurations within the test restrictions, the areas and the kinds of things that had been tested. Only in 1969 and '70 when General Electric started to think in terms of a new configuration of containment, which is the Mark III design, which employed horizontal vents, did the tests get restarted.

Again, if you notice there, the fact that we were thinking of a new configuration started from small scale

tests and then got larger and larger and finally simulated the full scale horizontal vent in the Mark III design.

So there was not a need to create some more pressure supression tests between the time of the Bodega Bay test until finally the Mark III configuration was being developed.

Q. Or at least not a need as you perceived it?

A. Not needed as we perceived it.

Q. You mentioned the Mark III with the horizontal venting. Didn't you just indicate that the 14-inch vents that you discussed from the GEAP-3143 were horizontal vents?

A. Those are horizontal vents, but actually they are different. Those are very short horizontal vents in the sense it has a little weir behind it.

I think in the test that I was describing for the tests that were performed in the condensing facility, there was a rather long run of horizontal pipe both at the bottom and at the top versus really a very short distance that was allowed in the Mark III design.

Q. Also along the line of the 14-inch pipe you discussed, I think your comments with respect to that document and the water hammer that you were discussing relates only to that horizontal 14-inch vent and not to the other sized configured vents in that report.

A. I was trying to draw the distinction that in the case of the 14-inch pipe, a real water hammer type

of phenomena occurred and probably created some pretty substantial loads.

I think in the other tests, the people used the word "water hammer effects." I believe that what they saw in those events I do not call water hammer. I call them more like pressure pulsations in which you are pushing water.

The pressure involves the pressure oscilations. They are not very large. They are actually reported in these things.

So I am trying to separate what I believe are more like pressure oscilations in the vent versus what I believe in the 14-inch pipe because of its horizontal run in which I believe we saw a true water hammer.

Q. Is this pressure oscillation you're talking about chugging?

A. That is correct. These vent oscilations I think have been referred to as chugging.

Q. And that is a hydrodynamic load as we now call it?

A. The chugging became -- some of the early tests had chugging in them, I think, as these reports point out, but the loads that were measured at that time in the Bodega Bay and the Humboldt Bay tests were not significant; they were not really that large in terms of load.

The first time major, substantial loads were measured with chugging is when we started to assemble a full-scale facility to simulate the Mark II design, and under those conditions we got once in a while what looked like a real big chug. That was really the first time that we measured what I call some significant chugging load.

Q. But just to be clear on terminology, chugging is a hydrodynamic load?

A. Chugging is a hydrodynamic load by my definition, and if you notice, I try to differentiate when they became significant versus when they were not.

Q. Yes, I've noticed that. Finally, you read us a portion of a document GEAP-3013 from page 5, discussing the purposes of the test and whether or not they were

fulfilled. Would you agree with me that the next paragraph -- let me put it this way: could you read the next paragraph following the one you read into the record?

A. Absolutely. I think the next paragraph -- since these are very small scale tests, the next paragraph actually recommends that additional large scales be performed, and in fact they were.

Q. Could you read the next paragraph?

A. You want me to read --

Q. Starting with "However."

A. Okay; I'll read the next paragraph. "However, it cannot be safely concluded that a full-scale steam discharge will not create shock waves or forces which could be damaging solely on the basis of these small scale tests.

"It is quite probable, though, that any forces which might be created would be significantly below disaster proportions.

"It would be advisable, if any large scale tests of steam condensations are performed, that a pressure transducer be inserted to once and for all settle the question."

Q. Just so it is clear in my mind, when it says that it might be below disaster proportions, that doesn't indicate that there might not still be some forces and there might not be some damage, just that there wouldn't be a disaster?

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A. That's what that paragraph says. I'm not going to change it.

MR. WERSAN: That's all I have, Your Honor. Thank you.

MR. HALL: Your Honor, just one question.

REDIRECT EXAMINATION

BY MR. HALL:

Q. I believe you indicated, Dr. Levy, that the further testing of that paragraph that you and Mr. Wersan just discussed was in fact taken out and resolved that concern?

A. Actually, these tests were followed with the condensing test facility tests, which were then done with 14-inch pipes. And then subsequently to this they were followed with really prototypical tests, which are the Humboldt Bay tests, which again were done with 14-inch pipe, and finally the Bodega Bay tests, which were performed with 24-inch pipe.

MR. HALL: That's all the questions I have.

JUDGE MATUSCHAK: Is there anything further of the witness?

(No response.)

JUDGE MATUSCHAK: Thank you.

(Witness excused.)

MR. HALL: Your Honor, we have Dr. Mattson to

present. Dr. Matton is the last witness that we need to present today. We can do Mr. Boyer on Monday, if folks are agreeable.

MR. WERSAN: Your Honor, before we go on, after reviewing -- partly due to the lateness of the hour and just after reviewing my notes on Dr. Mattson, I have decided not to have any cross-examination, and I would stipulate to the authenticity of his testimony.

MR. HALL: Fine; very good.

JUDGE MATUSCHAK: Are you going to offer his testimony?

MR. HALL: Yes. Let me get that out so that I have it.

(Pause.)

MR. HALL: Your Honor, Dr. Mattson has some corrections to his testimony that he would like to make.

In addition, Dr. Mattson has three documents that he would like to reference for the record which are related to the quotations which Mr. Wersan has brought forth and quoted to Dr. Levy.

These quotations are brief passages -- and I believe there are four of them -- from ACRS letters. The ACRS, of course, is an official organ of the Atomic Energy Commission. They are letters referencing the type of phenomena and actions that Mr. Wersan has cross-examined Dr. Levy on

very extensively.

The purpose of offering these and presenting these to Your Honor and the Commission is to show that indeed the Atomic Energy Commission and one of its major decisional bodies, the ACRS, at the time of the making of these tests and the licensing of the Humboldt Bay and Bodega Bay facilities, was in fact aware of all of the results that Mr. Wersan has been pointing out as contained in the testing documents.

I think that is a very significant piece of information for Your Honor and the Commission to have. It is a a piece of information that was not significant until Mr. Wersan today selected and brought into the record the various portions of the proprietary GE documents which refer to these same phenomena. Therefore, we are in a position to offer them at this time for the first time as relevant in this proceeding.

JUDGE MATUSCHAK: Has this witness been sworn before?

MR. HALL: Yes, he has.

MR. WERSAN: Your Honor, I believe I am going to object to this, whether or not Mr. Hall wants to move those in. Those documents obviously were available to Dr. Mattson for many years. They were not proprietary; they were not protected. He has put in testimony on Mark II in this case already. In his testimony, if he had anything to include,

he should have included it at that time.

I think the company has had every opportunity to put more paper into this record. I think at this point in the game it is a little late.

MR. HALL: Your Honor, I don't believe that that is true at all with the particular passages that we are seeking to put in. Dr. Mattson has indeed raised this issue before. He has indeed pointed out and stated that there is specific knowledge --

JUDGE MATUSCHAK: We are going to overrule the objection. It was first presented here by the Consumer Advocate in the cross-examination of Dr. Levy. We are going to overrule the objection.

You may proceed.

MR. HALL: Thank you, Your Honor.

Whereupon,

ROGER J. MATTSON

having previously been duly sworn, testified further as follows:

DIRECT EXAMINATION

BY MR. HALL:

Q Dr. Mattson, --

MR. HALL: Mr. Wersan, to save time, do you want to stipulate to the authenticity so I simply have to put this in?

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MR. WERSAN: That's fine.

BY MR. HALL:

Q. Dr. Mattson, would you make corrections to the three documents that you are sponsoring at this stage of this proceeding, those documents being PECo Statement No. 9A, PECo Statement No. 9B and PECo Exhibit RJM-1?

A. Yes. I would like to start with PECo Exhibit RJM-1. About six pages from the end is a page titled "Schedule 1." For completeness, we discovered just within the last day or so that we had left one plant off of that list of plants licensed since the accident at Three Mile Island.

The entry should be made for a plant called Sequoyah 1, which docketed its OL application on 1/31/74, received its low power license in July of 1980; and if you are following across with the columns there, that would have corresponded to a 77-month OL review schedule.

That is the only change on RJM-1.

In PECo Statement 9A there are two typographical and one substantive change. Let me start with the substantive change.

On page 8, line 31, there is a reference to an AEC Assistant Project Manager. That is a mistake. It should have been a Mississippi Power & Light Assistant Project Manager.

On page 9, line 35, we refer to some "event tests." That should not be "event tests," it should be "vent tests."

On page 30, line 41, there is a number, "17,836." The "7" and the "1" were inverted. The number should read "71,836."

JUDGE MATUSCHAK: What page is that on?

THE WITNESS: Page 30, line 41, the line corresponding to Grand Gulf 1 in that table.

JUDGE MATUSCHAK: What should that be?

THE WITNESS: "71,836," sir.

Finally, in PECo Statement 9B, on page 11, I have three changes, all driven by the same error in addition.

On line 37, there is a number, "60 months." It should be "66 months."

On line 45, it is the same error; instead of "60" it should be "66."

Those errors in addition led to a subsequent error on line 47 on that same page; "12th" should read "16th."

That is all of the corrections.

MR. HALL: Your Honor, the Consumer Advocate has stipulated to the identification of PECo Statements 9A, 9B and Exhibit RJM-1, and also to its authenticity.

I ask that they be admitted into the record.

JUDGE MATUSCHAK: The motion is granted.

MR. HALL: Thank you.

(Whereupon, the documents were marked as PECo Statements Nos. 9A and 9B and PECo Exhibit No. RJM-1 for identification, and were received in evidence.)

BY MR. HALL:

Q. Dr. Mattson, you were here during the cross-examination of Dr. Levy, were you not?

A. Yes, I was.

Q. Did you listen to the cross-examination as respects the reading of various portions of certain proprietary General Electric documents, those being GEAP-3143 and NEDM-11036?

A. I did.

Q. In those documents, is it not correct that there was mentioned various vibrations or hydrodynamic-related phenomena?

A. Yes.

Q. Do you have to present to the Commission at this time references to those same phenomenon as stated in Atomic Energy Commission ACRS letters respecting or describing the results of those tests?

A. Yes. What I have are minutes from three subcommittee meetings of the Advisory Committee on Reactor Safeguards from 1959 and 1960, which refer to the phenomena observed in some of these early tests.

I believe that the descriptions that are given of

phenomena are similar to the descriptions that were given in the documents read by Dr. Levy, and these ACRS letters would establish the fact that the information available to General Electric and Pacific Gas and Electric in the testing for the Humboldt Bay power plant were also made available to the Advisory Committee.

Q. Could you read those specific passages that you feel are important?

A. Yes. I will take these letters in their chronological order. The first one is October 29, 1959, and it is the minutes of an Advisory Committee on Reactor Safeguards subcommittee meeting on Pacific Gas and Electric Company, Humboldt Bay power plant. The meeting was held in Washington, D.C.

On page 3 of those minutes -- they are not long; it is five pages of minutes -- I will read from the top paragraph: "It was noted that vibration developed in the suppression pool if the temperature was permitted to rise above a critical value. PG&E indicated that normally heat losses will prevent the temperature in the pool from rising above this value (130 degrees Fahrenheit).

"The estimated normal pool temperature at full power is 78 degrees Fahrenheit. The applicant was asked to provide additional information regarding the method by which these results were scaled to the full scale design.

"In the event relief valve discharge raises the pool temperature appreciably, a cooling system is provided to lower the temperature rapidly. It was noted that approximately one-and-a-half minutes of relief valve discharge are required to raise the pool temperature to 130 degrees Fahrenheit."

I will stop reading there. It goes on with some other discussion of temperatures.

I believe this is the high temperature condensation instability to which Dr. Levy referred when he read from the other documents.

The second set of minutes is from an Advisory Committee on Reactor Safeguards subcommittee meeting on Humboldt Bay held at the Oak Ridge Operations Office at Oak Ridge, Tennessee, on February 25, 1960.

At page 4 of six pages of minutes there is a short paragraph at the end of a section entitled "Session With Pacific Gas & Electric Drywall Design."

I quote: "Mr. Osborne inquired if there was throttling of the steam flow during the test program. The applicant had studied lower flow rates and had observed water blow-out and fill-up (in an oscillatory manner) and some hammering or vibration effect."

Although the chugging is not used here, I believe this is the chugging phenomena to which we heard Dr. Levy

refer this afternoon.

The third subcommittee minutes are dated June 22 to 24, 1960. They are much longer. They go on for about -- there are number of enclosures, so let me see here -- 13 pages.

They are minutes from the 26th meeting of the Advisory Committee on Reactor Safeguards. I'm sorry, I misspoke. This is a full committee meeting held in Livermore, California, Moss Landing, California and Idaho Falls, Idaho, covering the period June 22 to 24, 1960.

I will read a short paragraph from page 11 in a section entitled "Pacific Gas & Electric and General Electric."

"The peak of the curves of pressure in the condensation chamber is attributed to the bubble of air and steam just after release pushing the condensation water up like a piston and causing a sizeable temporary pressure increase."

I believe this is the pool swell phenomenon that we have heard referred to this afternoon and elsewhere.

That is the three documents.

MR. HALL: That's all that we have.

MR. WERSAN: Your Honor, could I have a few minutes to read these?

JUDGE MATUSCHAK: Yes.

(Pause.)

MR. WERSAN: I assume that copies will be provided

to all parties?

MR. HALL: Yes, copies will be provided.

MR. WERSAN: I have no questions, Your Honor.

MR. HALL: I have nothing further, Your Honor.

JUDGE MATUSCHAK: Are you offering those as exhibits?

MR. HALL: No, Your Honor. We will, however, supply them as responses to data requests in response to the Consumer Advocate request.

MR. WERSAN: I didn't realize that. So you are just including those sentences that he read?

MR. HALL: Yes. That's all we're bringing forth.

Do you still want copies?

MR. WERSAN: Please.

JUDGE MATUSCHAK: If there is nothing further, the witness is excused.

(Witness excused.)

MR. HALL: That's all that we have, Your Honor.

JUDGE MATUSCHAK: What time does counsel suggest we start on Monday?

MR. HALL: Would 9:30 be convenient?

MR. WERSAN: That's fine.

JUDGE MATUSCHAK: We will adjourn at this time until 5:30 on Monday, March 17.

(Whereupon, at 5:30 p.m., the hearing was adjourned, to be reconvened at 9:30 a.m. on Monday, March 17, 1986, in Harrisburg, Pennsylvania.)

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C E R T I F I C A T E

I hereby certify, as the stenographic reporter, that the foregoing proceedings were taken stenographically by me, and thereafter reduced to typewriting by me or under my direction; and that this transcript is a true and accurate record to the best of my ability.

COMMONWEALTH REPORTING COMPANY, INC.

By: Phyllis Glass

Phyllis Glass

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